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Careers in Food Science: From Undergraduate to Professional

Second Edition

Springer

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Preface

Do you find yourself intrigued by new products in the grocery store? Maybe you spend your weekends watching the Food Network? Or do you find yourself in the kitchen trying your hand at the latest food hack you saw on the Internet? If so, you should consider how this interest in food can be turned into a career in food science. A degree in food science prepares you for a broad range of opportunities in the food industry and beyond.

The aim of this book is to help you discover and explore the wide range of exciting careers you can pursue as a food scientist. This text will guide you through everything from choosing food science as a major, landing your first internship, applying for your first job, and how to continue your professional development after landing your dream job. To help guide you through each stage of your career, the book has been broken down into five parts. Part I will introduce you to the food industry and the various career paths available to those with a food science degree. Part II will be your guide through the undergraduate experience in a food science major. There are tips on how to interview, land your first internship, and continuously develop your professional and leadership skills. In Part III, we begin to explore the food industry and the many opportunities it offers. Here you will find advice on finding and negotiating your first job, achieving work-life balance, and managing employer expectations. In Part IV, each chapter dives into detail of a career path available to those with a food science degree. The second edition of this book has been updated to include chapters on careers in sensory science, community-based food systems, food start-ups, sustainability, and management. Lastly, Part V provides guidance for any student considering a graduate degree in food science. These chapters were written by authors who recently went through the experience of choosing a graduate school, degree, or advisor.

The authors have been invited to contribute to this book based on their expertise and experiences in the food industry. This includes academics, food industry professionals, and food science students who all came together to offer you their best advice, wisdom, and guidance. We hope the updated version of this book will be a useful tool in your decision-making and career management.

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Part I
Introduction

Chapter 1
Introduction: Career Preparation for the Food and Beverage Industry

Richard W. Hartel

There are over 7.9 billion people on the planet, and the UN estimates that number will grow to ten million by 2057. That's a lot of people to feed. For now, the food supply is sufficient to feed everyone (although various factors cause some people to face food insecurity), but many are worried that the food supply may not keep pace with population growth in the future. The food industry is one of the largest industries in the world, creating a wealth of opportunities for those studying Food Science.

It's an exciting time to be involved with food and its production. The continued popularity of food shows on the television clearly indicates avid public interest. Moreover, recent advances in Nutrition, Biochemistry, Medicine, and many more fields have spurred an interest in food as a vehicle for nutrition and health. The adage that "you are what you eat" has never been truer today than at any time in the past. You can still enjoy a Twinkie if you so desire (remember, you are what you eat), but the majority of the food industry is heading toward providing optimal nutrition to enhance health and wellness and doing it in an environmentally friendly way. To that end, the sustainability question has spurred recent developments in plant-based foods and cellular agriculture to replace animal products. Where these trends will go in the future remains to be seen, but the opportunities in the food industry now are even broader than ever.

Almost no matter what you want to do, the food industry offers you the opportunity because of its size and diversity. If you're a Food Science major

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or thinking of majoring in Food Science, the food industry is your oyster, so to speak. The future is bright, and you have the chance to be part of one of the largest and most important industries around. You can satisfy your desires to do good in the world while still having an enjoyable and profitable career.

The Vast Food Industry

A walk through the grocery store aisles shows the diversity of food products available these days. For nearly every food, from peanut butter to yogurt, there are literally dozens of options to choose from. Where do all these foods come from? The "food industry."

However, what exactly do we mean by "the food industry"? Most of us think of the larger food manufacturers, from General Mills to Nestle, but there's so much more. There are suppliers of ingredients, equipment, and even personnel. There are small companies that make foods for niche markets. There are the government regulatory agencies that ensure the safety of the food supply. Also, there are training, analysis, and research facilities, from universities to private labs to government labs, which support food manufacturers and suppliers of all sizes. It's this wide variety of important components that makes the food industry so large and diverse, resulting in the broad range of job opportunities. Take a look at some of the opportunities in more detail.

Food manufacturers are those companies that turn raw materials (or intermediate products) into finished products – the ones we see available on the grocery store shelves. Food manufacturers vary in size from small start-up companies (think of Ben and Jerry making ice cream in their garage) to the largest multinational conglomerates (Nestle is the largest food company and one of the largest ice cream manufacturers), with every size of company in-between. Of course, these food manufacturers hire food scientists for a wide range of jobs. There are production supervisors, who oversee the manufacturing lines, and plant managers, who oversee the entire operations within a manufacturing facility. Quality control/assurance people ensure the products are safe to eat and meet the company's quality standards. Product developers, often in conjunction with research chefs, are the people who create and develop the new products we see on the grocery store shelves. The job of R&D personnel is to better understand the physical, chemical, and microbial attributes of foods and to develop new and better manufacturing technologies. Although marketing isn't typically a job that food scientists fill

immediately upon graduation, some food scientists gravitate toward the business side of food manufacturing and transfer into the marketing division after a few years. There are even food scientists who start their careers as purchasing agents within a manufacturing company; they're responsible for procuring the necessary ingredients from supplier companies.

Suppliers are companies that provide ingredients or components to the food manufacturers. One of the largest supplier industries is the flavor industry. A food scientist at a flavor company works directly with the food manufacturers to find exactly the right flavors that suit a new product being developed. For example, when Derek, a product developer at an ice cream company, decides to make a new flavor of ice cream, he approaches, Chris, the technical sales representative at a flavor company with an idea. Chris takes the idea back to the flavor labs, where flavor scientists develop prototypes for evaluation by Derek. Chris and Derek may go back and forth several times until Derek feels he has the right flavor to suit his new ice cream, at which point they go into plant trials and, eventually, if everything is successful, into full-scale production. If the new flavored ice cream makes it through all the hurdles to get to market, eventually consumers like you and I can buy it at the grocery store. Also, both Chris and Derek get a huge feeling of satisfaction when they see their product on the grocery store shelves.

Ingredient or food component supplier companies vary widely. Ingredient suppliers provide food components, such as flavors, colors, acids, specialty chemicals, and other ingredients. Some supplier companies produce intermediate ingredients for food manufacturers to use. For example, there are large cookie and biscuit companies who don't make any chocolate themselves. They simply buy chocolate as an ingredient from chocolate supplier companies. In the same way as Derek and Chris worked together to come up with an appropriate flavor, food scientists John and Michelle work together to ensure that Michelle's chocolate coating would work well on John's new cookie product.

Another example of an intermediate ingredient supplier is the company that makes breading for frozen breaded onion rings produced at a local manufacturing plant. Food scientist Jeanne from the frozen onion ring manufacturer would work with Lori, a product developer at the breading ingredient supplier, to make sure the breading had exactly the right qualities at a low enough cost to fit within the profit window.

Other suppliers of food manufacturers include companies that provide packaging materials and manufacturing equipment. Some food scientists may develop a specialization in packaging, bringing a deeper knowledge of how package and food interact to enhance safety, convenience, and marketing of products.

Other companies or organizations that either support or interact with food manufacturers include *special interest groups*, *regulatory agencies,* and *service companies* (i.e., companies that provide chemical and/or microbial analyses, external sensory labs, etc.). One could also include *placement agencies*, or companies that specialize in matching food scientists looking for employment with companies looking to hire new employees, in the list of companies that support the food industry.

According to the Food and Agriculture Organization (FAO) of the United Nations (UN), our food supply is easily sufficient to feed the entire population of the world. Advances in crop production and yields have continued to improve food production at a pace fast enough to keep up with the growing population. However, at least 800,000 people around the world, mostly from developing countries but also some here in the USA, are under-nourished. If you're interested in helping to ensure that everyone in the world gets enough nourishment every day, there are also opportunities to use a degree in Food Science to help the public good. Consider working in the Peace Corp or at various nonprofit institutions whose aim is to provide healthy and nutritious foods where needed around the world.

Perhaps you have an interest in starting your own business? The food industry is an interesting economic model, with large companies seeking growth through purchase of smaller companies. That provides an opportunity for new start-up companies to fill a niche in the market. A degree in Food Science, particularly with a business slant, provides an excellent background for becoming a food entrepreneur.

Again, a wide diversity of opportunities are available for employment within the food industry. Almost no matter what your inclination for a career or your personality type, you can find an opportunity for it in the food industry.

Prepare for a Career in the Food Industry: A Learner's Guide

This book is chock full of tidbits on how to prepare for almost any job related to foods. However, one of the most important things to get out of this book is the message that it all depends on you. You can make what you want of your life, no matter where you are right now.

Are you a new student, either declared or just considering a major in Food Science? If so, you can find some great advice in Section 2 (The Undergraduate Student Experience) to help you make the most of your college career. If you think you're just taking courses as an undergraduate, think again. There are so many ways to develop your skills, both technical and professional.

For many, finding and starting your first job in the industry can be quite daunting. What's expected of me? How should I behave? What types of things should I watch out for? How do I make the most of the opportunities presented? Section 3 (A Successful Industry Career) is intended to provide guidance about how to make the most of your opportunities in the corporate world.

If you're interested in working in the food industry with a BS in Food Science, Section 4 details a wide array of potential career choices available to you. This is really just a sampling of the options, and they keep growing year by year.

Perhaps you're considering graduate school. Section 5 (The Graduate Student Experience) provides guidance for finding an appropriate graduate program, making the transition to graduate school and making the most of the opportunity.

Almost no matter what your inclination within the food industry, you can find insight and advice from past experience within this book.

Why should you consider the food field for your career? Again, the wide diversity of opportunities in the food industry allows you to find a great fit for you almost no matter what your career aspirations. Do you like science with a meaningful application? Are you interested in psychology – why do people eat what they eat and taste what they taste? Are you creative and want to produce new and exciting foods? Are you concerned about people's health and want to do something about it? Does sustainability drive your daily decisions and you want to have a career focused on protecting the environment? Do you make a killer cookie – maybe you can turn that skill into a successful business? The opportunities are virtually endless with a degree in Food Science.

Richard W. Hartel is a professor at the University of Wisconsin-Madison since 1986, Dr. Hartel has seen numerous food trends and fads come and go. He has helped numerous students successfully complete college and start their career in the food industry. To help them through the undergraduate program, he developed a freshman "careers" course called Discovering Food Science and developed this book for that course to provide answers to their numerous questions. Although his wife thinks he needs a hobby, he responds that writing books is his hobby.

Chapter 2
Finding Your Path to Major and Career

Amy Shannon

Few college students know exactly where they are going when they begin college. Some know the major or field of study that excites them, but not where it can lead in terms of a career. Some have an idea about a career that seems right, but not the path of study to get there. Some feel as if they have too many ideas, while others do not know enough about their own interests or skills to have a starting point. No matter what stage of decision-making students are in when they begin college, they all need to discover things about themselves, about the majors available to them, and about the wide variety of careers that exist. In this chapter, we'll examine majors and careers and how to make choices that feel consistent with who you are and who you want to become.

A few years ago, at an amusement park with my then 6-year-old, a young park employee asked him, "What do you want to be when you grow up?" He paused and said, "Well, it's too early to tell. I need to figure out what I'm good at and enjoy, and that's going to take a while." She was stunned and said, "Yeah, I guess I don't know what I am doing either, and I'm 22." Figuring out and creating your career path does not happen with one decision or along a prescribed timeline. The best decisions come from figuring out what aligns with your interests and abilities—and this takes time, experience, and self-reflection.

Most college students will have moments of doubt. When you were younger, many of your choices were constrained. You took English, math, social studies, science, a language, physical education, art, and music on

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repeat for 12 years, with only a few choices of electives in middle and high school. Your teachers, family, coaches, counselors, and pastors were responsible for many of your decisions. Now you are entering a time where you are being asked to make more choices, and the choices feel like they really matter. This can be exciting—and scary! The good news is that you have a new community of professors, academic and career advisors, and teaching assistants to help you along the way!

I invite you to start this journey with a deep breath and a spirit of curiosity.

Choosing a Major

You have probably been asked, "What are you majoring in?" and "What are you going to do with that?" These questions can trigger anxiety if you don't have the answers. Discomfort with not knowing yet can make it tempting for students to declare a major quickly without having enough information about themselves or the major. The key to making good choices about your college major is to slow down, take classes that sound interesting, and take the time to reflect on your strengths and interests.

What Majors Are…and Aren't

Majors are a portion of your degree and only a portion of what you will showcase after your years in college. At hiring time, what is most important to employers are your skills and experiences and what you bring to the role for which they are hiring. Some of these skills will come from your major coursework, and some you will gain in your experiences outside the classroom through student jobs, volunteering, and internships.

To make it an equation:

$$\text{Degree / Major} + \text{Experience} = \text{Career options}$$

While it may seem that everyone else has their major figured out, you are in good company if you are still deciding. Many incoming college students do not yet know what they want to study; and almost a third of college students will change their major within 3 years, some more than once (Leu, 2017). Part of the reason for this is that few students have been exposed in high school to subjects such as anthropology, agronomy, astrophysics, food science, dietetics, and nutritional science. College can open your eyes to a

variety of fields you never knew existed! As you go through college, the questions you engage with in your courses, the material you read, and the labs you perform are all resources to help you with the process of figuring out your interests and strengths.

Choosing a major based on interest and strengths and then working in a field not directly connected to that major is fairly common. A decreasing number of people work in a career related to their major, even in science, technology, math, and engineering careers (Huo & Redford, 2019). This is not a poor outcome of their education or choices. Rather, this highlights that you learn skills from all your college courses and experiences, not just your major. Employers understand the value of transferable skills, such as working in a team, communicating effectively, and thinking critically. These skills are not taught through one major or field of study. For example, I majored in English and history. My English classes gave me keen insight into the struggles of what it means to be human, as each character I read about came from different backgrounds dealt with complex relationships and changed over time. History helped me understand and critically think about how we are all impacted by the choices of the past. Human motivations, choices, resilience, and growth are part of both courses of study and helped prepare me for my eventual graduate studies in counseling and for my profession as an undergraduate student advisor.

Your Turn: Gauging Your Strengths and Interests to Choose a Major

- *Will you have enough interest in the topic to do the work?*
- Do you have enough interest to take 30–60 credits of work, or are you only interested in one or two classes? Can you envision reading the textbook or doing the problem set rather than engaging in social activities or studying other topics? Or is watching YouTube clips or reading articles occasionally about the subject enough to satisfy your interest?
- *What interests have you had throughout your life?*
- When you have free time, how do you spend it? What do you create, seek out on the Internet, watch on YouTube, read about, and discuss with friends? Always got excited about planting your summer garden? Dove into keeping sourdough starter "alive" or making homemade kombucha? Helped on your family farm with the crops? Wondered why some ice creams have better consistency than others?
- *What are your academic strengths?*

- What subjects were you best at in high school? If you've taken college courses, in which did you earn your best grades? What things are so easy that you don't have to think much to do well in them? What strengths have others noticed in you?

Next Steps:
- Review the requirements for the major, read the course descriptions, and realistically assess your interest level in that depth of study.
- Take a course or two and see if you enjoy it.
- Try to engage with others in the major or field outside of class. Consider joining a student organization related to the major. Ask an advisor or professor how to talk to professionals in the field.

Choosing a Career

If you asked me at the age of five what I wanted to do for a career, I could not have guessed that advising students in college would be my calling. I would have said teaching. At eight I would have said I wanted to be a doctor. Our ideas about career are very much limited by what we see around us. The average person can probably name about 20 careers, even though careers are practically innumerable! Also, of course, there are careers emerging that we cannot yet imagine or describe. Choosing a career is a process of understanding much about yourself and about your options. The steps include thinking about your strengths, interests, and motivations, researching what career options exist, and building experiences toward a career that fits you and what you want to achieve.

Who Am I and Why It Matters

Students often come into the career center and ask, "What test can I take that will reveal the right career for me?" The truth is, there are countless careers that may be a good fit for you. Career assessments can help with understanding options but understanding *yourself* is the most important place to start. Thinking about your interests and strengths, the skills you want to use, and your personal values is key to finding a career that will suit you.

You might start by asking yourself: "What problem do I care about or want to solve?" and **"**What do I spend my time thinking about?"

I recently met with a mechanical engineering student who found little interest in his engineering classes but was spending 20–30 hours a week

bringing food to the homeless on the streets of our city. I helped him move away from a career with machines and into social work. Similarly, I worked with a student who was disappointed that she had spent 4 years taking classes she didn't enjoy to prepare for a career in dentistry she no longer wanted. When I asked her what problem she wanted to solve, she immediately said, "world hunger." She saw herself working in a developing nation and just needed encouragement to change paths. Another student I met with loved baking and wanted to turn her hobby into a career. The problem she wanted to solve was "creating the perfect cupcake." According to her, this meant a moist cake busting with flavor, with the optimal amount of not-too-sweet frosting. She planned to study economics and then go to culinary school so she could successfully run her own bakeshop.

Everyone has strengths and skills. Finding a good fit for yourself in a career includes identifying your strengths and skills and then thinking about which ones you would prefer to use in work. For example, some people feel energized by engaging others in conversation and helping them. It can feel so natural that it doesn't feel like work. For others, those interactions may feel forced, awkward, and draining. However, give them a data set or a lab experiment to run, they are focused and much happier. Which skills do you want to use in the work you do?

It can be difficult to sustain motivation when you don't feel engaged in work that is meaningful to you. An Internet search on job satisfaction will reveal a wealth of popular media articles about what contributes to and detracts from job satisfaction. According to Cornell Psychologist Anthony Burrows, a key contributor to job satisfaction is finding work which feels purposeful (Vedantam, 2021). Purpose does not have to be some grand life-changing mission. Finding purpose in your work is highly personal and likely to be found at the intersection of your interests, abilities, and curiosity. It could be that you help local farmers sustain and grow their business by connecting them to new markets. It could be creating a food product that brings people joy or feeds more of the world's hungry. My purpose is helping students develop themselves and connect to their education and career goals. For many, job satisfaction comes from connecting your work to a bigger vision and realizing that the work you do makes a difference.

Your Turn: Reflecting on Interests, Skills, and Values to Find a Career

- What problems do you care about and want to help solve?
- What do you spend your time thinking about?

- Which of your many skills do you want to spend your workday using?
- Some examples might include: writing, listening to people, understanding the nature of a problem and creating or proposing solutions, using scientific principles and laboratory skills, analyzing data sets, or creating websites and marketing materials.
- To what extent do you want to spend your time working with people, ideas, information, or things (e.g., machines, plants, lab equipment)?
- What is important to you in your job?
- Some examples: helping society, making a high salary, having a flexible schedule, being independent, feeling a sense of community, having opportunities to advance, being creative, facing change and variety or maintaining structure and predictability, or working with a group or team.

Next Steps:

- Work with advisors at your campus career services, who can help you think about your interests, strengths, and values. They can also help you identify ways to gain experiences, reflect on what you learned, and create materials to apply for internships and jobs.
- Job shadow or talk to someone in the field (s) of interest. Talk with family and family friends, or reach out to career services to identify contacts in fields of interest. Ask them about what a typical day of work looks like, what they like about their job, what challenges they face, and what skills/strengths are needed.
- Get experience. Work, volunteer, or land an internship to test out the work as closely as you can.

You Are Choosing Your Next Step…Not Your Whole Life

In this chapter I have given you pieces to work on called "Next Steps." These are the sorts of questions and actions which can be considered or pursued now and revisited across time. Students often panic when choosing a major because they feel like they are committing to a defined career pathway, closing out other options, or making one choice for the rest of their lives. None of these are true, and that is way too much pressure to put on yourself or one decision. Consider this: the average person will hold more than 12 jobs across their working years (US Bureau of Labor Statistics, 2020). This means that you are not making ONE choice about a career that you are going to do for 50 years. The world of work is constantly evolving, with globalization and automation creating rapid changes. Jobs that don't exist now will be available by the time you graduate, and some jobs will disappear altogether.

This means that it's impossible to predict what your career will look like 10, 20, or 40 years from now. Think of it as job freedom—and as an opportunity to continually learn and grow. You don't have to make ONE career choice now. You just have to focus on your *next steps*.

What does it look like to be open to changes in career? To illustrate what the fluidity of careers, I share a couple of examples.

Some will shift their career focus within the same industry. For example, Chris started out working for a bovine nutrition company right out of college. He gradually became less interested in the formulation of feed for best nutrition and more interested in understanding the most compelling way to market the product to the consumer. The consumer in this case was the farmer/feed lot, not the cow. He liked the creativity, data analysis, teamwork, and psychology of marketing food more than the scientific formulation. He was soon able to pivot to the role of scientific consultant to the marketing team.

Others will use broad skills to switch to new fields entirely. Take Michelle, who was singularly focused on being a lawyer at a top law firm. Because she had her eyes set on becoming partner, she didn't mind working long hours. She achieved that goal but recognized that as a Black woman, the community that supported her dreams was suffering. Giving back to the community that nurtured her and providing for the next generation became a new focus. Poverty, violence, poor schools, few jobs, and food insecurity were struggles that needed to be addressed. She pivoted to use her skills to lobby, advocate, and run a nonprofit organization to change these problems. Community gardens and better nutrition in schools are the results of that work.

While you don't know your whole career journey at this point, or what interesting options will come your way, the important thing is that you just get started on the journey. Take that all important first step and then the next one….

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Amy Shannon is the Director of Advising & Student Success for the School of Education at University of Wisconsin-Madison. Her career journey wound through wanting to be a rock and roll violinist, teacher, a doctor, and Supreme Court justice and came back to teaching. She discovered advising as a career at 27 and went back to school for the third time. She found the fit she sought working with emerging adults, helping them recognize their strengths and interests through academic and career advising.

Chapter 3
First Jobs for Food Scientists

Abigail E. Thiel and Steven Hill

You just received your degree in food science. Congratulations, you've successfully navigated a rigorous technical curriculum and have proven that you own a broad base of valuable knowledge (and a nice-looking diploma) that'll provide tremendous career opportunities over the next 30–40 years. The first step in embarking on your new career is to land that first job in the food industry. What type of job can a newly minted BS, MS, or PhD in food science expect? It all depends on your interest, your skills, the available job opportunities, and the degree you earned (BS, MS, PhD). If you were able to participate in an internship, you've likely developed some interest in what direction you would like to begin. There are many places to start and many "sub-sectors" of the food industry to explore.

This chapter will be divided into three sections – (1) an overview of the general types of entry-level or first jobs a new food science graduate will start their career with, (2) the sub-sectors of the food industry where these roles exist, and (3) specific examples of what's expected of a new hire in these roles.

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Overview of Roles

First is a discussion on the types of roles a recent food science graduate is qualified to hold. There are six general categories of roles a recent graduate usually starts their career:

1. Product development
2. Food safety/quality assurance
3. Sensory science
4. Process development (or food engineering)
5. Food chemistry (or food research)
6. Technical sales

The top two (product development and food safety/quality assurance) are, by far, the areas with the most job opportunities for recent food science graduates.

Product Development

The product development capability of any company in any industry typically resides in the function known as R&D – Research and Development. Smaller companies may have this area housed in a "technical services" group or just the "technical group," but generally product development is found in the functional group called R&D. Not surprisingly, the food industry hires people into the product development area who know about food, such as food scientists. Job titles for roles in product development are varied depending on the sector of the food industry and the particular approach a company has to creating titles; but the common titles include food scientist, scientist, food technologist, or product developer.

Depending on the sector of the food industry, a product developer may focus only on ingredient application or creation of ingredients (ingredient supplier sector), creation or improvement of a manufactured food or beverage (food/beverage manufacturing sector), or the design of food components to create elements of a meal, snack, or beverage (food service sector). Product development roles are technical in nature. To be successful, a product developer is required to understand the broad aspects of food science – chemistry, microbiology, material science, nutrition, biochemistry, math (statistics), physics, and communication while also engaging in food trends and new technologies relevant to their area of product development.

A product developer designs and specifies what and how to make a product for the operations or production function of a company to follow and produce.

A common misunderstanding of product development is that a developer actually "makes" the product. Just like an architect designs and specifies how to make a house, a product developer does the same for a product.

Food Safety/Quality Assurance

Food companies don't want to be in the headlines because of an issue with food safety. Companies stay out of the unwanted headlines by building a strong food safety team that includes individuals with backgrounds in food science and food microbiology. The biggest component of a food safety organization in a company is the quality assurance (QA) organization. Typically, this organization has individuals located in manufacturing plants and in corporate locations. At manufacturing plants, the entry-level role for a food scientist will typically be titled quality assurance analyst or quality assurance technician. Most companies have moved away from quality control roles – these are roles that measure, or control, every aspect of products as they are manufactured, from beginning to end. In place of this approach, companies have adopted the prescribed approach from the Food and Drug Administration (FDA) and have built a preventative controls approach where food safety control plans and policy are being met. Analytical measures and methods are still used in the plant but used to verify compliance of predetermined specifications or sampling plans.

Key to success in these roles is an understanding of why certain specifications are in place, adherence to these specifications, and, importantly, how to react to situations where specifications aren't being met or where federal and state regulations aren't being followed. Like the product developer, the broad knowledge gained in a food science academic program provides a QA Analyst the tools to be successful in this role.

The area of food safety encompasses more than just QA (compliance with FDA and USDA standards). Many companies have microbiologists, or food safety scientists, who play key roles ensuring aspects of the manufacturing plant are being operated as they should. Examples may include:

- Monitoring plant sanitation to confirm practices are being conducted as designed
- Checking products to make sure they meet the correct specification for microbiological content
- Conducting mock audits to prepare a plant for external audits by federal, state, and local authorities (ensuring compliance with standards set and defined by the FDA)

It's not an overstatement to say that food safety, along with the safety of employees, is a food companies' number one priority. Companies that fail to get this priority correct are the ones that end up in headlines. As a result, those food scientists, who are in the food safety area, play one of the most critical roles in the entire company. Keeping customers and consumers safe each and every time a product is produced is a great responsibility and a very satisfying role to hold at a company.

Sensory Science

Food creates a sensory experience through taste, smell, texture, and appearance. Food science teaches there are ways to use humans as analytical tools that can produce quantitative and qualitative data that can be converted into useful information to help make decisions. A sensory scientist will organize and conduct sensory tests for a variety of purposes including establishing the readiness of a new ingredient or product for market launch (also called "qualifying" for market launch or commercialization), determining the desired intensity or characteristics of a certain flavor (examples could be garlic or vanilla or cream), texture, or appearance of a food product. Statistics play a big role in sensory science, so it's important that you enjoy working with numbers and data, as communicating the meaningfulness of this data will be an important aspect of your job. In addition, having an interest in the attributes of food is also key to enjoying your role as a sensory scientist.

Process Development

Usually someone in a food engineering role has been trained as an engineer. However, due to the unique education a food science student can receive, it's not uncommon that a food scientist ends up in a food process development role or in a hybrid product development/process development role. Many smaller companies rely on food scientists to have a broad skill set that includes the ability to design the process to make food. Process development jobs focus on the process to make ingredients or food products. As the title implies, the work conducted by a process developer centers on equipment and the flow of material through equipment to create a process that ultimately results in a product of some type. Similar to the sensory scientist, an aptitude toward math and numbers is important, as a process developer will be using measurements of process equipment to make decisions. Examples

of projects a developer would be involved in include optimizing a process to make a product or designing a thermal processing system to ensure the right temperatures for the right amount of time are attained while also having the correct flow rates of pumpable material moving through the process. In this example, understanding thermal processing (heat transfer for food safety) and physics (rheological behavior of a fluid) are important considerations of the process developer when creating or optimizing a process.

Food Chemistry or Food Research

Many food companies (manufacturers and ingredient companies) will have organizations that separate R&D, while smaller companies typically consider R&D to be one functional group. In some cases, very small companies – start-up companies – will be based on a particular food technology that requires much study and investigation. In these companies, there's considerable research being conducted to fully develop the science and technology behind the foods that'll be commercialized and launched in the market. The "R" component at large companies is a subunit of R&D and will have many (food) scientists studying and researching the chemistry and other scientific aspects of food. In these roles, research is conducted to answer questions and solve problems. Some of the problems to be solved may be about a consumer problem: how to sweeten a beverage without using a caloric sweetener, while delivering a sweetness exactly like sucrose; how to make a cheddar cheese without dairy but taste and melt exactly like real cheddar; and how to deliver meaningful amounts of long chain omega-3 fatty acids in a food without it oxidizing over shelf life. There are some very difficult and challenging problems to be solved in the area of food science that'll only be overcome with sustained research and focus on the specific problem to be solved. Usually, an advanced degree in food science is sought out by a company to place graduates into a food research scientist role.

Technical Sales

Why would someone with a food science degree become a salesperson? Because there's a need in certain companies to have people in these roles that have an understanding of food science. Many ingredient companies that make and sell components of food to other companies need salespeople who understand the technical details of the products they sell. Some of these food scientists will be involved in the R&D of developing the products and the

sales side of explaining the benefits or technical aspects of the particular ingredient to a potential customer. Some people have an aptitude for selling: strong communication skills combined with a talent for working with people, understanding business fundamentals, and knowing the technical details of a food is a great combination for a technical sales representative. Many food scientists may start as a product developer first and then move into a technical sales role.

Food Industry Sectors

The food industry can be thought of as an industry with several sub-sectors, or parts of the industry that define the entirety of the industry. To best describe entry-level roles in the food industry, four sub-sectors of the food industry are defined: food manufacturer, ingredient manufacturer, food service, and service provider.

Food Manufacturing

The companies that are in food manufacturing are the ones that make food for consumers. These are the big, medium, and small companies that have brand names and sell products in retail outlets like grocery stores (such as Kroger) and big club stores (such as Costco). These companies also will make food products to be sold in restaurants and schools and for the military. Examples of these companies include Nestle, PepsiCo, Coca-Cola, Kellogg's, Kraft Heinz, Mondelez, General Mills, Campbells, Hormel, Mars Wrigley, and Hershey. Mid-sized companies include T. Marzetti, B&G Foods, Smucker's, Schreiber Cheese, and Johnsonville. There are small start-up companies that compete in this food industry sub-sector such as Beyond Meat, Impossible Foods, and Kite Hill. All of these companies hire food scientists for a variety of roles discussed above (product development, QA analysts, sensory scientist, process developer, research scientist); generally, a technical sales position will be found in the next sub-sector, ingredient manufacturer.

Ingredient Manufacturer

As the name implies, an ingredient manufacturer produces components or ingredients for food manufacturers. This sub-sector of the food industry produces the commodity ingredients like dairy (milk, cream, butter, whey, cheese), oils (soybean, canola, olive), flours (bread flour, whole wheat, different grains), eggs, and corn component (starches, sweeteners). Equally important are the thousands of other ingredients supplied to food manufacturers including flavors, spices, colors, texturizers, gums, preservatives, sweeteners, and more; the list is huge. This sector of the food industry hires all roles indicated above including technical sales. The companies can be extremely large and global, such as Cargill, ADM, Tate and Lyle, Kerry, and Ingredion, or can be very small, specialized, and local dealing in just one unique ingredient.

Food Service

An area of the food industry that isn't as obvious for food scientists to start their career in is the food service sub-sector. Think of all the quick service restaurants like McDonalds, Wendy's, Chick-fil-A, Chipotle, Dominos, Dairy Queen, Taco Bell, and even Starbucks fall in this category. All of these companies hire food scientists to support product and menu development. There's also a need to have a robust food safety and quality assurance organization to support the company's operation and product development teams; these teams typically hire food scientists to work in a role to ensure quality and food safety programs are being followed by both suppliers and restaurants. These restaurant companies hire chefs and food scientists with an emphasis in culinary skills, who use customer insights and emerging trends to drive new ideas and products to be added to the menu.

Service Provider

The last sub-sector to discuss is one that focuses on providing special services for the food industry. These companies could be ones focused on food safety and quality assurance (conducting food microbiology studies), or they could be focused solely on product development, or the company could specialize in sensory and consumer research. Examples of these companies

include Merieux NutriScience, Covance, EuroFins, National Food Lab (part of EuroFins), Merlin, Curion, and EcoLabs (sanitation chemicals and services).

Specific Examples

Now that you're better acquainted with the roles and sub-sectors of the food industry, it may be helpful to explore some specific examples. This will give you a better idea of where your skills and interests will best fit in a food company. In no way is this an exhaustive list; it's simply a short list of possibilities. For a more detailed description of each role, refer to section four of the book where an entire chapter is dedicated to a specific job that food scientists often find themselves in.

Food Manufacturing

Food Scientist An entry-level food scientist in food manufacturing may have many different titles (food scientist, scientist, product developer, food technologist), but generally a new hire in this role will be responsible for portions of a product development project to learn how a project begins and progresses to a desired outcome. These projects could be developing a new product (a.k.a. new product development), a quality improvement (where an aspect of the product is changed), or a cost reduction (development is targeted at reducing the cost of the product). On any given day, you will likely be working in a product development lab conducting experiments, working with your R&D teammates, with occasional interaction with marketing teammates. You may also be working with suppliers of ingredients to help you with your project and you may be working with others to design sensory and consumer testing to gauge certain attributes of the product under development.

QA Analyst Every food manufacturing company that has their own facilities will have a quality assurance department and will have QA analysts who conduct a variety of analytical testing, data analysis, process verifications, and in some cases microbiological testing. On any given day working in a production facility as a QA analyst, you might be collaborating with others working in the large-scale processing and production of food and sampling in-process food to ensure it's being made according to specification. To

accomplish this, you'll be using analytical equipment (similar to equipment you used in food science labs in school), and you may be analyzing data to determine if everything is being produced according to the proper manufacturing specification and formula specification. Your team in QA will be making important decisions about shipping products out of the manufacturing plant that are safe and ready for consumers to eat (once they're purchased). You may also be evaluating the incoming lots of ingredients and packaging materials being used in production to ensure they're meeting the specification your company has developed for those raw materials. On occasion you may be called to conduct food safety and other quality system checks and audits in the plant to ensure the plant meets expectations of your company (per your food safety policies) and the FDA and USDA (per the food safety modernization act called FSMA).

The responsibility of a QA analyst is much bigger than the day-to-day testing and analysis; a quality assurance program is critical for a company to create, maintain, and build its reputation with consumers and customers. If a company has problems with, for example, foreign material in products (such as black specs from a faulty pump gasket) or massive color variation in a product each time it's made, the company's reputation will suffer. It's up to you and the QA team to hold high levels of standards of products that are released to customers to maintain and grow the desired reputation of your company.

Research Scientist Some companies have research departments that require food scientists to study aspects of food or ingredients that are more fundamental in nature. For example, you might be working at a company that makes cheese and/or other dairy products; as a result of these processes, a by-product called whey is created. It may be of great interest for the company to better understand how to utilize whey more effectively in its products. You may be asked to conduct fundamental studies on different types of whey and the utilization of whey ingredients in cheese products, nutritional dairy beverages, or baked products. The focus of your days may be very much in a lab conducting experiments both on whey and how to use it in food products. This is only one example of many.

Ingredient Manufacturer

Food Technologist As a food technologist at an ingredient company, you'll be in a lab setting working with your company's ingredients to meet a customer's needs. You may be building a unique flavor profile from scratch or matching one that's to be replicated. You could be building a new texture

system in a product that needs specific attributes for water activity control or for a certain mouthfeel. You may be partnering with your colleague in technical sales to better understand a customer's need for cost reduction in a certain type of product, which will require you to experiment with different combinations of ingredients to sample with a customers' R&D team. Many times, this type of role will work with customers to help solve problems with your customers' use of your ingredients. This could require you to travel to your customers manufacturing plants or to their R&D center to collaborate on problem solving. You may be asked to work with a process developer in your company to improve a process used at a manufacturing plant which makes your ingredients. Maintaining good records and documentation is an important aspect of your role. You'll write reports to capture the important data and conclusions of your work. These detailed records to ensure proper specification are developed to support your customers' needs when using your company's products.

Technical Sales As a salesperson for an ingredient manufacturer, you're expected to know the ins and outs of each ingredient available. Many food companies will come to you, the expert, when they're formulating a new product and ask what ingredient is best for a certain application. For example, your company may sell several different types of starches: native starches, modified starches, and starches from various food sources. Your job as the technical salesperson is to understand the needs of the customer and recommend the best ingredient. The customer may also give you certain specifications to meet, which will help you pick the most suitable ingredient. These details might include: temperatures used during processing, a certain thickness that the product needs to attain, and if the final product should be visually opaque or clear, among many other possibilities. This role requires the skills of a scientist to be combined with good salesmanship.

Food Service

Menu Development Product Developer While it may be obvious that food scientists have the skills to develop new food products, another option that is less well-known is menu product development. This type of product developer would be employed at food service companies that prepare foods to be consumed outside of the home. Typically, this role uses current trends and consumer insights to create or update a menu. If you're equipped with a culinary background, or at least have an interest in culinary knowledge, this may be a good fit for you. The role of menu product developer must balance

many different factors when creating new items such as meeting consumer expectations, considering the practicality of creating this product in a food facility, and weighing nutritional benefits while also keeping in mind the price point. A menu development product developer must have an intimate understanding of their customers and also the essence of their brand.

Service Provider

Sensory Scientist Many food companies don't have the size or scale to run their own sensory groups. Instead, these companies will contract a service provider to perform their sensory analysis. As a sensory scientist at a company that specializes in sensory and consumer research, you'll be responsible for designing and executing projects to help other companies understand and explore attributes of ingredients, packages, and food products. Understanding how to design experiments using the variety of sensory science techniques, such as descriptive analysis, comparative analysis, and time intensity studies, will aid you in becoming an invaluable asset for your customer. Your daily activities will focus on sensory test execution: helping customers design the experiments to answer their questions, setting up panels to be run, working with panel members, and analyzing/interpreting data.

Final Thoughts

Regardless of your new role, there are many common expectations a company will have of you. For example, you'll be asked to collaborate with your team and with others in your new company. Those teammates will want to hear your opinions and your perspective – so don't just think it; say it. As a new employee to the company, one of the very important skills you bring to the team is fresh creativity. You aren't influenced much by "the way we do things here," and as a result, you should question why things are done the way they are. You were hired because you have demonstrated skills to learn, and you have ideas. Those ideas aren't doing your new company any good if they stay in your head. Communication of ideas is important, and thinking through the best way to communicate your ideas so you're heard is also important. Your teammates and your supervisor are your allies in taking action on those ideas. Your company will want you to continue your learning journey by doing and by asking questions. They'll encourage you to take smart risks and to learn from your mistakes – you'll make mistakes – everyone makes mistakes; learn from your mistakes and try not to make the same

mistakes. Be creative and analytical; that's what a food science degree teaches and prepares you to do. Most of all, be curious and enjoy your job; it's the beginning of an amazing career.

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Steven Hill is currently Chief Science and Technology Officer at the T. Marzetti Company, based in Columbus OH. Prior to T. Marzetti, Steve spent almost 25 years working at Kraft Foods in R&D, specifically ingredient research and product development. He obtained his degrees at Iowa State University (BS) and University of Illinois (MS, PhD) all in food science. His greatest enjoyment, outside of spending time with family and friends, is helping others achieve their goals. Hopefully, this chapter and this book will help you do just that.

Part II
The Undergraduate Student Experience

Chapter 4
Making the Most of Your Undergraduate Experience

Christina P. Klawitter

Preparing to write this chapter on how to make the most of your undergraduate experience, the take-home message from a professional development event I attended as a student came to mind. After a week spent exploring our passions, strengths, and places we could grow, the retreat facilitator wrapped up by giving each participant a foot-long, brightly colored bungee cord. All the participants began stretching the cords in amusement as he asked a simple but profound question: *Over the next year, how will YOU stretch yourself?*

One of the great things about being a college student is that choices and chances to stretch yourself are all around. You choose which major to pursue and how much you'll invest in preparing yourself for a career in that field. You choose how often you meet your advisor and whether you approach those meetings as a box to check or as a learning opportunity. You choose how to spend your time out of class, including how much time you spend studying and how engaged you become with your university and community. You choose whether to join the club, attend the rally for justice and equity, or show up to the public talk on a topic with which you disagree. With every choice, you make the call: play it safe or stretch. It will probably be no surprise that this chapter is about how and where to stretch past your comfort zone, as a way to make the most of your undergraduate experience.

Indeed, a food science curriculum will stretch your intellect and skills as you develop the content knowledge relevant for professionals in the food science field. Faculty at your educational institution will insist on a level of technical and scientific competence. When you graduate, your knowledge of

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food microbiology, chemistry, and engineering as well as nutrition, sensory science, and business related to the food industry will be well established. By contrast, you might have to be a bit more intentional in order to stretch yourself and develop what writer/researcher Bill Coplin (2003) calls your "know how skills." In his book, *10 Things Employers Want You to Learn in College*, which was based on data from the National Association of Colleges and Employers (NACE), Coplin pointed out that grade point average (GPA) doesn't top the list of characteristics that will compel employers to hire you. Rather, your ability to solve complex problems, work with and influence others, manage conflict, think critically and ask good questions, communicate in writing and orally, work hard, and behave in principled and ethical ways will position you for success far more effectively than your GPA. Nearly 20 years later, in *NACE's Job Outlook (*2022*)* which asks employers to forecast what types of new college graduates they will hire, a very similar set of competencies top the list. Critical thinking, communication skills, and ability to work well as part of a team are standing the test of time and still top the list of most desired competencies among new graduates. Stretching yourself academically, professionally, socially, spiritually, and physically will advantage you when it comes time to convince employers you have the competencies required in today's job market. In this chapter, the experiences of Dylan, Paulina, and Jazmine, several exceptional undergraduates who made the most of their undergraduate experiences, will be woven together to give you some ideas for making the most of yours.

Stretch Outside Your Comfort Zone

Making the most of your education requires you to open and expand your mind. It requires you to push yourself to the point where you become uncomfortable. It requires you to be open to experiences that will challenge you and, in fact, might change you. Dylan wasn't sure what he would face when he decided to study abroad in Chile. It wasn't required for his major, but he saw an opportunity to stretch himself by becoming immersed in a language in which he wasn't fluent, adapting to a new educational system, and navigating an unfamiliar culture. Like Dylan, many students say that studying abroad is a life-changing event. They meet people unlike those they have met before. Their long-held assumptions about life, family, and ways of doing things are challenged. They discover parts of themselves, such as confidence and an ability to adapt, that they didn't even know existed. Doesn't this sound like something to consider?

Can't study abroad? No problem because there are plenty of chances to push yourself outside your comfort zone on your campus. Take a variety of classes on topics with which you are unfamiliar and less comfortable. Take a class just because it sounds interesting. Try subjects completely outside your major like language, culture, history, or literature. Attend campus lectures on topics beyond food science. Participate in cultural celebrations on your campus. Develop authentic friendships with people who are different from you in some way. Serve in your community.

These may not be the right activities for you, but remember that your goal in college is to become educated in the broadest sense of the word. What does being educated mean to you? What do you think being educated means to people who will hire you when you graduate? What is the most important thing you think you ought to learn while you're an undergraduate and what are you doing to make sure you get out of your comfort zone and learn it?

Maximize Your Tuition Investment and Immerse in Professional Development

Colleges and universities are rich with people, tools, and experiences, there to ensure you transition successfully from college into your career. So rich are these resources, it can be hard to figure out what to prioritize. One place to start is by learning about your strengths and weaknesses. Sometimes, this can be accomplished with some honest self-reflection. Self-assessment tools can also help and can usually be taken in career centers. Another simple idea is to ask for feedback from family, peers and advisors, professors, or mentors that know you well. Ask them what you're good at and ask them to identify skills which you could enhance. Follow that up by asking if they have any specific ideas of methods you could use to improve. Even though you should plan to repeatedly assess your strengths and weaknesses throughout your life, college is an especially good time to do this because there are so many (free) resources to help you grow and learn.

Paulina was particularly good at self-assessing and executing a self-improvement plan. After taking a Strengths Finder assessment in her career center, she explained to her advisor that her work ethic, her orientation toward goals and achievement, and her curiosity and ability to learn were the best of what she had to offer, but her communication skills and confidence, and the resultant anxiety she felt, sometimes got in the way. Paulina found a communication skill development group that met weekly through her university's counseling center. She was challenged to listen and give others

direct feedback and then had the opportunity to practice her own oral communication skills and receive feedback. She also engaged in a leadership development seminar where she identified the issues that felt meaningful to her and built her confidence for acting on them. Following this seminar, Paulina organized a service project for her student organization which benefitted from her strengths and allowed her to practice public communication of all types. These opportunities weren't required for graduation, yet Paulina saw a couple resources to help her develop and, wisely, capitalized on the richness of her university's offerings. What are your strengths and how can you further hone them? What are your challenges and what resources exist on your campus to help you?

Jazmine took a different path for professional development, engaging in several internships, each one a little different so she could explore various industries and positions within those industries. She attended all the career fairs, resume writing workshops, etiquette dinners, and mock interviews, starting as a freshman. She went to company information sessions, even when she wasn't sure it was a company of interest to her and participated in as many virtual networking and meet up opportunities as possible. She asked a lot of questions when guest speakers came to class. She developed her professional network by following up on every lead recommended to her, even if she wasn't sure it would lead somewhere productive. She wasn't focused on building her resume; rather, she just followed her professional interests and curiosities, wherever they led. This took notable effort and time, but her commitment to learning led to an impressive resume and a variety of job offers upon graduation. What can you do this semester and this year to develop a new connection, experience, or skill relating to your professional path?

Get to Know at Least One Professor

Research shows that students who are most satisfied with their college experience have regular and meaningful interaction with faculty (Light, 2001). If you're wondering why this might be, consider my observations about students who are connected to faculty on their campuses.

Students who build connections with faculty are likely to:

- Seek and receive good academic advice
- Be mentored to pursue careers that are a good fit for them
- Consider graduate school and have the confidence that they could succeed there

- Engage in mentored research projects as undergraduates
- Obtain strong recommendation letters
- Solve academic and personal problems with minimal setbacks to their degree progress
- Feel connected to their departments and universities
- Be more engaged in out of class learning activities, such as student organizations, study abroad, leadership programs

Make it your goal to know at least one faculty member before the end of your freshman year. Developing a faculty connection can help a big university seem smaller or a small university seem even more personal. You're likely to find that faculty are very interested in helping you and getting to know you, so be bold and seek those connections early.

Develop Your Leadership Skills

Dylan, Paulina, and Jazmine went to great lengths to develop their leadership potential by participating in enrichment opportunities of all kinds, including leadership retreats and courses, and workshops and conferences. They took leadership roles in student organizations, in projects at their internships, and in interpersonal interactions in their research labs. Developing your leadership skill is important because, as an educated person, you have a responsibility to make a difference, in your community, in your profession, and at your university. You *will be* called upon to lead, somewhere, sometime, and you need to be ready to be effective. You don't have to move mountains or lead a crusade, but you should think, for example, about what you can do to leave your university better than when you arrived.

The term "leadership" can be loaded with images of positional leaders with great authority demanding action. Challenge yourself to consider alternative views of leadership. For example, consider Badaracco Jr.'s (2002) claim that great leaders must not be public heroes or high-profile champions of causes. Rather, he argued that great leaders move patiently and persistently, doing the right thing for themselves and their organizations, day in and day out. Or consider the notion that leadership is really about relationships through which groups of people accomplish change or make a difference to benefit a greater good (Komives et al., 2013).

Consider the skills that effective leadership, given these perspectives, might require: self-awareness and a sense of what is ethical, solid communication skills, an ability to involve and relate to others, and an ability to

recognize important issues and develop a plan to engage others and make positive change. How could you develop some of these skills?

1. Read about and observe leadership. There's a host of books and articles written about the topic of leadership. Follow leaders you admire on social media. Seek out leaders who share your views and ones who do not. Read about and observe leaders whose tactics you admire and some whose tactics concern you.
2. Practice leadership. For example, engage in student organizations and offer to lead a service or social project. Rally a group of people to take a stand for a cause you care about. Offer to be the group coordinator for a team project in one of your courses. Suggest improvements for how your research team communicates with each other.
3. Reflect on what you did. Keep a journal or ask someone you trust to talk with you about your own lived leadership experiences. What would you do differently next time?

Summary

Even if the stories of Dylan, Paulina, and Jazmine aren't convincing, or the advice in this chapter isn't persuasive, then at least consider one of the main conclusions made by prolific researchers, Pascarella and Terenzini (2005), after more than 20 years of research on college student development. They concluded that the impact that college has on students depends almost entirely on students' effort and involvement in the academic, interpersonal, and extracurricular activities available to them. When I was a student, one of my trusted advisors regularly told me, "It's not going to come to you. You have to make it happen." Pascarella and Terenzini's research suggests that this phrase applies to your undergraduate education; not surprisingly, you must be a proactive participant to make the most of your college education.

Remember the bungee cord that prompted me to stretch myself? I still have that bungee cord hanging in my office. It serves as a regular reminder of a very fundamental lesson that applies long beyond college: indeed, we are responsible for stretching ourselves. So, what will *you* do over the next year to stretch yourself? Realizing that you have a great deal of control over the answer to that question is the first step in making the most out of your undergraduate experience.

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Dr. Christina P. Klawitter is now working as Associate Dean for student services at the University of Wisconsin-Madison. Her career path has been circuitous. She's benefitted from the help and support of many mentors and a variety of unexpectedly informative career experiences. She uses her own lived experience as a first-generation college student, who knew little about preparing for a career, to inform her advocacy for students. Wishing she'd read a book like this when she was an undergraduate, she hopes this book fills a need for students who are curious about the food industry.

Chapter 5
Campus Career Services and Centers

Jennifer M. Neef, Amanda Cox, and Julia Panke Makela

Campus career centers support the career development of students and sometimes alumni or others with a connection to campus. They may be staffed by a wide variety of personnel, including career counselors, career coaches, student affairs professionals, advisors, paraprofessionals, peer advisors, and more. Career services staff come from many different educational and training backgrounds. "Career services professionals" will be used to describe all those who provide services to students in this chapter. The Code of Ethics provided by the National Career Development Association (2015) establishes that career services professionals provide only those services that are aligned with their education, training, and credentialing.

Career services on a campus are typically structured in one of two ways – centralized or decentralized. In a centralized system, all career services offerings are provided from a single office or unit and are designed to meet the needs of every student on campus, regardless of major or year. Typically, centralized offices are supported and administered by a single campus entity, such as Student Affairs. In a decentralized system, career services designed for specific groups of students are provided by various offices or units on campus. In the decentralized model, services tend to be tied to an academic discipline, and students will find services and resources provided within their college or academic department.

Career development is a cyclical process that builds on itself and isn't necessarily linear. Campus career centers are equipped to guide you through

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the entire process and provide a wide range of services, resources, and opportunities for you to develop and use career management and decision-making skills. These are skills that you'll need and use many times during your career. The work is grounded in career development theory and shaped to fit the specific needs of students, as well as the culture of the campus. For purposes of this chapter, the career development process will be simplified and segmented into five main areas: (1) exploring self, (2) exploring options, (3) gaining experience, (4) story-telling, (5) and search, application, and transition. Your career services office can help you at any point in the process – from exploration through offer acceptance and negotiation.

Exploring Self: Your Interests, Skills, and Values

Understanding yourself is foundational to the career development process and is an important part of making sound career decisions. Taking time to explore and develop a strong understanding of your interests, skills, and values and how they intersect with your major and career will result in greater career satisfaction and meaning.

Career services professionals can help you explore and identify your interests, as well as opportunities to engage in curricular and cocurricular activities related to your interests. Taking courses and participating in activities outside the classroom will provide insight into your likes, dislikes, and preferences while uncovering new opportunities for further engagement that inform and influence your career-related decisions.

Career services professionals may direct you to interest assessments or inventories, such as the Strong Interest Inventory® (SII; https://www.themyersbriggs.com/en-US/Products-and-Services/Strong), the Self-Directed Search (https://self-directed-search.com), and others, which can be useful tools when connecting your interests to potential occupations and careers. While these and other similar assessments can be found on the web and accessed for a fee, campus career services offices usually offer them at no charge or for a nominal fee. Additionally, by accessing these tools through the career services office, you'll benefit from having a career services professional interpret the results and help you develop an action plan for next steps.

Identifying the skills you have, the skills you enjoy using, and the skills you want to build is important in preparation for career success. Your food science coursework provides opportunity to build your skillset that's specifically required for a career in the food and beverage industry. You don't need

to have a confirmed career or occupational goal to begin identifying and building transferable skills such as communication, leadership, teamwork, technical, and interpersonal skills. Working through a motivated skills exercise with a career services professional can help you classify skills on a confidence-enjoyment matrix. Choosing an occupation or professional path that calls upon your strongest skills and competencies, as well as the ones you enjoy using, will likely result in greater professional motivation and success.

Identifying your personal values as they pertain to a career, referred to as work values, is also an important part of self-exploration and discovery. Work values are connected to how you feel about your job and relate directly to the tasks associated with a specific occupation and the conditions or settings that are inherent with that occupation, such as work environment, salary, upward mobility, geographic location, work schedule, service to others, contribution to society, and recognition. People usually feel satisfied and successful when their job aligns with their work values. For instance, you may choose a career in product development because you value a research-based position that utilizes your creative ability. To be satisfied with this choice, you must also accept that you'll typically work indoors in a lab setting with regular hours, likely be required to have an advanced degree, and need persistence to achieve results.

Determining your values requires much thought and self-assessment. Career services professionals can guide you through activities that will help you identify and prioritize your work values. They may guide you through activities, such as values card sorts, to help you identify and prioritize your values. Otherwise, they may use a narrative approach by asking you to reflect on people, places, ideas, causes, or things that are important to you. As they listen to you reflect, they are able to help you identify themes and patterns that are consistently part of your narrative. Your values may be influenced by your family, loved ones, home community, culture, identity, previous experiences, and many other factors. Also, they may evolve as you gain exposure to new opportunities, perspectives, and ideas on campus and over your lifetime.

Exploring Options

Exploring the many occupations and career paths in the food and beverage industry is part of your career development journey. This book is an excellent place to start exploring your options, providing detailed information

about 15 career options that are specific to the food industry. You can gather general information about specific occupations through O*NET Online (https://www.onetonline.org/). It's an interactive database that allows you to search specific occupations or to find occupations based upon your interests. Search results also include a list of related occupations which enable quick analysis and comparison of many occupations. Another useful online resource is the Occupation Outlook Handbook (OOH) (https://www.bls.gov/ooh/). It, too, is an easy-to-use, searchable, online database that provides information about hundreds of occupations. Both O*Net Online and the OOH provide general information about job responsibilities, earnings, education requirements, employment outlook, and more. Both resources are regularly updated and are provided as a service of the US Department of Labor. Industry-specific resources and related professional associations, such as CareersInFood and the Institute of Food Technologists (IFT), also provide valuable information about careers in the food and beverage industry.

With a narrowed list of potential careers, you may want to seek more in-depth occupation information. Valuable information can be gleaned from someone performing an occupation of interest. Job shadowing programs, externships, and informational interviews provide a realistic snapshot of what a particular occupation is really like. Attending employer information nights and career fairs are also great ways to learn about occupations and career paths with specific employers.

Job shadows and externships are usually one-day to one-week long programs that pair students with a professional in their field of interest. Through these experiences, you gain exposure to careers and workplaces while learning about the daily responsibilities of a job. They also provide great networking opportunities as you'll likely interact with various people throughout the duration of the program. Sometimes, more formal work experiences, such as internships, are derived from job shadowing or externship programs.

If a campus-sponsored job shadow or externship program isn't provided, you can create these opportunities for yourself by arranging an informational interview. An informational interview is an information gathering session – not a job-seeking session. You arrange an appointment with a professional of interest and ask questions about the profession. The informational interview itself isn't long – maybe 60 minutes. However, it takes considerable effort to identify a list of professionals to engage; develop a list of questions; arrange and confirm the date, time, and details of the meeting; etc. Career services professionals can help you prepare for an informational interview and identify professionals to interview. Alumni and contacts garnered through a professional organization, such as IFT, LinkedIn, or alumni organizations, are usually great candidates for an informational interview.

Gaining Experience

While completing a degree in food science provides you with the core technical knowledge and skills required for a career in the food and beverage industry, experience beyond the classroom is important and provides opportunities to build other competencies required for career success. IFT developed a list of essential success skills that are required for all roles in the industry:

- Communication skills, which are defined as oral and written ability, listening, interviewing, etc.
- Critical thinking/problem solving skills, which are defined as creativity, common sense, resourcefulness, scientific reasoning, analytical thinking, etc.
- Professionalism skills, which are defined as being ethical, having integrity, respectful of diversity
- Life-long learning skills
- Interaction skills, which are defined as teamwork, mentoring, leadership, networking, interpersonal skills, etc.
- Information acquisition skills, which are defined as written and electronic searches, databases, Internet, etc.
- Organizational skills, which are defined as time management, project management, etc.

These success skills can be developed by gaining experience through campus-based professional and social organizations and student clubs, part-time employment, and internships. Career services professionals can direct you to specific organizations and campus activities. Student employment and part-time jobs off-campus provide another avenue to advance your career success skills. Industry-based internships provide an opportunity for you to apply the knowledge and skills you have gained through your degree program. They will deepen your technical skillset and enhance your knowledge of career options. They may also uncover gaps and areas of growth in your core technical skills – which is also a benefit of an internship. If you know you have a gap, you can take action to remedy it. Your career services office can help you find and apply for part-time jobs and internships.

Gaining experience outside the classroom while earning your degree in food science enhances your ability to land a job of your choice. As reported by the National Association of Colleges and Employers (2021) in their Job Outlook Survey, employers indicated that internship experience, holding a leadership position, and having general work experience are influential factors that affect their hiring decisions. Like other employers in technical

fields, food and beverage industry employers assume that graduates with a degree in food science have the technical skills and knowledge required to perform tasks associated with the role. After meeting initial educational and knowledge qualifications for a position, hiring decisions are influenced by experiences outside the classroom and evidence of competencies that are required to be successful in the world of work and experience.

Telling Your Story

Learning how to share your qualifications, skills, competencies, and professional interests via resumes, cover letters, online profiles, and application documents, as well as in interviews, is crucial to your career success. Career services professionals can help you be well-prepared to share your story with a variety of audiences in multiple formats. Your career services office may offer workshops to help you develop skills to write your resume, cover letters, and LinkedIn profile.

Workshops on resumes, cover letters, LinkedIn, or other similar platforms are typically designed to teach the basics of sharing your story. They often cover format, content, use of powerful language, and other general information. If you've already written a resume or created an online profile, you may be ready for a one-on-one review and conversation about your documents and profile. The review is more than a simple proofreading or editing exercise. Career services professionals can help you effectively and efficiently describe your experiences and competencies with a particular audience or purpose in mind. They seek clarification and details about experiences, both those listed and not listed. After the conversation, you may decide to reformat your document to emphasize and showcase your most relevant experiences, skills, and qualifications. You also may decide to delete some content or add something new. A one-on-one review provides you an opportunity to ask specific questions that cannot be appropriately or adequately answered in a group workshop setting.

Sometimes, career services offices provide students opportunities to have resumes reviewed by industry recruiters. This is an opportunity that shouldn't be missed. Garnering advice from a recruiter involved in the hiring process is invaluable. After several resume reviews, consider the comments of each reviewer and then decide if changes are needed. Remember, resumes are a representation of your unique qualifications and competencies – not a representation of the reviewers' opinions. Also, before paying for a resume review by an "expert," wisely consider what is received for the money. Is the paid

"expert" going to provide any insight beyond that from career services personnel on campus?

If you struggle to write a resume because you believe that you have no experiences worthy of being listed on a resume, an appointment with a career services professional is encouraged. Resumes showcase transferrable skills, wherever they are gained – in work experiences, student organizations, class projects, volunteer and service opportunities, etc. Your career office can help you find meaning and relevance in the variety of experiences you have.

Many career services offices offer mock interviews. Take advantage of this opportunity if it exists on campus. Mock interviews are typically focused on preparing you to respond to commonly asked interview questions, such as "Tell me about yourself," or behavioral-based questions designed to assess career readiness competencies that are required for success in the workplace, such as communication skills, problem-solving ability, leadership, teamwork, etc. Additionally, mock interviews may include technical questions related to knowledge of a specific role. While the mock interviewer may not have expertise to provide specific feedback on the in-field content of your response, they can offer guidance on response strategy, as well as clarity of your answer, nonverbal cues, and other characteristics of your reply. Mock interviews that are recorded may be especially beneficial given the increasing prevalence of interviews conducted remotely and/or asynchronously. While reviewing the recording may be unsettling, it can be incredibly insightful and useful to improving your interview skills. In addition to mock interviews, career services offices provide other interview preparation resources:

- Dressing for an interview
- Sample interview questions
- Sample questions to ask the interviewer
- Preparing to respond to behavioral-based interview questions
- Case interviews
- Second-round interviews or on-site visits
- Handling illegal questions

Search, Application, and Transition

Searching and applying for opportunities is time consuming and requires perseverance. Everyone's search is unique, and, therefore, it's important to identify the resources and search strategies best suited for what you're

seeking. Also, learning when and how employers recruit for entry-level talent influences the timing and tools needed for your search. Many career offices also provide assistance and resources for students who are searching, applying, and transitioning to graduate or professional school. Career services professionals can help you identify and prioritize the search strategies and tools that are aligned with your goals – either employment or an advanced degree.

Many career services offices devote significant resources to fostering relationships with employers and coordinating events and opportunities for them to recruit students for internships and jobs. The types of employers that participate in on-campus recruiting (OCR) tend to be large corporations that devote significant time, financial resources, and human capital to campus recruitment efforts. The amount of resources devoted to OCR is often related to the number of hires, both intern and full-time, that are targeted. Smaller employers within close geographic proximity to campus or those with strong allegiance to the institution may also likely be involved in OCR.

If you're enrolled at a university with robust employer engagement and OCR activity, your career services offices may host career fairs held in-person or virtually. Regardless of the format, career fairs can be scary and overwhelming even for the most confident student. Career services professionals guide your preparation and help you devise a plan to be successful at the fair.

When preparing to attend a career fair, first decide why you are attending the fair. Are you seeking to work in a role that a participating employer is recruiting for? Do you want to explore what opportunities may be available for you? Are participating employers recruiting for internships that are aligned with your interests and will further develop your knowledge and skills? Are you seeking a new connection at an employer of interest? Then, prepare to attend with your goals in mind.

Career services offices usually provide the list of participating organizations and the positions they are seeking to fill well before the fair. Research the ones that interest you. Update your resume and have it reviewed. Make a plan to have meaningful conversations with organizations that interest you. Career services can assist you in developing your professional narrative, sometimes referred to as your pitch, for a career fair setting. Prepare questions for each of the employers. Be sure to include customized content related to the research you did on the participating employers. If you're seeking an internship or job, indicate why you're interested in their role, along with the qualifications and competencies you possess that are needed to be successful in their role. For in-person fairs, gather items to take to the career fair, such as portfolio with notepad and pen, copies of your resume, and research notes on the companies. Plan your attire for the event.

Preparation for virtual career fairs is similar, except for needing copies of your resume. In a virtual format, you may have to pre-register to attend the event and sign up for individual or group sessions with employers of interest. Also, be sure to have a digital copy of your resume at your fingertips and be ready to share your LinkedIn or other professional profile. Regardless of format, determine if companies are holding pre-fair talks or events on campus and get a head start by learning about companies and meeting their recruiters before the fair.

Beyond the career fair, there may be other valuable opportunities to engage employers, including informational meetings, career workshops, and class presentations. All of these may be held physically on-campus or virtually. Take advantage of opportunities that career services offices provide for you to easily engage employers, whatever shape they take. They offer excellent opportunities to learn about careers and network with professionals.

Some employers may have limited campus presence and only engage via job postings. Therefore, it's important for you to understand the job posting system on campus. Is there a single campus-wide job board or is accessing more than one board required to see all the positions of interest? Whatever job boards exist on campus, you can be certain those position announcements only represent a fraction of opportunities that are available. Career services professionals can recommend job search resources and techniques, beyond the campus job posting system, that are aligned with the type of opportunity you're seeking.

Networking is another important aspect of searching and applying for opportunities. Some students find the idea of networking to be awkward or intimidating. Keep in mind that you already have a network – your friends, peers, professors, previous employers, and social media contacts. Don't forget your family and friends of your family. Networking is the process of building mutually beneficial connections with others. It can be extremely useful to acquire information, advice, and referrals about careers, industries, internship opportunities, and job prospects. Networking works best if you try to focus on getting advice from the life experience of the individual rather than asking for something like a job or internship. Use your network throughout your search – let them know what you're seeking, reach out to connections at employers of interest, connect recruiters to seek advice on preparing for interviews, and much more.

Alumni from your school may be a beneficial source of information and assistance. Ask career services professionals about effective ways to find alumni who may be interested in supporting you. There may be campus tools that make finding and connecting with alumni easy. Career

professionals can also teach you how to use social media to develop alumni connections for career networking and mentorship. Participating in career fairs and networking events provided by your school is an excellent opportunity to engage with interested alumni.

After your hard work results in an offer, career services professionals can help you understand and evaluate your offer, as well as negotiate certain aspects of it. There are many aspects of an offer beyond starting salary. Monetary benefits include your salary, as well as bonuses, commission, profit-sharing, stocks, and contribution to a retirement plan. Other aspects of an offer include insurance benefits, relocation assistance, tuition reimbursement, vehicle, start date, paid time off, and much more. When you get an offer, take time to understand the full value of your compensation package. Ask questions if you don't understand any part of the offer. Prior to accepting an offer, do research to determine if your offer is commensurate with your qualifications, is aligned with norms for the role and industry, and reflects the cost of living where you'll be employed. Then, assess if you are well positioned to negotiate your starting salary or other aspects of the offer. Career services professionals can guide you through the negotiation process.

Even after you've landed your first job and successfully transitioned from campus to the world of work, the career development process continues. Throughout your career, your professional interests and values may evolve. You will gain new technical knowledge and skills. The industry will change, and new roles will be created. There will be opportunities for lateral moves and promotions. For a variety of reasons, you may need to seek a new opportunity with a different employer. Your career holds more possibilities than what can be imagined.

Engaging with your career services office provides opportunity for you to learn career management and decision-making skills that you'll use for a lifetime. Learning about and engaging in the career development process with the guidance of a career services professional have value long after you leave campus. Career centers help you gain skills to know when a career change is needed, how to make a career change, and where to seek help when the time comes.

Summary

In conclusion, career services professionals understand the career development process and are available to guide and walk with you along the way. Establishing your career goals based upon your interests, skills, values, and preferences and exploring occupations and career paths are foundational to

the career development process. Career services offices can help you create a plan to acquire the educational qualifications, experiences, and core competencies required to successfully pursue your career goals. You're responsible for making your own career decisions. Career services professionals will not make a decision for you. They will not tell you which options or decisions are right for you. They get to know you and provide information and resources best suited for your specific situation. They help you make informed career decisions and build strong career management skills that will be used over and over throughout your career. Your career services office wants you to be successful. They are available to help and provide a plethora of resources and services at each step of the career development process. Take advantage of them!

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Jennifer M. Neef has spent her career helping students learn from and leverage their personal and educational journeys as they choose their professional paths and prepare to launch successful careers. Serving as Director for the Career Center at the University of Illinois Urbana-Champaign, many unexpected opportunities, experiences, and people have supported and informed her career decisions and professional growth over the last 20 years. She hopes students embrace all of the planned and unplanned turns in their journeys and see them as the chance to do something extraordinary.

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Chapter 6
Professionalism and Leadership

Steven Hill

Transitioning from college to your first job may seem like a straightforward move. However, going from studying all the time to doing a full-time job is a challenge for everyone new to a job. Making this change from student to professional can be facilitated with preparation and can help avoid some missteps. When you enter a new company, there'll be a company culture that dictates how things are done, such as how employees dress for work, typical work hours, balance between remote vs. office work, how to run a meeting, and many more. These may be written down in the form of an employee code of conduct, or they may be part of a large set of "unwritten rules" of how employees operate within that company. This chapter will deconstruct four broad areas of professionalism to give you insight on how to both prepare for your first role at a company and help you during the early stage of your career.

Many of these facets of being a professional are common sense – be nice to others, look people in the eye, and tell the truth – but others need to be explained more for better understanding and application in the workplace. The four areas of being a professional are the following:

1. Establishing a reputation (appropriate behavior in the workplace) – in many cases, it's easier to discuss what's generally considered not appropriate to understand what's considered acceptable. The culmination of all the good and bad impressions you make on others is how your reputation is built.
2. Building credibility (being reliable and responsible) – consistently delivering against expectations builds credibility.

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3. Success in your job (having the right knowledge and competence) – master the fundamental technical and leadership skills to give you early career success.
4. Integrity – how you behave when no one is watching. This is deeply rooted in your values.

Establishing a Reputation – Appropriate Behaviors in the Workplace

What some consider appropriate in the workplace, others may not. What may not have been appropriate 20 years ago is widely accepted today. As an example, in January of 2020, working remotely for most employees wasn't considered appropriate for their job. Conducting meetings remotely was rarely the accepted way of working. Today, in 2022, these remote working conditions are considered appropriate. Different times create different circumstances that form new norms around what's appropriate for the workplace.

What to wear to work can be another example of making good and not so good choices. This is a daily challenge for some, but for others who've enjoyed working remote or from home, the challenge isn't as great. The reality is people do work in offices and in other professional settings, and there's usually an expectation that employees won't come to work every day in baggy sweatpants and T-shirts. It may work in college, and in some start-up company cultures, but depending on your work situation after college, you need to understand the expectations of what to wear. Remember, you only have one chance to make a first impression, make it a good one. Since the early 2000s, companies have increasingly adopted a "dress for your day" approach for what to wear to work. This is a relaxed form of a dress code and allows you to decide what your appropriate attire is based on your day – are you working in a lab or in a manufacturing plant today, or are you meeting with customers or senior management from your company? Each day will dictate how you dress. The bottom line is that the business casual approach to workplace attire won't kill your budget and will give you flexibility on personal choice. Baggy sweatpants and T-shirts are probably not the solution.

A question you may not have thought about in terms of unwritten rules at a company focuses on your cell phone. Smartphones are a way of working; everyone has one and uses them daily at work. The justification for you having the company pay for a phone is clear – a cell phone makes you more productive; it connects you to others at work and provides instant access to work-related information. However, a cell phone can also be a distraction. It's up to you to use the phone for its job-related benefits. Ask your coworkers and manager if texting them and others in the company is common, or if

other instant messaging platforms are used for communications. You want to be using the communication tools appropriately and effectively. Most people have a habit to use their phone often, carry it around, and respond to texts immediately. At work, there's a time and place for phone use (text or talk), and there are different degrees of need to respond. Try to filter the important but not urgent, the urgent but not important, and the urgent and important. For example, if your boss texts you with a question, that may fall into the urgent and important; it needs a fast response; if a friend is asking about an event over the weekend, it can likely wait a few hours. When you're in a meeting at work, turn your phone over and turn off the sound. Engage in the meeting, not your phone. Remember the company is paying you to be at that meeting, not thinking about the texts, tweets, and snaps that are pouring into your phone. Stay focused on what's important in that moment at work.

One of the most common phone-enabled distractions at work is social media. Many studies have documented the massive loss of worker productivity due to black Friday, the NCAA basketball tournament, the day after the Super Bowl…the list goes on; however, few studies indicate how much productivity is lost at work due to employees tapping into social media during the day. Resist the urge to engage in your personal life while at work. Of course, there are always exception to this – family emergencies, major events in life, and personal health, but, generally speaking, managers frown upon employees spending time on social media when at work. Tapping into some site occasionally isn't a problem; however, the chronic abuser of company time being spent on nonwork-related social media is a problem. Many companies will track use of company hardware to access social sites – be aware. If you're called out for spending too much time on social media during work, you'll likely get a warning and be told to stop visiting these sites. If your manager has to continue to talk to you about this behavior, you'll likely be looking for other job opportunities.

Emails are a form of workplace communication that can be misused and found to be inappropriate. Typically, emails are just fine to send useful information and connect with other employees. A fun book to read is called *Send*, by Shipley and Schwalbe. This book is full of practical tips and funny stories about emailing at work. A quick search of YouTube on "email etiquette" will bring you to short (3–5 min) videos of how to best utilize email as a communication tool. Some of the bad behaviors people use while emailing include: writing lengthy emails with unnecessary information and sending emails with many misspellings and with awkward sentence structure. Do you know the saying "measure twice, cut once"? It also can apply to good emails, as they are usually a result of think twice, write once. Other misuse of the email is using it as a conversation, rather than a phone call or face-to-face discussion. Word selection and tone of a message can be difficult to understand at times, and this is where questions about appropriateness can arise. There's also the "oops" email – an email sent to the wrong person, or with too strong

language, or some other aspect that makes you think "I wish I hadn't sent that." Here are two tips to help you ensure your emails are sent as intended:

1. Put a three-minute delay on sending emails; that allows you to stop the sending right after you push "send" and you suddenly realize you made a mistake.
2. Wait 2 hours before replying to an email that makes you mad, upset, or some other form of anger. Rarely do you send the best reply to these emails when you write a response in the 1 minute after reading it. Pause and take a deep breath; it may be better to talk to the person sending the message rather than replying with a tersely worded email.

Writing good effective emails probably will not get you noticed. Writing bad, poorly worded, or inappropriate emails will get you noticed but for the wrong reasons. Another visible trait that others notice is your body language.

Your body language can say much without you verbally saying anything. Your stance can say whether you're listening or not and if you're believing what they are saying or not. One simple way to say you're paying attention is through eye contact. When people avoid making eye contact, others notice and question why. However, holding eye contact says "I'm listening; I'm engaged." Along with eye contact, pay attention to other factors of your body language. Crossed arms, facing away from a person, not talking directly to someone, or slouching can make you appear disinterested. If you aren't careful, your body language could ruin trust-building efforts with a coworker or team. To show you're engaged in the conversation, try turning toward the speaker or leaning in toward them during your conversations. You can also nod slightly as they speak to show you are listening to what they have to say. By making eye contact and being careful with your body language, you can say much without actually saying anything.

The culmination of all the good and bad impressions you make on others is how your reputation is built.

Building Credibility – Being Reliable and Responsible

Being considered reliable and responsible are elements of a person's reputation that are built through repeated consistent behavior. Reliable employees don't call in sick when they're not. They don't take time off when they know timing is critical to finish a project. They don't come in late to work whenever they feel like it (and don't make up the time). They don't use "working from home" as a day off. They keep their word. They're productive and helpful. Reliable employees show up on time for meetings. They contribute while attending a meeting. They step up to volunteer and step in to help coworkers. They're cooperative.

Being reliable doesn't mean you prioritize your work or your job above everything. It doesn't mean you work the most hours or crazy long hours. That doesn't define being reliable. If asked by your manager to take on an urgent task or provide some data, let your manager know when you can do it and deliver against the request. Being reliable means you have a track record for doing what you say you'll do but with realistic understanding when you can do it. Providing accurate timing to a request is critical to being considered a reliable, responsible employee.

Agreeing to get something done and then delivering against that agreement is what defines responsibility. Repeated success in taking responsibility and delivering expected results is how you build credibility as an employee who can get work done – an employee who reliably delivers against agreed responsibilities. One common approach used in companies is for employees to write annual goals for what they'll accomplish over the next 12 months. The employee agrees to the delivery of specific results over a certain timeframe. Responsibility is demonstrated by the employee when they successfully build a plan to accomplish the goal and deliver the desired result.

Occasionally, the result cannot be delivered for some reason. It may be that that a mistake was made. You've heard the phrase "nobody's perfect"; well it's true. Everyone makes mistakes. Some don't admit they screwed up, but everyone makes mistakes. Being able to admit your errors and communicating this to those impacted by the mistake demonstrates you taking responsibility and "owning the result". It is critical to building your credibility and keeping others' trust in you. Building a positive reputation helps create credibility that you deliver results, which in turn earns you trust from others. Building trust doesn't mean you never make mistakes. Having things not turn out as planned will happen. If you never make mistakes, you're not taking risks, not pushing yourself or challenging yourself to achieve results above what's expected. When you make a mistake, admit it, own it, and learn from it. Here are some simple rules to consider:

1. *Learn from the mistake*. As long as you make original mistakes and don't repeat the misstep, you're demonstrating that you're pushing your limits…maybe you're trying to do something faster or more efficiently or you took a different approach to solve a problem but each resulted in a mistake. At least you were trying to do something different and, importantly, you understand and learned what didn't work, so you won't make the same mistake in the future. It's an original mistake not a repeated mistake. Repeated mistakes indicate you didn't learn the first time.
2. *Communicate the mistake and the consequences to those impacted by the mistake*. Bad news doesn't get better with age and often doesn't just go away. If something needs to happen in response to a mistake you identified, speak up and tell others. Take responsibility for your work and your

mistakes. It may be uncomfortable and make some people concerned, but you can rest assured waiting too long to inform others about a mistake may be your second mistake.
3. *Don't blame others for your mistake*. Own your results and actions. Often when something doesn't work out or things go wrong, fingers are pointed. Rather than using fingers, use your thumb and say "I did this" or "I could have done better by…." No one likes a finger pointer, especially managers. Sometimes it's better to swallow your pride and take blame when it's your blame to take.
4. *Offer options to correct the mistake*. Owning up to a mistake and communicating the mistake are steps one and two, but step three is often overlooked – that's providing options, ideas, and solutions to fix the mistake.

Success in Your Job – Knowledge and Competence

Early career success in a technically focused job requires many skills and capabilities built up over time. Technical competencies are practical skills and knowledge used for delivering against expectations in a technical job. They're usually obtained through academic and short course type training, technical mentorship, and on-the-job learning. Other types of skills are usually called leadership competencies or behavioral competencies. These refer to the observable behaviors and skills that matter most for success at work to make a meaningful impact.

Learning and applying the technical skills needed for your job is straightforward. What you learned getting your degree in college coupled with training at your company are the foundation for this technical knowledge and knowhow. Technical mentoring from coworkers more experienced is also a valuable source of knowledge building.

Fundamental career leadership competencies that are important to understand and develop include being organized and action oriented (taking on new opportunities and tough challenges with a sense of urgency, high energy, and enthusiasm), having the drive for results (consistently achieving results, even under tough circumstances), and being able to communicate effectively (developing and delivering communications that convey a clear understanding of the unique needs of different audiences). One job function that integrates all these competencies is organizing meetings.

What's difficult about organizing and running a meeting? Simple, right? Then, why are so many meetings a waste of time, with attendees not knowing why they were invited to the meeting with no purpose or stated desired outcomes? How to avoid the worthless meeting? Plan in advance, prepare your attendees, and organize the outcomes with a bias toward action. When

you schedule a meeting, make sure you understand the purpose of the meeting, and then let your attendees know that purpose so they can prepare appropriately. Build an agenda and stick to it; use allocated time for each topic and keep an eye on progress vs. time (assign a timekeeper). When discussion drifts off topic, steer it back to the agenda to ensure you accomplish what you want in the meeting. If a decision is needed, make sure everyone understands this and drive toward that decision. Take notes (assign a scribe) to document the meeting and send to attendees after the meeting. Leave the meeting ensuring everyone understands what was accomplished, what decision was made, and who has what follow-up due by when (this is called the action register). Also, importantly, send meeting notes out within 24 hours. Planning, preparing, and organizing for a successful meeting will build your reputation as someone who understands the value of well-run meetings.

Below are some tips to use for planning and running meetings:

- Email agenda 24 hours in advance
- Arrive 5 minutes early (also known as being punctual)
- Share all relevant data before meeting or at meeting
- Start and end on time
- Stay on topic
- Be brief and concise
- No side conversations
- Silence = agreement
- Follow-up/notes/action register sent within 24 hours

Questions to prepare for the meeting and build the agenda:

1. Identify your desired outcomes for the meeting (decision, problem to be solved, ideas, clarification, support).
2. Why are the outcomes important to the meeting attendees or other stakeholders?
3. What are the things the meeting *is not* going to cover?
4. What are the consequences of not achieving your desired outcomes?
5. Can you achieve your desired outcomes without a meeting?
6. Invite the people who:
   (a) Have the right expertise or decision making authority.
   (b) Are directly affected by the outcome.
   (c) Provide the information for the decisions.
   (d) Offer input for meeting success.
7. What information can be shared prior to the meeting?
8. Is the meeting room the right room – presentation compatible, Wi-Fi/webcam connected?
9. What topics will be discussed and is there enough time to discuss?

10. Do you anticipate any conflicts among participants or individuals with strong opinions (how to best manage the situation)?

Meetings are excellent ways to demonstrate leadership competencies. If the meeting is technical in nature, then you have an opportunity to also demonstrate your technical understanding and knowledge during the meeting. Organizing and leading a meeting is also a way to learn. Don't expect every meeting to go as planned. If things don't work out, use it as a lesson learned and improve the next time you're in that situation. Continual learning is the underpinning of success in your job and career.

How to Act When No One Is Around – Integrity

Recently, the term *integrity* has been used to describe some bad behavior of chief executive officers (CEOs) and chief financial officers (CFO). The stories that show up in the nightly news illustrate where executives demonstrated poor judgment and the lack of integrity. However, what exactly does "integrity" mean? A simple way to think of integrity is how you behave when no one is watching. Do you follow ethical principles in all aspects of your life – in decision-making and how you interact with friends, family, and coworkers? There's no faster way to demonstrate a lack of professionalism than to operate without integrity. Here are several characteristics demonstrated by people with integrity: grateful, respectful, honest, trustworthy, responsible, and helpful.

Say thank you This may seem obvious, but sincere communication to indicate your thanks can go a long way in others becoming more open and trusting of you.

Be respectful of others People with integrity value other people by showing them respect at work. They show up to meetings and appointments on time; they meet project deadlines and pay attention to the feelings and emotions of others. How you respond to other's ideas also says much about your level of respect for them. You don't need to agree with everything others bring to you, but how you disagree will say much about the level of respect you have for that person.

Tell the truth This is simple. Tell the truth, even when that truth may be uncomfortable; in the end, it will keep you out of trouble. Usually, one lie leads to another and another.

Keep your promises This is a straightforward concept – if you promise to do something for a team, a coworker, or your boss, then follow through and

deliver on the promise. There's a phrase commonly used in business: "under promise, over deliver." This means be conservative in what you promise and be careful not to overcommit. Overcommitting may impact your ability to deliver what you promised. Consistently doing what you say you'll do is a fundamental aspect to building trust.

Help your teammates Having a full-time job and a life outside of work creates a busy schedule. At times, your coworkers may need help. Being a person others can count on to help with a project or a task goes a long way in building trust and is the right thing to do.

Admit mistakes Have you seen that person who never seems to take blame for a mistake? They happen to be that one rare person that's perfect. Ha, that person doesn't exist; no one is perfect. Being able to admit mistakes and owning results demonstrates that you're accountable for your work and won't hide when things don't go according to plan. People notice when you own your results and take blame for mistakes, and they give you credit for being honest.

Keep confidences – don't share secrets Being told something in confidence, and holding that confidence, can be difficult. People gossip and things slip out. However, betraying a confidence can have devastating, long-lasting effects. Breeching a trust says something about your integrity (or lack of). Resist the urge to communicate something you shouldn't be sharing.

Pulling It All Together as a Professional – Building Trust in the Workplace

Acting in ways to build the reputation you want and gain the credibility for success in your job will contribute to the level of trust placed in you. Rarely do people get trained on how to build trust. It just happens, or it doesn't. As you gain experience in your career, you'll find trust is a great asset for being a successful professional. Employees don't want to work with or for those they don't trust. In Patrick Lencioni's classic field guide titled "The Five Dysfunctions of a Team," he describes trust as the most important quality for a person or team to be successful. You can control if you're trustworthy by acting in ways that inspire others to trust you. The four pillars discussed in this chapter will aid you in establishing trust. Trust is built in small moments that happen every day; you need to be aware of those moments, so they don't pass you by.

Understanding there are unwritten rules on how to act and behave in your company takes time to digest and requires you to pay attention and ask

questions. Doing so will help you build your reputation early in your career. As stated earlier, the culmination of all the good and bad impressions you make on others is how your reputation is built. Being the person who dresses for their day, responds to emails and texts appropriately, pays attention in meetings and in work groups, organizes well-run meetings, learns from mistakes, and acts with integrity when no one is around goes toward creating a favorable reputation, establishing credibility, and earning trust from your coworkers and managers. This also builds your reputation as a leader. When you join a new company for your first job, you'll probably not be thrust into a traditional "leader" role, meaning you'll not be expected to lead others; rather, you're expected to lead yourself. You're establishing yourself as an employee who's dependable, who can deliver results, and who can step up to a challenge, and importantly you're becoming someone who can be trusted.

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Chapter 7
Is Food Science Right for Me? The Transfer Student

Zoe Sullivan Atkins

Do you stay up late at night wondering how Ben & Jerry's can so reliably deliver the perfect number of cherries and dark chocolate pieces in every pint of Cherry Garcia right when you need it most? Does this concept seem outlandish? Asking yourself questions like these may indicate whether transferring into the food science major—even if you find it late—is the right choice for you.

Finding Food Science

Food science is much harder to happen upon than many other majors. By the end of high school, students have typically had science classes in physics, psychology, chemistry, and biology. They've most likely heard of other less common avenues they could pursue in the science field like geology or even entomology. When I was in high school, I nearly stumbled upon food science when I asked my chemistry teacher, "who invented the artificial banana flavor in Laffy Taffy?" My teacher supposed some sort of chemist was behind the flavor. Now, I know it was probably a food chemist with an impressive background in both organic chemistry and food science.

Questioning teachers, or even friends and family, is a common way students discover food science. Others may come upon food science as they peruse the list of majors on college websites while searching for an area that

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sounds interesting. Some people wind up finding food science in multi-major classes (like nutritional science or introductory chemistry) just by talking to food science students. In my case, I went to the Majors Fair and visited all the booths until finally talking to a group of food science students and an advisor. It was there that I learned of the University of Wisconsin-Madison's Food Science Club, which had an executive board member dedicated entirely to outreach to help others find food science.

When people discover food science while already in college, they might find themselves wondering if it's worth the hassle of transferring into a new major. While each situation is different, transfer students typically experience challenges when switching education tracks. For example, students might have to spend more time in school (longer than the traditional 4 years) and spend more money on tuition. This might also lead them to enter the workforce later in life, taking them longer to start earning a salary. It could cause them to have to adapt to an entirely new environment and make new friends. For some, transferring and changing course in the middle of pursuing another major might make them feel perpetually behind.

Even with all the challenges of transferring into a new major, many people who find food science later than others take on the challenge of transferring because they know it'll be worth it in the end. It usually means pursuing a field of deeper and more genuine interest. It almost certainly means the transfer student can enjoy knowing they'll have the potential to have a fulfilling career where they can make a lasting, meaningful difference. Transfer students to food science will find themselves a member of a small and supportive community. They may even be more valuable at the end of their college career, having a more varied background than peers. The food science program provides hands-on and job-specific training with eating as a learning requirement. Although there are many factors to consider when making such a big decision, graduated food science transfer students don't seem to regret theirs.

These decisions can be made easier by consulting others and utilizing campus resources. It can be helpful to go directly to a group like Cross-College Advising or advisors with expertise in the majors of interest. One of the most helpful resources can be the food science community, where students in all majors are welcome to join Food Science Club, Product Development Teams, or College Bowl. Additionally, professors are always willing to provide information about their research and offer words of advice. Conducting all sorts of informational interviews can help students understand what they might expect in their studies and future careers depending on the major they choose. Many campuses even have networks of alumni who have volunteered to be contacted by students for this exact purpose. Of

course, it's never a bad idea to reach out to trusted friends and family for their advice – but looking inward can be just as important.

My Personal Transfer Story

I began my freshman year at the University of Wisconsin-Madison studying chemistry. It was the class I looked forward to the most in high school. There was always an answer to "why?" unraveling the underlying magic of everyday happenings. Yet, I found college coursework dry and uninteresting, struggling to envision a fulfilling career.

I reached out to my general chemistry professor for his advice. In response to my uncertainty, he explained many routes I could take with a chemistry degree and the resources on campus I could use to find my niche. I listened on the edge of my seat, to the vision of his research group on campus and the meaningful achievements they'd made. However, still, it felt like there was something missing; I was aware of a plethora of opportunities and resources available to me, but each one registered as work. I felt lost and concerned I'd be spending money and years learning skills and material I wasn't completely passionate about.

Feeling uncertain about my decision to pursue a career in chemistry, I biked to the Majors Fair to explore other options. I perused the booths, asking questions as I went. However, it wasn't until I passed a booth labelled "Food Science" with M&Ms on the table and two students on either side that I got excited. The students described the experiences they'd had in the food science program and their summer internships in product development. They gave me an elevator pitch for the major and I was hooked. I thought, "it's still chemistry... but with food!" I enrolled in Food Science 201 (the first course in the program), joined a product development team, joined College Bowl (food science trivia), and started attending Food Science Club meetings. The more I learned about food, the food industry, the wide variety of courses I would take over the years at the university, and the career paths I could pursue, the more certain I became that food science was right for me. Yet, it wasn't until I stayed up late at night wondering how the quality control team at Ben & Jerry's ensured each pint of ice cream had the right number of inclusions that I was certain I should transfer. Within days, my academic advisors helped me declare food science as my new major, and the whisperings of doubt that taunted me as a chemistry major were banished. I knew most people would find the thought of spending time wondering about the intricacies of food boring, but I absolutely loved it.

Transfer Student Stories

I was lucky to find my place early on, avoiding many of the drawbacks of changing course. Transferring often requires nontraditional college paths like taking more than 4 years to graduate, moving to a college that offers certain programs, taking summer classes, having an especially heavy course load, and other challenges. To provide more meaningful advice, I interviewed classmates— Claire Michel, Kate Higgins, and Annika Madler— who transferred into (or out of) food science. They reflected on their individual journeys to help me address the concerns we all tossed and turned over before making our ultimate decisions to transfer and the advice they wish they'd been given during that time.

Time and Money

Food science, as Claire put it, "is such a rigid course." At UW-Madison, the classes all build on each other, requiring the previous semester's classes be mastered before the next are attempted. This leaves very little room for meeting the specific and unusual needs of a transfer student. Still, advisors like those in the College of Agriculture and Life Sciences (CALS) can make magic happen, enabling future food scientists to determine and execute the best plan of action to reach their goals.

For Annika, that meant, "taking classes at really weird times" and "tacking on a whole extra year" when she was two classes short of having a BS in Biology. Despite the added time, she felt, "getting a food science degree would lead directly to a career path as well." Annika viewed her fifth year in college as a sort of "master's degree." She equated the two, asserting a master's degree is generally used to specialize in a specific field and food science is inherently specialized. Graduating with extreme proficiency in biology and a food science degree would directly lead her to a lab bench with food at the heart of her 9:00–5:00 days.

Like Annika, I accepted the trade-off of spending another year on campus to major in food science. Largely to afford tuition at UW-Madison, I joined the military and took one fall semester off for training. My advisor gave me options to address the rigidity of the food science track: pack my semesters with classes and graduate on time or spread my classes out across 5 years and enjoy a lighter workload. I attempted the first route and immediately was overwhelmed by adding a difficult physics class to an already challenging semester. I pushed the physics course to the following semester,

accepting an additional year and more time overall to study for classes, participate in clubs, work in an ice cream and candy research lab, and play with my dog.

Although it worked well for Annika and me, taking an extra year to graduate isn't an option for everyone. Claire was in a bind right off the gate as she mapped out her class schedule as an intended food science major; she didn't meet the entry-level math requirements for the traditional fall semester, pushing most initial classes to her spring schedule. Additionally, she had hoped to minor in Italian, which would prolong her time at UW-Madison even further. Ultimately, accepting the idea of more time in college was too difficult. She explained that the "sheer feeling of being behind set the mood for the rest of my time." She knew the longer she spent in school, the longer it would take her to start earning a salary as a full-time employee. She had a hard time "justifying spending that kind of money" and decided to transfer out of food science.

Annika rightly said that with food science "there's not as much wiggle room, so you have to know." Claire, Kate, and Annika all did their research until they were confident enough to transfer, whether majors or schools, pursuing the path that brought them the most joy.

Logistics and Making the Decision to Transfer

Annika recommends this to students who are uncertain: "utilize the resources that are provided to you." For me, this meant joining food science clubs and learning more about the material I would be studying. When finding a major to transfer into, Claire utilized the Cross-College Advising group on campus. They helped her connect her personal interests, academic goals, and placement scores to a major that would allow her to graduate within 4 years. That major wasn't food science, but after declaring a major in Life Science Communication and a minor in Italian, Claire said "it felt like a relief."

Kate felt a relief from choosing her major less immediately, explaining that "every class I attended just felt more and more right based on my interests." Kate transferred into the UW-Madison food science program after a semester of prerequisites at a local community college. She always intended to study food science but used transferring colleges as a means to get to her program of choice. To do this, she utilized a one-time program for waitlisted high school seniors in Minnesota and Wisconsin. The program guaranteed admission to UW-Madison after students studied at a local community college for one semester. Rather than be discouraged by being waitlisted from her college and program of choice, Kate uncovered the best option for

herself. Although she was sure transferring was right for her, it didn't come without challenges. In my interview with Kate, she said, "I was living at home and all my friends left and did the whole college freshman experience…" Kate missed out slightly, having to overcome the intimidation of making friends when groups had already formed. Making the most of every decision, by the time her first semester at community college was over, she "was excited to move away and start something new."

Beginning something new isn't always easy. Every transfer student accepts trade-offs knowing they're necessary to reach an end goal. For Annika, Kate, Claire, and myself, every sacrifice was worth attaining the future we want. Although we had very different experiences, we all were overwhelmed and uncertain at first. To get past our fears, we did what scientists do best and asked questions until we found answers.

Summary

If you are one of the many people who don't find food science until later in life and contemplate transferring into the major, there are many different factors to consider. Some of the most common *challenges* are the following:

- Extending time in college
- Spending more money on tuition
- Earning less income while in school
- Taking longer to enter the workforce

The common *advantages*:

- Training in a job-specific, hands-on food science program
- Joining a small, supportive community
- Pursuing a field of deep interest with great potential to make positive change

Most college campuses have built-in *resources* to help you determine whether this is the right choice:

- Cross-College Advising
- Major-specific advisors
- Food Science Clubs
- Career advisors
- Networking groups to facilitate informational interviews

Although daunting, don't be afraid to ask for help. Annika's advice: "If you think it's right for you, take the leap; do it."

Zoe Sullivan Atkins studied food science at the University of Wisconsin-Madison while working as a research assistant in Dr. Richard W. Hartel's ice cream and candy lab. As an enlisted member of the Wisconsin Army National Guard, Zoe became a licensed operator of the largest vehicle in the US Army (the HET) and served as a first responder amid the Covid-19 crisis. As an undergraduate, she was a member, Historian, Social Chair, and Vice President of the UW-Madison Food Science Club. Zoe grew up on a hobby farm with cats, dogs, horses, sheep, tortoises, chickens, ducks, bunnies, and black swans. There, she developed a love and respect for all creatures that she hopes to apply as a product developer of plant-based, sustainable foods. When hard to reach, Zoe might be found figure skating, rock climbing, or running around the dog park with Mishka (her 3.7 pound, long-haired Chihuahua).

Chapter 8
The Decision to Pursue an Internship

Elizabeth James and Katherine Higgins

Internships are an exciting opportunity to dive headfirst into the food industry. Many advisors, professors, and professionals will agree that an internship is a must! Internships provide invaluable work experience that is needed to gain a true sense of what the food industry is all about. This work experience complements learnings in the classroom and laboratory. There is a wide range of internship opportunities available in the food industry. Students can start pursuing internships as early as freshman year.

Not only do internships introduce students to the food industry, but they help to build confidence, provide networking opportunities, and offer a source of income. As stated by industry professional Mike Gehrig:

> An internship can provide you with insight into what field of study you may want to get more into, such as the Meat vs Vegetables, Dairy vs Baking, Processed vs Beverage etc. There are many different paths a Food Scientist can pursue. Having a better understanding of the industry will help you select a path after graduation. An internship can also help you tailor your studies to get a better understanding of a particular area of focus. Internships help to ground you and direct you into a career in the food industry. You gain firsthand understanding of the roles and responsibilities that will be expected of you as you enter the job market. Interning will also help you to build a network of industry professionals. The food industry is a lot smaller than it looks and you may be able to establish a relationship that will last a lifetime.

Long gone are the days of interns running around to get coffee and make copies. Internships have grown in importance, and their purpose has shifted

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throughout the years. The old roadmap of internships looked something like the following—students intern during their summers and learn about the industry, company culture, etc. Then, students graduate college and apply for full-time positions at various companies, potentially including the places at which they interned. Now, internships have become a crucial part of the application process. Many companies are hiring fewer people externally and instead drawing more from the competitive pool of interns they have worked with. Some companies may not even require interns to apply via the conventional route for full-time positions; interns are automatically considered for a full-time offer after graduation based on their performance and fit.

In summary, here are some key benefits to interning:

- Gain experience in the food industry.
- See if the food industry is the right path for you.
- Determine which area of expertise is right for you.
- Network with fellow interns and industry professionals.
- Familiarize yourself with corporate culture and etiquette.
- Boost self-confidence.
- Advance technical skills and abilities, develop credibility.
- Develop your resume.
- Apply academic learning in a practical, hands-on way.
- Obtain a full-time job offer.
- Gain leverage for obtaining internships during future summers.
- Foster a competitive advantage and differentiate yourself from other food science students.

How to Find One

The first step to landing an internship is of course to find one! While there are numerous paths to finding internships, the most common methods are utilizing the Internet and opportunities available at universities.

There are numerous job search websites available that allow students to not only apply directly to internships but also stay up-to-date with companies and communicate with company representatives and network. These websites allow students to see opportunities all over the world from both large and small companies.

LinkedIn is a well-known networking and job search platform that allows students, industry professionals, recruiters, and many others to share their experiences, follow companies of interest, and connect with industry professionals. Getting the most out of LinkedIn starts with creating a strong

profile, which essentially becomes your resume. A profile can list past work experiences, tasks and accomplishments, education, interests, and skills. This profile can be viewed by a general audience on LinkedIn, allowing recruiters or companies with job openings to reach out if you are a good fit. Your profile can also list if you are actively searching for a job, along with the type of job, location of the position, and area of interest. While creating a strong profile may draw the attention of recruiters, you can also proactively take steps to discover available opportunities. LinkedIn has a "Job" tab that can be used to search for any job listings by location, type of job, skills, and plenty more. Students may also directly message connections in their network to inquire about job openings. Job listings can also be posted by anyone in your network, meaning the more connections you make, the more job opportunities you may see.

Although LinkedIn may be the most popular job search platform, there are numerous other websites, such as Indeed, Glassdoor, or Handshake, that are just as useful in finding internships. These websites focus less on networking and more on companies and their available opportunities. Both Glassdoor and Handshake offer "Company Review" sections that allow you to view company bios, available positions, benefits, and reviews from employees. Handshake is a website specifically designed for college students seeking out internships or full-time employment after graduation. The benefit of Handshake is that all employers advertising on the site are seeking out college students, rather than anyone with an interest.

While job searching online is convenient and quick, remember that these opportunities are available to anyone, and it could be difficult to make an impression solely based on an application. One way to set yourself apart from other applicants is to take advantage of the on-campus opportunities available at your school, such as job fairs, company presentations, and relationships with organizations like the Institute of Food Technologists (IFT).

Job fairs are the perfect environment to meet with companies and recruiters seeking out prospective interns. These are the kind of opportunities that allow students to distinguish themselves and catch the eye of a recruiter. Keep an eye out for any emails or flyers about these job fairs as the school year starts, as they are usually scheduled early in the fall semester. Universities typically have multiple job fairs that are specific to engineering, agriculture, or other colleges, so make sure you are attending the appropriate fair.

Thoroughly preparing for job fairs will make the experience less stressful and impress recruiters. Review which companies will be in attendance so you have an idea of who you would like to connect with. After identifying companies of interest, do a general search on their company philosophy,

culture, and opportunities available. This will not only allow you to establish which companies you are most interested in meeting with but allow you to come prepared with questions. Some questions you may ask include:

- Can you tell me a little more about [job opportunity] and its responsibilities?
- What makes a successful intern at [company]?
- What do you enjoy about your job at [company]?
- What is the hiring process like at [company]?
- What is the company culture like at [company]?

Along with questions, you should also come with copies of your resume that can be given to a company representative. In addition, it may be helpful to prepare a short elevator pitch that allows you to briefly discuss your experiences and interests while encouraging further discussion with the recruiter. On the day of the fair, make sure you dress professionally and have a game plan for which booths you want to visit first. Start off by visiting a couple companies that you are moderately interested in so that you feel more prepared for the companies in which you are most interested. That being said, do not focus on just one opportunity and keep an open mind. Retain any contact information to follow up with a thank you note for recruiters you connected with.

Another on-campus opportunity to meet with prospective employers is through company presentations organized by the Food Science Department or Food Science Club. Similar to job fairs, students should come to these presentations prepared with questions and a general understanding of the company. Make sure that you act professionally during the presentation, and show a genuine interest in what the presenter is speaking about. After the presentation, most speakers are open to one-on-one conversations, so do not be afraid to introduce yourself and ask further questions. It is also helpful to get their contact info so you can follow up with the speaker and thank them for their time.

Many universities also have relationships with organizations, like IFT, that can provide helpful tools in finding internships. The core benefit of IFT for students is the ability to build their network. Like LinkedIn, the more industry professionals you meet and connect with, the more likely you are to find internship opportunities. These connections can also be beneficial later down the line if you need references during the application process. Other than the networking benefits of IFT, there are also opportunities for students to apply to internships directly through programs available to members. For more information on IFT, see Chap. 9!

Interviewing for an Internship

For the lucky few who are blessed with the ability to not sweat through their business attire, fidget with their hands, or throw in "um" or "like" every other word while conversing with an interviewer, a half-hour chat about experiences, skills, and weaknesses may not seem too bad.

However, for many students, or anyone for that matter, interviews can be a major source of anxiety. Luckily, a positive attitude and a little practice and preparation can go a long way. Interviewing for internships can be especially daunting because students may not have as much experience in the field to draw from, have little experience interviewing, and feel like if they cannot get a job in the field right away, then they are on the wrong track.

It is important to remember that interviewing is a skill that can be developed, not an assessment of personal worth. Practice builds confidence. Most universities offer mock interviews where students can be interviewed and receive feedback. This method can help students become acquainted with what kind of questions an interviewer may ask as well as getting objective feedback. For some, even a mock interview can seem too daunting. In this case, it may help to organize an informal mock interview with an acquaintance, peer, mentor, or parent and work up to a formal mock interview. The more practice you can get, the better. Eventually, the interviews get easier.

Proper preparation can build confidence and prevent any surprises. It can help to go into the interview knowing who will be interviewing you (one person or several), the types of questions that may be asked, and, of course, the format (phone interview, video chat, in-person, recorded, etc.).

Interviews may include a technical aspect where you are asked questions that require you to draw from your food science knowledge. Though it is little use to "cram" or study all your food science learnings the night before, it can help to know these types of questions may be asked so you are not caught off guard. Give your resume another read over and make sure you are prepared to talk about any included skills or experiences. If an interviewer asks you about a skill or experience on your resume and you cannot speak to it, that is a major red flag. Being truthful and honest about the skill set you have will look better than trying to embellish. Interviewers are more and more looking for people who demonstrate intellectual curiosity and enthusiasm. Sometimes those traits are weighed more heavily than grades or hard skills. From Mike Gehrig, who has interviewed countless intern applicants over the past few decades:

> I look for people who demonstrate some form of intellectual curiosity in the questions they have about the internship. Are they interested in finding out about how

> past interns have viewed their time in the internship? Can they look me in the eyes when asking questions or listening to answers?

You should make sure you know what the position you are interviewing for generally entails and have a basic understanding of the company. This information can be acquired by giving the job posting a thorough read and looking over the company website. Having a baseline knowledge of the position and company will help build common ground between you and the interviewer, contextualizing your conversation. However, it is unnecessary to fall down the rabbit hole of extensive research and memorizing facts. This strategy may be stressful, overwhelming, and unnecessary. Remember, an interviewer is assessing your fit for the position and not solely evaluating your knowledge. It can help to remember that an interviewer may not be that far removed from where you are in your journey and talks with many students. No need to sweat!

One consideration to remember is that an interviewer may gather information about you from your peers and professors, especially if you are a part of a smaller, well-connected program. Mike Gehrig is in charge of hiring interns and offers these insights:

> I rely a lot on what my past interns know about a potential intern and whether they have the right stuff to be an asset. I've not offered people an internship based on less than glowing feedback from a previous intern. I want to get as much information/feedback as possible to make the best decision possible.

Though you have less control over this part, it is an important reminder to maintain positive relationships with professors and peers. Involvement in your food science department (food science club, college bowl, etc.) can help you out in this regard!

Before the interview, think about a couple questions you can ask. An interview is not only a chance for a company to assess you but a chance for you to assess them. Is this a position you want to have at a place you want to work? Think about what you value and see how this company makes or falls short of these values. A set of nonnegotiable values can help guide you throughout a healthy career. Maybe you want to work at a place that provides the flexibility of working online and in the office. Maybe you want to work somewhere where everyone comes into work. What do you value in a company culture? What kind of support and tools do you need to become successful? Once you know what is important to you, formulate that into questions to ask the interviewer. When they ask you at the end of the interview if you have any questions, it is critical that you have something ready. Asking questions about things that are important to you is a great way to demonstrate your enthusiasm. This is also a good time to ask any follow-up

questions about anything they mentioned in the interview or specifics of the position. If you are lacking in a certain skill set, you can even ask the interviewer what you can do to improve this skill before you start. Perhaps they have materials, information, or books they can key you into.

Enter every interview with an open mind. Trust in yourself and your skill set and make sure not to oversell or undersell yourself. Being authentic, open, and curious can go a long way. After the interview, email a personal thank you to the interviewer and make sure they know how to reach you. Remember, you are just having a chat with someone who was in your shoes not too long ago!

How to Evaluate Different Offers/Opportunities

After the long process of searching and interviewing for internships, students may find themselves stuck between multiple offers and in need of further evaluation of the available opportunities. The first thought for students may be centered around direct benefits, such as wage or living accommodations, but it is important to consider other factors. This extra consideration can ensure that a student has the best chance at a positive experience with an internship. Some of these factors include:

Position

What is the job position offered and its goals? Each student's career goals are different, and it is important to consider whether an internship brings students a step closer to those goals. For example, if a student knows they want to pursue a career in food engineering, it may not be the best idea to accept a position in product development. On the other hand, if a student is unable to secure an internship that directly helps them move toward their career goals, an internship that helps broaden their knowledge of the food industry may be the best path. While different areas in food science may have different responsibilities, all areas interconnect and affect one another. Understanding how changes made in product development can affect the manufacturing of a product can make a strong, well-rounded student. These opportunities to explore a new area may also come as a surprise, and a student may decide that they would like to further explore that type of position.

Company Size

The size of the company can have a large impact on various factors of an internship. To start off, a large company could have a well-established intern program that has greater resources for interns, larger teams, and more guidance through the internship experience. Larger companies may also have more interns in general, which can be positive or negative depending on the student. Smaller companies may not have as many resources or guidance but could be a better fit for a student interested in more independent work. Smaller companies may also allow for more opportunities to learn about other departments in the company, rather than focusing on one area. These generalizations are not true for every company; it is essential that students ask about the company culture and supervision to get a better picture of how the company runs.

Company Culture

Company culture is a set of beliefs in how employees and a company function, which can have a large impact on the day-to-day activities of an employee. Some companies may emphasize diversity and inclusion, employee feedback, teamwork, individuality, and other values. If a student enjoys working on teams and forming bonds with coworkers that can lead to real-life friendships, they should ensure they research the companies to determine if they have that environment. As mentioned earlier, some websites like Indeed or Glassdoor offer employee reviews that describe what real people experienced while working for a company and can be great tools in determining what the company culture is like. Previous interns are also a great resource for students curious about what working at a certain company is like.

Supervision

Depending on both size and company culture, the supervision in an internship can look very different. Some internships can involve a supervisor that is regularly involved in weekly activities and offers plenty of guidance. These supervisors may schedule weekly meetings to check in on the progress of projects and encourage interns to ask frequent questions. A student who prefers to work closely with teammates and receive more frequent feedback could benefit from this type of supervision. Other internships may have

a more independent model where interns have less contact with their supervisor. These types of internships require a self-sufficient student that is able to reach out when help is needed and find solutions to problems on their own if possible.

Format

With an increase in the presence of virtual jobs, students should also make sure to consider whether an internship is in-person, online, or a hybrid. In-person internships may allow more hands-on experiences and opportunities to learn skills like running laboratory tests. Online internships may lack that opportunity but present an excellent chance to hone communication skills through online meetings, emails, and more. Hybrid opportunities can give you the best of both worlds and allow for greater flexibility when it comes to daily activities.

Projects

Every company can have a different approach to the projects given to an intern. An intern may be given one large project that they focus on for the duration of the internship, while others may focus on a few smaller projects. Large projects may give an intern the opportunity to really dive into a project and own it, while smaller projects may allow for a broader learning experience.

Future Employment

Students should always be considering whether they could see themselves working for a company after their internship. Students that cannot envision working for a company after graduation should consider looking into a company that fits better with their ideals. No matter the internship, students should always give their all and work to complete their projects as best as possible. If a company is impressed with the work done by an intern, they will keep them in mind for future job openings. Ensuring that you leave a good impression at your internship could make the job search after graduation a much smoother process.

Duration

Some internships will fit right in between school years during summer break, while others could last for 6 months or longer. If a student is looking to take off a semester of school while still improving their knowledge and experience, a longer internship could be a good path to take. If considering a 6-month internship, make sure to talk with your advisor to see how taking a semester off would affect your academic roadmap. Others hoping to stick to a more traditional college plan could benefit from shorter, summer internships.

Work Hours

Depending on the company and type of position, work hours can vary greatly. Some companies are flexible with work hours and allow for time off or overtime if needed. This may be beneficial for a student in a summer internship that may take time off for a vacation or the occasional long weekend. Some positions may require more strict or untraditional hours. For example, a position in manufacturing may include both first and third shift hours to gain a better understanding of how a facility runs.

Location

Depending on company size, there may be multiple locations for an intern to work at or visit during their time in an internship. Some positions may be centered at main buildings where there are more office jobs but allow for the opportunity to visit manufacturing facilities. This allows for even more learning experiences for an intern. Some students could also be concerned with moving out of state and may not have the resources to do so.

Living Accommodations

Many companies, especially those with larger intern programs, offer to cover the expenses of housing during an internship. This can benefit those concerned about moving out of state for an internship by reducing the stress of finding an apartment in an unfamiliar area. A company may also have

multiple interns living in the same apartment or building, which may be a positive for students that look forward to meeting others in their program.

All factors can vary in importance for every student, and it is essential that they ask questions about each one before deciding on an internship.

Connecting Internship Learnings to Academic Learning

Academic learning and internships are mutually beneficial experiences that can help develop one into both a great student and employee. While academic learning provides the basis of knowledge needed for an internship in food science, internships can put those learnings into practice while also teaching skills not taught in class.

In an internship, a general knowledge of the food industry and food science concepts are required and can improve the internship experience overall. Knowledge of different areas in food science, such as quality assurance, product development, or manufacturing, is needed to understand how a food company functions and what kind of responsibilities one might experience in those departments. For example, it is essential to understand that the goal of a quality assurance technician is to maintain high standards in food quality. To achieve that, a technician will perform common laboratory tests that measure moisture content, salt content, fat content, and more. In contrast to that, an employee in product development may focus on improving current products and creating new innovative products. This could involve benchtop work, communication with suppliers and internal team members, and research. Recognizing the differences between different areas in food science will allow students to focus on the lessons and concepts specific to their internship.

For students in their freshman or sophomore year of college, it may be intimidating to approach internships with less experience and knowledge. While that may be the case, advisors, professors, and supervisors are great resources for students in need of help. These contacts are more than willing to share articles, textbooks, and other pieces of information so that students are prepared for any position. In a different light, going into an internship with less experience and knowledge means that a student has an even greater ability to absorb as much information from the opportunity as they can. Employers love when an intern is able to come in as someone with a different and new perspective. Interns who question why a certain process is done one way not only encourage their employer to explain the thought process behind their decisions but can also lead them to question whether they are

making the best decisions. In turn, this leads to learning experiences for both the intern and employer.

For all students in an internship, one method to maximize the knowledge learned is to keep a journal or another form of notes on daily activities and lessons learned. This not only helps to reinforce the knowledge gained from an internship but can be a useful tool to have in future college courses. With a journal about their experiences, students can quickly reference their notes and recall any useful facts as a reminder or clarification about a topic covered in class. Journals can also be helpful for students receiving credit for their internship, since they may need to write a paper or discuss what their responsibilities were as an intern.

In addition to reinforcing academic learnings, internships teach students lessons not taught in classes. One example of this is the communication and teamwork skills required in an internship. Although internships are temporary, short-term positions, interns are still treated as part of a team no matter which department they are in. Interns can be included in team meetings where they are able to share updates or questions about projects, face questions from other team members, and work to achieve a common goal. Learning to listen to all opinions, question others, and take on an appropriate workload are all skills that will improve any group activities in school or future jobs.

Internships and academic learning work together to develop both a well-rounded student and worker. The more a student can take advantage of both their time in an internship and college, the more wisdom they will bring with them at every stage of their career.

Getting the Most Out of Your Internship

There are endless perspectives and opinions on how to make the most of an internship. Strategies to maximize the benefits vary widely from person to person and internship to internship. The goal of this section is to compile a few general, guiding principles that are applicable to a wide variety of internships and people.

Understand the Business

One of the most beneficial knowledge bases an intern can build for themselves is an understanding of how the company operates and the products that they sell. Interns have the unique opportunity to meet with people of all

different functions and levels. Employees, directors, and leaders in a company are usually enthusiasts of the intern program and more than willing to answer questions, meet, and share their knowledge. Every engagement is a learning opportunity. Meeting with people of different roles and levels allows interns to gain a fundamental understanding of every aspect of the business. For example, if you are working in research and development (R&D), reach out to the sales team. See if you can join a sales call or sales meeting and understand what aspects of the product are marketed and what the consumer base or retailer is seeking in the product. Figure out why (or why not) consumers are buying your products.

A way to gain a better understanding of consumers is to go out to various grocery stores. Watch how people shop. What products are they buying? How long do they take to decide? What products are stocked well? Talk to the store-keepers—what products sell fast? Are any products harder to stock than others? You might find some surprising answers.

Talk with operations. What could make this product run faster on the lines? What changes to the formula could decrease batch times? What ingredients are already stocked in the warehouse? Which products pose more challenges on the line?

Engage with the consumers, the products, and people from all sides of the business to enrich your experience. Gain an understanding of the corporate structure, products, customers, organization, and culture and figure out who to go to with your questions. Know everyone on your team and what is important to them. If you can understand how the decisions are made, you can be the person making them one day.

Set Goals

Some internships are more structured than others. Regardless, you can structure your own goals. Create a set of realistic goals for the course of your internship. Goals should focus on personal development, technical skills, etc. It can be helpful to review your goals with an advisor, mentor, supervisor, or fellow intern. Periodically check back on the list and update your accomplishments. Make sure you are sharing your goals with people who you report to or organize the intern program. Internships are what you make of them. They usually have some degree of built-in flexibility to allow interns to pursue their interests. By setting and sharing your goals, you can make your interests known!

Be Humble

One of the biggest pitfalls an intern can face is coming in thinking they have all the answers. This mentality can blind you from learning opportunities. Though companies do look for people who can bring in external knowledge or can apply academic learnings, a base of academic knowledge is expected. It is assumed that all interns have successfully passed their classes. When coming into a new role, you won't have all the answers. In fact, many industry professionals say 70% of your knowledge will come from on-the-job learnings and challenges, 20% from other people, and 10% from academic learning. Really take time to learn the business, the people, and the products. Ask questions and listen to everyone's perspectives.

Though being humble is important, so is being confident. These two can coexist. Knowing your stuff, knowing the business, and doing your homework will allow you to communicate with confidence. Combining your confidence with your humbleness and eagerness to learn will allow you to get the most out of your experience.

Be Curious

Take advantage of being surrounded by experts in the food science field. Start asking questions on day one. Many experts are more than happy to answer them. Asking questions can also prevent you from making a costly mistake. For example, using the wrong formula for a product can waste valuable resources. Operating a piece of machinery in the pilot plant incorrectly can cost thousands of dollars in repairs. Not understanding an assignment can waste hours of your time. Asking questions demonstrates your eagerness to learn and technical curiosity. One challenge can be asking the right questions to the right people! Track down the right person to ask by looking at corporate hierarchy structures, talking to your manager, talking to other interns, or finding people who worked on similar projects in the past. For example, questions such as company culture and dress code are more suited for a peer mentor, while technical questions might be best for specific subject matter experts. Employees and management will likely appreciate well thought-out questions. Their time and expertise is incredibly valuable and should not be taken lightly.

Questions can extend to learning about what other employees are doing and why. People who pitch in to help when help is needed are generally seen as positive, especially if it does not compromise their own work. Being

curious is essential, especially when paired with being proactive and conducting your own research to gather solutions and ideas for current projects. Take initiative to address your technical curiosity and avoid questions such as "What do I do now?"

Stay Organized

Figure out the best way to organize and store files for efficiency and ease of use. Schedule meetings ahead of time because many employees will have packed calendars. Keep a to-do list and a calendar to avoid missing events and tasks. Something as simple as forgetting to submit a prototype or microbiological test can set a project back by weeks, which can be detrimental for a short, fast-paced internship. Keeping track of project work, due dates, and meetings will prevent high levels of stress. Reflect on a regular basis on learnings, accomplishments, and upcoming tasks.

A foolproof organizational system will also help you be prepared for meetings. An executive at a large global company explained during a Q&A that he never attends a meeting without first reading the agenda and forming a hypothesis. He emphasized the importance of investing time up front. If you have done research and come in with a hypothesis, you never know how many conversations you can lead just because you are the most knowledgeable in the room on the subject. This strategy also helps prevent making decisions or commenting on-the-fly and uninformed.

Get to Know the Other Interns

Spend time getting to know the other interns! It is a great opportunity to share valuable learnings, connections, and tips. Plus, you will make lifelong friends!

Participate Outside of Work

Take full advantage of opportunities a company has to offer such as intramural sports leagues and organized events. Getting to know your coworkers outside of work not only provides an invaluable opportunity to learn about company culture but can help build meaningful connections. Attend

seminars and executive speaker series to learn about new, emerging technologies in the field, receive advice, and learn about different career journeys of executives and other leaders in the company.

Communicate and Network

Starting an internship can be daunting. At the beginning, it may help to schedule weekly or biweekly meetings with direct supervisors to establish direction and an understanding of deliverables. Topics discussed may include progress reports, expectations for the following week, questions about projects, and accomplishments/learnings so far.

Schedule "meet and greets" with your team and other people in the company. These meetings can be informal and provide insight to what they need from you as an intern and what they do in the company. Learning what different people's roles are can help you communicate more effectively. For example, when talking about your project, the details you share with someone in regulatory may be different than the details you share with someone in supply chain. Reach out via email and see who is willing to connect! Most people will be. Make the intentions of the meeting clear; explain you would like to introduce yourself and learn more about their position and experiences at the company. Set up these meetings early to ensure you can find time on the calendar and establish a network and rapport right away! If you are unsure if a particular person would want to meet or perhaps you want to meet with someone in a particular role but are not sure who, reach out to your manager and they can help introduce you.

Making connections beyond your work can help you create bonds that go deeper than just intern/employee. Asking people about what they do outside of work may give you context to why and how they operate and what they value. You might even find some common interests! Maybe you find someone you work with shares a mutual passion for beach volleyball, and they invite you to join their intramural league. People want to work with someone who elevates the company culture and brings fun, positive energy into the workplace.

Building strong, professional relationships with managers and employees in the company is imperative when being considered for future employment. The talent acquisition team will likely collect feedback about you from managers, supervisors, and other people you connect with.

Learn About Yourself

An internship is a time like no other when you can learn about yourself, primarily finding some answers to "What do I want to do and is this a good company to do it at?" Take advantage of the unique opportunity to meet with many different people in many different functions! These opportunities will not only grow your network but give you a sense of the breadth of opportunities that exist in the food/beverage industry. Maybe your internship even helps you rule something out. After a summer interning in quality assurance or research and development, you might discover that is not what you want to do at all, and that is valuable too! Find what you value and even start creating your list of values that will help guide you through your career. Learn how you like to work. Would you prefer to work somewhere where everyone is in the office or partly online to allow for more flexibility? Do you want to work in a function with lots of interactions or more independently in a lab doing research?

In the food industry, breadth and depth of knowledge will tend to fall into two categories: an inch wide and a mile deep or a mile wide and an inch deep. An internship can help you figure out if you want to work in a very specific discipline and become a technical expert on a particular subject matter or have a broader base of knowledge on a wide variety of subjects. Though you will not have to formally select one of these paths per se, an internship can help you see which roles at a company fall into either of these camps and where you see yourself ending up.

Finding what you value and how you like to work will also help you with those tricky, end-of-interview "So do you have any other questions?" questions! Maybe you learn a company's culture is important to you. This could lead you to ask, "What do you do to build company culture?" Throughout your career, knowing what you value and prioritize will help you find companies that share similar values and priorities.

Find a Mentor

You will have various mentors throughout your career. Having a mentor, or even a couple of mentors, during your internship can be extremely valuable. Some intern programs have formal mentorship programs, and some may not. Regardless, you can always ask someone if they would be willing to mentor you or even just establish a relationship with someone who provides good guidance. They do not necessarily need to know that they are your

mentor. A mentor can provide valuable feedback and answer day-to-day questions. It can be helpful to have cultural and day-to-day questions answered by someone who likely will not be giving feedback in your evaluation. When looking for a mentor, find someone who will challenge you, question you, and be truthful rather than someone who just tells you what you want to hear. Mentors are a good resource for feedback when practicing presentations or creating a write-up. They may also provide guidance and input on your post-college plans.

To best utilize this resource, prepare for mentor connects with invigorating, challenging questions that you think a mentor could help you with. Learn about their career path and learn from their learnings. Ask about their stories: how they have built their skills, how they dealt with challenges, what they wish they did differently in their career, how they deal with their managers, etc. People will likely be honored to share their wisdom and experiences with you!

Keep in Touch

After you finish your internship, take time to keep in touch with close contacts made during the internship. These connections may include, but are not limited to, fellow interns, managers, supervisors, and technical experts. Regardless of whether or not you decide to stay with the company full time, maintaining contact helps to nurture friendships and professional connections. Food science is a small world; you never know who may be your boss, coworker, or a member of your team someday.

Resume Update

Throughout your internship, keep track of your skills, learnings, and accomplishments. Adding this information to your resume will give you leverage when searching for your next job or internship. For example, being able to talk about or add to your resume information about how you worked on a productivity project and saved X amount of dollars could really impress someone. At the end of the summer, bring in a copy of your resume to review with your manager. This is important to ensure no proprietary information is released and can be helpful to get advice on how to add all the contributions, skills, and knowledge attained.

A successful intern is someone who can work with all kinds of people. This would include learning from the lower level people how the job is being done. Also being able to identify and learn from Experienced/Technical people within an organization is critical to learning the fundamentals. One other key might be the ability to analyze data with which to make decisions from. A successful intern is someone who is able to pick out the people with the technical and business knowledge at the internship with which to grow their own knowledge base and understanding of the industry. — Mike Gehrig

Internships as Interviews for Full-Time Employment

As previously noted, internships have become an integral component of the interview process at many companies. However, it is important to remember that landing a full-time offer should not be the only goal of your internship, just a consideration. As an intern, you are still an employee of the company who has been hired to do a job. That is the number one priority!

Your time interning is a chance for the company to evaluate your fit and potential as a full-time hire, as well as a chance for you to assess the company and whether it is somewhere you see yourself working. John Mendesh, Senior Advisor, Special Projects at Partners in Food Solutions, who retired with over three decades of R&D experience at General Mills, has managed many food industry professionals and interns over the years. He asks his employees and mentees three yes or no questions:

Are you working on something important?
Do you have everything you need to be successful?
Do you enjoy coming to work each day?

These questions are founded in the belief that people want to work on important things, be successful, and enjoy their day! As an intern, asking yourself these questions can be a great way to find out if you see yourself working full-time at a company. Mendesh argues if your answer is “no” for one or two of the questions, steps can be taken. Communicate with your manager and team and figure out what is wrong and how to move forward. If your answer is “no” for all three, what are you doing there?

A common mistake for interns and even professionals of all ages is trying to be the person they think the company wants. When executives and high-ranking leaders reflect on their career, a common note is “I wish I would have been myself at work. I would have gotten to where I am today faster and happier.” As Mendesh puts it, “Be who you are, which means understand yourself. You can be who you think the Company wants you to be for

12 weeks but you can't be someone other than who you are for 20+ years." Nobody wants to work somewhere where they have to put energy into being someone else every day on top of a workload. The goal of your internship should not be to attempt to be someone you are not for 12 weeks to get a full-time offer because odds are that is not what employers are looking for.

So what will get you that full-time offer? In general, efforts toward putting in the work to make the most out of your internship, delivering on results, and connecting with people in the company will show through. Demonstrate your intellectual curiosity and apply on the job learnings as you progress through the internship. Do not waste effort comparing yourself to other interns. Even if you do not get a full-time offer right off the bat or decide to pursue further education after your internship, stay in contact with people you connected with in the company, your manager, and other interns. You never know when a position might open up and who might pass along your resume. The food industry is big, but the world of food science is always smaller than you think!

Elizabeth James is a student at University of Wisconsin-Madison studying food science with a certificate in fermented foods and beverages (class of 2022). Liz has had great experiences interning with Dairy Farmers of America and Organic Valley. At Dairy Farmers of America, Liz learned all about spray drying in a manufacturing facility. Liz's internship with Organic Valley gave her an insight into the world of research and development as she tested various formulations of cheese and protein drinks. In her free time, Liz enjoys cooking, listening to music, and fishing.

Katherine Higgins is studying food science at the University of Wisconsin-Madison with an interest in business (class of 2022). Kate has had two fantastic experiences interning in manufacturing and R&D at companies she loves. Food science was an obvious choice when selecting a field of study, as she grew up with a passion for science, all things food, and a father with over 30 years of experience in the food industry. Aside from studying business and food science, Kate loves to ski, sail, read, and spend time with her family.

Chapter 9
The Institute of Food Technologists Student Association

Sam VanWees

The best and easiest way to advance your career in food science as a student is to take advantage of opportunities outside of the classroom setting. Internships, laboratory research, and involvement in community or campus organizations are excellent ways to gain skills and experiences beyond lectures and exams and are often significantly more fun. Many professions, including food science, have membership organizations or associations that provide additional opportunities for skill development and community within that specific field. The wide diversity of study within food science means that there are dozens of associations to be a part of, including those that focus on dairy, meat, fats and oils, sensory science, regulatory affairs, and more, but there is one association that caters specifically to members from all of food science: IFT.

IFT and IFTSA

The Institute of Food Technologists, or IFT, is the premier professional organization for food science that harnesses the diversity of thought and study within the profession. IFT is a membership organization that provides access to events and opportunities to grow your network, develop your skills and knowledge, and advance the profession. There are specific divisions within IFT where members can share information about specific fields of

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food science, such as food chemistry, aquatic foods, carbohydrates, or food packaging, as well as geographically based sections for nearby IFT members to meet locally. Like many professional associations, IFT also hosts an annual conference to discuss the latest scientific advancements and trends and allows for food scientists to network with others who share their interests.

First and foremost, IFT exists to advance the science of food by connecting the people who work in the field. While most members are trained food scientists, many come from a variety of backgrounds and experiences. Those with a background or career in chemistry, biology, marketing, education, engineering, and many other disciplines all join IFT. Together through the organization, individuals collaborate and connect to create a safe, nutritious, and sustainable food supply for everyone.

Undergraduate and graduate student members of IFT are automatically a part of the IFT Student Association, or IFTSA. IFTSA is a separate association within IFT that specifically looks out for the needs of students like you and provides an instant community for all students throughout their undergraduate or graduate education. This association is managed and lead by students, for students, and aims to provide opportunities to connect, develop, and support those interested in any career in the science of food.

IFTSA provides students with unique events and programs that add to traditional classroom and laboratory education. Student members grow their skills by participating in competitions, holding leadership roles, or simply by accessing the resources available through the premier professional association for food science. After your time as a student is over, the opportunities provided by IFTSA will have enhanced your career and propelled you into the future of your choosing.

How It Works for You

During your education, there are many ways to participate in IFTSA events and programs. These opportunities may vary, but each opportunity is specifically designed for students to grow. Members benefit from exclusive access to competitions and awards, scholarships, trends and salary information, opportunities to publish and present their research, and networking opportunities both locally and internationally.

One of the areas IFTSA is most known for is student competitions. Since 1985, IFTSA has offered a variety of research, product development, and trivia-based competitions that enable individuals and teams to apply the skills they learn in classrooms to real-world applications and compete on the

international stage. In addition to these competitions, there are awards for outstanding chapters or food science clubs and individual leaders who are recognized each year.

Product development competitions are a way for a team of students to grow together and individually and are an incredible way to gain experience in the field before graduating. Winners of these competitions use their technical food science knowledge, business and marketing skills, graphic design, and their team camaraderie to excel and win cash prizes. Students gain technical skills in the preparation for these competitions and also demonstrate leadership and communication skills that enhance their resume and advance their professional career.

Research competitions and leadership awards are individual opportunities for both graduate and undergraduate students. Students can showcase their skills and competencies at the national and international level, to an audience much broader than just their campus. Participating in these competitions leads directly to networking opportunities that could lead to internships and jobs in the future.

IFTSA also hosts a classic trivia competition called the College Bowl Competition. Teams of students practice all year for the regional and national competitions. This quiz-bowl style competition tests the students' knowledge of food science, IFT, culinary science and trends, and popular food items. Some fan-favorite questions might range from "what two proteins make up gluten?" (answer: glutenin and gliadin) to "what are the four shapes of McDonald's chicken nuggets?" (answer: bone, boot, bell, ball) to "what is the technical term for the fear of peanut butter sticking to the roof of your mouth?" (answer: arachibutyrophobia – say that five times fast!). This fast-paced trivia competition is a low-stress way to meet other students on your campus, study for exams, and impress your friends and family with fun food science facts.

IFTSA is a membership organization dedicated to meeting the needs of its student members around the globe. One of the most vital aspects of this is by providing a community within the science of food. These opportunities to network are extremely valuable. Meeting and communicating with other students and professionals will expand your views on food science, the types of career paths available, and provide valuable connections once your career begins. Many student members have met their future colleagues, mentors, buyers and suppliers for ingredients and services, and more simply through their participation in IFTSA.

Participation in student associations, especially ones directly associated with food science, can significantly advance your career even before it begins. These associations are designed to add to your academic experience

outside of the classroom and lab. Students have unique experiences to build technical and leadership skills while connecting with peers and professionals who share an interest in the field. These connections and skills are invaluable when the student experience comes to an end, as they enhance your resume and make you a more marketable and successful employee.

How You Can Get Involved

IFTSA is a global association with opportunities to get involved locally, nationally, and internationally. Beyond individual membership benefits, there are ways to get involved both on your campus and within the wider IFTSA community.

Many universities in the United States with a food science curriculum at the undergraduate or graduate level are affiliated with a local chapter of IFTSA. These chapters operate as student organizations or clubs on the university campus but are supported by the IFTSA leadership at the national level. Chapter members can participate in competitions and apply for funding to advance the chapter's local events and programming. Additionally, these chapters are an excellent place for students to grow their leadership skills as a chapter officer. Leaders are responsible for the day-to-day operations of their organization and gain skills leading teams, managing meetings, fundraising, and working with their peers. IFTSA supports these chapter leaders by providing additional trainings and networking events for these dedicated volunteers.

All programs and events offered by IFTSA are led by a student volunteer. For example, the chair of a competition would be responsible for promoting the competition, organizing submissions, training judges, and managing the final presentations. Other volunteers may be dedicated to communication in social media or blogs or management of events throughout the year. Much like being a chapter leader, these students become skilled project managers and see the start-to-finish tasks required to complete a project over one year. Competition chairs and other appointed volunteers have greater responsibilities, which means the return is even greater.

The volunteer opportunity with the most responsibility is as an international student leader. IFTSA has a student-led Board of Directors who work together throughout the year to oversee all aspects of the student association. Rather than managing individual events on campus or single competitions, these volunteers work to improve the entire student experience and prepare

all members for the future of their choosing. In doing so, students who serve on the Board of Directors gain skills in strategic thinking, project and personnel management, facilitation of discussions, financial planning, and more. Serving on the Board of Directors instantly improves your future career, as these roles prepare you for situations that managers and senior leaders face daily.

Below is a summary of some of the ways you can get involved in IFT and IFTSA during your student experience.

Opportunity	Description	Time
IFT member	Joining IFT as a student gives you access to all events and programs through IFT and IFTSA during the year	
Chapter member	Participate in competitions, volunteer locally, and meet others through your campus club	Low
Chapter leader	Lead meetings, organize events, fundraise for your club, and provide local opportunities for chapter members	Moderate
Competition team member or individual	Gain skills and apply your knowledge from the classroom in research, product development, or trivia competitions	Moderate
Competition chair	Volunteer with IFTSA nationally to lead a competition. Chairs will organize events, coordinate judges, and manage the preliminary and final competitions	Moderate
IFTSA volunteer	Opportunities vary and may range from participating in a committee, planning a virtual or in-person event, or assisting with a local section or interest-based division	Low–moderate
Board of Directors member	Lead national programs for IFTSA. Some specific opportunities include managing all chapters, all competitions, hosting events at the annual meeting, and more	High
IFTSA President	This three-year term (President-Elect, President, Past President) is a demanding and extremely rewarding leadership opportunity for dedicated students. The President leads the Board of Directors and oversees the direction of the Student Association	Very high

Whether you choose to be a member of a product development team or local chapter, a competition chair, a board member, or even President, the skills gained through participating in IFTSA activities will provide a solid foundation for your career after graduation. These opportunities are not limited to anyone of certain ages or experiences and are available throughout your career as a student. For more information on how you can get involved, contact your academic advisor or visit www.IFT.org/students.

Your Future in Food Science

Professional associations like IFT and IFTSA exist to advance the field. They bring people together to advance science, to network and communicate, and to discuss the relevant issues that affect the current and future populations. In a field like food science, the diversity of thought and study is essential to provide a safe, nutritious, and sustainable food supply for everyone.

Involvement in IFT and IFTSA enables students to be more aware of the social issues in the field of food science beyond just the technical ones faced in classrooms and labs. IFTSA in particular is committed to diversity, equity, and inclusion and how each of these concepts cannot be ignored when looking to the future of food science and society as a whole. The association has made strides to ensure that IFTSA opportunities are available to all students around the world: those unaffiliated with a local chapter, those in scientific disciplines other than food science, and those who have a more traditional path through the field.

Undergraduate and graduate educational experiences expand your views of the world, and participating in IFTSA events and programs aims to expand them even more. IFTSA offers trainings and education specific to inclusive and equitable practices in professional settings, such as working on teams and hosting accessible meetings or events, as well as global issues facing the food supply, such as sustainability practices and food inequity.

The advancement of food science relies upon the next generation of innovators and educators, which is why student involvement in IFTSA is so valuable to the profession. The connections formed through the association are invaluable to collaboration in the future, and the awareness of social and global issues facing food ensures a more equitable future of food science and innovation. Very few student associations are equipped to deliver structured and validated approaches to diversity, equity, and inclusion as well as IFTSA, which makes involvement in IFTSA that much more valuable.

Your future in food science is up to you but one certainty is that the broader the experiences you can have as a student, the more prepared you will be for the rest of your career. IFTSA is specifically a student association, but involvement in the greater IFT community can be lifelong. There are countless opportunities for professionals in food science to continue expanding their network, building technical and leadership skills, collaborating with others, and learning more about diversity, equity, and inclusion through IFT.

Get Involved Now

The earlier you can get involved with forward-thinking professional associations like IFT, the greater your chance of success in the future of food science. Membership provides instant access to wide-reaching networks, opportunities to build technical and leadership skills, and becoming an instant community that follows you throughout your career.

For more information on how you can become a member of IFT and IFTSA, visit www.IFT.org.

Sam VanWees is a PhD student at the University of Wisconsin-Madison and holds a bachelor's degree in food science from Cornell University. Sam has been a member of IFT since 2013 and is a Past President of the IFT Student Association, serving from 2019 to 2020. They are still actively involved with the Wisconsin section and are a proud national champion of the College Bowl competition.

Part III
A Successful Industry Career

Chapter 10
A Successful Industry Career

Moira McGrath

While you're in college, you need to start thinking about what your career should look like after you have completed your BS, MS, and/or PhD in food science. The question to ask yourself is "What is my dream job, and how do I succeed in receiving an offer for one in the city and state in which I want to live?" This chapter will cover how to do just that with tips on how to write a well-written résumé and cover letter, develop excellent interviewing skills, learn how to look for that perfect job, and negotiate a fair package for yourself.

Résumés

Your résumé is your foot in the door, so it must be informative and well written. If your résumé is poor, it's a poor reflection on you. You must "sell" the reader as to why they should call you for the interview vs. another student with the same degree. There are two basic types of résumés: one for industry and one for academia or government. An academic or government résumé is referred to as a CV or curriculum vitae. For industry-based resumes, use this basic outline:

- *Name, address, phone number, and e-mail address*

  Don't confuse the reader with too much information. Make it simple.

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- *Maryann Graduate*
- *1181 Park Avenue*
- *Elizabeth, NJ 07208*
- *908,555–1212 (cell)*
- *igraduated@uccl.com*

Note: As a student, you might consider including both your college address and your home address (parents) so that if someone is trying to get in touch with you after you have graduated, they will know where to find you. If you're using a cell phone number as your contact number, make sure you plan on continuing to use that cell phone after graduation.

Objective

The objective tells the reader what you want to do in your career. Example: *Seeking a position that enables me to utilize my MS degree in food science in the field of new product development.* This is especially important when you're a student with little to no history of employment. If there is no *Objective*, the reader has no idea what field you want to pursue. For example, let's assume that the job opening for which you're applying is to work in *new product development* for a cultured dairy products company (yogurt, cottage cheese, etc.). The job description mentions that there will be a lot of microbiology work. If you have an interest in microbiology, the *objective* is a perfect place on the resume for you to mention it. Note the difference between *Seeking a technical position in the food industry* vs. *Seeking a position in the field of new product development that will allow me to utilize my degree in food science and my strength in microbiology.* The second objective grabs the reader's attention. This is especially important when the internship you finished was in quality assurance, and you want to be in product development. If the reader is reading only your experience, he/she might only consider you for quality roles. Since you want to be in product development, you need to spell out your interest.

Education

List your most recent degree first, and then list the rest in chronological order. Summer courses, certifications, or short courses should be listed after the college degrees.

- *PhD Food Science, University of Minnesota, 2023*
- *MS Food Science, South Dakota State, 2020*
- *BS Chemical Engineering, Cornell University, 2018*
- *HACCP Certification, 2020*

You can add information about your thesis topic but be brief. You don't need more than a title for your research. Your GPA can be listed if it is above a 3.0. Do not include high school; it is no longer of interest, even if you attended a fine preparatory school. If you attended courses that might be of interest for the company, include that information here. For example, if you attended a summer program learning culinary skills, that should be included under *Education*. However, don't include education that doesn't apply to the position you're seeking. A summer class in rock climbing does not belong on your résumé.

Work Experience

This section describes, with dates, what work you've done in your career.

Summer, 2023	*Kraft Foods, Inc. Chicago, IL*
	Intern

- *Conducted work on bottled tea beverages, focusing on new flavors, and improving antioxidant levels*
- *Brewed innovative tea and protein beverages for various tests*

"Bullet-point" your experience under each company. Begin each point with an action verb – past tense when appropriate. Imagine that the reader has no idea what food science is. Also, chances are that the first person reading your résumé will be a human resource representative, not a scientist, so make it clear. Explain what your responsibilities were and what you have accomplished.

Include brand names of products whenever possible. There is nothing like name recognition to pique another person's interest.

Awards and Achievements

If you've won awards, scholarships, and competitions, list them here.

- *IFT Product Development Competition, Captain, Alabama A&M University*
- *Won First Place for "Plant-Based Protein Hot Dogs" 2022*

Personal Information and Activities

If you've been involved in sports, clubs, teams, other academic departments, and competitions, list them here. Whether it's in college or outside of school (local fun runs, garden club), include it. Age, salaries, religion, and marital status should not be on a résumé. None of that has anything to do with your qualifications for the job.

- *Captain, Swim Team, University of Florida 2020–2023*
- *Ran New York City Marathon, 2019*

If you're just graduating college or are in graduate school, a one-page document will be sufficient. As you move on in your career, it should be two pages, but no more than that. Lists of publications, patents, and presentations are not part of the résumé. These are separate documents and can be presented when requested. Names of references also should not be included on your résumé, but have a list prepared and provide them to your recruiter or human resources contact also when requested.

Overall, ensure that your résumé is attractive and easy to read. Use an interesting, modern typeface, and leave adequate margins. Pictures of you are not necessary. Make sure there are no spelling errors or grammatical errors. If English is not your first language, have a friend or colleague whose first language is English read and correct it.

When e-mailing your résumé, make sure that your document is transmitted in a form that can be immediately opened and printed by the recipient. A PDF file is best.

Sample Résumé

Maryann Student
1181 Park Avenue
Elizabeth, NJ 07208
908 555-1212 (cell)
maryannstudent@ucd.edu

OBJECTIVE

To use my food science education and experience to develop non-dairy beverages and frozen desserts.

EDUCATION

University of California, Davis
Masters of Science 2021
Major: Food Science Specialty: Product Development & Research
GPA: 3.7
Rutgers University
Bachelors of Science 2019
Major: Food Science Minor: Packaging Science GPA 3.0

WORK EXPERIENCE

M&M Dressings, Inc. **Summer 2020**
M&M products are all natural and preservative free salad dressings, sauces, and dips.
Research and Development Intern

- Coordinated R&D projects for new products (salad dressings and sauces), product improvements and product matching.
- Collaborated with others through product ideation and problem solving.
- Conducted several product audits, along with supplier audits and plant tour.
- Evaluated products through quality assessment: moisture, pH, viscosity, acid and salt concentrations.

HONORS & AWARDS

- Graduate Student Teaching Assistant Merit Award – May 2020
- National Collegiate Dairy Products Judging Contest – 2nd place (Oct. 2018)

INTERESTS AND ACTIVITIES

- Actively involved in the Culinary Initiative team at M&M, where we collaborated with other companies to develop innovative products.

Cover Letters

Do I Need a Cover Letter and What Should it Say?

A well-written résumé is, in just about every case, the most important document in a candidate's professional portfolio. Cover letters are sort of a lost art, but they still can open doors for you. It might set you apart from others who have not included one, so we recommend submitting them with your résumé.

The purpose of the cover letter is to make the reader so interested in you that, after reading it, he/she will call you immediately to learn even more. Your cover letter is the appropriate place to let your personal self shine through. You may have talents, abilities, or interests that would be inappropriate to mention in the résumé proper but which a company deciding whom to interview would consider major assets.

For example, if your preferred geographic location is Boston, and you live in California, be sure to note that in letters to Boston-based employers. If you want to work in an area outside your realm of direct experience, the cover letter is the place to make a compelling case for your specific knowledge and inherent abilities that will allow you to succeed.

Directed enthusiasm might also be effective in your cover letter. Have you been inspired to create a new use for, or application of, the employer's product? Let the hiring authority know!

Temper that enthusiasm with wisdom and brevity, however.

Professionalism Counts

Limit your letter to, at most, two or three carefully constructed paragraphs. As in your résumé, be absolutely sure there are no spelling or grammar errors. Proofread; proofread; proofread; then have another person do the same. Trust your instincts. If you're not sure about the spelling of a word or construction of a phrase, it's probably wrong. Use Spellcheck. Do not gamble that it will not be noticed!

The physical appearance of your cover letter is almost as important as its content. You'll probably be e-mailing this cover letter, so make sure it presents well. E-mail in a PDF format as well.

Whom to Address and How

If you're answering an ad that calls for you to respond to a company's human resources department, call the company and get the human resource manager's name. Address your e-mail to that person, being sure to include his or her title.

If you know a contact's name but not the specific title, ask. That small effort just might set you apart from the rest of the crowd. It certainly will give you a better idea of how to gear your letter and maybe, even, your résumé.

Yet another reason to know your audience is that, armed with the name, you will be able to avoid the Mr./Ms. dilemma. Be sure to use Dr. wherever appropriate; avoid Mrs. That designation is reserved for social and certain other occasions when a woman is being addressed in her capacity as a wife or widow: Mrs. John Doe.

Your cover letter is your marketing tool, your door opener. It's worth the time and energy to make sure it represents you in the best possible light.

Remember that you have but "one shot" at impressing a hiring authority, who may spend as little as 9 seconds scanning all the paperwork you've worked so hard to create. You'll have competition with other candidates' résumés and cover letters. It's essential that you get every possible bit of mileage from each document you present.

What to Say and What to Avoid

Mention specifically the title of the position for which you are applying and note the source of your information. If a mutual colleague recommended that you apply, be sure to mention that colleague's name.

Don't waste time and paper describing yourself in trite generalities, no matter how glowing.

Short-list two or three examples of the training and/or experience that make you a perfect fit for the position at hand.

Interviewing Skills

What Are They Looking For?

You've been called by a major food company and been invited in for an interview. However, as a recent graduate, what do you have to offer? You haven't really *done* anything yet! Nonetheless, you offer more than you think. When you interview for your first job, remember that those who are interviewing you KNOW that you have limited to no industry experience. So, relax; don't try to compete with those who have more experience than you. The interviewers at your entry-level job interview look at not only your technical skills but your "soft skills" as well. Both are equally important.

Interviewing Necessities

You've heard the expression "first impressions count." This couldn't be truer than in a job interview. If you look sloppy, have bad manners, or come to the interview unprepared, even if you're the "best qualified" candidate, kiss that job goodbye, because you're not going to get it. Absolute MUSTS include:

Social Media

What does your Facebook page look like? Is it filled with photos of you and your buddies drinking or acting silly? Are you making politically inappropriate comments? Using swear words? Clean up whatever you do not want a potential hiring manager to see. Companies will go to your Facebook and other social media pages to learn more about you.

Professionalism

Always dress in a professional manner – even if your interview is on a Saturday morning in Florida. As many interviews are video conferences, you still need to look professional on camera.

Turn off your cell phone before the interview. If by some horrible accident it rings during the interview, do not answer it!

Advise the interviewer/hiring authority promptly if your flight is delayed or you're stuck in traffic.

Greet everyone you meet at an employing company with a firm handshake. Look the interviewer in the eye. Be gracious to everyone you meet, including security guards and maintenance personnel.

Refrain from calling an interviewer by his or her first name unless invited to do so. Address PhDs as "doctor" unless told otherwise.

Refrain from any use of profanity, even if the "corporate culture" seems to allow it.

Answer all questions – including salary questions – directly, even if you've been asked the exact same question by three previous interviewers.

Treat the human resources associate with the same respect you've shown the hiring manager. In fact, treat everyone with respect. You're being observed and considered by everyone you meet.

Provide requested names and phone numbers of references in a timely manner.

Get everyone's business card so that you can send them a thank you e-mail after the interview.

Return messages promptly, whether from your recruiter or possible new employer.

If you're unable to talk when you receive a phone call, inform the caller about when you will be available.

When you're leaving a message for a hiring authority (or anyone else, for that matter), always say your name clearly and your phone number slowly. It's helpful to say "My phone number is. .." so the recipient is prepared to write it down.

Make sure your cell or home phone message is clear and businesslike. Your phone message starting with "Yo!" is not good business practice. Check for phone messages regularly in case someone is trying to call you for an interview.

Finding a new position is not easy, but a poised, professional candidate will have an immediate advantage over those who are less prepared. Do not sabotage your search – good manners make good business.

Personality

While grades are important, they are not nearly as important as well-roundedness. Students who have been on teams and competitions (i.e., Institute of Food Technologists (IFT) Student Product Development Competition, College Bowl, etc.) are perceived as having a sense of team spirit, fairness, an ability to communicate, and a competitive nature – all

traits that work very well in industry. Since industry is very team driven, an individual who "plays well with others" is considered a top candidate. A good attitude and an outgoing personality go a long way.

Communication skills are critical. Making technical presentations is only one type of communication skill. Others include knowing how to get your point across in a small meeting, explaining a technical problem to a nontechnical person, and getting things done with and for people who are not at the same level as you are. You may be asked to make a presentation during your interview.

If English is your first language, you must know how to express yourself properly as well. Language peppered with "like," "um," or "ya know" is an absolute no-no. Giggling throughout an interview is not appropriate.

All students should take a public speaking course, either in school, or courses taught by companies such as "Toastmaster." Taking these courses can really help you speak clearly and effectively, abilities you'll use for the rest of your life.

Good Work Ethic is rarely discussed but is an underlying and extremely important trait. You were probably raised being told about doing the "right thing." "Finish the job," no matter how small or trivial. "Do the job right," not sloppily or half-way. "Treat others as you would have them treat you." Those rules still apply, particularly in the workplace. The candidate who has mediocre grades, but a good strong work ethic, will be the candidate who gets the job over the candidate without the work ethic.

Internships

The most important thing you can do while in school is to work in an internship or preferably two. Students who have worked in industry during the summer or a semester definitely have an added advantage. Why? If an interviewing company sees a résumé of a student who worked two summers, it tells them that, first, you have an interest in working in industry (vs. academia). Second, you have some practical experience, which brings you to the top of the stack of résumés sitting on the interviewer's desk. The benefit to the candidate is that now he/she has one or two different companies to approach after graduation who already know their work and work ethic. It's common for a company to make a full-time employment offer to those who have worked summer internships with them. The company has had an opportunity to learn about you as well as you have had an opportunity to learn about them. It will also give you practical experience so that you can

understand what jobs might be available to you when you graduate. It also gives you an opportunity to learn more about industry and what you might want to follow as your career. You may find out that, as an example, you have a passion for food safety, not product development as you initially thought, something you may not have known had you not worked in the field for the summer.

Prepare for the Interview

Learn about the company, either on the Internet, or by speaking to other scientists who work there (or both). You will impress your interviewer by having knowledge about the company and its direction. Are they introducing a new line of cheeses that are expected to blow away the competition? You need to know this before your interview. Be informed. Be prepared to ask questions. Bring multiple copies of your résumé.

Leadership skills are considered a "plus." If you're captain of your team, whether it be a scientific team or a sports team, make sure to include this on your résumé, and talk about your leadership abilities and experience in your interview.

What to Expect

When you're invited to a company for an on-site interview, you'll be greeted at the door, brought in to sit down in someone's office or a conference room, and will meet with several people from a hiring team. You may be there for a few hours, or all day. You'll be asked a series of questions, sometimes in "group" interviews or one-on-one. The purpose of this exercise is twofold: First is to confirm that you have the right technical qualifications for the job. Second, and most importantly, is to see if you're the right "fit" for the company. All companies have a personality or "culture." The interview team looks at each candidate to make sure their personality matches the company's culture. Cultures can vary from being aggressive, marketing driven, and fast paced to research driven, a slow but steady approach to growth. Many times the candidate who doesn't have the "perfect fit" in technical skills is the candidate who gets the job because they fit the culture. This obviously works in your favor as well, as you want to work in a culture where you feel comfortable. Imagine that you're a very detail-oriented individual and you accept a position in a company where you're surrounded by peers who only

see the big picture and are not interested in the details. This would not be a good long-term relationship. You would drive each other crazy!

How Do I Find a Job in Food Science?

So, you've done the best you can do in school, your résumé and cover letter are both prepared, and you've practiced your new interviewing skills. Now it's time to look for a job. Where do you start? To whom do you send your résumé? You have a few options.

Companies Interviewing on Campus

There are many companies who send representatives to college campuses to interview graduating students. These companies generally look for the "cream of the crop" candidates. One Fortune 50 company sends representatives to the chemical engineering departments of only the top schools and offers positions to *juniors* to lock them in for a start date immediately after graduation. However, companies sending representatives to interview food science students is happening less and less, probably due to the small sizes of classes, and the expense of doing so without any guarantees of success. This is a good option for students if it's available at your school, but it's not always available. If your school has an Advisory Council for the Food Science Department, try to meet the members of the Council. Many schools have students join the Council for lunch, or make presentations, or even have a mentoring program available. This is a great way to be able to speak to individuals who are in industry and can either be a hiring authority or a good contact for future job reference.

Internet

There are a few ways of job searching online. You can send your résumé to a particular company's website, as many companies list their job openings. Go to the website of a company you like and look at their job listings. If there is a posting that you feel fits your background, send your résumé. You may not get an acknowledgment that the résumé was received, but it probably was. You can also send your résumé to a blind ad, (no company name

listed) or post your résumé on job boards like Careers in Food or Indeed. These are all passive ways of finding a job, and there are a few problems with these strategies. As a student with little to no experience, your résumé is now in a huge pool of résumés of other students who are looking for a job just like you. Also, with blind ad and job boards, you really don't know where your résumé went. Who were those "blind" companies? Who has a copy of your résumé? You may have sent your résumé to companies who were "fishing." These can include both reputable and disreputable companies that are looking to see "who is out there" without having a job opening. When you're looking for a position, whether you're employed or unemployed, be discreet, and be careful. It's not recommended to submit a résumé without knowing to whom you are sending it. If you want to use the Internet in your job search, make sure that you have a person's name and company name to which to send your resume. Know what the job requirements are, and make sure that you meet those qualifications. Refer to the job title in your cover letter and explain to the reader in your cover letter why you qualify for the job. However, searching for a job on the Internet is probably the least effective way to job search.

Recruiters

Recruiters who specialize in placing food scientists are another option. Sometimes hiring companies will ask an executive search firm to screen the candidates if they have an entry-level position open. This doesn't happen often, as the recruiter charges the company a fee for the service. The candidate needs to be much better qualified than all the other candidates, as hiring this candidate will be more expensive. Again, this is an option but certainly not the best.

Networking

Networking is by far the best approach to a job search, and this will be true throughout your career. Eighty percent of all jobs filled in the USA, in food science as well as all other industries, are filled as a result of networking with others. Use every opportunity to network at food science clubs, events, and social gatherings. Join the IFT Student Association and get involved with their programs so that you can network with industry leaders. Go to the local IFT events and talk to people who work for companies where you

might have an interest in working. Go to the IFT Annual Meeting and become a volunteer so that you can meet others in industry. Companies hire people whom they know and like. Get out there and get to know people who can help you in your job search.

Thank You Notes

You just had a terrific interview with a company you would love to work for. What next?

Once upon a time (this is a true story), a job candidate felt that a personal interview had gone exceptionally well. He expected an employment offer immediately. After 2 weeks, however, no offer was forthcoming, and the candidate's enthusiasm turned to dismay. Only then, when he was mentally reviewing (for the hundredth time) everything that had been said – and done – before, during, and after the interview did he remember that he had not sent a thank you note.

Hastening to correct the error, he express-mailed a letter to the employer who, it happened, had never before received such a communication. The candidate's thoughtfulness so impressed the employer that she phoned him and made the offer on the spot.

It's essential to send a thank you letter, whether or not you're interested in a given position. A letter or, at least, a note keeps the door open for future contact. It's a polite way to let the company know where you stand just as quickly as you would like to know their thoughts. It sets you apart from less conscientious candidates and proves you are caring as well as courteous.

It's the perfect venue to reinforce your enthusiasm for the job and the company and the logical place to remind the employer of your qualifications and to summarize the strengths you can bring to the position.

A thank you note also reminds a hiring manager that he or she needs to respond to you.

Determining where to send your letter should not be difficult, and it can be an e-mail. However, is one letter enough? The hiring manager will, of course, be the principal recipient. Nonetheless, don't forget the human resources staff who set up the appointment and the other team members who were on your interview agenda. Let them know you appreciated speaking to them.

Deciding what to say is not as difficult as saying it succinctly – and sincerely. Thank the employer for the interview, express your interest in the position, and clarify points that might have gotten short shrift during your

meeting. Don't neglect to summarize why you're right for the job, personally (e.g., you want to live in that part of the country) as well as professionally.

While fairly simple and fun to write, thank you letters are essential to any job search. The right letter could cinch the offer.

Negotiating a Fair Package

Let's assume that you've been made an offer or two. How do you know which job is the best one for you? What leverage do you have to negotiate a better package? How will you know if there is any room for negotiation?

First, ask yourself: "Is this the job I want, in the city I want? Does it use my best skills as well as give me an opportunity to grow in my career?" "Will I be challenged and enjoy the work?" If the answers are "no," tell the company right away that you're not interested, and thank them for their time. Be gracious, as the food science industry is a small world, and you don't want to shut any doors for future consideration. If the answer is yes, then evaluate the offer fairly. An offer includes:

Salary Companies generally have a salary range that they offer students based on the students' level of education and industry experience. (Another reason to do those internships!) Unfortunately, as a student, you don't have much leverage to negotiate. You should research what the company has offered other students who have a similar background to yours and make sure that it matches the offer you received.

Benefits (health, dental, bonus, etc.) Good questions to ask would be "When do the benefits start?" (The first day of work or in 6 months?) and "How much, if any, do I have to pay for the benefits?"

Bonus Is there one, and on what is it based? Personal performance? Company performance? Both? When is it paid? Quarterly, annually? Bonuses can add from several hundred to several thousand dollars to your annual income.

Authorization to work in the USA This is an issue that has been more and more difficult to overcome. Are you authorized to work in the USA on a full-time basis, and on what basis are you authorized to work? All companies realize that our undergraduate and graduate programs in the USA are filled with excellent international students. However, not all companies have the

financial capability to sponsor. It is an expensive process and time consuming. The company has an obligation by the US Government to post the position for a certain amount of time before they can open the opportunity to candidates from outside the USA. This is, again, why internships are so important, as a company may be willing to "fight" for a candidate they already know and in whom they have confidence. Companies that are international in scope will be more open to sponsorship than a US-based company whose sales are predominantly US driven. Sometimes smaller companies will be willing to sponsor, as they cannot afford paying a higher salary but will make it up by paying for the sponsorship. If you're not authorized to work in the USA and a company is willing to hire and sponsor you, you must be clear on what the terms and conditions are of your sponsorship before you accept the offer.

Relocation Does your offer include moving your household goods and/or your car? Are they reimbursing your expenses, or is it a lump sum? Any of these options are good; it depends on your personal situation. If you are a married student with children, you might need a little more help than a student who just has a suitcase and a car to move.

Start date Are you ready to go to work right after graduation, or were you expecting to take the summer off? You need to be flexible. Do not expect a company to wait more than a few weeks for you once you have graduated.

Asking for more You were offered your dream job, but there are a few things more that you need. How and when do you ask? The time to negotiate a better package is *before* you accept the job. Don't wait until after you have the offer letter and have verbally accepted before you "remember" one more thing you need. However, if you negotiate a better package, and the company gives you what you asked for, it is not appropriate to turn the offer down. If you're negotiating, it's assumed that in good faith you will accept the job if you're given the extra dollars/benefits, etc. that you've requested. Let's use the example that you've been offered a position where the salary and bonus is fair, but the company offered you only $1000 to relocate yourself to the new city, and you have a boat that needs to be moved. You have researched the price of the boat move and found that it will cost $1500. How do you ask for more without appearing greedy? You must first do your homework and find out exactly how much your move is going to cost. Get written estimates that you can provide to the new company. Tell the company how interested you are in this position, and their company, but ask if they can increase the relocation dollars to cover the written estimated expenses that include the boat. Remember that they may say "no," and you'll then have a

second decision to make. Do you want the job despite the fact that they didn't cover your additional $1500 expense? There's no shame in taking less than you asked for. You're making a long-term decision, not a $1500 one. However, the time to ask for more is *upfront*, when you're in your best bargaining position. Once you accepted, it's too late.

Accepting the offer When you've been made an offer, you need to give your answer within a few days. It's not fair to any company to make them wait for your decision. Waiting for your next interview is not an excuse for stalling your answer for a few weeks. If you've done your homework, you'll probably know *before* you have your interview whether or not you want to work for that company. If you like the people, the offer, the culture, and the company, don't wait. Accept the offer and cancel the other interviews. If you're not sure, perhaps it's not the right fit for you. Listen to your "gut." Do what your heart tells you is the right thing.

Summary

Taking the right steps while in college can lead to having a successful industry career in the field of food science. Good grades count sometimes but not always. Working in the food industry while in school (summer internships) is the best way to guarantee that you'll be at the top of the list of candidates for the top jobs. Professionalism, good communication skills, preparation, and the right attitude during the interview process are equally important. Everything you do or do not do during the interview process counts. There are no shortcuts to finding the right job for you. It takes work, just like anything else you really want in life. Some say looking for a job is a

full-time job. That statement is not far from the truth. Writing a good résumé, cover letter, and doing your homework before your interviews is a lot of work. However, it can be very rewarding when you find the right company and job. Remember, it's all up to you.

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Chapter 11
Employer Expectations/Managing Corporate Life

Dennis Lonergan

Have you ever wondered if you'll end up working for a large corporation or an entrepreneurial business? Some people seem to thrive in one environment but falter in another. Or, they just seem to enjoy one more than the other, while being able to function equally well in both. This chapter won't provide you a crystal ball to look into and predict your future career path. However, hopefully it'll provide you with information that you'll find useful at some point in your career, be it in a large corporation or a small entrepreneurial venture or both.

What You Bring to the Company

The short answer to this topic is your *knowledge*, *enthusiasm,* and *innovative thinking*. Or, put in other words, "yourself." Rather than being a flippant answer to this topic, it really is something for you to think about in depth. By "yourself" I mean to suggest that you've had different knowledge and experiences than anyone else in the company. Hopefully, this will give you the ability to look at problems and challenges just a little differently than will anyone else in the company. You need to bring this unique set of skills and perspectives with you to work every day, and, most importantly, use them! Don't fall into "group think"!

There's a hypothesis, and a historical perspective, that big inventions often come from someone who isn't just new to the specific problem which

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is being tackled but also new to the area in general. This is described in *The Art of Scientific Investigation*, by William Beveridge (2004), a book that I recommend to all scientists, regardless of where they are in their careers. Surprisingly, and probably counter-intuitively, being new to the company actually gives you some advantages over your more experienced coworkers in this regard. Being new brings with it the ability to challenge assumptions. You must feel comfortable asking the "why" questions.

In addition to benefiting the company, there's also one big benefit to you. If you practice bringing all of yourself to work each day, there's a reasonable chance that you'll actually continue to enjoy coming to work! This is especially important after the elation of the first big paycheck wears off, which usually happens after the equally big mortgage, furniture, or car payment bill arrives in the mail.

There's of course a potential downside to this approach. What I've just suggested contrasts with the approach of figuring out how "the company" typically goes about getting things done and then fitting in with that culture. Figuring out the norms and adapting to them will certainly earn you praise as being a "quick learner," being described as someone who "comes up to speed quickly" and is a "real team player." There's nothing inherently wrong with being any of these, and of course they have their obvious benefits, such as helping you keep your job and even getting a promotion someday.

I think it's possible to have it both ways. You can still bring your whole self to work and not be described as a "square peg in a round hole" or, worse yet, seen as being "disruptive." A lot of this has to do with how you question things. One self-imposed rule that I've found very useful is to "*challenge the situation, but never the person.*"

For example:

Counterproductive: *I think that you're wrong in how you are approaching this question.*

Productive: *The current approach isn't getting us where we all want to go…. perhaps we should consider a different approach*.

Now you may be thinking to yourself: "*but the person who has been pushing the current approach is sitting right across from me, so they're going to know I'm talking about them.* Logically true, but, from my experience, these two approaches yield very different results.

Also, as in most things in life, balance is required. Perhaps it's best described by the concept of emotional intelligence. The concept is discussed in the book *Emotional Intelligence: Why It Can Matter More Than IQ,* by Daniel Goleman (2005). It's well worth reading.

Preparing for Your First Day of Work

Since this is your first day of work, you obviously have passed the interview process. That means that you've done your homework and know about the company, their brands, mission statement, and possibly even the names of your supervisor's children (if you are really good with Internet searches). All of this is great, with the possible exception of the last item. So, what do you still need to do to get ready for the first day at work?

The answer may lie in what you need to leave behind. My experience with most people who enter the workforce after just completing their MS or PhD thesis is that they feel that they clearly were hired because of that work. This is certainly understandable. It's the research that you poured your heart and soul into for the last several years. It was summarized in what will probably prove to be the largest written work of your life: your thesis. Also, if that wasn't enough, you had to endure several hours of professors making certain that, although they were "granting" you this degree, you realize that they're still much smarter than you.

Forget it! Your thesis showed that you can learn to do research and that you know how to approach and solve technical problems. That's it. The chances that the specific content of the work had anything to do with you getting hired, or with what you'll be doing in your new job, are very small. However, don't worry; with time, and perhaps a few sessions with a psychotherapist, you'll get over it.

You may also need to leave behind the comfort of being "top dog." Often, the position of "senior" graduate student in a lab is real, powerful, and in the end useful for the smooth functioning of a college research lab populated with students, be they undergraduates or graduate students. In your new job, you definitely will be the new kid on the street, so don't expect folks to follow your dictums with head bowed. You aren't "senior" at the company. Your advanced degree doesn't equate to company experience.

So, is there anything that you need to do to prepare for work? Here are a few specific suggestions:

Find out the dress code No sense feeling even more self-conscious by wearing a business suit when your coworkers are in jeans. Conversely, you probably don't want to show up in a Hawaiian shirt or a tank top and shorts. I've never seen a major food company where that fits the definition of business casual (if you find one, let me know). It may actually help to speak to someone at the company. When I asked a relatively new employee what they wished someone had told them before starting, her response was how cold the air conditioning was set in the building. She wished she'd brought along

a sweater to her first day of work, even though it was summer. This is the type of information that can only come from speaking to a future coworker at the company.

Read the packet of benefits information Expect to spend time with the human resources. You'll be filling out W2 forms, making decisions on various insurance coverages, 401 K deductions, etc. It would be helpful if you read the material that the company most likely has provided you ahead of time, as it'll make this process go more quickly. Also, bring along your Social Security card and a photo ID.

Bring an open mind You're bound to learn a lot in your new job. It most likely will involve products and processes that at best you have only read about before. So be ready to be a sponge and soak up this new knowledge.

Relax Before you know it, it will be your second day, then your second week, and then your second year.

Entering the Corporate World – The Details

There are several things that you'll need to adjust to that you didn't need to be concerned with before entering the corporate world. This includes attending more meetings, on more topics, than you thought could possibly happen. However, probably the most important detail is something called "corporate culture."

A simple definition of corporate culture is that it describes "the way things get done" in a corporation (and it varies from corporation to corporation). A more cynical definition is that it's internal politics or unwritten rules of a corporation.

If you're starting to work for a large corporation and you ask the human resources department about corporate culture, they'll probably hand you a glossy multicolor handout on their corporate culture or values. It most likely will include affirmation of their respect for ethnic and religious diversity, that it's the people in the company that make it great, and the role that the company plays in the larger community. All excellent, but that isn't the part of "corporate culture" that speaks to how things get done in the corporation, which is important for your survival, let alone success, in the corporation.

It may be most useful to give some examples.

Does everyone really own the final objective of a successful project and is cross-departmental collaboration encouraged, or does work get done in silos?

For example, you're working on a new product concept, and you sketch out a quick financial analysis of the approximate delivered margin. Will this be greeted as sign that you're proactive and take initiative (as well as indicating that you were awake during your Finance class, even though it was at 7:45 AM), or will the Finance group get in touch with your boss to make certain you get the message that, in this company, financial analysis is done by the finance group and not research and development (R&D).

Communication Style

Is a PowerPoint presentation (with animation) expected for any "important" meeting or is the culture one of black and white handouts, even if the meeting is with the CEO? It's best to check beforehand. Doing it the "wrong" way will be taken as an indication that you haven't "gotten up to speed" yet in your new job. Mess up twice and you'll probably be headed for a three-day seminar on "effective communication." The best way to find out what's expected is to ask your boss or a trusted coworker.

Understanding the accepted norms for communication up the chain of command is another important aspect of corporate culture. For example, is it okay to discuss information with your boss's boss before you've shared it with your boss? In many cultures, this isn't acceptable, even though all parties will claim to have an "open door" policy and to believe in the value of clear, timely, candid, and honest communication. Again, ask someone, probably the person you report to.

These are only two examples of the intricacies of corporate culture. You'll be able to find more general information by doing a quick Internet search on the topic.

When you do this search, you will undoubtedly run across two general themes. First, keep in mind your audience and use language that is appropriate for them. Communicating to your peers in technology will be very different than communicating with, for example, the marketing and sales team. This shouldn't be considered or come across as, talking down to anyone, it's just common sense and, in a way, good manners.

The second general theme that you'll come across is to 'Lead with a Story,' which actually is the title of a good book on communication. Let me give you a real-life example. I recently gave a presentation to the head of food safety for a major retail food chain in the USA. The topic was a new

path and technology which we had developed that would ensure the safety of sprouts. My first slide was as follows:

> If you have one hour to save the world, spend fifty-five minutes defining the problem and only five minutes finding the solution. — A. Einstein

Now I never met Mr. Einstein, but making a short story out of this reported quote from him, and how it applied to the development of our technology for safe sprouts, certainly got everyone's attention. In fact, the head of food safety mentioned it in the discussion that followed my presentation.

Getting Started on Projects

Read! This is the best advice that I can give to anyone starting on a project. What to read falls into several categories. These include:

Intracompany Documentation

Reports related to your project or similar efforts in the past. These can be technical, marketing, consumer insights, or finance reports. This can eliminate time wasted redoing work that's already been done. Unfortunately, this isn't always practiced. I actually sat through a presentation by a research team that enthusiastically described a technology they'd developed and were suggesting that the company protect it with a patent application. It was a great idea, except for the fact that another team in the company had come up with the same technology and had filed a patent application on it 18 months earlier. All of this was in the company's electronic notebook system…available to anyone in R&D who could read.

Scientific Literature

Although your team is probably certain that it's the first to be exploring this idea, the reality is that others have probably tried something similar before. It won't be described the same way, but the underlying technical challenges have probably been investigated before by someone, and possibly the results are published in the literature. I think you'll find that Google Scholar and Entrez PubMed are excellent search engines.

General Interest Writings

Examples on innovation and new products include:

"*The Tipping Point: how little things can make a big difference*" by Malcolm Gladwill 1999, Little Brown and Company

"The Innovator's Dilemma" by Clayton Christensen 1997, Harvard Business Press

"Blink: The power of thinking without thinking" by Malcolm Gladwill 2005, Little Brown and Company

Delegation and Collaboration

In addition to reading, there's one large difference between how you got things done on your thesis research project and how you'll get those same things done in the corporate world. *The change is that you don't have to do everything yourself*. In fact, you'd better not. Again, it is best to illustrate with examples.

Chemical analysis You'll be expected to submit samples to your company's analytical lab. There may be some very specific or simple tests, such as the specific volume of a baked item or pH, respectively, that you'll do in your own lab. However, in the whole, analysis will be done by another group. Learning to trust results generated by someone you've never met may be a challenge at first.

Sensory analysis This is often broken down into two areas. Large tests that are conducted by a sensory analysis group, and smaller, less formal "team tasting" conducted by the development team. Team tasting can give good guidance but be careful. The first project I worked on in the corporate world spent 3 months going down the wrong path based on a faulty "quick and dirty" sensory test. Long story short, they forgot to balance presentation order, and unfortunately that gave very erroneous results.

Patenting your inventions This varies with company, but I doubt you'd ever be expected to write your own patent application. One model is to have an internal "Invention Review Committee," and inventions which they feel should be patented will be sent to the in-house patent attorney(s). Note that you might have a great invention, but it could be deemed best to keep it a trade secret. This is often the case if it would be very difficult to detect infringement.

This freedom from doing routine analysis and other tasks will free up a lot of time. Some of that time will be taken up by the before-mentioned meetings. Hopefully, there'll be some time left for you to think about how you'll approach the challenges of your new project. This is addressed in the following section.

Project Management

Many corporations use a standardized process for project management. This often consists of phases or "gates" that a project passes through on its way from an idea to finally launching the product. With this gate system, there may be a formal gate meeting, where "key stakeholders" (a.k.a. department heads, also known as "the suits" before business casual became the norm) decide if the project moves forward, recycles to gather more data, or is killed.

Killing a project is something that I should say a few more words about before moving on. First, it isn't necessarily a bad thing. Most ideas don't proceed all the way to a new product launch with a multimillion dollar launch budget. "Fail often and fail early" is actually a wise model for product development. The objective is to minimize the time and money that's spent on a project before it's killed. Second, don't take it as a sign that your career has been fatally tarnished if your project is killed. It has not, and life will go on, both yours and the corporations.

In place of a project gate system, a less formal process of key milestones that need to be passed may be used. These processes are all helpful in making certain that important questions are addressed and addressed in some semblance of a logical order.

The order in which one answers questions is very important but cannot be totally addressed by a project management system. One of my mentors put it this way: "*do the last experiment first.*" What this saying suggests is that you should think about what's the most challenging item on the list of things that must be accomplished for the project to be successful. Identify that item, or items, and work on them first. Since you're the technical expert on the team, this means that it'll fall to you to identify the technical hurdles and identify which one will be the hardest to overcome.

This isn't a trivial task. My experience is that many people have a difficult time with it, especially since there are many items that must occur for a project to be successful. That is, any one of them not being achieved will result in the project failing. However, on this list of things that must occur for the project to be successful, there are one or two items that have the

highest odds of tripping up the project. The key is to identify these and *work on them first*!

This may sound obvious, but human nature tends to push us to work on the problems that we can knock off easily first. The benefit is that this will allow us to show progress on the project, which is seen as a sign that the project is on track, that the team is working together well, and that work should continue. However, it can also serve to increase the amount of time and money that's spent on a project which is killed because the most difficult technical hurdle couldn't be surmounted.

So now you have identified the key hurdle that separates success from failure on the project. The fun work, which your education and scientific training has prepared you to tackle, now lies before you. This work may require that you find a new innovative solution to the problem posed in the "last experiment first" exercise.

Working in Teams

This seems to be an area that's currently being addressed in a student's academic career much better than it was a generation ago. Working on a project as a member of a team is now fairly common in many college classes. That experience is certainly helpful as you start your corporate career.

However, the part that'll differ in corporate life is that the team is now much more diverse than was the team, for example, in your food engineering class. In that class, all of your team members were obviously enrolled in the same course, had taken similar prerequisite courses, and were at a similar point in their academic career. The team in the corporate world will probably be a cross-functional team. This means that there will be people from Finance, Sales, and Marketing on the team, and they took very different courses during college than you did. The team will also be much more diverse in terms of demographics. There'll be people like yourself, just starting their career, and there may be people with 30 years of experience on the team and people any place in between.

This diversity will lead to a much more robust answer to challenges the team faces, but it can also lead to misunderstandings and even distrust among team members. This will test your skills at building a team. There are many good books on team dynamics and how to build a strong team. One that I've found to be particularly helpful is *Managing for Excellence: The Guide to Developing High Performance in Contemporary Organizations* by Bradford and Cohen (1997; Wiley Management Classic).

Moving Up the Corporate Ladder

Probably the first question that you'll face in this area is "which ladder." In most large food companies, there'll be two career ladders: one "technical" and the other "managerial." There of course will be company literature that describes the job expectations of each career path. In general, the technical path focuses on developing technical expertise in one or several areas, being an individual contributor as well as a cross-functional team player and providing technical leadership. The managerial path will entail accountability for achieving business objectives, developing strategies to meet business objectives, and, most importantly, skills to manage people and help with their career development.

However, I think there is one question that you can ask of yourself that will help with this decision. That question is "will I be happiest being the person actually coming up with the innovative solutions, or will I be happiest being the leader of a group and watching others in that group come up with the exciting inventions?" A reflective and honest answer to this question will help to point you in the right direction.

So, once you decide which ladder you want to ascend, how do you go about getting promoted (and promoted, and promoted, etc.). My suggestion is that the way you move up the corporate ladder is by *not* focusing on it when you are new in your job. Doing excellent work and accomplishing more than is expected of you is the foundation for moving up the corporate ladder.

Whatever your path up the corporate ladder, make certain that the trip is an enjoyable one and one in line with your personal goals in life. I believe that enjoying your work every day is much more important than where you end up on the corporate ladder.

I'll give one last book recommendation. This is a very short book, so if you only read one, I suggest that you try this one. It's *The Radical Leap: A Personal Lesson in Extreme Leadership*, by Steve Farber (2004; Kaplan Publishing). Enjoy your career and make the world a little better place for your efforts, and I'll end by leaving you with my own list of Principles for Scientific Innovation.

Lonergan's Principles for Scientific Innovation

- A problem well-defined in fundamental terms is 80% solved.
- The best person for the job is the one who knows what to ignore.

- What a fool sees and believes, a wise man reasons away.
- Don't read all the literature in the area before attempting to solve a problem. It'll result in looking at the problem the same way as everyone else has in the past.
- When trying to stop an unwanted event from occurring, think about what you'd do if you were trying to make it happen.
- The least useful seven words in research are "we tried that before; it won't work."
- Have passion and set audacious goals. Then, see who wants to follow you. They are the ones you want as colleagues.
- Be careful of falling in love with your own theories. Even Nobel Prize winner Niels Bohr said that his theory on the structure of the atom, although useful, was probably incorrect (and it was….both useful and incorrect).
- If you don't look forward to coming into work in the morning, figure out why and do something about it. Great inventions never came from someone who didn't like what they were doing.

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Chapter 12
Employer Expectations: Could a Smaller Company Be for You?

Susan M. Hough

Good Things Can Come in Small Packages

You have probably heard a lot of stories about smaller companies such as the dictator, tyrant owner who micromanages everything you do, that small companies are not as stable so you will have less job security, or they cannot afford to pay a decent salary. The information can be contradictory and confusing. One thing is certain, smaller companies dominate the landscape of job opportunities. It is estimated that two-thirds of all jobs are from small companies. Small companies are defined by the US Department of Labor as less than 500 employees (50 or less could better be defined as a start-up company). Of course, a lot depends on the specific industry and how much automation a company may have. You will find that many in the industry will consider a small company to be under 200 employees and a company that has 200–500 employees to be more of a midsize company. However you define it, there is a distinctly different culture and work environment between a small/midsize company and a larger national/international company.

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Are You Happier Being a Bigger Fish in a Little Sea

It is very easy to fall in love with the idea of working for the largest of the food manufacturers, Kraft Heinz, Nestle, General Mills, or Unilever. These are names we all recognize, whose products we grew up buying. However, there are many more manufacturers we do not see. They dominate the smaller niches in the food chain, such as private labels, smaller brands, or the ingredients themselves that go into those famous brands.

Daily life in the smaller company can offer you some significant advantages over the corporate larger company. They can include the following:

- Since there are fewer employees, the smaller company typically will have a flatter organization, meaning fewer bosses to contend with and less of the associated bureaucracy. Less time is typically spent in meetings, and decisions are made more quickly. This means you have more time to focus on your work versus navigating the landmines of corporate politics.
- You may find yourself working side by side with upper management or the owner themselves. You can learn from their example and management styles to help you understand those traits that allowed them to get where they are. Working side by side with upper management can lead to much more visibility and opportunities for recognition. Your ideas and suggestions can be given the attention needed for implementation.
- You get to see how the organization functions as a whole versus seeing just one small corner of a division of a large company. The corporate and manufacturing may all be under the same roof, so you can see how customer service, scheduling, sales, purchasing, production, quality assurance, and research and development all interact.
- With fewer employees, you will often have more job responsibilities and the ability to help out in areas outside your job description or department. You could find yourself on the line helping production, traveling to visit customers, or helping logistics on the year-end inventory taking. These experiences are a bonus in building a foundation for future employment and advancement.
- A growing small company's environment can be more exciting, dynamic, and fast paced. Smaller companies are often nimbler and more versatile in order to compete in the marketplace. Changes and new product rollouts can occur more easily and quickly.
- With only a small group of co-workers, you are likely to get to know everyone, form strong bonds, and act as a team. Often the small company has a less formal atmosphere.
- Do not fall for all the stereotypes that a small company cannot compete with larger ones when it comes to salary or perks. There are always the

cases where this may be true, but you really need to look at each opportunity on its own merits. In very rapid growing small companies, you may, in fact, have more opportunity for career advancement or profit-sharing programs.

Welcome to Boot Camp

With smaller, leaner companies, all employee contributions are critical to the success of the company, so with all the above positives can come some negatives. Visibility to the upper management can have the opposite effect if you are struggling to fit in or cannot handle the challenges thrown your way. The smaller company can be more demanding, from the standpoint of getting their money's worth. They cannot afford to carry extra employees on the payroll who cannot deliver. You need to be honest with yourself in assessing whether the above environment excites you, or if you really are better suited for a workplace that is more predictable with more structure, defined rules, and responsibilities.

What You Bring to the Small Company

When reflecting on your abilities, look for the following traits that could help you predict your future success:

- Are you a self-motivated individual or do you need someone to tell you what to do each step of the way? Initiative and a "can do" attitude are a definite must.
- Are you a quick learner who picks things up easily? The smaller companies may not have as formalized training programs as the larger corporate giants. Your training may involve much more "on-the-job" learning. There is a certain expectation that you will adapt fast and speak up if you need assistance.
- You are good at multitasking and juggling several responsibilities or tasks at the same time. The more you assert yourself, show initiative, make suggestions, and show the desire to roll up your sleeves and dive in, the more successful you will be.
- You have good communication skills (written and verbal). You are a team player. You thrive on that feeling of camaraderie you get with working together with your peers.

- You are not afraid of a challenge and can be flexible enough to handle changes in your work and responsibilities on a regular basis.

Getting That Job

There are a tremendous number of food companies out there. Do not wait for an Internet posting to send in your resume. You can take advantage of the fact that a company has a job opening coming up soon or has delayed advertising for a job. An unsolicited resume will often get looked at much more closely than one that shows up with hundreds of others. If you have the right stuff, a company may take the path of least resistance and give you that chance first to be what they are looking for versus spending a lot of money on ads and recruiter fees. Companies have been known to see an outstanding candidate and even make an opening for them.

Before sending in that resume, do your homework first. You will want to consider the geographical area you will live. Is the company the right size for you? Are you open to all industries, or do you want to narrow your field (meat, canneries, dairy, bakery, or confectionery)? Does the company have a website you can visit? Many small companies (and some large companies too) may still be family owned. Try to avoid making assumptions or falling for stereotypes. Although there are the owners who are domineering and like to micromanage their employees, you can find this also in any company with the wrong boss. At the interview, try to get a feeling for how much freedom the employees are given to run the business.

A small company may be more flexible in the types of jobs they will consider you for. One area in which there is often an advantage to the food science candidate is in research and development/product development. The fact of the matter is that many of the larger companies may not even consider a candidate for this department unless they have a minimum of a master's degree. Smaller companies are much more negotiable on this. Depending on your resume and work experience (including internships), they are more willing to entertain a bachelor's degree.

Stepping-Stone to Greater Things

Do not forget that the smaller company can act as a great stepping-stone to add to your resume. Today very few employees stay with the same company for a lifetime. If you plan your moves carefully, you can quickly gain a

tremendous amount of experience and people skills to move up that ladder. Much can be said for the advantages of having interfaced with the upper management directly, having those diverse work experiences and broader responsibilities to build your career from.

Many people also move back to the small companies later in their careers because of the sense of control they can have over their work environment, not to mention the feeling that they can really make a difference at the company. A strong leader in a small company can positively influence it from a company that is always fighting fires, to one that is proactive and preventative. New ideas on policies and procedures to improve quality, reduce downtime, or increase sales are more readily embraced. If you have a strong yearning to have a significant impact and change the culture of the company in a positive way, you may find a small company is for you.

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Chapter 13
Successful Career Management

Christine Nowakowski

You've worked hard, and now you find yourself with a job in your chosen career. What is a career anyway? I like to view it as a daisy chain of experiences, mostly comprising of a job, and includes other, equally important items, such as a network and continuing education. The beautiful thing about food science is that folks have one common thread – an interest in food. Unfortunately, that's also a challenge as a typical job in the food industry can span the topics of engineering, biotechnology, chemistry, material science, microbiology, law, human safety, sensory, psychology, and more. Regardless of these differences, common themes for a successful career are alignment of your level and type of education to your employment, market demand for your skill set, your resilience and awareness, and your ability to generate and maintain a network to enable change and security.

Understanding your own skill set will help you solve many issues, whatever your job function. It's also important to know how to learn what you need to about a topic you're not familiar with. That is, you need to learn how to find reliable information and sort through what you find to figure out what is important. Part of this equation is deciding what is a topic of interest for you versus a business need. If this is an interest with minimal alignment to the business, then it's best to keep enrichment on that topic to off-hours. Occasionally, serendipity strikes and your interest aligns with a business need, so be open to those opportunities. If a topic of interest does align with business needs, then review your company's policy on open work time. Do they support small, low investment incubation of interests? A healthy

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company environment will readily invest an hour or two per week on employee learning, thinking, and informal prototyping.

One key difference, after graduation, is that you don't need to have the answer immediately. In fact, how you answer can be equally important to what you answer. It is okay to say "I don't know," but how you say it can influence your perceived success. A better answer might be "I don't know, but I can find out" or "I know a resource/person who does know." This response shows that you can help others and be a positive force in ways other than your specific technical excellence, shows integrity, and builds trust with others, independent of their position (supervisor, direct report, etc.).

Career success depends also on what your goals are. It's best to have an idea for short-term (2 years), long-term (5+ years), and legacy theme (20+ years). I know trying to grab at a legacy theme will be hardest of all, but think of that as your overall core values, as in "I want to be a successful technical innovator with a strong technical, external network." Or, "I want to be a successful business influencer who enabled product growth." Most of your career time will probably be spent making sure your short- and long-term goals are on track.

Create Your Structure

In addition to a vision and goals, you'll need a way to measure success toward those goals. As a career is more than your job and it also involves your personal life, I suggest having some work-life balance criteria in your assessment.

Start by assessing your skill set. This includes not only your technical and formal training but your traits and habits. Getting that first job is great, but a good career fit is even better. You'll be able to assess goodness of fit once you have your goals and skills clear in your mind, and then you can probe the employment culture around you to see how it can support you best. I recommend reviewing your goals and accomplishments toward those goals at least annually. For your short-term career goals, I suggest having specific goals with tangible actions that are measurable.

Individual Development Plans (IDP)

Table 13.1 is a good start to something commonly referred to as an IDP. Originally, the concept of the IDP was solely focused on individual development. However, companies have seen the advantage of the IDP as a

Table 13.1 Sample career goals and metrics

Long-term goal	Short-term goal	Actions	Timing	Outcome
Maintain technical excellence	Investigate 1–2 business relevant technical solutions	1. Connect to businesses to identify needs 2. Investigate fundamental principles underpinning technical solutions	6 months.	Identify one technical solution to develop into a formal project

retention tool, improving employee satisfaction, and as a talent development tool, creating new skills to quickly adapt to new market needs. A successful IDP has three elements: goal design, delivery, and company support. Adequate goal design reinvests in both you and the company. It is not necessarily tied to project goals, but it maintains measurable milestones. Take time to craft your goals as an individual, with support from your mentors, peers, and manager. Delivery on these goals is essential to maintain the credibility of an IDP. Hold yourself accountable to your stated goals and seek outside review to measure progress. If you do meet with your manager on this topic, keep this meeting separate from project update meetings or performance review meetings. None of these plans are sustainable if the company itself doesn't support this process with people, time, and money. Support from managers and mentors can take the form of making time, actively listening, and becoming truly invested in your success. Also, it's not all about you, either. Will you be willing to support a mentee in the future?

Money is also an influencing factor for a robust IDP program. Money comes in the form of supplying employee time to focus on this rather than "getting product out the door." It also can be tangibly linked to management's performance reviews, which are commonly linked to bonuses and raises. The idea must be internally marketed as valuable to the individuals within the company as well as a valuable asset to the company.

Feedback

All the plans in the world will not help if you do not get feedback from others. Whether it's positive or negative, honest independent insights will help you avoid mistakes before they become problematic and will cover your blind spots. Sometimes what we cannot see is due to our position, especially if one is at a lower "clearance" level in a company, or it could be our personality or others' personalities. However, leveraging the insights of others is the best way to test the validity of a career plan.

There are five common ways to get external feedback: informal/impromptu feedback, periodic reviews, network checks, anonymous reviews (i.e., 360 reviews), and formal performance appraisals. Informal/impromptu feedback is best described as simply asking people you're in dialogue with about how you're doing. Be specific as to the type of feedback you would like to get. For example, at the end of a meeting, simply ask: How did you think that meeting went? Is there anything I should consider changing or anything that went particularly well? Jot notes to yourself and consider the feedback. I like to save these notes in a file to reflect upon to identify trends that may need improving or talents I have personally overlooked.

Regular periodic reviews with supervisors are critical to your success. If you have a supervisor that is crunched for time or simply does not see the value in regular meetings, take charge and organize them yourself. Biweekly or monthly meetings are usually sufficient. My goal for these meetings is to inform my supervisor of what I've been doing and ask them what is the strategy in the near and not so near future and how I'm syncing up with expectations and stated goals. Create the agenda or jot notes to yourself prior to an update meeting. This allows you to reflect on 2 weeks of work and supports self-direction. If you come to meetings prepared, you will stand a better chance at shaping your own destiny. It also opens up the dialog for you to learn the next levels of responsibility in the company. It's also helpful to retain notes from these meetings as they will easily compile into a 6-month or annual review document. If you have specific feedback you would like during a periodic review, it's helpful to send questions ahead of your meeting so your manager's response can be thoughtful.

Networking is a critical function in business. Good manners and appropriate dress are important facilitators of credibility. Casual dress and conversation style may undermine your efforts as a contributor if they're inappropriately applied. Regardless of what your job is, you will likely encounter persons from other countries. For example, international meetings, especially in Europe, have a more formal sensibility and hierarchical structure than in the USA. Within your own sphere, network establishment and maintenance are important. I know of individuals whose networks are so large that they keep a reminder calendar of when to check in with people in their network – holidays, birthdays, etc. Connecting with others sporadically, outside of times when you need something from them, builds trust and connection. It is better to have a connection with a former mentor/mentee before you're looking for an employment opportunity. It can be tempting to let a network connection fall away, especially when challenged with looming business deadlines. Resist this. Networks are one of your key powers for you to maintain a perspective outside of work and are critical to life balance.

I keep some formality to some network meetings where I like to have specific questions sent ahead of time of a scheduled meeting. Not only do I do this with mentors, but I also do this with mentees. Mentees typically enter the network relationship with some hesitancy and an overabundance of humility. I tell mentees upfront that I consider this a dialog and I'm hoping for them to help me as much as I help them. For example, mentees give me valuable advice on my coaching style, link me with opportunities and other networks, and improve my technical skills. There have been numerous times when someone in my network did something that was so easy for them that they didn't notice how significant a contribution they had made. I try to call those things out to others and thank them (and thank their boss)!

When I'm considering my network, I look for peers in positions that I may want to learn more about, a skill I may want to explore, or a way of looking at things that is very unlike me. I personally like to see strategy and interconnectedness. One of my weak spots is following through on communicating details, especially if it is something I consider a "check the box" kind of thing. However, often details are very important in order to confirm the job is well done and to also get the credit for the effort. Think of your strengths and weaknesses, and find allies who can help you improve those skills or compensate for them on a team.

Anonymous reviews such as a 360-review is a computer-generated questionnaire that generates numerical feedback from a broad group of peers, direct reports, managers, and others within the company. Some companies require these reviews periodically for assessment purposes or for promotion. Some companies assist employees to set these up upon employee request. In addition to a numeric evaluation, there is a direct comment function. Both values and specific comments can assist you in career development. Be cautious of reading too much into specifics, however. Look for general trends and plan accordingly. Also, do your colleagues a favor and don't use these anonymous feedback systems to simply complain. It's truly meant to be a constructive tool. That stated, this approach has fallen a bit out of favor. Personally, I think they can be incorrectly applied and result in a company culture that biases toward making sure everyone is happy. Sometimes, tough decisions need to be made yet will disappoint people, and anonymous reviews can lead to culture stagnation by indecision as a means to avoid "a bad review." The computer-generated results can also give a false sense of greater validity due to "quantifiable" data. These types of reviews are best applied for broad concepts and test a large number of employees vs. an individual's performance with very small sample groups.

Performance appraisals are another formal means of getting feedback. Also, accountability is critical in a corporate setting. As you establish

weekly, biweekly, or monthly update meetings, review and compile your meeting notes to create a mid-year summary. I typically request a mid-year review with my manager to check if our goals have changed and to get a semi-formal opinion on progress. This gives enough time to correct course if expectations are not being met, and it also diffuses the potential for unexpected outcomes at a year-end review. The natural force is to push these mid-year reviews aside as the daily pressures amount. Resist this. It is in your best interest to have this meeting. This is especially critical when you're aware that there is a suboptimal fit in regard to skills, expectations, or work styles. These meetings will help you identify potential communication or expectation issues early and also help you identify new opportunities. If you have leveraged your informal and formal tools properly, your annual performance appraisal should not contain any surprising information. If it does, since you have kept your records throughout the year, both your manager and people who report directly to you can review prior documentation to see where the communication disconnect occurred. This provides you some insulation from mercurial management moments and again allows you to control your own destiny. At each of these points, consider the feedback and decide on a specific action plan.

Other formal feedback mechanisms that are popular in business are style/type/strengths assessment tools such as the Myers-Briggs personality indicator or Strength Finders. These are meant to assist people to understand differences in teams and individuals and develop communication tools suitable for their personal style.

Mentoring

Formal mentoring programs are helpful to become involved in as both a mentor and a mentee. It's a way to network with persons outside of your immediate sphere and is a good source for honest external feedback with a safe place to test new ideas. Informal mentorships also commonly arise and are very valuable for external feedback as well as improving your overall knowledge of a company. These types of mentorships can be with anyone and can be part of ad hoc "mentoring circles" formed by peers or groups with other points of affinity such as persons of color, LGBTQ+, or veterans' groups, for example. A healthy mentoring relationship is mutually rewarding. Both the mentor and the mentee expand their network and learn new things. These relationships can also ebb and flow as needed over the years or may be of short duration, focused on more specific goals. Formally supported mentorship programs within a company and networked out to the

community tend to philosophically support informal mentor relationships. Another mentoring system, outside of the company, is within professional groups. Look to your professional associations such as the Institute of Food Technology (IFT), American Chemical Society (ACS), Academy of Management (for the business-inclined), or other professional groups for formal mentoring programs. These associations also give you excellent access outside your company for informal mentoring and networking opportunities, and it demonstrates your service to the discipline, which is necessary to support your visibility both internally and externally.

Bring the Outside In

Networking benefits the company too. Also, if you can align your growth goals with your company's, then you will likely be able to align resources toward these efforts. Let's go back to Table 13.1's long-term goal – maintain technical excellence. You're in a unique position in that you have been trained in a field through your formal education, and now you can filter outside ideas and convert them to apply to a business need while advancing your long-term goal. Today, it's relatively easy to access information; the challenge is to discern that information to useful and truthful bits and apply that to our world. I start this process looking at my company's portfolio: What types of products are being sold? Who are the consumers? How broad is that portfolio? Are there unmet needs? Are there unmet technical needs internally? That's the start of my shopping list. Then, I look to external resources and network to internal resources that may have history and a helpful skillset or will be a good ally/sounding board. Through some of the professional associations, there are opportunities to learn new technology. This can be done through reading articles, attending conferences, participating in conferences, and being active in local chapters. As food scientists in the industry, we generally benefit from two bits of information – technical advances that enable meeting consumer needs or improve a company's ability to accomplish a consumer need and business advances that enable a new way of thinking about a consumer opportunity. For the first part, technical advances, I like to read research articles, and these can be more easily obtained through associations, company subscriptions, or government resources. For example, the National Institutes of Health (NIH) has many resources online for health topics. Your company may be large enough to have a library service or knowledge service. If it does, seek it out. It's an excellent way to efficiently get information. If your company doesn't have

internal resources, then local colleges and universities may be your best bet. The best way to get access to those is to be an alumnus, to volunteer at the school, to access the university libraries through your local civic library, or to build a case for why your company should invest in accessing this type of resource (1–2 business "wins" leveraging outside info can go a long way on this last point). For the second part, business opportunities, I like to canvass popular press. Book vendors usually have a top 10 reader list for business. I try to review that every month. I also try to screen what's going on in other countries. Knowing what the latest is in organizational behavior – maybe it has to do with the color of your hat or if your cheese got moved – will help you speak the same language as your nontechnical business counterparts. I also like to scan the general nonfiction popular press as I find it a quick way to learn about food trends in the mainstream. Most importantly, your consumers are reading these books and are influenced by them. This will help you identify with your consumer and give you ideas on how you can convert those influences to product opportunities.

You might be thinking about now: that is a great aspiration, but when will I have time to learn?

Project Snelling

I spend most of my week gathering information (I tend to print it out or write down the links). Then, usually on a Friday afternoon, I spend an hour learning. The first 10 minutes is culling through that information. I admit most of my collection does not make the cut. Some gets deferred to next week, some tossed. The remaining time is to learn – sometimes for no known purpose other than it's interesting. Do your best to defend this time to think. Alas, the pace of business is brisk and just about everyone can see our calendars. So, many years ago, I invented Project Snelling. A Snelling hook is a type of fishing hook. By calling something on my calendar Project Snelling, the casual meeting-scheduler will pass on scheduling something over that time. I found when I booked time for myself on my calendar using the phrase "library hour" or "thinking time," it helped me organize and respect this time, but sometimes meetings would overlap with the general sentiment of "meeting X is important, and it's hard to break into everyone's schedule, you can just learn some other time." Yes, however, time erodes away if not defended.

Creating Intellectual Property

You have carved out your time to do "technical scouting"; you have looked at your company portfolio and consumer needs and have identified opportunities and ideas. It's time to internally network. Set up time with someone working on a product that you think could benefit from your insight. Start by asking and listening. How are things going? Any new projects? If you don't already have a connection with this person, perhaps start with getting to know them, and then move on to what can be described as a casual informational interview. After learning about them, the product, and the cultural surround, then share your idea. How are they responding to the idea? What are they adding to the idea? Most of my ideas don't go anywhere, at least at the beginning. A few make it through to patents and in-market improvements or new products. Every conversation has been worth it. None of my ideas would have made it to fruition without the collaboration of others. Patentable ideas can be very clever or really simple. The key ingredient is as follows: Does it make sense for the company? Also, another caveat: Will the company patent it (other patents, cost of patenting, etc.)? From the perspective of a scientist, engineer, and inventor, we see the technical opportunities. Collaborating with others will help bring the business rationale alive and will help bring ideas to the action level – try it in a product or manufacturing facility. Understand the financial impact. What are the hurdles? As you share your ideas, I'm sure someone will provide you with a reason why not to do it. Listen to them and address as many of their points as you can to make your idea better and attract allies. There are some things to keep in mind, however. Companies typically have a method of internally tracking inventions. If it doesn't, this is a critical need for a company to grow. Ideas must be internally documented by a legal team. It is the recorded "sketch" of the idea, why it's novel and what business application it will improve. Generally, if discussing internally in your company, feel free to share your idea. If you need to involve people from another company, then this is when your management and legal team can help you navigate the waters. Sometimes, you need external help to get an idea off the ground. How you involve an external group depends on the relationship with that group and what role they play. Confidentiality agreements are key tools in external collaborations. However, I still think it comes down to this – Do you trust them? Rely on a team in these cases; you will learn a lot from others who are skilled in external collaboration and innovation.

Proprietary Information

There are three tools to a company to protect their discoveries: trade secret, patent, and public disclosure. Trade secrets are things that your company has documented and kept to a small circle of people knowing the details. A product formula is an example of a trade secret and it would be critical to not disclose any information regarding this. Competitors can go to great lengths to dig for information. These attempts can be pretty aggressive (hacking, phishing) or subtle (conversations).

Patents protect companies by ensuring that they can use a particular discovery and prevent others from doing so. Patents are not forever nor are they ironclad. They are a type of public disclosure, and one can learn about how an invention was created, which is a great starting point for a new invention. Patents are costly to file and maintain, so even if the idea is technically brilliant, it may not be patented unless there is a demonstrated business need to protect that idea.

Public disclosure can be another way of communicating, although it isn't as commonly used in a company. It can be a great tool on topics of general good – health, regenerative agriculture, and philanthropic efforts. Additionally, it can be part of external collaborations where a university may wish to publish information in a refereed journal.

Overcoming Resistance

Sometimes you will hit a brick wall. Maybe your ideas are going nowhere. Maybe you are feeling stuck. Maybe it's just a bad cultural fit overall. When these things happen, you need to change things up. First thing I do is look at the kind of resistance. There are good reasons and bad reasons for resistance. Actively listening to others and then honoring yourself by actively listening internally will help you determine if this is "good" or "bad." You may find yourself saying, time to look for new opportunities outside of this current employment (time to find a new daisy in the daisy chain of jobs). However, if you decide this is still a good overall fit, then think about how you can improve your situation. You could look to expand your network, especially in areas that you had not explored earlier. You could look at internally adding new skills either through mentorships or education. Although it's very uncomfortable to come up against resistance, this is an excellent learning opportunity. What is the nature of the resistance? Is it a style mismatch? Do you need to change how you express yourself? Is it a

technical gap? Do you need to educate yourself in a new skill set? Is it cultural? Can you find allies more aligned to your cultural or personal sentiment? Brick walls need to be gotten around, over or through. How expansive is the resistance? Cultural or just one person? Is their validity to the resistance? Can your colleagues or managers help you overcome a resistance? Can you reduce the resistance directly? Sometimes the best way to move someone away from the word "no" is to find a better "yes" for them than the status quo.

Education

Expanding your skill set is always a good idea. This can be done in several ways, some of which have already been mentioned – mentoring, reading. Formal education can involve getting another degree to add on to your skills portfolio. MBAs (Master's in Business Administration) are now readily available (online, on ground, or blended) through for-profit and nonprofit schools. There are also specialized MBAs – Executive MBA, project management, etc. The choices are so plentiful that I suggest you investigate your personal return on this investment and consider what the educational value vs. cost investment is when considering programs. A company may have an education reimbursement program. Typically, these programs go toward degree programs but can also include specific training such as language training or specific business skills training (successful negotiations, organizational management).

If you're interested in a larger investment such as advanced degree training, then find out what are the conditions for educational support. Some companies have requirements such as grades attained to determine the level of financial support or length of time employed before and after course completion. Companies who have education programs may also have accreditation requirements for learning institutions. Really take the time to investigate. Just because online might be more convenient, it may not have the rigor expected of a conferred degree. This may seem not as important until, after degree conferment, potential employers have knowledge expectations of you. For example, although not as common, there are Masters in Food Science. However, these programs commonly rely on coursework vs. a written thesis. Unfortunately, most expectations of a technical graduate degree assume a hypothesis was formed, tested, and written about, which is unlike expectations of an MBA (no thesis assumed). This disconnect can surface in a variety of ways, either at a job interview or during work collaborations. If you choose to do a non-thesis technical degree, then you must, at minimum,

learn the basic skills of creating scientific insights and developing them to a conclusion. Otherwise, you may lose just as many employment opportunities as if you had not attained the advanced degree. Good resources to find both funding and quality programs are your HR department, colleagues, and professional sites (IFT, ACS).

Internal Training

A company will have internal training resources as it is critical for the company's and an individual's success. Commitment to safety and adequate technical training demonstrates clear valuation of employees. Most commonly, safety training is a requirement to avoid workplace accidents. If a program is well-run, this is a benefit that keeps on giving. Safety training can highlight common habits at home that are improved by increased safety awareness – fire extinguishers, smoke detectors, hearing protection when moving the lawn, etc. As this type of training occurs annually, it may also be an opportunity to get more involved in the company, especially if you're a new employee.

Specific skills training commonly revolves around the key products manufactured at a company, and a healthy company will provide access for employees to improve their knowledge. This can take the form of internal schools or training sessions specific to core business needs. Product-related training, human resources courses – organizational development, ideation skills, and marketing – or consumer insights courses are common. Also common are online training resources. These could be suites of information through a contracted university or could be instructive links posted ad hoc through an HR website. The best way to access this is to connect with HR, your manager, and peers to find out where the best places are to go to improve specific skills. You could also put this as one of your goals for your IDP.

Annual Goal Setting

Annual goal setting is the formal way for groups within a corporation to demonstrate success. It is a promise to do what you say you will do for the next fiscal year, and it is a rubric for how well you accomplished things at the end of the year. Most times business goals work their way from top down. You will see this at annual meetings as the leadership sets the tone and

aspirations for the company that year. Regardless of your position in a company, pay attention to these meetings and prioritize them. Listen to what they say, how they say it, and what they do not say. Although your training may have focused on scientific studies in school, being in a food business means you will need to equally respect the business side of things. If a company is publicly traded, then they will publish an annual report. Read it. Get familiar with business terms such as earnings, stock price, divestitures, acquisitions, ROI (return on investment), ROA (return on assets), etc. These metrics will influence how the senior leadership will prioritize work for departments, directors, managers, and, ultimately, you. Let us assume one scenario where you are a new scientist at a specialty snack company. It is a new company with one successful product on the market. You have just heard the company president say she would like to increase the business by 10%. What immediately comes to mind as you're sitting there listening? Sell more of the same thing? Okay, that might not involve you, or might it? Do you have an idea on how to manufacture the product more efficiently, thereby increasing production? Does your technical expertise make you the best person to team up with others to find an external manufacturing resource so your company can make this product at an additional location? Can you think of a way to make the product cost less to manufacture, so you could lower the price of the product and increase sales by providing consumers with a better value? Or, do you have an idea for a new product that could be made using the same manufacturing line, thereby attracting new consumers or adding delight to your current consumers? From thoughts like this, you can work with your leadership to craft your next year's business goals. As you watch and listen during leadership meetings, you'll get better at comparing your place of employment to the success of other places of employment. Also, if you can anticipate a merger or divestiture, this can also help you prioritize your work. Getting familiar with the business of food will help you anticipate when or if you might need to be open to moving on to other employment opportunities. When writing your business goals, work closely with your management team to make sure your goals align with the company and division goals and are attainable with concrete metrics in place. There are several ways to do this, but my favorite is the SMART model (specific, measurable, attainable, realistic, timeline), as seen in Table 13.2. Let's go back to the snack company and set a business goal to enable that 10% growth.

A large company probably has favored models for setting and managing business goals. You may need to invent one of your own or adapt one from existing models. Adding in the specifics regarding resources needed, timing, and success milestones will help bring your ideas to life and create a

Table 13.2 SMART business goal

*S*pecific goal	Create new snack flavor
*M*easurement	1. Consumer insights identifying top flavors 2. Taste testing to decide top flavor to launch 3. Cost calculation to confirm profit margin is in line with business expectations (so it will not cost a fortune to buy!) 4. Plant trial and sales sample manufacturing to confirm you can make the stuff efficiently
*A*ttainable	Resources needed Plant manufacturing – line time, plant manager and leadership team support Product testing – sensory, consumer Marketing and sales External resources – ingredient suppliers and technical expertise
*R*ealistic	Create project timeline, responsibility, and resources chart, also known as a charter or project brief
*T*imeline	Create milestones to track progress along the way

transparent agreement on expectations for what success looks like. Milestones are also important to track as they can help you celebrate successes along the way to attaining the business objective, and it is an early warning device to show when things are not developing as expected. In this latter case, with the specifics identified, you're in a stronger position to ask for more resources to overcome whatever is preventing you from attaining success.

Product Life Cycle

As you may have noticed, a product life cycle starts at the top, where there is a business strategy objective. This is followed by ideas and concepts that are internally developed by cross-functional teams or externally obtained from a business collaboration. After concepts are tested with consumers or otherwise narrowed down (manufacturing feasibility, availability of a key technology, etc.), prototypes are developed. These could be manufactured on a small scale, such as during a plant trial to test manufacturing feasibility or it could be a virtual mock-up to test consumer interest. If a product successfully passes these hurdles, then the lead developer is responsible for the fidelity of reproducibility from prototype to mass production. A product's development timeline depends on market trends, the company's expectations for the product, and the desire to market the product. Photo shoots and packaging materials, for example, take time away from product

development time. New processing platforms can also limit a team's ability to tweak a final formula. Also, once packaging is sent for printing, there is very little that can be done on ingredient changes.

Scale up is a critical consideration when developing a product. Typically, development work starts at the bench and increases in scale to a pilot plant and then a manufacturing plant. Sometimes, there is no pilot plant in between, and you have to test the robustness of your formula prior to manufacturing. I find this best done by trying alternatives of your winning formula so that you can force it to fail. What does failure look like? How did you change the formula or process to force that failure? That way, when you get to the plant, you'll be prepared for unexpected outcomes, and you'll know what to fix if things aren't going well. The evolution of a formula typically coincides with activities of other functions on market fit, profitability, and manufacturability. The product will start to come to life, and this naturally narrows a team's ability to modify it into something else like a different flavor or texture. Timing may be constrained by external need. Changes in federal guidelines or consumer demand for change can severely limit a developer's discovery time. Depending on the size and structure of the company, and business model for that product line, a team may be accustomed to development times of hours to years. Typically, however, for consumer goods, development times for a product are 6–9 months.

Documentation is important but takes time to do well. Every company has its own type of bookkeeping, and it will take time to learn the different aspects of it. Large companies will have software to help with formula specifics, labeling, packaging, and financing, and it is worth your while to concentrate on these details at first. Using a new ingredient, for example, will likely require you to create a new internal ingredient code, which will need to be entered into a database system and approved by labeling in order for it to be used at the manufacturing site. Each step will require input from multiple functions, and this can be a real-time robber. Therefore, consider your new ingredient in the light of this to balance the benefit (cost, technical advantage, sourcing).

Manufacturing Considerations

Most often, you'll be travelling to the manufacturing site. Travel is a necessary component of business, although less so now since so much can be done virtually. Virtual plant trials are more common as it is technically possible to send videos or run a live video stream from someone on the plant

floor to a remote technical expert. There are a few caveats to this; seeing is only one sensory input so you may miss some important inputs (smells, sounds), and there are security and legal considerations, such as "Are any aspects of the plant considered proprietary information?" and "Is your streaming platform secure from hacking?" These caveats can be especially important when leveraging an external manufacturing partner or leveraging an external partner for technical expertise.

When planning a production run, whether it is to test the feasibility of your formula (plant trial), sales samples, or start-up, it's recommended that you conduct a pretrial meeting to make sure all expectations are clearly understood and any questions or concerns are addressed. It's also a good time to review the plant's expectations, especially if you'll be travelling to be physically present. What are the safety expectations? Are there any areas of the manufacturing site that is off-limits to you? Keep in mind, too, that you need to protect your company's proprietary information. I always ask if there is a room where I can put my things and I can keep my laptop locked unless I'm using it. I also try to not take any other business-related calls while I'm at a plant but rather try to answer questions "back home" via email or text.

Business Structure

Larger corporations will have multiple divisions based on product type and business category and several roles within a division. This contrasts with small companies, like start-ups, where a person could have multiple business roles (i.e., product development, quality, ingredient sourcing) and there are no product divisions. Also, in larger companies, there may be different development paths, technical vs. business or nontechnical. Depending on the company philosophy, an employee may move between "ladders," typically using their IDP. Consider your holistic career goals when considering cross-functional opportunities. It may be the corporate culture that favors one ladder that leads to faster promotions to higher levels of responsibility and business influence than others. Cross-functional moves can broaden your understanding of a business overall and expand your network. It's a great way to expand your skill set and get to know the pressures and expectations of roles you had not trained for initially. That stated, you will also want to make sure, when you make a cross-role jump, you maintain your previous network in case the cross-function is not a good fit. Goodness of fit may depend on your level of efficacy at the role or how much you like it. Getting timely and constructive feedback will help you navigate this. Taking

a cross-functional role for the sole reason of promotion is risky especially if it's not a good fit for your personal career goals and work skills.

Closing Thoughts

You are your best advocate, especially when you leverage the power of others. Reach out to the resources available within your company and through your networks. Through specific approaches such as an IDP, continued education, and watching out for business opportunities, you will be enabled to build a successful career.

My final thoughts are the following:

- Networks are as important as technical skills, and both need development and maintenance time.
- A career well managed helps both employers and employees.
- Continued learning and challenging oneself propel a career forward.

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Part IV
Careers with a Degree in Food Science

Chapter 14
Quality Assurance/Quality Control Jobs

Janelle Hefty and Melody Fanslau

Quality is never an accident; it is always the result of intelligent effort

John Ruskin

The production of safe and quality food products is essential to the success of any food manufacturing facility. Because of this, a career in Quality can be extremely rewarding. Without satisfied customers, a company wouldn't be able to survive. When a customer purchases a food product, there's an assumption that it meets a set of quality standards. Issues such as foreign objects, spoiled or mislabeled product, failure to meet net weight requirements, or a recall can all turn customers away from buying a product. The food industry is a customer-driven market in which some consumers are brand loyal based on a history of high quality or in which a single bad experience with a product will turn them away for a lifetime. With this said, the main role of a Quality department is to help ensure that quality issues such as these are eliminated or kept to a minimum to maintain the company's customer base.

Being a part of a Quality department requires a set of distinct characteristics in your Quality tool belt that will enable you to successfully problem solve. Issues that arise can range anywhere from employee relationship problems to manufacturing issues. Sometimes, you will have to solve a problem quickly, for example, to keep a production line running, while other situations will allow you ample time to fully research and develop your

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solution. In both cases, it's an extremely rewarding experience to successfully solve a problem and see firsthand how your solution helps a company produce a safe and quality product for its consumers. You may already possess some of the tools you'll need to be successful in Quality and the others you will be able to develop while in the field. Overall, a career in Quality is an outstanding way to find your niche within the food industry while developing a skill set that'll aid you in all future endeavors – whether they are in the food industry or within another business sector.

Skills of a Quality Professional

One of the primary skills necessary to be successful in Quality is being a good listener. It may sound simple, but listening skills are key to analyzing a situation and determining a proper course of action. Being able to listen and get a good handle on all sides of the situation before reacting will help you to make a sound decision. Proper verbal and written communication are just as important as listening skills. As part of a Quality team, you'll be called upon to make decisions and communicate those decisions to others. Oftentimes, someone may not agree with your decision, and you will have to explain your stance concisely to facilitate cooperation. The "someone" that Quality professionals typically find themselves in disagreement with is production personnel with the nature of disagreement following the age-old dilemma of "quantity versus quality." The fact of the matter is that any business cannot survive without sustaining the delicate balance of producing a large volume of product (quantity) while producing a good wholesome product (quality).

It is for this reason that effective communication skills are an important tool to always have in your belt. It is important to understand that not everyone is going to see your point of view in every situation, so being able to back up your actions with logic while understanding where the gray area lies is essential. For instance, you'll probably not shut down a production line for a couple of mildly skewed labels – the product may not be the "ideal" end product; however, the defect may not be likely to affect customer perception of the brand and prevent future sale of the product. Shutting down the line will however hinder production, and the success of a business depends on the efficient production of product. Nevertheless, there are instances when shutting down the line, no matter what the cost, is vital. In any potential food safety issue, it is important to act immediately, whether it's stopping a production line, putting a product on hold, or shutting down a production room. You can always resume operations or take a product off

hold once the potential food safety issue has been cleared. In the end, it is essential to understand the balance between "quantity versus quality" in order to ensure that both customer and manufacturer satisfaction are achieved.

Another skill that's valuable to have in your tool belt is the ability to multitask. A manufacturing facility is a fast-paced and exciting environment. Because of the speed at which production occurs and the need to get quality product out the door, the Quality department is often called upon to do numerous tasks at once. The ability to multitask in this fast-paced environment is a valuable skill. You must be able to determine which task has the highest priority, tackle that one, and then move on to the issue with the next highest priority. For example, you may be in the process of conducting one of your required production line checks when it's brought to your attention that there's possible metal contamination on another production line. Due to the importance of taking control of any food safety issue such as metal contamination, you'd cease conducting your line check and tend to the food safety issue. Once the food safety issue was taken care of or under control, you would go back and complete your production line check.

The ability to work with a cross-functional team that will most likely include people from all levels of education and industry experience is yet another useful skill to have or to develop. In a food manufacturing environment, you will likely get a chance to work with production, maintenance, sanitation, product development, and management. In most cases, you will not be able to correct a problem or improve a process without the help of one or all these individuals or departments. Being able to work together with a team is key to solving most problems that can arise in a manufacturing environment. Many food manufacturing facilities are going toward a total quality management (TQM) system where it's typical to have cross-functional teams solve problems. There are multiple benefits to a TQM system including a greater sense of ownership in the process, more efficient systems that work for multiple departments, and creative ideas that may come from unexpected sources. For instance, at one food manufacturing plant during a preventative maintenance troubleshooting session in which a TQM team was assigned, a marketing manager who had never wielded a grease gun came up with a solution to the over-greasing problem that was occurring throughout the plant. This was something that saved time (less equipment shutdowns due to malfunction), money (cut down on unnecessary costs), and product (potential contamination of excess grease into the product).

While each of these traits may be characteristic of someone choosing the quality profession, everyone brings their own set of ideals and experiences to the table. There are many different positions that fall under the quality

umbrella, and, as such, there is a little something for everyone to explore. The structural hierarchy of the quality profession within the food industry will vary based upon the size of the organization in which you're employed. Below is a sampling of a few generic positions in which college graduates entering the Quality field may find themselves employed.

Quality Control/Quality Assurance Positions

Laboratory Technicians

Laboratory technicians generally are the go-to people within the Quality department that provide support through the generation of data. Technicians may conduct various microbiological or chemical tests that may be used for raw material inspection, pre-shipment review, product release, Certificate of Analysis (COA) generation, or problem solving in the event of a deviation in the process. A COA is a document provided by a supplier to ensure that the testing required by the customer is within the set specifications. This testing is usually done on a "lot" basis to represent anything from a single batch of product to an entire production day's worth of sample. This may include information such as percent carbohydrate or total bacterial load. Some companies may use this document in support of their food safety or food quality plans or in process control to ensure that the product is safe and consistent each time it's produced. Depending on the organization, a technician may also be involved in shelf life or sensory testing of a product. In addition to product testing, the technician may also be responsible for environmental monitoring to provide data supporting the plant's food safety program. The typical work atmosphere consists of a laboratory setting with periodic work out on the production floor.

If this type of position is something that you may find of interest, nothing is a better preparation than working as a student laboratory assistant either on campus or within the private sector. Many professors look for extra help within their laboratories and are willing to take the time to train and aid in the learning process. While ideally you would want to gain this employment in the field of food science, it's not necessary to get an understanding of laboratory practices. For instance, you can work in a plant microbiology lab and gain experience in sample collection, plating, sterile technique, and other Good Laboratory Practices (GLPs) that will be both impressive and desirable to a potential employer. In addition, it is a good idea to gear your electives toward chemical or microbiological courses including lab work to

gain greater experience and understanding. Further, since this type of position usually involves a lot of data collection and analysis, it would be beneficial to take advanced computer courses in database programs to gain proficiency in data organization and manipulation.

Line Auditor

Line auditors are responsible for monitoring the daily activities on the production lines. This monitoring function usually includes parameters such as net weights, package integrity, product code dates, and overall product appearance. In addition to package or product monitoring, the auditor is often involved in the monitoring of GMPs (Good Manufacturing Practices) including employee hygiene and sanitary line conditions as well as conducting facility audits such as pest control, release of equipment or rooms, and general plant inspections which identify potential hazards throughout the plant. Each of these monitoring functions are conducted to ensure the compliance with the quality standards set by the company or by regulatory agencies such as the United States Department of Agriculture (USDA) or Food and Drug Administration (FDA). A position as a line auditor will allow you to develop your communication and troubleshooting skills. You will likely be required to resolve manufacturing issues such as noncompliant product or sanitation problems through the interaction with production supervisors and line workers as well as with Quality and plant management. A quality auditor position is a great place to start out in the food industry to get hands on experience out on the production floor and gain a better understanding of the process.

Many internships within the food industry are auditor-type positions, so it would be advisable to seek an internship if this position is something that interests you. As mentioned above, the line auditor has a lot of interaction with sanitation and production. To gain knowledge in these areas, it may be beneficial to take some microbiological courses aimed at bacterial growth and inhibition. These will allow you to present your stance in a clear and educated manner in the event that a line needs to be shut down due to a sanitation issue or potential contamination issue. In addition, there are organizations that may offer courses in foreign material handling and assessment as well as public health. Either topic will help during line audits and when developing a Food Safety Plan. If you have a mechanical aptitude, this may be a career to pursue as an introduction into a continuous improvement or a quality engineer position. In this case, mechanical engineering or similar type courses may help you achieve your career goals.

Supervisors/Managers

In general, a quality supervisor or manager position requires someone with good understanding of the overarching process along with good multitasking and delegation skills. The supervisor will be responsible for reviewing the quality process, facilitating training activities, and communicating the quality philosophy of the plant. Using key performance indicators (KPI), the supervisor or manager will identify positive and negative quality trends to determine which sectors need the most attention to continually improve the process. If pursuing a career as a quality supervisor or manager, it is important to keep in mind that each day may be different from the next. While there are some routine activities that need to occur, a person in this position needs to be able to prioritize their activities based upon the daily needs of the production environment and the support staff.

Typically, this position is one that you need some experience working as a laboratory technician or a line auditor before acquiring. Internships or prior experiences working in a similar capacity may allow you to enter this profession without first starting off as an auditor. While that may be the case, it still would be beneficial to take similar type course work as you would for a technician or auditor. In addition, due to the nature of a management position, it is important that you have effective communication and presentation skills. Quality supervisors and managers typically will have to conduct trainings at either the department or plant level, so public speaking skills are essential. To better hone these skills, take some technical presentation and writing courses so that you can present your quality findings (such as KPI) in a concise way that makes sense to those you are presenting to. If you're confident in your speaking ability, it'll show and will inspire confidence in your decision-making skills.

Food Safety Coordinator/Food Safety Specialist

A Food Safety Plan (also known as a HARPC Plan) is a program that focuses on the identification, evaluation, control, and prevention of hazards at all stages of the food production process. HARPC stands for Hazard Analysis and Risk-Based Preventive Controls. Previously, this approach was required of all USDA-inspected plants; however, the Food Safety Modernization Act (FSMA) made this a requirement of FDA-regulated facilities as well. It is important to note that not all organizations may have a designated food safety coordinator on staff. Oftentimes, a quality

supervisor/manager will take on the role of managing the Food Safety Program as part of their overall job responsibilities.

Individuals that are in this area of expertise are responsible for maintaining food safety standards of a company. They are the liaison between the regulatory agencies and the company. A vital part of any Food Safety Plan is having prerequisite programs in place. These prerequisite programs will serve as the roadmap of standards necessary to ensure that preventive controls are maintained. Some examples may include prerequisites in place for transportation, storage of raw materials, allergen controls, sanitation, GMPs, and pest control. Once prerequisite programs are established, a food safety coordinator will develop the Food Safety Plan using plant history and scientific evidence to support their decisions. After the plan is developed and implemented, maintaining a sound Food Safety Program becomes the focus. Continual improvement of this plan is a necessity and includes keeping up-to-date with new government regulations, continuous training with current and new employees, and constant monitoring of the program to ensure justifications used for initial decision-making still stand.

Food safety coordinators or similar type positions should have a strong background in the four types of preventive controls: Process, sanitation, allergen, and supply chain. Advanced microbiology courses will give any future food safety professional a good skill set at assessing the bacterial hazards that may be addressed in both process and sanitation preventive controls. Process preventive controls may include physical hazards that pose a threat, and coursework or experience in foreign materials and public health will help for this position as well. Allergens pose a threat to the end consumer, and having a strong understanding of cross-contamination and allergen control practices will be vital. Supply chain controls are important when developing your Food Safety Plan as you need to ensure that all aspects of the supply chain, whether it be purchasing of raw materials for use in the formulation, using primary packaging materials, or shipping of both finished and raw materials, are held to the same standard that you're using in your process. Regulatory know-how is also essential to understand what rules and regulations must be in place to be in compliance with your plan. Many universities will have Food Law courses that can be taken to gain this experience.

As mentioned earlier, the hierarchy of an organization varies from one company to another, and the level of education required to perform different tasks is dependent upon this hierarchy. For example, larger food companies typically will require a college degree for line auditor or technician positions, while smaller ones may have these positions filled with a high school education. When looking for a position, it's important to investigate what

you want to get out of the experience and make your decision based upon your goals and aspirations.

A Day as a Quality Professional

Now, you may be asking yourself "How do these positions work together to assure a quality product is being produced?" or "What can I, as a quality professional, expect from a typical day on the job?" Let's take the following scenario: The corporate office is made aware of a problem with Product X, a new product that's been on the market for several months and is now getting customer feedback. Unfortunately, it seems that some of the customers are experiencing severe stomach problems after consumption of the product. Time is of the essence, so it's important to employ cross-functional teams to determine how much product is potentially affected, what about the product may be causing the adverse reaction, and what the final course of action is to segregate this problem and prevent a potential recurrence. While this scenario isn't a common one, it's one that Quality would be expected to solve.

Generally, the quality manager and plant manager would be the first to be made aware of the issue and would initiate the investigation by employing cross-functional teams to determine what occurred during the production of Product X and how it can be eliminated. To start, the quality manager would facilitate the investigation by determining what lot was affected or what production date was involved and try to get samples of this product returned. With this information, the food safety specialist, quality auditors, and laboratory technicians can begin to narrow the scope of the problem. The food safety specialist will begin to investigate any potential concern by reviewing microbiological data for the product and environment along with the quality technician. Shipping and Receiving and Production will need to be called upon to work with Quality to determine how much product was potentially affected and which customers received the product in question. Quality auditor reports will be reviewed so that any potential production issues that may have occurred during the process can be eliminated or verified.

With all the resources and people involved in the Quality team, a resolution can generally be made in a timely fashion, but it requires the cooperation of every person and their unique responsibilities. No single position can be solely in charge of assuring the quality of a product, which is why teamwork and communication skills are vital to the success of any food manufacturing facility. Each department within the organization may be a separate unit, but all activities can be tied back to the Quality department. That's what makes a career in Quality so exciting. It gives you exposure to every part of the production process and allows you to develop valuable problem-solving skills.

Getting Started as a Quality Professional

To better help you achieve your career and personal goals, it's often helpful to look to different organizations or certifications that'll give you an edge by providing you with a greater skill set and working knowledge of the food industry. Most professional organizations have discounted membership rates for student members, so it's important to take advantage of the knowledge that can be gained from these organizations. In addition, many of the organizations offer certifications and courses that can either be taken online or at a predetermined location. Some examples of certifications that food manufacturing facilities may look for when hiring someone to fill an open Quality position are HACCP, ISO Certifications, Lean Manufacturing, and Six Sigma Black or Green Belts. There are also more industry-specific certifications that you may want to investigate based upon your individual interests or career plans. Below is a summary of some of the general certifications that'll aid anyone interested in a career in Quality and will help in other sectors of the food or manufacturing industry.

Certifications

HACCP/HARPC (Hazard Analysis Critical Control Point/ Hazard Analysis and Risk-Based Preventive Controls)

HACCP or HARPC certification is offered by many different organizations and can range from a very basic course that gets one familiarized with the plans and what the different requirements are to more intense courses that prepare a person to be a facility HACCP/HARPC coordinator. If you think you may be interested in pursuing a career more along the food safety side of Quality, a HACCP/HARPC certification is probably right for you.

ISO Certifications (International Standards Organization)

ISO Certifications are more of a manufacturing tool than a quality-specific tool; however, many food industries are ISO certified to provide their customers with a greater level of confidence that they will be receiving a product produced within specification every time. ISO is a system of checks and balances that makes sure that a plant is doing what they say they're doing,

through careful document management and maintenance. This becomes especially important in the quality technician or quality auditor roles where monitoring and measuring of product and processes is an essential duty. Regardless of whether a food manufacturing plant is ISO certified, the skills learned through the ISO certification process are excellent ones to develop from an auditing and investigatory standpoint. These courses can be offered through local technical colleges, through Department of Labor subsidized programs, or through the ISO website.

Six Sigma/Lean Manufacturing

You may have heard a lot of buzz about Six Sigma or Lean Manufacturing. Both manufacturing philosophies have their roots in eliminating unnecessary loss throughout the process while continuing to provide a quality product to the consumer. Plants that practice one of these manufacturing practices generally value a TQM system as well and have their Quality Departments heavily involved in cross-functional teams. Obtaining certification as a Six Sigma Green or Black Belt will help you to "knock out" the competition when looking for a position in quality.

Organizations

ASQ American Society for Quality

The American Society for Quality (ASQ) is an industry-wide organization devoted completely to quality. They're a good resource for gaining a greater understanding of quality principles and problem-solving tools as well as up and coming quality initiatives. In addition, ASQ has a comprehensive training and certification program including quality auditor/technician/engineer, auditor, and many others. There are multiple divisions that you can get involved in based upon your interests and potential career path.

IFT Institute of Food Technologists

IFT is a great way to network and get more information about the trends and happenings within the food industry. In addition, there's a great student organization that provides an individual the opportunity to get involved in

leadership activities and various poster presentations, product development competitions, and other student activities that'll aid any student in gaining experiences valuable to an individual thinking a career in Quality may be right for them.

In addition to the above general organizations that a potential candidate for the Quality profession may belong to, there are always industry-specific organizations and organizations within the university and college that you may attend. Further, the Quality profession is getting a lot more streamlined in terms of technology. It would be beneficial to gain an understanding of graphing programs such as Microsoft Excel or basic statistics as these are some of the tools used to track the cost of quality within an organization.

Summary

The Quality profession can be an extremely rewarding career for anyone interested in being an integral part of the production of a safe and wholesome food product. Even if you are undecided as to what area of food science you want to focus your career on, a position in Quality can be a great place to start. While in school, it's important to take advantage of the resources and opportunities that are available to you. Talk to your professors and advisors about what you're hoping to accomplish post-graduation, and they can help point you in the direction of internships or jobs that may help you attain your career goals. In addition, student organizations are a great way to network and find out more about what interests you in your quest as a quality professional. Food science clubs often have guest speakers that talk about careers and general principles of the food profession. Take courses in areas that'll help you gain the skills needed to be successful, but most of all have fun with it. Learning is much more rewarding when it's enjoyable. By immersing yourself in your chosen field, you will feel more connected to it, and preparing for the "real world" will seem a less daunting task. By putting forth an intelligent amount of effort, you can ensure that you're prepared for a rewarding career in Quality.

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Chapter 15
Production Management

Joel Krein and Michael Pelton

Introduction

One often overlooked career path for the food science graduate is in Production Management, which encompasses the leadership and oversight of the manufacturing process producing the finished food product. We see the majority of food science students looking to utilize their education in the areas of product development and research. Production Management is often bypassed because students believe it is not a place where the skills and knowledge gained in school are routinely applied. In actuality, that could not be further from the truth. Each and every day, the production supervisor or manager applies food chemistry, physics, microbiology, engineering, and mechanical principles in the minute-to-minute oversight of the processes used in manufacturing.

The manufacturing process today is highly automated and mechanically dependent. As a result, a solid understanding of process control logic and the human/machine interface for monitoring and adjusting the process is essential to producing the finished product effectively and efficiently.

A concrete understanding of quality principles and regulatory rules applied to the process is also critical to ensure compliance – and that the best quality product is being produced to the highest level of customer satisfaction.

Production Management also exposes you to a broad and holistic view of the business requiring solid data evaluation and statistical analysis of the

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process to optimize yields and efficiencies, minimize product losses, and drive tight process control and adherence to specifications.

Last, but definitely not the least important, is the impact on career development. Early exposure can boost career growth and leadership potential. After your initial training, the first role in Production Management will be as a production supervisor, typically leading a production team over a portion of the manufacturing process, depending on the size of the facility. Each day, you'll have a team of people looking to you as their leader to provide clear expectations, feedback, recognition, and assistance in troubleshooting. You'll also support your team members in all aspects of producing the finished product.

In Production Management, you'll get an opportunity to truly lead people earlier in your career, compared to other initial roles available. In the end, your leadership capability is the skill that will determine your ultimate career growth and advancement. Gaining that experience early in your career is invaluable and, from my experience, is one of the most rewarding roles available to the recent graduate as you see your team develop and grow under your leadership.

The last consideration that the recent graduate should take note of is the scope of career growth available in the area of Production Management compared to other career options. In a medium-sized manufacturing company with a total of 4000 employees and multiple manufacturing locations, there are likely 500+ positions in Production Management (supervisor through plant manager) in the areas of production, quality, maintenance, and warehousing. Compare that to 20–30 positions in corporate product development or research and 30–50 total positions in corporate technical services or engineering. Based on the numbers and your willingness to take on new challenges, Production Management likely offers you more opportunities for advancement earlier in your career and also to elevate over time into more senior leadership roles in an organization.

At this point, hopefully your interest in Production Management has been piqued, and you have a desire to learn more and see if this career path could be a fit for you. Frankly, it's not for everyone and that's okay. The most successful leaders in Production Management share a lot of the same qualities. It requires confidence in your abilities, a contagious energy and enthusiasm, personal initiative, and a desire to excel both personally and as a team, along with an outgoing personality and a genuine enjoyment in working with people to earn their trust and respect.

How to Prepare for a Career in Production Management

If the Production Management career path has your interest at this point, it's important to understand how to best prepare yourself for that opportunity. Certainly, the core courses included in the food science curriculum lay a solid foundation. If available, a business-focused option in food science is a plus to gain some exposure to business and management principles that you would not get in a pure science focus, as well as building in some additional engineering courses outside of the core food engineering included in the food science degree.

Beyond the course curriculum, a prospective employer is going to look for examples of demonstrated leadership that you have pursued through your time in school and in your personal life. These experiences both look good on a resume and, more importantly, help you grow and mature as a person to be able to handle the challenges that we all face in our lives.

The most successful production supervisors and managers are hands-on people, not afraid to get engaged in the process with their teams and have a genuine thirst for understanding how things work and why a process is designed like it is. Taking advantage of an opportunity to work in the pilot plant and actually play a role in making products and operating equipment is extremely valuable in your development and valued by a prospective employer.

As noted previously, strong teamwork is a critical part of any successful manufacturing operation. Your demonstrated team experiences in athletics, clubs, projects, etc. are attention getters with any employer looking at you to join their team. Taking a leadership role within any of those teams is even better.

Lastly, working in the manufacturing operation is not for everyone, but the only way to know is to experience it firsthand. The best way to do that is through an internship in a manufacturing facility. After that firsthand experience, you'll have a good understanding as to whether that is something you truly enjoy and see as a career path or equally important would be for you to decide if it isn't the path that is right for you. Either way, you're in a better position to choose the right career path to pursue and avoid starting your career in a role that doesn't satisfy your goals and needs.

Leading in a Manufacturing Environment

Being a leader in a manufacturing environment equates to wearing many different hats, both in a physical and mental type capacity. Even at the production supervisor level, you'll play the role of the production leader, a

teacher, a mentor, an accountant, a lab analyst, a research and development specialist, a microbiologist, and sanitation leader, just to name a few. With all these competencies/responsibilities, it's important to know that you'll make an impact not only with your verbal presence and ideas but also being hands-on. Almost every day, you work cross-functionally with multiple different parties. It may seem at times things are moving very fast, or you're switching hats constantly throughout a workday. Being able to adapt to a constantly changing work environment sets you up for success as a leader in the production industry.

Exposing you to multiple roles all at once, the production operation's line of work allows you to grow skills faster, across several different competencies. As a frontline leader, you're exposed to several different challenges every day and are tasked with continuously working to improve the manufacturing process. Instead of focusing on one role, you'll experience each of these roles simultaneously, accelerating your growth not only technically but also as a leader on the floor. The key here is that it's a hands-on focus and engagement, rather than watching and acting from the sidelines. As noted earlier, from a career growth standpoint, there are more available positions within production operations than there are in research and development, product development, technical services, engineering, etc. Many of these non-operations positions also have limited growth within their individual divisions. There are many roles within production and across each facility within a company's structure such as the supervisor, senior production leader, department manager, operations manager, plant manager, and even specific roles within the continuous improvement line of work that expose you to multiple roles and responsibilities at once.

As you advance your career, it becomes quickly apparent that your overall leadership style and brand outweighs much of your technical knowledge. A production operations role sets the tone and starts working the skills needed for you to develop your own brand of strong leadership. The ability to lead many people in multiple capacities is aided by the daily work of a production operations leader. Keys here for success lie in your ability to gain the trust of your team and build solid relationships with cross-functional parties and your personal actions in the workplace. You also need to ensure you set yourself apart from the crowd. Starting off in production operations allows you to grow a more hands-on business mindset and understand process and operational constraints and limitations. Critical attributes of a successful leader in a manufacturing environment include the following:

- *Be personable*: Gain the trust and respect of your employees and peers, and they will go to the moon and back for you. Your operation is only as good as the people that run it. Invest the time and energy required to get

to know your people. Learn what is important to them, the challenges they may have in their jobs, and how you can help.

- *Have a high sense of urgency*: In a fast-paced production environment, it's important to attend to operational matters and upsets in a timely manner and help your team with resolution and direction.
- *Be timely and punctual, not only with plant leadership but also with your employees*: Responding promptly helps ensure you demonstrate your command of the business and your drive for delivering results, as well as your commitment to your team.
- *Be decisive; do your homework*: The operations environment moves at a very fast pace. Ensuring you have the information you need, and that you can get it in a timely manner, is critical to making the right call. Utilize all the tools available to you, whether its technology or people. Things don't always go as planned in the manufacturing process and being quick on your feet, confident in your decisions, and knowing how to take calculated risks are all critical attributes.
- *Work as a team and utilize your resources*: Effectively working cross-functionally in the manufacturing environment is critical to a successful operation. Work as a team and do not try to carry the burden alone. Your relationships with quality, maintenance, engineering, and other key functions within your operation are key to your success.

Realities of the Manufacturing Environment

Manufacturing or production operations in most cases is a 24/7, 365 endeavor. Especially in the food industry, there is a major commitment to your customers to ensure that they have a safe, quality, and dependable food supply. To ensure this takes place and to make the best use of assets, most factories produce product around the clock, on weekends, over holidays, and pretty much every day of the year. This will mean that you'll likely be asked to work a schedule different than 8–5 Monday thru Friday, especially early in your career. Each manufacturer may employ different scheduling formats for supervisors in an operation, but you'll likely work your share of nights, weekends, and holidays. The successful supervisor looks at this as an opportunity to prove themselves, as, during these times, you're likely the top management person in the factory, and proving your strength in leadership during these times will be recognized and rewarded.

Demonstrating your grasp of the business and differentiating yourself from your peers as a supervisor will lead to a promotion to the next level in

an organization (likely a department manager, unit manager, or superintendent), where you will be managing supervisors and responsible for all results within the department or unit. While moving to this level and beyond likely results in you moving to a more conventional schedule, you also now have responsibility for supporting the team now reporting to you and the operation you manage at all times.

Establishing yourself in your first supervisory roles and ultimately being outstanding at what you do will require "putting in the time." There are two overall themes here around: (1) ensuring your understanding of the operation and (2) understanding that every day may not go quite as planned. There will be days when the operation is shorthanded or a major upset occurs creating a cleanup or all hands-on deck troubleshooting-type scenario. In these cases, you may be asked or expected to remain on site to ensure the operation gets going again and putting product out the door. If you're in a production leadership role where you're managing the business of a particular operation (i.e., a senior production leader, department manager, and/or operations manager), it is an expectation and attribute of a successful production leader that you take care of your business and your people. As a manager of an operation, it's your responsibility that you run an efficient and successful operation.

From the perspective of initially understanding your operation, you'll need to flex your schedule to ensure you learn and understand all aspects of the process and duties of your team. This may cause you to have to work long hours on some days or shift your schedule between days, evenings, and nights. Successfully navigating this will allow you to connect more with your team by building trust and credibility among your team members, as well as the senior leaders in the facility.

You'll most likely be coming "off the street" and new to a production operation, so it's possible you will be tasked with leading many people who have longer tenure than you in a production operations environment. It is a work hard, play hard, and "prove your worth" type environment. Put the time in to gain the trust of your team members and show them your worth and knowledge of the operation. If you do this, you'll be successful.

You also may be asked to help support another operation, another plant, or another production team. Take these opportunities as they will help you grow not only in your technical knowledge but help you gain and grow valuable leadership competencies, while also networking with other resources in your company or industry.

At the end of the day, it's important to work on a "turn the switch on and off" type mindset as it relates to a work/life balance. This does not go solely for you as the leader but also for your team. Production operations being

24/7/365, you may be asked at some point in your career to be the on-call support for the team. Escalation protocols at your plant may also warrant this. There will be times that you become fully enveloped into the grind of the operation. Put the time in to learn how to navigate situations efficiently and ensure your teams are set up for success not only from an operation standpoint but also a training standpoint. It's much easier (and less stressful) for your team to give you a solution and you to give a yes or no answer quickly than work through a problem by micromanaging the situation. When outside the plant or operation, it's easy in today's world with all the technology at our fingertips to be constantly online. Know and understand when to step away, yet still be in contact.

Mike's Personal Story (5 Years with the Company)

Coming out of my junior year in college, I was still not quite sure where I wanted to go and what I wanted to do. Talking with my advisor, I had plans to work at a restaurant/brewery I had been working at since high school and was hopeful to get involved in the beer-making process there. This was not a set-in stone gig. I had also been previously unsuccessful at the career fair that spring in landing a potential internship. It was at that time that my advisor talked to me about production operations and potential opportunities in that industry. Being at a heavily regarded research institute such as UW-Madison, a lot of careers you hear about are specifically tailored to research and development, lab work, quality, etc. Very rarely do you hear the perspective of working directly in the industry in the operations division. One fairly quick phone call was all it took to get lined up with an internship at a production facility.

When I first learned about my project for the internship, I admittedly was very confused. Working to get my degree in food science in school, I was now completing a 3-month study on ergonomic safety in the production plant. The more I have thought about it over these last 5 years working for the same company, it was probably the best introduction into the plant setting I could have gotten. Even though the focus of that project was a safety assessment, I got to work hands-on with each operator in the production departments; learn about their job responsibilities, what the equipment does, and how the production process works; worked on different shifts to see production startup/shutdown/and sanitation; and gain an overall understanding of what working and being a leader in production operations means. After being a part of that operation for just those 3 short months, I was sold

that this was the career I was looking for – fast paced, dynamic, and overall "enamored and satisfied" related to the process and the product portfolio we were producing and putting out the door each day.

Following that internship, I was offered a job in the company's management training program, which was a targeted 1–1.5 year assimilation into learning about the production processes, job responsibilities, and how to manage and lead a production shift. After about 4 months into my learning of one department, I was asked to run a shift for a supervisor who was to be out for an extended period of time. Within a quick timeframe, I was able to apply my learnings from the past 4 months leading a shift and producing product. It was quite nerve-racking at first. I was able to work with an experienced production foreman who took the time to teach me the ins and outs of running a shift. Leading the shift for about 5 months, we saw both successes and some failures, but each day was a learning opportunity about the business, and I continued to grow an interest in wanting to lead the operation. Fast forward another few months and I was offered the chance to move to another facility across the country. Feeling quite confident from the previous 11 months, I immediately accepted the role as a shift supervisor.

Within just a year out of school, I was a shift supervisor working with two different production crews totaling about 60 people; the total headcount of individuals in our department was around 120. The operation I moved to produced a different style product than the one I had been previously making. The equipment was overall the same but newer models and variations, and the technology in the plant was much more than I had learned in my original plant. Being one of our company's newer operations, I got the opportunity to work with and lead people who didn't have a lot of experience in contrast to the plant I originally came from (much less tenure at the newer plant). This was a huge positive because we got the opportunity to figure out the kinks of the system. We were able to see the fruits of our labor firsthand and felt satisfaction that the product we put out the door was right the first time. I believe the learnings that resulted from being so involved in the operation is what set me up for the success and accolades I have seen so far. During that time, we significantly improved our out-of-specification product and overall financial efficiency and got to see the employee morale make a huge swing in the positive direction.

A year and a half into that role, I was selected for a program to further train and create masters of our process in order to help lead continued success and innovation for each of our operations. Having been in the program for about two and a half years now, I have been certified and recertified at the first level, while continuing to work on attaining the highest level of mastery.

During this time, I was offered a promotion to become the senior production supervisor of the operation, and, for some time now, I have acted as the manager of the department. Both of these roles opened up great learning opportunities about managing an operation as a whole and managing the day-to-day business of the operation to ensure we are financially successful. In these roles, I have been the manager of production planning, daily operations, quality control, and people of the department.

After 5 years with the company, I have now recently been promoted to a manager position. During those 5 years, I learned a lot about myself. I learned what it takes to be successful. I worked hard and invested a lot of time in really learning the business and building relationships up and down the organization. Also, it is paying off, as I am confident I have an exciting and bright future ahead of me personally and for our company.

Joel's Personal Story (37 Years with the Company)

After graduating with my food science degree (a very long time ago), I began my career with a vegetable canning and freezing company as a quality assurance (QA) technologist. While QA is a very honorable and important function for any company, I realized pretty quickly that I felt a better fit for me was in production. I then joined a dairy cooperative in a production supervisor role at a location that was installing a new cheese production line. I loved every minute and gained invaluable experience being a part of that project, such as start-up and commissioning and learned the ins and outs of cheesemaking from some amazing cheesemakers. After 2 years with that organization, I looked at my career growth opportunities and decided that the company I was with may not offer a career path that met my expectations and timeline. However, by this time, I knew that I loved the cheese business, and I knew Production Management was my passion. I found my current company at the time and, 37 years later, I can look back with pride at the various positions and roles I have held. I was fortunate to work with great people and locations. Managing a production operation, and the team environment, provides a sense of accomplishment each and every day. It is satisfying to know you are part of making great products to feed our customers, overcoming challenges as they appear, and seeing my team members grow and develop and take on new responsibilities. All this together has contributed to a fulfilling career that I would not trade for anything.

Conclusion

At this point, you hopefully have a better understanding – as well as appreciation for – what a career in Production Management is and whether it may be right for you. As discussed earlier, it's not for everybody, but that's okay. If you're reading this, it's likely you already know you have a passion for the food industry. Now, finding your passion within the industry is your next challenge. For those who enjoy:

- A fast-paced environment that allows you to use a broad array of skills every hour of every day
- Working with and leading a team
- Interacting with people at all levels in the organization
- Working hard and "getting dirty" with your team members
- Challenging responsibilities early in your career
- Hands-on exposure to process and equipment
- Knowing that you are responsible every day to produce safe, wholesome food that is consumed by your friends and family, young and old alike, then Production Management may be right for you and deserves your consideration.

Chapter 16
Product Development

Christine Nelson

What's Product Development

When you walk through a grocery store, do you ever wonder who creates all the delicious, trendy, unique, fun, or healthy new products? To answer your question, it's a product developer! Product development is the segment of research and development (R&D) focused on designing and producing new products for a company. Product developers design, formulate, and execute new food products. Product development is a very rewarding career, and product developers derive immense satisfaction from seeing their products hit the shelves after months or years of development.

I'll never forget my family's reactions to seeing my first candy product, a new jellybean shape, in the grocery store. I felt such pride in my job and loved having a tangible result of my work to share and enjoy with those around me. Consumer reactions from both friends and strangers feel like a personal expression of appreciation. This is what you get to experience as a product developer.

Types of Product Development Projects

Most product development projects fall into one of three categories: new product innovations, line extensions, and cost optimizations. These projects differ in overall objective, duration, and required team resources. As a

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product developer, you may encounter all three categories in your role, or you may specialize in one project type. For example, many companies have a team dedicated solely to cost optimizations, while other product development teams focus on growth opportunities through new product innovations or line extensions.

New Product Innovations

New product innovations are the biggest growth opportunities for companies. These projects involve expanding a brand or creating an entirely new brand to reach different consumers. By definition, new product innovations involve a new format or require a new manufacturing process from the original brand offering.

New product innovations are some of the longest, most complex, and most expensive projects. They may require purchase and installation of new processing equipment, which adds time and complexity. They also require more upfront research to build and develop the concept, as well as input from large, cross-functional teams including marketing, regulatory, quality, engineering, finance, legal, and purchasing. Timelines can often be two years or more.

Starburst® Gummies are an example of a new product innovation for an existing brand. The original Starburst® brand is synonymous with a chewy square candy. Then, in 2016, Mars Wrigley launched Starburst® Gummies, which have the same colors, flavors, and general shape as the beloved Starburst® chews but with a new gummy texture that tapped into contemporary consumer trends. This innovation allowed the Starburst® brand to reach a new segment of consumers who love the Starburst® flavors but wanted a different gummy texture.

Line Extensions

Line extensions—also called limited editions, flavor rotations, and product expansions—expand on a brand or product's original format. Line extensions frequently use the existing ingredients and the same processing line as the original format. Therefore, they typically have shorter timelines and fewer required resources. Additionally, product developers can often balance multiple line extension projects at the same time.

Limited edition products are fun for consumers, but one major reason companies invest in flavor rotations is to remind consumers of the brand and to keep the product fresh and exciting. Further, product expansions are financially attractive as they are significantly faster, cheaper, and less risky to develop than entirely new brands and products. Line extensions are a great way to keep consumers excited by extending and leveraging core products and brands.

The Oreo brand is a great example of successful line extensions. Oreo releases multiple new flavors throughout the year. Some are seasonally inspired, such as Peppermint Bark in the winter of 2018 or Peeps Marshmallow in the spring of 2018. Others are more creative or trendy, such as the Dark Chocolate and Carrot Cake Oreos in 2019.[1] Consumers get excited to try the newest flavor and share it with others, creating buzz for the Oreo brand.

Cost Optimization

Cost optimization projects aim to reduce production costs while maintaining product quality. Companies pursue cost optimization projects to save money, to keep up with commodity price changes, and to refine products after the initial launch.

During cost optimization projects, developers often work with suppliers to find lower cost alternative ingredients and with engineering to identify processing improvements to shorten production times or save money. Throughout the cost optimization process, developers focus on ensuring that product quality isn't impacted and that consumers don't notice a difference in the final product. Even small differences in perceived quality can be amplified over multiple cost reduction cycles, so developers must keep a close eye on consumer perceptions.

Another element of cost optimization is improving upon formula and process decisions made during the new product innovations stage. Sometimes developers make cost sacrifices to launch a product more quickly. For example, a developer may choose to use a more expensive ingredient that's more readily available. In that case, a developer responsible for cost optimization would attempt to identify alternative ingredients after launch to save money but maintain taste and function.

[1] https://en.wikipedia.org/wiki/List_of_Oreo_varieties

Finally, some cost optimization projects aim to adapt previously optimized formulas to account for changing ingredient prices. For example, many commodity prices rose during 2021. Coffee prices reached six-year highs due to a drought in Brazil, while soybean oil prices rose due to excessive rain in Argentina.[2] Before increasing prices for consumers, most companies will attempt to change suppliers, modify formulas, and adjust processes to maintain low costs.

Overview of Product Development Process

Product developers generally follow a project management process that falls into one of two major categories—stage gate or design thinking. Both project management frameworks attempt to manage the complexity of coordinating a cross-functional team, which can include other divisions of R&D such as engineering, package development, sensory, regulatory, and quality, as well as business partners like marketing, procurement, and finance. The stage gate framework has a longer history and is more prevalent within large organizations, but design thinking processes have advantages that make them more popular with smaller companies and for certain projects. The two processes can work together with the design thinking process being a prelude to the stage gate process. Implementations of stage gate or design thinking processes are tailored to the specific organization, but the general structure of each is the same across the industry.

Stage Gate Process

Most product development projects follow the stage gate (or phase gate) process. The stage gate method is a project management process in which a project is separated into distinct stages of work, separated by decision points called gates. Each stage is defined by the work to be completed, teams assigned, timeline, and task checklist. Gates take place at the end of each stage and consist of a governing committee reviewing the stage work based on a set of objective criteria to determine whether to proceed to the next stage, complete additional work at the current stage, or terminate the

[2] https://www.bloomberg.com/news/articles/2021-04-26/crop-prices-on-a-roll-as-soybeans-rocket-to-highest-since-2013

project. This committee typically includes business leaders across multiple departments of the company.

Stage gate projects follow a linear path and ensure that teams within R&D and across the organization have an opportunity to provide input throughout each portion of the development process. The primary advantages of the stage gate method are reducing risk and limiting investment in projects that won't meet the organization's goals. For example, if the finance team determines a product is unlikely to meet firm profitability targets or the sensory team determines that a concept doesn't score well with consumers at an early stage, the project can be terminated before expensive investment in engineering and packaging. Companies that use stage gate processes prefer to initiate many projects with the expectation that they'll terminate projects early and often. Terminating projects with low potential before significant investment conserves resources for higher potential projects.

A typical stage gate process is outlined below:

Stage name	Stage description	Example gate criteria
Stage 0: Ideation	Determine objectives and broad product concept for further development	Market opportunity, fit with organizational priorities, defined objectives
Stage 1: Scoping	Defining and sizing the market, competitive analysis, limited lab-scale prototyping, and factory capability assessments	Market opportunity, technical feasibility
Stage 2: Business Case Development	Validate concept with consumers, conduct initial financial analysis, identify manufacturer (internal or external), and develop sales strategy	Consumer concept feedback, profitability targets, sales feasibility
Stage 3: Prototype Development	Small-scale testing, packaging development, and initial consumer product testing	Drafted specifications, initial consumer product feedback, packaging capabilities
Stage 4: Validation	Factory-scale product and packaging tests, final consumer product testing, pre-sales	Manufacturing feasibility, HACCP and food safety, final consumer product feedback
Stage 5: Launch	Initial production run, sales, and marketing	Post-launch assessment

Not all projects start at Stage 0 or proceed through all gates. Cost optimization or quality improvement projects often have predefined concepts and scope, so they can start at Stage 2 or Stage 3. More complex projects such as new product innovations will typically begin at Stage 0 and follow the entire process. Product developers have the most responsibility in Stages 3, 4, and

5 but are present on the team throughout the entire process to bring a product development perspective.

Stage gate processes can be overly rigid, which increases the administrative burden of completing projects and reduces flexibility to pursue unexpected or novel product ideas. Despite these drawbacks, the stage gate method continues to hold an important place in product development, particularly at large firms where the cost of failure is higher.

Design Thinking Process

Design thinking processes were developed to address the shortcomings of the stage gate approach, namely, reduced flexibility to adjust the product development process based on new information. Design thinking is a human-centered approach, meaning it considers the "wants" and "needs" of end users throughout the process. Further, unlike linear stage gate processes, design thinking encourages a nonlinear, iterative approach, meaning product developers can revisit earlier stages and try again. Design thinking processes help companies identify unmet consumer needs and allow developers to solve problems more creatively.

Design thinking contains the following five components[3]:

Design thinking approaches seek to continually generate and test hypotheses about consumer problems and potential solutions. Companies following design thinking processes need to gain empathy with their consumers to understand the problems before trying to create solutions. Further, they need the right mindset to go into their customers' environments and always actively listen to consumers.

Like stage gate processes, design thinking also seeks to incorporate input and expertise of individuals across different functions. However, rather than collecting input at discrete gates, product developers working within a design thinking framework will work with different functions on an as-needed basis.

[3] https://canvas.unl.edu/courses/73802/pages/5-stages-of-design-thinking?module_item_id=1968000

The primary advantages of design thinking approaches are increased speed and flexibility, as well as reduced cost. Each stage in a stage gate process may take months due to the significant resources, documentation, and structure input required. In the design thinking process, product developers can jump between tasks quickly without necessarily needing approval from a review board to proceed, increasing the overall speed and flexibility. During the time it takes to complete one stage of a stage gate process, a design thinking team can identify and test many different hypotheses. Additionally, design thinking emphasizes running smaller, less expensive projects which saves overall costs. The investment in training, overcoming corporate inertia, and tracking process are the primary disadvantages to implementing a design thinking process structure into a corporation.

The design thinking and stage gate processes do work together. A project can begin using design thinking to identify the correct consumer needs and discover solutions and then transition into a later stage of the stage gate process to formalize the execution in the market. This harmony allows companies to move with speed at the start of a project while maintaining structure and efficiency during the scale-up and launch.

Burger King used design thinking to upgrade their menus in 2019.[4] They discovered some consumers wanted meatless fast-food options, which led them to partner with Impossible Foods to supply plant-based patties. Burger King made this change based on an emotional consumer need rather than existing capabilities. This type of innovation is where design thinking shines.

Whether you work at a large established organization or a new start-up, understanding the fundamentals of design thinking is essential.

Product Developer Responsibilities

Product developers have three main responsibilities: concept generation, prototype creation, and scale-up.

Concept Generation

Organizations develop ideas for new products or packaging concepts in a variety of ways. Marketing and consumer insights teams continuously identify new ideas based on competitive and consumer trends research.

[4] https://blog.experiencepoint.com/design-thinking-burger-king-dunkin-donuts

Additionally, companies often plan recurring formal ideation sessions that include cross-functional team members. Finally, employees are often encouraged to share ideas informally as inspiration strikes. Product developers are well-positioned to identify creative, yet feasible product ideas because they intimately know the organization's production capabilities and spend significant time interacting with consumers.

As themes or project areas arise from this pool of ideas, the research and development team—including product developers, engineering, and packaging—applies the Desirability-Feasibility-Viability (DFV) framework to screen ideas or refine concepts. Desirability considers the attributes or combinations of attributes that consumers want, feasibility evaluates whether the firm has the capabilities to make the product, and viability assesses whether the company can manufacture and sell the product cost-effectively.

During the DFV process, product developers are a critical link between sensory and consumer insights teams for desirability, engineering and manufacturing teams for feasibility, and suppliers and procurement teams for viability. Developers constantly revisit the DFV framework through the development process.

Prototype Creation

Product developers work hardest during the prototype creation phase. The type of project determines the length of the prototype phase and the complexity of each task.

Material Procurement

At the start of the prototype creation phase, product developers research and gather necessary ingredients for the product. Typically, developers start with their company's library of existing materials before contacting suppliers for ingredient recommendations and usage guidance regarding new or specialized ingredients. Suppliers can provide a wealth of ingredient knowledge, including samples and starting formulas, as well as trend reports and clinical study data. Developers that build and maintain relationships with suppliers can leverage suppliers for help during the prototype phase, as well as troubleshooting issues during scale-up.

Lab and Pilot Plant Prototyping

After procuring the necessary materials, developers begin to prototype at the lab scale, often assisted by a lab technician. Lab scale testing is just a proxy for the production line and may not resemble the full-scale production process. However, lab scale testing allows developers to make many formulas with limited ingredients and time.

Lab scale testing begins with designing the experiment and creating formulas based on internal knowledge or guidance from suppliers. After multiple tests and revised formulas, the result is one or more final formulas—optimized based on the project goal—that are ready for testing within the pilot plant.

Unlike the lab scale process, a pilot plant is a scaled-down version of the full-scale production process. Developers conduct pilot plant trials, working closely with technicians and the engineering team, to learn whether the factory production processes require any changes to the optimized lab scale formula. During pilot plant testing, product developers will observe product characteristics at each production stage as an indication of how the product will run at full scale, without the expense of a full production run.

Factory Trials

After adjusting the lab scale formula to run at the pilot plant scale, developers proceed to a factory trial, where they test the final formula and packaging together on the production line. Before a factory trial, the product developer schedules a trial time that doesn't disrupt normal factory operations, orders any new materials, prepares a food safety Hazard Analysis and Critical Control Points (HACCP) plan, and submits a trial request to the factory outlining objectives and success criteria for the trial.

During the trial, the product developer collects data and observes product quality throughout the process. As issues arise, the product developer works closely with factory technicians to troubleshoot. Effective product developers build strong relationships with factory operators, who are experts at the production process and can help ensure a smooth trial.

Factory trials cost more than other forms of prototyping but also provide important data about the product consumers will ultimately purchase. Product developers try to minimize cost by running the fewest possible factory trials while collecting all required data and achieving product quality metrics. The product created during a factory trial isn't saleable but often can be shared with key stakeholders like business leaders and sales partners.

Sensory Panels

Product developers partner with the sensory team throughout the prototype phase to organize appropriate sensory panels for the project. These may include tests with trained panelists, who are proficient at noting slight differences between samples, or consumers, who rate the product on overall liking, texture, taste, and other attributes. Cost optimization projects typically involve trained panelists to confirm that the optimized formula doesn't taste any different than the previous version. New product innovations or flavor rotations rely more heavily on consumer panels to confirm that the prototypes are meeting expectations.

Sensory testing can be conducted at any stage of the process, but most sensory is conducted on product from the factory trial because this is a perfect representation of how the consumer will experience the product. Smaller sensory panels can also be performed on early prototypes to learn if the product meets the expectations of the concept. Depending on the outcome of sensory panels, product developers may need to tweak recipes and reformulate.

Commercialization

After a product developer has completed all necessary prototyping, they must prepare the product for launch.

Specifications

Specifications are a major deliverable for product developers. Specifications document the critical, major, and minor attributes of a product and provide a target and range for the factory to follow during production. Product developers collect and draft the content for a specification during the factory trial phase, and they validate the data by the first production.

After the factory trial, product developers validate the recipe and finished product specifications. Regulatory, quality, and food safety teams review the product recipes, which specify the formulation's ingredients and quantities. Finished product specifications contain all product attributes including but not limited to weight, dimensions, density, color, texture, sensory analysis, and shelf life.

Shelf Life Analysis

A product developer determines the code date or expiration date of a product through shelf life testing. During analysis, the product is aged under controlled conditions and monitored for stability. A product developer routinely tests the product for quality changes such as product separation, color fading, texture change, or flavor degradation, as well as food safety concerns like microbial growth. The product has reached the end of its shelf life once it has deteriorated outside of a predetermined acceptable limit.

There are two major types of shelf life analysis: accelerated and real time. Accelerated tests stress the product under extreme conditions such as high heat and humidity for a short duration. Developers expect the product to fail under these elevated conditions and compare the results to historical shelf life data to predict how the product will perform in real-time conditions. Real-time shelf life assesses the product in the recommended storage conditions, such as ambient, refrigeration, or freezer for the duration of the code date. Accelerated tests are quick and provide directional results but must always be validated under real-time conditions.

To best assess the shelf life of a product, a product developer must understand the consumer's use behavior with the product. Some products, such as jarred goods, are stable at room temperature while sealed but require refrigeration after opening. A product developer must conduct shelf life testing as a consumer would use the product.

Factory Handover

After all of the required documents are finalized and testing completed, product development transitions product ownership to the factory. This formal process, called a factory handover, involves a cross-functional team tasting during the first production to align all parties on product quality. Department leads review and sign a detailed list of documents to confirm this alignment. At this point, the factory assumes responsibility for the product and begins producing inventory for sales.

A product developer benefits from staying in close contact with the factory for several months following the handover to ensure that production continues to run smoothly and to manage unexpected issues. A close connection can speed up any necessary troubleshooting once the process is at full speed.

Key Skills

Successful product developers must leverage a wide variety of skills, but the top three skills to highlight are consumer focus, organization, and communication.

Consumer Focus

A product developer's top priority is the consumer. Every product decision should center on the consumer since they'll be purchasing and enjoying the product. A product developer can exercise their consumer focus capability by talking to them directly or by collecting input indirectly. Consumer insights teams have tools to connect with consumers, and product developers partner with them for research on a project.

Product developers can also immerse themselves with their consumers informally. Though it may be intimidating, product developers can learn a lot from asking a shopper or even a friend what they think of a product or product concept. The Internet also provides a great source of consumer feedback. Product developers can evaluate online reviews, social media comments, and discussion boards. Practicing these types of activities outside of a job shows your ambition to be customer focused and will set you apart from the competition in job interviews.

Organization

Product developers need to be organized. They work on multiple projects at the same time, each at different stages in the process. Additionally, some projects last years, emphasizing the need to take and maintain good notes for later reference. As resources and priorities change, product developers join and leave projects. Without clear documentation, information is easily lost, which impacts the timeline and overall success of the project.

As a student, you can practice your organizational skills. Take good, clear notes during lectures and have a system for organization and storage. Practice time management by balancing large projects with smaller assignments to ensure that all are completed with high quality. Build your schedule to allow adequate time for studying, classes, work, and social time. Perfecting these skills now will help you academically and set you up for a successful career.

Communication

Along with organization, product developers need great communication skills. Product developers spend a great deal of time communicating with different departments like marketing, operations, and suppliers, and they need to tailor their message depending on the audience. Marketers prefer high-level, nontechnical updates with a focus on next steps and risks to the project. Alternatively, factory operators speak very technically and need to know the details about the product and formulation. Suppliers are also technical but, outside of the organization, preventing specific discussions without proper confidentiality agreements. Understanding your audience and communicating appropriately improves a product developer's success on a team.

Excellent communication skills are just as important for students. Communicating with teams on group projects or with your boss or professors relates directly to working in industry. While on group projects, be clear about your availability, follow through on your deliverables, and hold others accountable to their responsibilities. Write well-constructed emails to your professors with a clear question or comment. Academia is a great time to practice these skills and find the style that works best for you.

Conclusion

There are many benefits to product development making it an exciting and rewarding career. Collaborating with different departments across the business provides great networking opportunities and a social environment. It's a hands-on job with tangible rewards from prototypes to manufactured goods. Often times, product developers have the opportunity to travel for factory trials or supplier visits. Also, there are continuous learning opportunities to keep up with new technologies and trends. The enjoyment felt seeing a product of your own creation on the grocery store shelves is an incredible reward that comes with being a product developer.

Christine Nelson is from Wisconsin and graduated with a Bachelor of Science in Food Science degree from the University of Wisconsin–Madison in 2014. She spent her summers during undergrad completing internships in the food industry, first as an R&D/QA intern at the dairy plant Galloway Company in Neenah, WI, then two summers as an R&D intern at the Wm. Wrigley Jr. Co. in Chicago, IL. Upon graduation she joined Wrigley (soon to be Mars Wrigley) as an R&D Rotational Associate

where she completed short-term rotations in product development, quality and food safety, and science and technology. The variety of experiences she obtained in the rotational program helped confirm product development as her passion, and she became a product development scientist on the North America confections team, working on the Skittles©, Starburst©, and Lifesaver© brands. The joy of creating new products and seeing them come to life in the stores solidified her passion for product development and drove her to further her education in the space. She graduated with a master's degree in Product Design and Development Management (MPD2) from Northwestern University in 2019. This part-time program emphasized the importance of consumer focus and enabled her to become a Sr. Product Development Scientist on the global team that focuses on larger programs with consumers at the center. She has greatly enjoyed being a product developer and creating new and fun products that bring joy and excitement to people all around the world.

Chapter 17
Technical Sales

Russell Tietz

Introduction

A career in technical sales in the food industry can be technically challenging and rewarding with a wide variety of opportunities and experiences. In this role, you're working for a company that provides food ingredients, processing equipment, or packaging to food manufacturers. Ideation, problem solving, and working with customers and consumers are all part of your job. Technical sales coordinates communication with cross-functional teams in your organization as well as your customer's cross-functional teams to drive growth and value to consumers. You're part of building a strategic partnership, successfully launching, and continuously supplying value-added products to customers and consumers. Depending on your company and the product you're selling, your role and interaction can vary in the organization. There's also opportunity to carve out aspects of your position as needed to drive growth for your company.

A degree in food science or chemical engineering is preferred. Technical expertise or in-depth study in specific ingredient categories can be an added benefit. For example, if your company is selling fats and oil or confections, a technical background in fats and oils would be very beneficial to your job. Another key to success in technical sales is having experience with the product development life cycle or stage gate process of taking a product from concept ideation to commercialization. Experience in project management,

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operations, food processing, and marketing is also beneficial. Skills in problem solving, communication, and project management are required.

In technical sales, you're the resident technical expert and key technical contact for your customer. It's important to fully understand the product that you're selling. Understanding everything from the technical formulation, processing, competitors, and application of your product is necessary. Knowledge and experience conducting various sensory and consumer tests will also be helpful in this role.

Traveling will be part of the job. Travel can consist of going along with sales for customer meetings. It also includes meeting with customer's technical teams to conduct training, support bench-top development, participate in innovation sessions, and discuss projects. You can expect to travel to customer's manufacturing facilities to support trials, address technical issues, and support continuous process improvement and operation training. It can also include travel to equipment manufacturers to support factory acceptance tests. Other travel would include seminars, tradeshows, short courses, and meeting with other ingredient suppliers.

The ability to work with and build rapport with cross-functional teams is critical. In a technical sales role, you'll work with sales, marketing, research and development, engineering, supply chain, operations, quality, finance, legal, customer service, and packaging.

Trends and Innovation

One of the exciting roles in technical sales is keeping up to date on the latest trends and innovations both for your company as well as for your customers. This includes keeping up to date on ingredient technologies, health trends, flavor trends, and consumer trends. Activities include being involved in focus groups, attending ingredients seminars or industry-sponsored seminars, attending short courses, and tradeshows.

Technical sales leads innovation and ideation with your customers. This can be through coordinating innovation presentations for research and development teams, marketing teams, and your customer's sales teams. You'll want to understand your customer's finished product, manufacturing capabilities, and brand positioning. These presentations can also include your company's capabilities, category market trend, and concepts using your ingredient or product in application to meet a consumer trend or consumer behavior. Customers look to leverage their suppliers for new ideas so you may also do presentations featuring your ingredient in a new product

concept. You may also participate in customer innovation days or supplier challenges where you would bring new product concepts to your customer. These supplier challenges can be new product ideas, cost savings ideas, quality improvement, or solving a consumer need.

Project Management

Most of your time will be spent in a project management role. You'll operate as a liaison between your technical team and your customer's technical team. You'll coordinate all aspects of the project work. Project work can consist of innovation, matching an existing ingredient or product the customer is purchasing from another supplier, cost savings, quality improvement initiative, or an application process improvement. You may also get involved with legal documents in the initial stage working through confidentiality agreements, project development agreements, or a supply agreement.

An investigative mindset is required to kick off a new project. There are many questions you'll need to ask. First would be to find out what's the final product application. Are there financial or cost guidelines? Does the customer have a list of the ingredients they allow or will not allow in the product? Are they planning to make claims on health, sustainability, organic, bioengineered or non-bioengineered, vegan, allergens, ingredients, or processes? When developing flavors and colors, it's important to ask what requirements they have such as natural or artificial. Are there specific claims on the package that would dictate using a specific flavor type or color in formulation? For both flavors and colors, you'll want to ask your customer for reference products. For example, the customer may request a strawberry-colored and strawberry-flavored product. Someone's idea of a "strawberry" flavor and color could be very different from yours, so you would want to get guidance on what they are envisioning. For colors, a reference product, photo, Pantone color, or even paint color swatch can be used for guidance. Additional questions to ask would include microbiological requirements, analytical testing requirements, Kosher status, allergen restrictions, and packaging of the ingredient and finished product. Storage and handling should also be addressed. Where will it be stored and does the customer have adequate storage for the ingredient? You'll also want to discuss consumer testing. What type of consumer testing will be done? How will consumer testing be used to approve or qualify your product? Customers may have various protocols or requirements for internal sensory testing as well as external sensory testing. You may also coordinate sensory testing for them.

You'll want to obtain as much information on what the customer's technical team is looking for to develop a sample. The objective is to develop a product that'll meet the customer's and consumer's expectation with as few iterations as possible. You'll want to methodically go through the product development and process guidelines in advance in order to have a successful project commercialization.

Commercialization and Process Support

After working with your customer through the ideation and development process, the next step is to work with them on commercialization and process support. Experiences working with operations and in a manufacturing environment are essential. Technical sales participate in customer plant trials, commissioning new production lines, and troubleshooting. It's important to develop a relationship with your customers' operations team and be a key contact for process handling, troubleshooting, and technical advice. Technical sales may provide training to operations and quality teams on the handling of the ingredient and application. You can also provide audits assessing the entire manufacturing process and application to look for opportunities to improve manufacturing efficiencies, reduce costs, or solve quality issues. This could be through assessing things like optimal temperatures, process times, reformulation, product harmonization opportunities, packaging, and ingredient handling.

Troubleshooting

Troubleshooting and answering questions are part of everyday responsibilities of being in technical sales. You'll be contacted regularly from your customers with questions. Critical thinking and problems solving skills are used daily. Being available to take calls from the customer and talk through product issues is an important skill. These calls can come from engineering, scientists, procurement, or operations. Other calls could be from research and development seeing changes over shelf life. These could be changes in product attributes such as color, flavor, texture, appearance, or mouthfeel. It could also be that they've received consumer complaints and are reaching out to you to ideate around how to solve this issue. You'll want to ask as many questions as possible to diagnose and determine what corrective

actions might be taken. If it's something operations or process related, you may need to go to the manufacturing site and work with the operations team there. You'll also want to meet internally with your scientists, engineers, and operations group to let them know what issues the customer is experiencing to get their thoughts on what might be causing these issues and potential corrective actions. These changes could be something you might be able to change through your process or product specification. After going through questioning, operating information, and analytical data, you'll work with the customer on a game plan to solve the issue. Often the issues they are having aren't directly related to your product but something that may have changed with another ingredient, storage conditions, process parameters, or a scenario that hadn't been thought of as a risk during the development process.

One example of troubleshooting was with a customer who'd been using a coating to enrobe a granola bar for years with no issues. Then one day, they called and said they were having issues with the coating and stated that it ran well for a few minutes, but soon it had thickened up and plugged up the entire enrober. They assumed there must be something wrong with the coating. As their technical sales representative, I began to ask questions to find out what may have changed and to try and solve this problem. In this case, I discovered that they were enrobing a brownie and not a granola bar. I then asked a series of questions about the brownie and if they could send some photos. After further review, I found out that the brownie had a water-based ganache layer on the top. The water-based ganache layer was sloughing off and dropping into the coating recirculation reservoir in the enrober. This caused the chocolate coating to thicken. After 10 to 15 minutes running like this, the chocolate coating thickened up to the point that the enrober plugged and the line needed to be shut down. The solution to fixing the enrobing issue was to reformulate the ganache layer to be fat-based. When the fat-based ganache layer fell into the enrober recirculation reservoir, it no longer caused the chocolate coating to thicken up, and the enrober could run for hours with no issues.

To prepare for a role in technical sales, you'll want to have experience in product development with a consumer-packaged goods company developing a product from ideation to commercialization. Experience and exposure to cross-functional roles like quality, operations, engineering, packaging, and marketing can provide valuable skills in project management, product development and problem solving.

Summary

Technical sales is instrumental in building strategic partnerships with customers. This position drives sales and value for the company. Companies look for suppliers that have experts that can bring them innovation, product development services, and cost-saving ideas. There's a lot of variety in your job working with different cross-functional teams and customers. Keeping up to date on trends, staying on the cutting edge of technology, managing the product development process, and problem solving make technical sales a rewarding career.

Russell Tietz has been with Clasen Quality Chocolate for over 12 years and currently serves as the Director of Technical Sales working with customers on formulation, process improvements, and innovative applications for confectionery coatings and chocolate. He has 24 years of experience in the food industry working in project management, product development, process development, equipment engineering, and package development. He has worked with different food systems from confections, bakery, snack foods, dairy, frozen foods, dressings, and sauces. He has a BS and MS in food science from the University of Wisconsin–Madison.

Chapter 18
Science and Technology

Amy DeJong

Overview

Science and Technology (S&T) teams are challenged with thinking toward the future, focusing on the larger fundamental technical challenges facing the business. Such teams spend a lot of time horizon scanning, determining where to focus research efforts so that the business can continue to execute cutting edge, innovative products 5, 10, or even 20+ years into the future. These projects include things like researching novel ingredients and their functionality, completely reinventing manufacturing processes, and understanding the fundamental science behind key products, processes, or ingredients so that they can be implemented safely, sustainably, and in a way that brings fun, high-quality products to consumers. These types of longer-term research projects often involve universities as well as experts across many different scientific and engineering disciplines, partnering together to unlock exciting new things and solve some of the biggest challenges facing the food industry. Most often, these types of teams exist at larger companies, but that's not to say they don't exist in some capacity at smaller companies.

To bring this to life a bit, let's look at an example from the color industry. There's been a large consumer push for food companies to move away from artificial colors in favor of natural alternatives. For many hues in the color spectrum, we have found solutions in using extracts from beet, purple carrot, spirulina, and turmeric, to name a few. Creating a stable, vibrant,

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natural blue hue, however, proved to be the ever-elusive missing piece in producing a full color spectrum of natural color alternatives. The quest for a food safe, natural blue color pigment was led by a researcher working in industry on a Science and Technology team, in partnership with university researchers, suppliers, and countless others across different business functions over many years. This discovery of a natural blue required deep technical expertise in organic chemistry, color science, and sound research and collaboration skills to bring to life. This was not something developed for a specific product launch; rather, it was a larger technical unlock that could be applied across multiple product formats, geographies, and industry segments.

S&T functions are most often part of a larger research and development (R&D) organization. In S&T, we generally focus more on the "research" within R&D and work on solving some of the larger technical challenges needed for longer term growth, as illustrated in the color example above. S&T teams work very closely with product development teams, who, as their name suggests, work on the "development" side of R&D. Product development scientists tend to focus on shorter term innovation initiatives, solving technical challenges required to bring a specific product to life in less than three years (and in some cases, less than three months). If we go back to the color example, a product developer working toward an innovation in need of a natural blue color would be looking at ingredients already on the market to bring the product to life on a short timeline, while their S&T counterpart would be focused on understanding why the current solutions don't work as desired and looking toward novel ingredients that the business may be able to use five years from now, when inevitably another product developer is working on something where this discovery could be employed. The timelines by which product developers operate on to bring things to market don't allow for deep dives into fundamental technical challenges; this is where the partnership with a Science and Technology team comes in.

The vast majority of activity that takes place in S&T can be divided into three main categories: driving projects that create the future of the business, horizon scanning for new opportunities, and participating on cross-functional teams as a subject matter expert to troubleshoot an immediate business need. I'll go into each of these in detail to help you understand what this looks like in practice.

Creating the Future

In S&T, we often collaborate with universities or other strategic partners to drive our innovation initiatives. We invest in long-term, scientific work to solve the big technical challenges facing the business and, quite often, the food industry as a whole. The scientific depth and technical rigor isn't all that different from what one would expect in academia, with the distinction being all research must always be tied to a specific, strategic business priority. When pitching a project or writing up proposals to request funding resources, we must focus on the impact to the business and not just the scientific component. This type of long-term research forms the foundation for creating the world we want for the future of the business.

One of the major pieces of work that I've been excited to be part of is my company's sustainability research. My company has set some rather impressive goals around improving the impact we have on the planet. We are looking at ways to reduce consumption of water, energy, and land, to name a few. There are people within the greater Science and Technology team working on all aspects of sustainability – starting with how the raw materials are grown all the way to how they're manufactured, packaged, and sold and everything in between. We are working with farmers and academic researchers to better understand the crops we use and learn about their susceptibility to disease, efficient land use, and watering practices. Such research requires experts across many different technical disciplines working together: ingredient spaces, agronomy, food science, chemistry, engineering, and more. Sometimes, the expertise lies within the S&T team, while other times it requires collaborating with external experts and partners to bring to life. This type of work isn't necessarily targeted at a specific product; rather, it solves larger supply chain challenges that touch many products across many different geographies. This very often is the case for S&T research, where the focus is less on a specific product and more on a challenge that can impact many products.

Another area that S&T functions drive is related to new ingredients. When new ingredients hit the market, there's a tremendous amount to learn about how they function in products, how they're impacted by process, and what value they deliver to the consumers. In some cases, there are clinical studies that may need to be conducted if there's interest in making a health claim. We're regularly hearing about novel, plant-based proteins and sugar alternatives, for example, all of which require food scientists who are interested in fundamental research to scope, develop, and understand their behavior so that they can be applied to our food system and product concepts can be developed.

Horizon Scanning

Horizon scanning is another major responsibility of an individual on a Science and Technology team. I am continually monitoring scientific journals, consumer trends, new food products, ingredients, and companies to understand the future needs of the business. If I start to see reoccurring themes, for example, I might put together a proposal for a new project to work on. Depending on the opportunity, this may be work that we choose to conduct internally, externally, or both. One of the most enjoyable parts of my role is the ability to explore "white space" opportunities and pitch new ideas to the business. Sometimes, these ideas come from something I have read, and other times I find something interesting while doing lab or pilot plant work for another project.

There are also times where there's a recurring technical roadblock that prevents new products from being successful. This would also be a reason to launch a new S&T research project. I would imagine at one point in history, chocolate makers didn't know why some chocolates they produced developed a white, hazy surface over time, for example. In modern times, my team would see this recurring challenge and try to figure out the fundamentals of why this was occurring. We now refer to this white appearance as "bloom" and know that it can be controlled through a process called tempering, by which a very specific cocoa butter crystal structure is formed to create the desired texture and appearance. You can quickly see how solving this fundamental quality problem with chocolate could be applied to a wide variety of products that a company makes. It starts with identifying themes and recurring problems and then allocating resources to solve such problems that are believed to have a wide benefit across the business. The decision to invest in chocolate bloom research years ago, for example, has enabled chocolate makers to continue to bring fun, high-quality innovations to consumers at scale.

Troubleshooting

While a large part of my job is scoping and conducting longer-term research to shape the future of the business, I'm also responsible for extracting relevant learnings and applying them to our initiatives with shorter timelines. Let's say, for example, I'm working on a project to understand something really specific at the molecular level about how sugar crystallizes. This type of project could take years to hypothesis test and apply at scale. While the

specific project objective may take multiple years to deliver, there will be learnings along the way that can help troubleshoot new innovations or any challenges with current products. It's my responsibility in S&T to make sure relevant learnings are being funneled to the business to be applied as needed. Another example of a technical project one might be working on could be trying to improve "creaminess" in low fat ice cream. Decades of research have gone into figuring out exactly how fat droplets form complex networks to elicit a creamy mouthfeel. While researchers are still testing new hypotheses to figure out this exact mechanism, we have learned a lot along the way that can be applied to ice cream in the here and now. As the person leading research on figuring out the microstructure behind creaminess on a Science and Technology team, you may be called on by other functions to provide technical insight and expertise to a wide variety of other projects where a knowledge of lipid chemistry or emulsions is important. By conducting fundamental research that truly expands the body of knowledge around something, you start to grow into a subject matter expert in that topic.

S&T teams are filled with subject matter experts in topics relevant to the company. If there's a technical challenge associated with a product that we currently make or a new product we're trying to launch, these individuals often get brought in to consult and provide prospective to the project team. This type of skill and expertise comes with time and significant research on a topic of interest. It's often helpful to find a more senior researcher to serve as a mentor and work with them on projects if this is a career path of interest. Many people also pursue graduate degrees in food science or a related field to really hone their independent research skills, but this isn't necessarily a requirement. S&T careers are great for people who really love science and want to apply their technical expertise to making products safely, efficiently, and sustainably.

Important Skills for a Career in Science and Technology

Collaboration

Teamwork and collaboration are essential in technical career paths. R&D exists to solve problems that we don't yet know how to solve. It takes a group of people with different backgrounds and areas of expertise working together to solve these complex problems. Learning how to compromise, resolve conflicts, and engage in scientific discourse in a corporate environment are extremely important.

Networking

The food industry, while seemingly large, is quite small, especially once you start specifically drilling down to food scientists and engineers. It's very helpful to get to know others in the food science community, both within your company and externally, to solve problems and build effective teams. By being involved in an organization like the Institute for Food Technologists (IFT), for example, you may meet university researchers who have expertise in a problem you're looking to solve at your company. Through this network, you can help identify external partners and researchers of interest whose publications you want to follow. The same can be said by networking within your company. By knowing people in other functions and with diverse backgrounds and areas of expertise, you can build effective project teams and have people you can go to for advice or information on how similar problems have been solved in the past.

Science Communication

It's very important to be able to communicate research proposals and results to a wide variety of audiences. While it's critical to be able to engage in technical, scientific dialogue with peers, research partners, and project teams, it's equally important to be able to explain to senior leaders and others outside of technical functions what you're doing and why you're doing it. For an idea to get implemented or funded, buy in will be needed from a variety of different stakeholders to make sure your idea is aligned with the business strategy.

Curiosity

A genuine curiosity and ability to question how things work and why they work the way that they do will serve you well in an R&D career. Having the drive to question things, develop hypotheses, and propose new ideas and solutions is very important. Scientists and engineers who are part of research teams are expected to bring their own hypotheses and ideas to the table on a daily basis.

Dealing with Ambiguity

In S&T, we spend quite a bit of time not only finding the answers to current questions but also assessing what questions we need to be asking. Oftentimes, we are tasked with figuring out what to do as well as how to do it. We combine technical expertise with a knowledge of the business strategy to propose research project areas we may want to invest in long term. Being comfortable in an environment where both the specific problem and the solution are ambiguous and figuring out how to ask questions, gather data, and propose hypotheses to solve both is a critical skill for success in S&T.

Preparing Yourself for a Career in S&T

Does a career in S&T sound interesting to you? There are many things that you can do as a student to prepare yourself for an S&T career. In addition to developing the skills outlined above, there are other things you may want to consider.

1. *Obtain an internship or university research position.* By landing a summer internship or joining a university research lab, you'll develop important research skills that will benefit you tremendously in your career. These types of experiences not only give you specific work skills but also give important perspective to help you figure out what types of roles are a good fit.
2. *Stay curious.* Spend time reading journal articles of interest, give yourself space to explore aspects of food science that you find interesting, and talk about your interests with professors and classmates. By giving yourself space to explore your interests outside of classroom assignments, you'll start to figure out which aspects of food science you gravitate most toward and may want to pursue as a graduate student or in your first industry job. You'll also become more comfortable reading scientific literature, which is a skill onto itself.
3. *Consider graduate school.* A good place to start is by reading the section on graduate school in this book. Many people on S&T teams have graduate degrees, but not all. If you love research and know research is for you, graduate school is a great place to hone research skills so that you can come into industry prepared to lead complex technical projects. While graduate school is a great option for some, I want to be very clear in that graduate school is not a prerequisite for a career in S&T. Talk with your advisor and mentors about your career interests to determine if graduate school is something you want to explore.

Summary

A career in R&D just might be for you if you're the type of person who likes to ask why, likes to challenge the status quo, enjoys problem solving, and is naturally curious about the world around you. Careers in Science and Technology are exciting. You're in the thick of cutting-edge technologies aimed at truly step-changing how food is made. We dream big, think big, and have the opportunity to drive positive change in the way we bring safe and sustainable food to the masses. Much of the work on brand new ingredients, technologies, or processes begins with researchers on Science and Technology teams. These types of teams dedicated toward longer-term research projects are most common at larger companies, but that isn't to say that some of the types of roles discussed above don't exist in some capacity at smaller companies as well.

The "research" or Science and Technology component of R&D is very broad and varies in scope from company to company. At larger companies, this is most often a group of people investigating and pushing the limits of the body of scientific knowledge related to the products the company makes. They may be driving clinical studies to understand new ingredients, working on larger initiatives to shape the organization 10+ years down the road, developing completely new and innovative product and process concepts, and so much more. If you enjoy learning and pushing the boundaries of what's possible and are excited by the prospect of having an impact on shaping the future of food, a Science and Technology career may very well be a perfect fit for you.

I'll conclude by saying welcome. The food science community is a fun, lively, and passionate bunch. Get involved, try new things, and ask questions. People are generally excited to meet you and help you grow in your career.

Amy DeJong is part of the Global Science and Technology team at Mars Wrigley, where she uses her expertise in sweetener science, food physical chemistry, and phase transitions to unlock future innovations. She's held roles in Material Science, Product Science, and is currently a Sr. Process Development Engineer on the Global Breakthrough Technology team. She has a BS and PhD in food science from the University of Wisconsin–Madison, where she conducted research on polyol crystallization. Amy is a Past President of the IFT-Student Association and continues to be an active IFT volunteer serving in a variety of capacities. You may also recognize her from traveling the globe on CBS's Emmy Award winning reality show, "The Amazing Race," which she won with friend and fellow food scientist, Dr. Maya Warren, in 2014.

Chapter 19
Government Regulatory

Katie Becker

Government regulation of food products, food processing, and food preparation is imperative in bringing an unadulterated, non-misleading, and safe food product to market and is relevant to all areas of food science, including engineering, processing, chemistry, and microbiology. The liability associated with providing consumers with an adulterated or substandard product cannot only tarnish a company's name and reputation but also impose substantial financial repercussions on the company and those individuals who play an active role in the violation. In order for a company to fully comply with the relevant food laws (both federal and state), an intimate knowledge of food science is required. Individuals knowledgeable in food science play an integral role not only in implementing and counseling food companies/processors to ensure compliance with government regulations, but these individuals are also necessary to the state and federal governments that make and enforce the relevant laws and regulators. For these reasons and more, to be further explained below, government regulation of food protection and processing presents many diverse career options for a food scientist.

Federal Regulations

Food regulatory law encompasses many areas of study including food science, business, and law. The primary reasons for enacting food laws include prevention of foodborne illness and preventing consumers from receiving

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illegitimate or adulterated products. The two main government agencies that regulate foods are the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA). The FDA is responsible for enacting and enforcing laws including, but not limited to, the labeling of foods, setting standards of identity for food products, and approving and regulating food additives and GRAS (generally recognized as safe) substances. The FDA also enforces and regulates its laws in the following areas: misleading products, mislabeling of products, the contents of a food label, and nutrition facts and claims (i.e., health claims, nutrition claims, and qualified health claims). The two major roles the FDA plays are to administer inspections of food plants (and thereby protect the health of the public) and to test and set standards for products. Furthermore, the counterpart of the FDA, the USDA, concentrates its regulatory efforts on compliance in the meat and poultry industry.

With innovation at its height, as many new ingredients, additives, and new technologies (e.g., implementing nanoscience into foods and food processing) are being developed daily, food regulatory requirements are at elevated levels of importance. Labeling issues, evaluation of GRAS status for packaging components and food ingredients, developing and implementing FDA compliance procedures, and implementing responses to government inspections (i.e., recalls) are taking a front seat following threats of bioterrorism in the food supply, highly publicized and nationalized foodborne disease outbreaks, and new food products and ingredients being developed at rapid-fire pace.

One technology in particular, application of nanotechnology in foods, will pose many challenges for the FDA and will require the knowledge and expertise of food scientists to assist the government in regulating this emerging technology. In particular, areas of interest in food nanotechnology include: nanoparticles in edible coatings and barriers, preservatives, antimicrobials, and mineral supplements. With the possibility and probability of applying nanoscience in food packaging and processing and ingredient technology, interest in this emerging technology is especially prevalent to food companies and is also resulting in increased private funding in this area. In order for food nanotechnology to be approved, accepted, and implemented into food-related applications, the involvement of food scientists in obtaining the requisite government approval is necessary.

The most prominent statute enacted and enforced by the FDA is the Food, Drug and Cosmetics Act (FDCA). The FDCA is a strict liability statute which imposes criminal penalties, seizures, and injunctions on individuals or corporations who violate the Act. Products also may be recalled either voluntarily (by the company) or by an order from the judge (court order).

In addition to lawmakers, attorneys, and lobbyists, scientists also play a pivotal role in the government/regulatory realm. Job opportunities for food scientists in the government/regulatory arena incorporate many facets of the field of food science and include, but are not limited to:

- Food analysis (studying the biological effects of various agents commonly found in foods, such as additives or contaminants)
- Food chemistry (conducting research projects that study the effects of food components and dietary supplements on utilizing essential and toxic minerals in the diet)
- Food process engineering (presenting reviews, conclusions, opinions, and recommendations to appropriate scientific review panel on premarket approval applications, product development protocols, and petitions for reclassification)
- Food microbiology (conducting research on the development of media and procedures for isolating and identifying pathogens from foods and on the definition of the kinetics of growth, survival, or destruction of foodborne pathogens under the environmental conditions occurring during food processing and storage)

Even though the FDA is headquartered in Washington, DC, it has district offices scattered throughout the nation, including Chicago, Dallas, Baltimore, and Minneapolis.

If an individual is interested in not only the laws themselves but the science behind the laws, a career in food regulation will likely be a suitable fit. Analyzing, interpreting, and implementing laws is also crucial in the food regulatory arena. Therefore, if an individual is interested in food science (processing, engineering, chemistry, microbiology, etc.) but would like to use their food science knowledge in contributing to and/or analyzing and implementing food laws and explore a career outside of the well-recognized food science careers (i.e., research and development and quality control/assurance), the career and internship opportunities in food regulation should be considered.

As mentioned previously, the USDA regulates meat and poultry products and processing. Opportunities for food scientists in the USDA include: meat and poultry plant inspectors, food microbiologists, and the like. Similar to the FDA, the USDA also creates and enforces laws and regulations in the meat and poultry industry, with respect to labeling, packaging materials, additives (traditional additives in addition to radiation used to reduce microorganisms in meat and poultry products), and allergens, in addition to performing safety inspections of facilities. Inspectors for the USDA must be knowledgeable in food science applications such as food processing,

engineering, and microbiology to ensure that meat and poultry facilities are functioning in conjunction with the standards set forth by the USDA.

Although the USDA is best known for its regulation of meat and poultry products and processing, it has carved out a niche for its technology and intellectual property management (e.g., patenting new and emerging technologies in the meat and poultry industry). The USDA partners with commercial firms to transfer its technology to American farmers, businesses, and consumers. The USDA offers private sector businesses, state and local governments, and universities the opportunity to license federally owned inventions. In the words of the USDA, these partnerships are designed to "expedite research results to the private sector, exchange information and knowledge, stimulate new business and economic development, enhance trade, preserve the environment, and improve the quality of life for all Americans." Some patent applications and issued patents available for licensing through the USDA are as follows: "Sweet-N-Up" A New Distinct Peach Variety; Gene That Extends Fruit Shelf Life; New Technique to Eliminate Bitter Compounds in Potatoes; and New Edible Food Coatings. The USDA is also responsible for the National Organic Program and Organic Foods Production Act, for certifying foods as organic, "to assure consumers that the organic foods they purchase are produced, processed, and certified to be consistent with national organic standards."

Many subsections and specialties exist within the umbrella of food law. For example, some practitioners specialize in packaging law, compliance, GRAS approval petitions, and litigation surrounding violations and/or foodborne disease outbreaks. Packaging law relates to the regulation surrounding both the packaging and labeling of food products in conformity with FDA regulations, whereas compliance refers to counseling food manufacturers and processors to ensure compliance with the relevant foods laws. .Additionally, GRAS approval petitions require not only legal counseling but also counseling by a food scientist in order to perform the relevant testing and research and opine as to the safety of a substance in a food product in order to obtain government approval for using the substance in a food product. The knowledge and experience of a food scientist, in litigation surrounding violations and/or foodborne disease outbreaks, is also necessary, as food scientists are used as expert witnesses and are needed to build both sides of the case.

State Regulation

The states also play an important role in regulating food products and the food industry. For example, in Wisconsin, the two enforcement bodies of the state government are the Department of Health and Human Services along

with the Department of Agriculture, Trade, and Consumer Protection. It should be noted that the state laws that regulate in the same area as federal laws cannot be more lenient than the existing federal law; however, they may impose stricter guidelines. Additionally, states have embargo type power which allows them to halt a product's movement in interstate commerce; however, the FDA doesn't have the power to go into a food plant and seize/embargo it. Yet, the FDA can take action against anyone in the chain of the product's movement, including production, distribution, and retail.

In recent years, there has been a push on the part of the FDA to streamline states' regulations. As stated in the September 2007 issue of the *Journal of Food Technology*, in order to achieve consistency throughout the states, the FDA is urging states to adopt the Manufactured Food Regulatory Program Standards "for measuring and improving the performance of state programs for regulating manufactured food and help the state and federal authorities reduce foodborne illness hazards in food facilities." These Standards define best practices for the critical elements of state regulatory programs and include: staff training, inspection, quality assurance, incident investigation, enforcement, etc.

In addition to federal and state regulations, if products are marketed abroad, they are also subject to international regulations. International regulatory groups include the Food and Agriculture Organization and the Codex Alimentarius Commission.

My Experiences

Due to the variety of disciplines encompassed in food regulation, this career path sparked my interest. As an undergraduate majoring in food science, I was particularly interested in the laws surrounding the processing, distribution, and sale of food products. Following graduation with a BS in food science, I interviewed with and obtained an internship through the Wisconsin Department of Health and Family Services (DHFS) in the Food Safety and Recreational Licensing Division.

During my time at DHFS, I evaluated the efficacy of the Wisconsin Food Manager Certification Program, a program included in the Wisconsin Food Code and enforced by DHFS. This program requires that at least one certified food manager is employed in the particular eating establishment and is based on the establishment's size and/or type of food being served. This research was supported by a grant from the Centers for Disease Control (CDC).

In evaluating the Wisconsin program, I met with interested parties, such as the Wisconsin Restaurant Association to obtain their feedback and

opinions on the program. Additionally, I researched and contacted other states with certification programs and attempted to correlate the type of certification program implemented to the number of instances of foodborne illness complaints in that state during a specified period. I also met with representatives from the Department of Agriculture, Trade, and Consumer Protection (DATCP) and the Environmental Protection Division of DHFS regarding the Food Manager Certification Program. An additional duty of my position entailed digitizing a database including policies passed by the Division.

In addition to internships with state regulatory agencies, an undergraduate can gain experience in the governmental regulatory arena by taking food law courses and interning with a food manufacturer or processor. Internships with the FDA and USDA (in both the national headquarters and district offices) are also ways for an undergraduate to gain invaluable experience in this field.

After working at DHFS for a year, I attended law school, planning to specialize in food law and/or intellectual property law (in food science and the chemical arts). During my undergraduate studies, I took a food law course which sparked my interest in the regulatory arena of food law and also took a food and drug law course during law school. However, although many law schools do not offer extensive food and drug law electives, the food-related agencies, such as the FDA, are discussed in a variety of courses offered by law schools, such as legislative process and administrative law. Food science-related issues are raised in many intellectual property law classes, such as trademark law, trade secret law, and patent law.

During law school, I clerked at one of the largest food and beverage corporations. In clerking for this corporation, I experienced firsthand how the FDA regulations governed many aspects of the legal department and the corporation as a whole. Any food corporation needs to keep abreast of any labeling laws and all other pertinent regulations, to ensure compliance with these laws. The federal laws that are most integral to most food corporations include labeling, including ingredient labels and claims, in addition to standards of identity, certifications, and the like.

While in law school, I found that my food science background was an invaluable asset to my legal education. The technical writing required in many of my food science courses helped me to seamlessly transition into legal writing. In addition, the time spent researching in preparation to write technical papers and perform experiments and independent study projects also proved advantageous in helping me excel at legal research. Additionally, a technical science background, such as food science, is required in order to sit for the patent examination to practice before the United States Patent and Trademark Office.

Summary

Many diverse and exciting opportunities are available for food scientists in the government regulatory arena. Opportunities arise not only in the federal government but also in state governments and private food companies. The federal and state governments conduct the research behind, implement, and enforce the laws, whereas an industry must ensure its compliance with these laws. Whether your interest lies in bacteriology, chemistry, engineering, processing, etc., the state and federal governments in addition to private food companies provide a wide and interesting array of career options for the food scientists.

Katie Becker joined the food science program at UW–Madison in 1999 due to her interest in food technology and laws and regulations pertinent to the food industry. While at UW–Madison, she worked as a lab assistant in a food safety research lab on campus, joined the Food Science Club and the Badger Student Fan Club, and was a member of the UW–Madison fishing team. After graduating in 2003, Katie spent a year with the State of Wisconsin Health and Family Services Department working on food safety compliance programs. She then attended law school and has worked as a private practitioner at an intellectual property law firm in Chicago, Illinois, since graduating from law school. Her practice focuses on patent procurement and enforcement, representing clients ranging from start-ups to Fortune 50 corporations. While she finds all of her work exciting, she has a soft spot for representing clients and innovations in the food technology space.

Chapter 20
Careers in Traceability

Sara Bratager

Introduction

Traceability is by no means a new concept to the modern food industry – the ability to trace a foodborne illness back to its origin has been a clear and present need for many years. Traceability-focused careers, however, are relatively new and actively growing. Legislation introduced through the early twenty-first century forced the food industry to dedicate more resources toward traceability. This, coupled with the additional benefits of a robust traceability system and increasing consumer demand for transparency, created opportunities for traceability-focused careers within the food industry.

What Is Traceability?

Traceability refers to the ability to follow a food product as it moves from its origin (e.g., farm), through each step of the supply chain, to the final stage of its life cycle: consumer purchase. The ability to do this requires a foundation of data capture and storage throughout the product life cycle.

Traceability system development begins with the identification of Key Data Elements (KDEs) and Critical Tracking Events (CTEs). CTEs are the various events in a product life cycle at which data must be collected to document product movement or transformation; KDEs are the pieces of data

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captured in order to maintain a record of product identity at each CTE. For example, "blending" could be defined as a CTE in a sausage production process. At this process step, KDEs would likely include but aren't limited to the date and time that the blending took place, the weight of all ingredients used, and the batch/lot numbers for spices and raw meat associated with the sausage blend.

The complexity of the CTE-KDE framework increases with the length of the supply chain and the complexity of a food product. Consider a small Wisconsin apple orchard that harvests and sells apples directly to a single local supermarket; it's relatively easy to trace that farm-to-fork process as illustrated in Fig. 20.1. Consider Fig. 20.2 in contrast, depicting the hypothetical movement of Mexican sugar cane that passes through several hands before it's eventually consumed throughout the United States in its final candy form. The multitude of transformations and locations associated with this life cycle make it far more challenging to maintain the traceability framework.

Much of the difficulty in achieving end-to-end traceability lies with the level of participation required; each party involved in a product supply chain must collect, store, and communicate data. It's a never-ending group project in which no single group member can make up for the work another failed to complete.

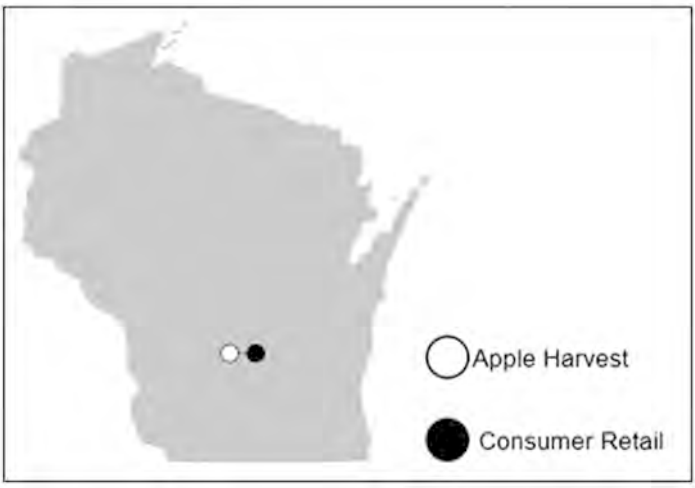

Fig. 20.1 Commodity lifecycle – Apples

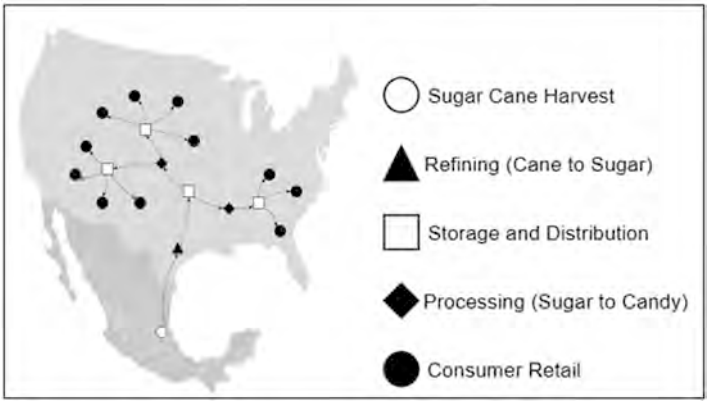

Fig. 20.2 Commodity lifecycle – Sugarcane

Why Is Traceability Important and What Role Does It Serve in the Food Industry?

Across generations, today's consumers are increasingly inquisitive of the current food system. Consumers not only want to know what's in their food and where it comes from but also what social and environmental impacts are associated with the production of the food they eat: they want transparency (Markenson, 2020). Supply chain traceability is the first crucial step in providing consumers the transparency they expect from their food providers.

Both food providers and regulatory agencies use traceability systems for the investigation and identification of noncompliant or potentially harmful product (Centers for Disease Control and Prevention, 2016). In the event of a foodborne illness outbreak, traceability systems are used to trace suspected food products backward to their origin and forward to all affected parties. Traceability isn't only critical for protecting consumers from outbreak events but also for protecting businesses from excessive product loss. Say, for example, that multiple consumers report illness after consumption of romaine lettuce. There may only be a few hundred pounds of contaminated lettuce, but if regulators are unable to trace the suspect lettuce back to the origin of contamination, ALL romaine lettuce is subject to removal from store shelves. In situations like this, a robust traceability system may be the difference between a two-thousand-pound recall and a two-million-pound recall.

Another commercial benefit of traceability is the enablement of certification programs and market differentiation product claims. If a poultry

processor produces chicken tenders with an "Antibiotic-Free" label, they're legally obligated to have evidence in support of that label claim. Supply chain traceability would allow that processor to identify the farm from which those chickens came and provide documentation of the antibiotic-free feed that said chickens consumed.

Though traceability is most often viewed as a mechanism to manage recalls, it serves a variety of different functions in the food industry. The functions detailed in the previous paragraphs are those most relevant to food scientists, but it's worth noting that traceability is also useful for supply chain/operations optimization, food fraud prevention, waste reduction, and sustainability/human rights initiatives support.

What Does a Career in Traceability Look Like?

While the job market for careers in traceability is relatively small, the field offers a diverse range of opportunity. Within the food processing/retail arena, members of food safety, quality, and regulatory management teams perform mock recalls, manage data capture, and update traceability systems to align with government or third-party regulations. In the food industry IT space, traceability software providers employ technical account managers and business analysts to help manufacturing customers build and implement electronic traceability systems. Philanthropic foundations may contract traceability scientists and supply chain analysts among other consultants that trace food commodities through their life cycles with the intent of identifying supply chain areas in which environmental sustainability and human rights compliance could be improved. Certain professional associations and nonprofits also do a variety of work in the traceability space. Using the Institute of Food Technologist's (IFT) Global Food Traceability Center (GFTC) as a case study, let's examine what a role in traceability consists of.

The GFTC aims to advance the food and agriculture industry through the lens of global traceability challenges. GFTC teams work collaboratively with private sector institutions, nongovernmental organizations (NGOs), academia, and government organizations to foster the development of traceability tools and bring awareness to the importance of food traceability.

While the responsibilities of individual staff vary, their general day-to-day activities relate to three major categories: applied research, solution/standards development, and education/outreach.

- Applied Research:
  - Traceability Systems: Some days this might mean collecting information on supply chains that have achieved a high level of traceability

(e.g., Norwegian salmon) and assessing best practices that could potentially be applied to other food commodities or value chains. Other days this research might involve learning about traceability software to evaluate its potential for scalability.
  - Supply Chain: Because end-to-end traceability requires participation throughout the supply chain, significant time is spent researching *who* is involved at each step of a supply chain, *how* they're involved, and *what* resources they have for data collection.

- Standards and Solution Development:
  - Standards Establishment: This is where the research meets application. Traceability systems and supply chain research are used to develop data collection standards for commodities of interest. For example, the GFTC team collaborated with World Wildlife Fund (WWF) to establish the Global Dialogue on Seafood Traceability (GDST), a data collection standard to facilitate improved traceability in the seafood industry (Institute of Food Technologists, 2020a).
  - Technology Development: Traceability scientists collaborate with tech developers to translate standards into software requirements. This way, developers can create tech solutions that allow businesses to implement and uphold traceability standards.
  - Pilot Tests: Traceability scientists often support supply chain or technology pilots. Pilots may be conducted to test new technology and/or new standards or to evaluate the use of existing technology/standards in a new environment. In 2020, for instance, the GFTC worked with several industry associations and retailers to pilot traceback methods for leafy greens in conjunction with the FDA's Leafy Greens Action Plan (Institute of Food Technologists, 2020b).
  - Policy Impact: When new traceability legislation is proposed, feedback is collected from industry stakeholders (think retailers and processors) to determine what education, tools, and services might be needed to achieve regulatory compliance. The GFTC also takes proactive steps to shape policy – e.g., publishing of reports and white papers, engaging directly with government officials, and developing public comments on draft policies.

- Education and Outreach:
  - Project-Specific Communications: Privately contracted projects often require the creation slide decks and small-scale presentations to summarize research. For noncontract or publicized projects, traceability scientists might develop case study documents or speak about various projects at food and/or tech-focused conferences.

– General Education: To raise awareness and understanding among stakeholders, traceability scientists develop and facilitate in-person and online trainings. They may also spend time crafting articles, blog posts, or concept papers about industry trends or new developments in technology as they relate to traceability.

While this may appear to be an overwhelming list of tasks, it's important to note that very few of these tasks are done independently. Research is often a tag-team effort. Solution development *always* requires input from multiple stakeholders like retailers, regulators, processors, and farmers, among others. Communication is most effective when the diverse perspectives of all team members are considered in crafting a narrative. More than anything, a career in traceability is about cross-functional collaboration.

How Might One Prepare for a Career in Traceability?

For food scientists interested in traceability, I would first recommend taking steps to acquire a strong understanding of food processing and distribution. Where offered, food systems courses can help to provide a holistic view of the systems in which we work; classes focused on global food systems are especially relevant given increasingly globalized supply chains. Food processing classes will be helpful in providing background knowledge of common food production processes, while hands-on experience will offer a more in-depth understanding of product life cycles. I highly encourage internships and entry-level operations or food safety/quality management roles with food producers, processors, manufacturers, distributors, and/or retailers. After graduating with my food science degree, I spent about 4 years working at a turkey processing plant in the food safety and quality management department. Participating in daily production as a new associate gave me a good grasp on the various ways in which food ingredients can flow through each processing stage of a product life cycle. As I progressed to a supervisory role, I began working with traceability technology, implementing data collection standards, and running mock recalls; this experience furthered my understanding of the complexities in product movement and information tracking and gave me the background I needed to land my current job as a food traceability and food safety scientist. Though traceability expands well beyond food processing, food scientists can provide unique food production knowledge needed for the development and success of reliable traceability systems.

Outside of traditionally required food science courses, additional electives can be helpful in preparing for a career in a specific traceability focus area. For students interested in foodborne illness investigation and recall management, classes in food safety, microbiology, and public health would be advantageous. For those interested in technology, classes in coding/programming may improve your ability to develop and implement traceability systems, understand tech capabilities, and communicate with software developers. For food scientists interested in nonprofit or trade organization traceability work, a supply chain and logistics management course will likely help connect dots through the full farm-to-fork process.

Closing

The field of food traceability offers food scientists unique opportunities to solve some global food challenges – and these opportunities are expanding! Demand for brand transparency is growing. The impacts of climate change threaten to increase the risk of foodborne illness. Supply chains are becoming more globalized. Food waste must be tracked and subsequently reduced to meet the needs of our growing population. Each of these trends will require traceability-focused resources and innovation, generating a wealth of potential careers in which food scientists can apply their experience and education in a meaningful way.

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Sara Bratager joined the food science program at UW–Madison in 2013 and quickly developed an interest in food safety and quality. She spent her summers working food safety/quality internships in produce and meat manufacturing plants. During the school year, she worked as a lab assistant in a food safety research lab on campus, joined the Food Science Club, and skied for the UW–Madison Alpine Ski Team. After graduating in 2017, Sara's desire to experience food manufacturing at its core brought her to the poultry mecca of Northwest Arkansas. She spent four years in food safety/quality management at a turkey processing plant developing quality programs, leading mock recalls and traceability exercises, investigating customer complaints, learning Spanish, and managing the inherent chaos of food production. Seeking a new direction, she then took her love for traceability to her current role as a food traceability and food safety scientist with Institute of Food Technologists (IFT). Sara is passionate about traceability and accountability and hopes to improve the ease and accessibility of food traceability throughout our food system.

Chapter 21
Using Food Science in Special Interest Groups

Alison Bodor

Employment opportunities are excitingly broad and varied for food scientists. There are many special interest organizations including food trade associations, commodity promotion groups, and consumer advocacy organizations that require the skills of a food scientist. Unique aspects of these employers and jobs will be explained along with the special food science and related skills that contribute to success in these fields. I have had the honor of using my food science background to work for several special interest organizations representing dairy, candy and chocolate, and now frozen foods in Washington, D.C. I will use these experiences to describe the opportunities available to food scientists in these organizations.

What Are Special Interest Groups and How Are They Unique?

An interest group is an organization whose purpose is to advocate for a cause, an industry, or a demographic sector, for example. Interest groups related to food are often established to promote and/or protect a sector of the food industry. A trade association is a type of interest group comprised of industry competitors. Businesses—not individuals—join trade associations.

For instance, the American Frozen Food Institute (AFFI) is comprised of frozen food companies and the suppliers who provide those companies with

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products and services. AFFI's members include small, family-owned, multi-generation companies that grow, harvest, and freeze fruits and vegetables, as well as larger, multi-national companies that produce value-added, multi-component foods like frozen chicken pot pies, frozen breakfast sandwiches, frozen pizza, and even frozen ethnic dishes like pot stickers and paneer. I am fascinated by the frozen food industry because what binds our member companies together is that they all sell foods at a frozen temperature. Although these companies are competitors, they rely on AFFI to bring leaders from the industry together to address strategic opportunities and threats to the industry. AFFI provides leadership on legislative and regulatory developments that may affect their business, research and statistics on trends in the industry, professional education, and communications and trade activities to promote the category of frozen food.

Other sectors of the food industry that are represented by interest groups or trade associations include most commodities (e.g., eggs, dairy, milk, corn, meat, poultry, grain, peanuts, almonds, nuts), other ingredients, processed and specialty foods, and food retailers.

There are also food-related associations that represent a profession such as the Institute of Food Technologists (IFT), Academy of Nutrition and Dietetics, or the Food and Drug Law Institute. These are professional societies that individuals join (rather than businesses or companies) to learn the most up-to-date information and training for their profession and share common problems and solutions with peers. Professional associations also advocate on behalf of their members and fund research to advance their missions. In addition, there are many cause-related associations such as the American Cancer Society, the American Heart Association, and the American Diabetes Association that have programs related to food and food science.

Associations are membership organizations. Depending on the association, companies or individuals pay annual dues to be a member. A professional staff runs the day-to-day activities of the organization, but the overarching goals and objectives of the association are generally set by a governing board of member companies. Employees from member companies also participate on committees and task forces that are led by the association staff. Association staff generally work very closely with member companies.

Most associations are not located near food processing facilities. The Washington, D.C. metropolitan area has the highest concentration of associations in the United States. In fact, associations/nonprofits are the third largest industry in the D.C. area, behind the government and tourism. Many associations are in the D.C. area to work with Congress and regulatory agencies to keep abreast of Federal policy issues. Some food and commodity

associations are based in closer proximity to their agricultural base. For example, the Almond Board of California is in California where most almonds in the United States are grown. Food Northwest is located close to their membership base of food processors located in the pacific northwest in Portland, OR. The American Institute of Baking is headquartered in Kansas, a region associated with wheat and grain production.

What Are the Responsibilities of a Food Scientist Working for a Trade Association?

Every organization and position is unique so job responsibilities will vary accordingly, depending on the focus of the organization. I can best answer this question by describing my current organization, AFFI, where I am the CEO. At AFFI, we have four food scientists employed, including me.

The food science and regulatory team at AFFI works in the intersection of public health and the business of food production and distribution. We work closely with AFFI team members in communications and legislative affairs to address public policy issues relevant to frozen foods such as food safety, labeling, nutrition and health, international trade, and more recently COVID-19 pandemic response and preparedness. Functions covered by the AFFI scientific and regulatory team are as follows:

1. *Food safety*. At AFFI, food safety is the number one strategic focus. Following a major recall of frozen foods in 2016 due to illnesses associated with the pathogen *Listeria monocytogenes (Lm)*, AFFI's member companies and staff have doubled down on advancing food safety within the frozen food industry. The member companies look to AFFI's food scientists to develop and reinforce food safety practices that raise the bar across the industry while at the same time working with regulatory agencies to ensure food safety regulations are practical and science based and improve public health.
2. *Scientific research*. We work with members to fund, develop, place, and oversee research with private labs and universities related to frozen foods. For example, as AFFI has explored ways to improve public health outcomes related to *Lm*, we have worked with food scientists at Cornell University, University of Georgia, and University of Minnesota. Our multi-year research program has delivered insights on how to improve food safety practices and also how to best assess and mitigate further the already low risk of *Lm* from frozen foods. Our published research is also guiding our engagement with US and international regulatory bodies.

3. *Convening global perspectives*. Our food scientists have also led expert panel deliberations with globally renowned scientists to assess the latest science on both *Lm* and enteric viruses, the latter of which represents a risk for produce from regions where such viruses are endemic in the population. AFFI scientists identify expert scientists, facilitate discussions, and assist with summarizing deliberations and conclusions. These conclusions are important resources for our industry to improve practices, guide research needs, and interact with regulatory agencies.
4. *Regulatory and government affairs*. AFFI food scientists work independently and with other food industry stakeholders to influence the development of new legislation and regulations, so they are effective in achieving the intended public health objectives, yet not unduly burdensome to frozen food production. In addition to closely tracking bills and measures in Congress relating to food, we pay close attention to regulatory agencies with the oversight of the food industry, and those include the US Food and Drug Administration (FDA), the US Department of Agriculture (USDA), the Environmental Protection Agency, the Department of Labor, and the Consumer Product Safety Commission.
5. *Industry guidance*. During the COVID-19 pandemic, AFFI food scientists applied their risk assessment and food safety skills to provide the best available guidance and resources to manage the spread and impact of the coronavirus disease. We conferred with government officials in the White House, FDA, USDA, Centers for Disease Control and Prevention, and Occupational Safety and Health Administration to keep workers safe, food facilities operational, and food flowing through the supply chain to Americans' dinner tables. During a very stressful time in our nation and within the food industry, considered critical to our nation's infrastructure, our food scientists (along with the rest of our team) were a source of vital information, guidance, and security.
6. *Compliance guidance*. AFFI food scientists assure that frozen food processor members are aware of and have the tools to comply with regulations affecting frozen foods. These regulations cover food safety, traceability, food labeling, ingredient and chemical safety, supply chain developments and disruptions, composition of foods, and trade policy.
7. *International expertise*. AFFI scientists track international regulations and work cooperatively with international organizations, such as associations in other countries, on regulatory issues of mutual interest or concern. As feasible, AFFI scientists influence the development of other nation's regulations that may otherwise adversely impact exports of US-produced frozen foods. AFFI works closely with member companies to monitor and participate in the World Health Organization's

Codex Alimentarius processes on behalf of the frozen food industry. The Codex Alimentarius creates standards that are often adopted by countries around the world to which US companies export foods, so it is important to ensure those standards are reasonable and preferably in alignment with US regulations.

8. *Member engagement*. AFFI food scientists lead committees of members to advance strategic priorities of the industry, especially around food safety and regulatory concerns. This is a rewarding work because it keeps us close to our member companies and their operations. While we work in an office environment, we are never far removed from real-world food processing.
9. *Media relations support*. AFFI food scientists work with AFFI's communications team to respond to scientific stories in the press about frozen food. Often our scientific team is tasked with providing facts on issues that might be misconstrued in the press. For example, recently, AFFI scientists provided scientific input on stories related to the low likelihood of COVID spreading on food package surfaces, on the low sodium content of many frozen entrees, and to reiterate that frozen fruits are considered ready to eat and do not require a cooking step prior to consumption.
10. *Communication*. Association food scientists write articles for newsletters, present on webinars, and speak at conferences.
11. *Lending perspective in person*. AFFI scientists are often on the road, traveling at least a few days every month to visit member facilities, speak at food industry technical meetings, meet with member committees, and more.

The job of an association food scientist is challenging and interesting, as well as exciting and fun. Let me share a typical day with you. In the morning, we might meet with a member company and tour their facility to gain a better understanding of how vegetables are harvested, processed, and frozen and the food safety controls employed throughout. We will use this information in the future to assess the impact of changing food safety regulations on frozen food production. Before lunch, we may attend a frozen food industry meeting and update attendees on current regulatory developments related to traceability of food and how they affect the supply chain of frozen fruits imported to the United States. In the afternoon, we may write a newsletter article to our membership informing them of global developments on front-of-pack labeling requirements. Finally, we might round out a typical day by meeting with officials at FDA to discuss how the regulation of *Lm* is creating unintended risks for frozen food manufacturers and will offer ways to lessen those risks.

At the end of the day, I can attest that AFFI's food safety and regulatory team feels satisfied that we have helped frozen food companies improve their operations, lower their costs, and mitigate risks to their businesses. We are constantly learning about the realities of food processing and meeting smart, hardworking people along the way who make our food supply safe.

What Food Science Skills Are Most Important to Success in an Association?

Assuring a safe food supply is a principal goal of all food companies and regulators. Therefore, familiarity and in-depth knowledge of food microbiology, food chemistry, engineering basics (especially as they relate to principles of food preservation), cleaning/sanitation, statistics, and nutrition are valuable skills that I use daily. The principles of risk assessment provide the framework that we often use to address food safety and regulatory issues, so knowing those—the difference between a hazard and a risk—and how to manage and mitigate risks are very important.

While one should strive to achieve a solid foundation in food science principles, applying that knowledge to real-world situations requires yet more skills. IFT lists the following skills as core competencies for success in a food science career and they certainly apply in a food association setting:

- Communication skills (i.e., oral and written communication, including writing technical reports, letters, and memos; communicating technical information to a nontechnical audience; and making formal and informal presentations, etc.)
- Critical thinking and problem solving
- Interaction skills, especially leadership, interpersonal, and networking
- Information acquisition skills (i.e., written and electronic searches, databases, internet, etc.)
- Organizational skills (i.e., management of projects and consultants, facilitating groups especially long-distance teams, and conference calls)

These practical skills allow a food scientist to put their food science knowledge to work in a business environment.

To supplement a food science education, I suggest additional coursework, research, or summer job experience in food safety, public health, nutrition, or food law. I would also urge students to take an internship with a food company, perhaps in quality control, to gain an understanding of how companies operate and how they manage food safety or regulatory issues internally. An internship with a trade association or other group located in

Washington, D.C. would strengthen the resume of any candidate seeking a position in this region.

Job opportunities in associations or other special interest groups may be posted in several locations. IFT is a good place to start. The IFT Job Center is used by many of the larger associations to post job announcements and interview candidates. Additionally, the Washington, D.C. regional section of IFT covers the city of Washington, D.C., the state of Virginia, and surrounding counties in Maryland. Involvement in the Washington, D.C. section of IFT is an excellent strategy for networking with other local food technologists and food safety or health and regulatory professionals. These individuals often have the best knowledge of local organizations and employment opportunities. Food industry recruiters are sometimes retained as well to help fill vacant positions so it would probably be wise to reach out to those recruiters that specialize in regulatory work.

Summary

Current-day food scientists are experiencing a revolutionary period in the food industry. Innovation and technology inspired across multiple disciplines ranging from molecular biotechnology to artificial intelligence to sustainability present unchartered territories for learning, scientific advocacy, and industry guidance. Central to these developments is an evolving consumer base that cares deeply about nutrition and demands transparency in how food is produced. Food scientists will have to navigate complex problems that are likely best addressed through the application of scientific understanding and collaboration. These are exciting times in the food industry and food scientists have a pivotal voice and role, particularly at advocacy platforms such as trade associations. Ultimately, knowing that you are making a difference for the broader food industry and contributing to a more efficient and safer food supply makes working for an association such a rewarding experience.

Alison Bodor is president and CEO of the American Frozen Food Institute (AFFI), the member-driven national trade association that advances the interests of all segments of the $65 billion frozen food and beverage industry. As president and CEO, Bodor delivers member value by ensuring that AFFI's activities contribute to both the individual company and collective success of the industry. Bodor is leading the association's strategic goals to advocate before legislative and regulatory entities, serve as the voice for the industry, and convene industry leadership to create an environment where frozen foods are essential in a dynamic marketplace. She holds an MBA from the University of Maryland and a bachelor's degree in Food Science from Cornell University.

Chapter 22
Food for Good: Leveraging Food Science to Feed the World

Donna Rosa

Are you a do-gooder? Would you like to use your food science degree to tackle extreme hunger, enhance nutrition in low-income areas, improve food safety in the developing world, or contribute to global food security in some way? Then, this chapter is for you.

Food Science for Relief and Development

An exciting new food science discipline has emerged to address these issues; it is called Food Science for Relief and Development (FSRD). FSRD is the application of food science and technology (FST) to enhance food security, health, and economic prosperity for global humanitarian and development purposes. It aspires to increase both awareness and utilization of food science and technology (FST) to improve global food and nutrition security.

FSRD seeks to go beyond traditional agriculture and nutrition approaches in international development. It takes a holistic approach to food insecurity by integrating those fields with FST. This broader systems-based strategy is then implemented in a human-centered, sustainable, locally focused, and collaborative manner.

The International Division of the Institute of Food Technologists (IFT) runs an FSRD program that produces case studies of successful real-world

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food science implementation, works with international food science organizations to develop their own FSRD programs, and issues communications around FSRD. Volunteers gain exposure to this emerging field and have found the experience both interesting and beneficial. For more information, visit https://info.ift.org/en/fsrd-21. You must be an IFT member to participate.

Is Your Background in Demand?

The most relevant food science disciplines for international development work are as follows:

- Food safety
- Supply chain
- Process engineering and general processing
- Product development
- Quality management
- Packaging
- Regulatory and compliance
- Postharvest loss and waste reduction
- Nutrition-integrated food science
- Agriculture-related food science
- Applied research in specific areas such as nutrition, new food sources, and crop- and food-specific issues

Working in this field usually requires specialized education, training, and/or experience, as implementation in international development contexts is very different from high-tech universities and food companies in the developed world. Information on a few such programs can be found in the section on academia and research institutions.

What About Jobs?

I am often asked (especially by young people) how to apply their food science education and knowledge to do good in the world. Many are from developing countries and wish to help their homelands. The good news is that there are a variety of interesting options for young food scientists. The bad news is that the number of jobs is extremely limited.

In general, the following types of organizations may offer positions for food scientists interested in international development:

- Multilateral donor agencies
- Governmental aid/donor agencies such as US Agency for International Development (USAID), GIZ (Germany), FCDO (UK), and DFAT (Australia) (see https://en.wikipedia.org/wiki/List_of_development_aid:agencies)
- Philanthropy (foundations and non-governmental organizations (NGOs) that fund food-related projects)
- Implementers (consulting firms and nonprofits that execute projects under contract from donor agencies, foundations, and others)
- Academia
- Research institutions
- Private companies

If you do not have the required professional background, you may be able to start by volunteering. This is a great way to build experience and learn firsthand about food science in developing contexts. It can also be personally rewarding to make a tangible contribution to society. See the section on "Volunteering" for more information.

Multilateral Donor Agencies: United Nations (UN)

The two relevant UN agencies for food and nutrition insecurity are the World Food Program (WFP) and the Food and Agricultural Organization (FAO).

UN jobs are in high demand and very competitive. If you speak two or more of the UN languages (English, French, Arabic, Chinese, Russian, Spanish), it might be an advantage, depending on the job.

World Food Program (WFP)

The UN's WFP is perhaps best known for its efforts to feed millions of food-insecure people around the world, particularly in emergency and crisis situations. But beyond its efforts to save lives, WFP works to change lives through longer-term development on the road toward Sustainable Development Goal 2, Zero Hunger. WFP's activities span a wide range, including helping to create sustainable food systems through strengthening of supply chains and building resilience, working with communities to

reduce food waste, providing education around nutrition and healthy diets, and providing school meals to encourage participation in schooling.

WFP has over 20 food scientists on staff to ensure the safety and quality of the food it provides. They are engaged in a variety of roles, with many located in WFP's Rome-based Food Safety and Quality Assurance Unit.

The unit works with teams across the organization's headquarters, regional bureaus, and country offices to ensure that safe and high-quality food standards—from end product testing to quality assurance—are achieved and maintained. This is accomplished through enhanced food and packaging specifications, supplier assessments, and capacity strengthening, including the development of effective incident management systems. Many more food technologists are also employed as consultants working on specific projects such as food fortification.

The backgrounds most in demand at WFP are food safety specialists, general food technologists, microbiologists, and packaging experts. The organization employs people with varying levels of experience, with most holding postgraduate qualifications.

Peijie Yang, a specification manager at WFP Headquarters in Rome, loves working there and has this advice for those interested in a WFP food science job:

- Consider a career at WFP. It is different from typical jobs in the private sector and is an exciting journey that directly supports the fight against hunger.
- Be open-minded and willing to learn.
- Positions are posted on WFP's website (https://www.wfp.org/careers) and often on LinkedIn.

Food and Agriculture Organization (FAO)

FAO's mission is to eliminate global hunger and ensure that everyone on the planet has access to adequate healthy, safe food. The organization is involved in all facets of agriculture, livestock, and fishing and seeks to achieve sustainable global food systems.

Their programs and career possibilities are diverse, ranging from nutrition to food security to natural resource management to animal health. There are several avenues you can pursue if you would like to work for FAO. The first two are unpaid but may help get you in the door:

1. Internships (see http://www.fao.org/employment/collaborate-with-us/internship-programme/en/ for information on qualifications)

2. Volunteer Program (http://www.fao.org/employment/collaborate-with-us/volunteer-programme/en/)
3. Fellows Program (for PhDs, researchers, and professors with advanced technical knowledge in specific areas: http://www.fao.org/employment/collaborate-with-us/fellows-programme/en/)
4. Junior Professional Program (JPP) (junior professional officers (JPOs) work in programs funded by FAO members: http://www.fao.org/employment/become-fao-staff/junior-professional-programme/en/)
5. Jobs (http://www.fao.org/employment/home/en/)

Applications are made through the FAO's website portal. In some cases, you may be placed on a roster for future consideration.

Ndaindila Haindongo is a young Namibian food safety specialist and bioeconomy consultant at FAO Headquarters, Rome. She got her dream job at FAO with persistence and repeated applications for a variety of positions. Eventually she landed an internship that later became a full-time consultancy. She offers these guidelines:

- Familiarize yourself with FAO's work.
- Analyze your skill set and be very clear on where you might fit in the organization.
- Networking is important; make sure you are on LinkedIn and market yourself.

Governmental Donor Agencies

US Agency for International Development (USAID)

Many developed countries have foreign aid agencies, but few have food technologists on staff. Food scientists are mostly external field consultants hired on a project basis through an implementing organization, and these positions are usually reserved for mid-to-senior levels of experience (see section "Implementing Organizations").

The international development community has traditionally focused on agriculture and nutrition to alleviate hunger and food insecurity but has come to understand the role that food science can play. Integration of food science principles into projects is promising but complicated and still evolving.

The United States is by far the largest government aid donor in the world, yet as of this writing employs few food technologists. Kelsey Ryan was one

of them and provides her perspective, which is not necessarily that of the US government.

Kelsey has worked in USAID's Bureau for Humanitarian Assistance, responding to humanitarian emergencies. She was part of the nutrition team responsible for technical and program quality. Her job is to ensure the safety and nutrition of food assistance commodities that the US government donates for both short-term and protracted emergencies.

The food technologists work with procurement teams to manage specifications, review the latest nutrition data, and make necessary modifications. They also serve as advisors for local procurement or troubleshooting and work with related bureaus such as the Bureau for Resilience and Food Security.

While opportunities for food scientists at USAID are currently limited, students can research donor organizations in other countries for food security projects. For USAID, Kelsey has these suggestions:

- A background in food production facilities and supplier management is more valuable than lab bench experience.
- Knowledge of nutrition and humanitarian food assistance products is helpful.
- An advanced degree is an asset, but experience may be more important.
- A second language is beneficial.
- Peace Corps experience or a study abroad program in a developing country is a good way to accumulate subject knowledge.
- Be sure to make your career direction known to your professors, and get to know the international development community.
- Knowledge of, and preferably experience with, public policy.

Philanthropy

Similar to the multilateral and governmental aid agencies, there are foundations, charities, non-governmental organizations (NGOs), and other private entities that fund and carry out food-related projects, such as the Rockefeller Foundation. There are few (if any) jobs for food technologists at these organizations. However, there are opportunities at their implementing organizations, discussed below.

Implementing Organizations

There is an entire industry of consulting organizations and nonprofits that bid on and execute government and private-funded contracts in food-related areas. The work has traditionally focused on agriculture and nutrition but is beginning to integrate food science in order to increase food security, add value, improve food safety, and decrease postharvest loss and waste.

Depending on the nature of the project, food scientists may be hired as consultants or as full-time staff, with more opportunities for consultants. Consulting positions can run anywhere from a few weeks to a few years, with most requiring at least 5–10 years of industry experience. Relatively few of the many implementers engage in food science and processing projects, but two examples are provided here.

TechnoServe

TechnoServe (https://www.technoserve.org/) takes a business approach to address poverty. It is involved in various areas, and many of its projects involve food processing for value addition. They have a nonpaying Fellows Program, but it is generally for business graduates. However, they do employ food technologists locally in countries where they work.

Simon Hailu was a food processing specialist with the Alliance for Inclusive and Nutritious Food Processing working for TechnoServe in Addis Ababa, Ethiopia. As a student, he was assigned to chemical engineering with a focus on food engineering and came to appreciate the many opportunities for him in this field. After starting as a consultant with TechnoServe, he worked with them full-time to support small food processors.

Ethiopia's economy depends on agriculture, and donor support has been available for that. Simon cites opportunity areas for entrepreneurs in dairy, cereal processing, poultry, eggs, fortification, technology innovations, cold chain, and small-scale processing.

If you are originally from a developing country and wish to return to support programs like this, you might have an advantage, as implementing organizations try to prioritize local talent before hiring internationally. Otherwise, entrepreneurship is another option that will be discussed below.

Land O'Lakes Venture37

This is the nonprofit arm of Land O' Lakes, a member-owned cooperative with operations that span the spectrum from agricultural production to consumer foods. Named for the 37% of earth's land that is farmed for food, Land O' Lakes has been doing international development since 1981. With its roots in agriculture, Venture37 works in dairy, livestock, and crops as well as food processing.

Venture37 seeks to strengthen economies by improving local agriculture, helping agribusinesses create jobs, linking farmers to markets, and delivering integrated solutions that help build and improve food and agriculture systems. Their solutions produce more competitive markets, resilient systems, nutrition-secure communities, and inclusive societies.

Evie Severyn is Senior Quality Manager at Land O'Lakes Global Markets Development, splitting her time equally between Land O'Lakes corporate and Venture37. Her work focuses on food safety, which reflects Venture37's broader efforts to improve food handling and traceability systems in countries around the globe.

Evie says she always had a passion for making a difference, applying her food science education and experience in various international volunteer roles. She did not intend to go into international development work when she joined Land O'Lakes, but serendipity brought her to Venture37, where she began with HACCP training.

Venture37 works closely with volunteers and outside experts in labeling, shelf life, packaging, lab standardization, product development, and process engineering. (See section below on "Volunteering".) Evie also underscores the value of the scientific process, critical thinking, curiosity, creativity, open-mindedness, and being "comfortable with discomfort."

There are limited full-time opportunities in international development for food scientists, but, like TechnoServe, Venture37 hires a few food scientists in their project countries.

Evie has these tips for food scientists wanting to enter the field:

- Try different things to get new perspectives and experiences.
- Be a curious learner.
- Be humble.
- Be receptive to new ideas.
- Get cross-functional training, especially manufacturing experience; "take the scenic route."

If you do get a field assignment:

- Go with the flow; adapt to the situation.
- Check out the local grocery stores.
- Expect the unexpected; be flexible and ready to change as needed.
- Adapt and enjoy the adventure.

Academia

Academics and research may offer the best chance of employment for food scientists seeking work in international development. Positions can involve research, teaching, or both.

Dr. Juan Andrade is an associate professor of global nutrition in the Food Science and Human Nutrition Department at the University of Florida. He leads the human nutrition team at USAID's Soybean Innovation Lab, and through that program, he gained invaluable experience in solutions to food insecurity.

He recommends that students seek out universities that are part of the US government's Feed the Future (FtF) program. These universities are designated as Innovation Labs in specific areas such as food safety or nutrition. They seek novel approaches to tackle global hunger, poverty, and undernutrition.

There are currently 21 labs focusing on various aspects of global food security, so you can check which labs reflect your area of interest. See https://www.feedthefuture.gov/feed-the-future-innovation-labs/ for the full list of Innovation Labs and collaborators.

The Innovation Labs include collaborating institutions, and the network stretches across the country and the world. Private sector companies, NGOs, and farmers also participate in the program.

Be aware of timing, as Innovation Lab contracts run 5 years and lead/collaborator institutions may change. The consortiums allow both undergraduate and graduate students a way to network into international development by providing practical experience and exposure to the international development industry.

Juan strongly feels that students wishing to pursue this career path should be cross-trained in both nutrition and food science. As professors, they can conduct research and/or implement field programs in their area of interest.

Juan offers this guidance:

- Make sure you have a passion for the work.
- If possible, learn another language and travel internationally.

- Do your homework on the subject; read, attend seminars, and talk to faculty and experts in the field.
- Market yourself; find a way to get noticed and stand out.
- Connect with your office of international studies or study abroad programs.
- Look into universities with international nutrition programs such as UC-Davis, Emory, Tufts, Tulane, Harvard, Johns Hopkins, or Cornell to get started in the field or for summer opportunities.
- Apply to universities hosting or collaborating with Innovation Labs.
- Improve your knowledge of international development by taking free courses from the FAO elearning Academy (https://elearning.fao.org/).
- Check out the Global Health and Nutrition Resources from the Centers for Disease Control and Prevention (https://www.cdc.gov/nutrition/micronutrient-malnutrition/resources/index.html).
- Subscribe to newsletters (such as USAID Agrilinks) for job notifications, and check the Institute of Food Technologists and other organizations for jobs and volunteering.

Beyond Innovation Lab programs, some universities offer experiential training in interesting specialty areas. For example, Dr. Wan-Yan Kuo at Montana State involves her students in Indigenous food sovereignty, and Dr. William Kisaalita at the University of Georgia runs programs abroad in the relatively new field of development engineering.

Research Institutes

Research institutes offer another career track. Positions usually require significant experience in specialized areas and are most suitable for mid-to-senior-level experts, but some entry-level jobs may be available:

- The Barilla Center for Food & Nutrition (BCFN) is a think tank that employs a limited number of researchers in various areas of food security, climate change, and food systems.
- RTI International has a practice area in global food security, agriculture, and nutrition.
- CGIAR is a global network of 15 research centers and 3000+ partners in 108 countries engaged in research around food security and food systems. They list vacancies on their website: https://www.cgiar.org/.
- If you are interested in food policy, you might want to check out International Food Policy Research Institute (IFPRI): https://www.ifpri.org/.

Private Companies

There are a few companies that produce specialized foods for humanitarian purposes and malnourished populations. Therapeutic milk powders, rehydration drinks, fortified peanut butters, and cereal blends have been used by the World Food Program, UNICEF, Save the Children, USAID, and other relief organizations for years. See https://documents.wfp.org/stellent/groups/public/documents/communications/wfp255508.pdf for supplementary foods used by WFP.

Companies such as nutrient supplier DSM are also very involved in global nutrition. Edesia Nutrition is a relative newcomer to the humanitarian foods market. It was started by a stay-at-home mother with four children who was moved by a television story about a therapeutic food that was saving children's lives. She knew nothing of malnutrition, and now her company is supplying that food around the globe.

Edesia Nutrition

Edesia Nutrition (https://www.edesianutrition.org/) is a nonprofit social enterprise in North Kingston, Rhode Island. The company manufactures shelf-stable, ready-to-use, fortified peanut butter packets in 57 countries under license from the French company Nutriset (https://www.nutriset.fr/en/). The nutrient-dense products need no refrigeration or water, making them easy to transport and safely consume. Customers include USAID, NGOs, and UN agencies.

Edesia is small but fast growing, employing food scientists in research and development (R & D) and quality management and food process engineers. The company also hires interns each summer.

Zenia Adiwijaya was a food scientist in research and development at Edesia for 3 years, driven by the fact that 30% of children in her native home, Indonesia, are stunted. Her role was in R & D, working under the director of innovation (who has a background in nutrition).

Working for a small company allowed her to interface with other departments and develop broad experience, and the employees share a passion for humanitarian work. Through this job, she learned that food science can be used to create a "purposeful product," which she was not taught in school.

Edesia provides on-the-job training for young food scientists, and all aspects of a food science education are utilized. Zenia has these employment recommendations:

- Knowledge of nutrition and/or processing systems is helpful.
- Familiarize yourself with ready-to-use therapeutic food (RUTF) and other shelf-stable foods.
- Desired skills and character traits for R & D include critical thinking, willingness to learn, teamwork, and proactivity.

Entrepreneurship

Since there are few food companies that specifically focus on products benefiting developing countries, you can start your own. That is how Edesia, The Jackfruit Company, and countless global small food enterprises came to be. Your organization can be for-profit or nonprofit.

This option is extremely demanding, but also very rewarding. If you go this route, be sure to assemble an outstanding team with complementary expertise, such as finance, marketing, business development, human resources, fundraising, etc.

There are several entrepreneurial options that can support food security. From the least to the most challenging:

1. Set up a social enterprise that benefits a specific region or group of people. This can take many forms such as donating a portion of profits, providing in-kind items, or mentoring. In this model, your company need not even be a food company; it just needs to support food security in some way.
2. Start a food company that utilizes raw materials from smallholder farmers and pay them a fair price. There are many to choose from, such as coffee, shea butter, cocoa, moringa, baobab, etc. Focusing on women is a good idea, and your marketing should communicate your model. You will need to develop close relationships with your suppliers and involve yourself in their businesses.
3. Establish a food company in a developing country. This is not for the faint-hearted, but you can provide a much-needed safe food, knowledge transfer, and jobs. Be sure you or someone on your team is very knowledgeable about the country, its regulations, markets, and business practices. And be sure you utilize local materials as much as possible.

Volunteering

A great way to learn about food issues in international development and get a foot in the door is through volunteering. You can assemble valuable experience that can be your ticket to a job in the field; that is how I transitioned from the corporate world.

Partners in Food Solutions

Many food companies have corporate social responsibility (CSR) programs that employees can participate in. Few, however, involve food science expertise. One unique program that does is Partners in Food Solutions (PFS): https://www.partnersinfoodsolutions.com/.

PFS is a consortium of companies that provides remote technical and business assistance to food companies in Africa. As of this writing, the PFS member companies are:

- General Mills
- Cargill
- Hershey
- DSM
- Buhler
- Ardent Mills
- J.M. Smucker

Employees submit an online application to be included in the program. Volunteers are then placed in a database. They can browse available openings or be matched by PFS staff with assignments that require their expertise. The time commitment is about an hour a week, and assignments run about 6–9 months. Cross-functional teams are assembled from the member companies. There is also program management staff in the field (some with food science backgrounds) to help facilitate knowledge transfer.

PFS offers other support programs as well. The Ask an Expert Program is an on-demand service for specific questions and problems. The Mentor Program features one-on-one relationships between PFS and clients and runs a minimum of 1 year. In the Apprenticeship Program, new food science graduates in Africa are paired with PFS client companies. They are paid a salary and obtain real-world experience at the company, supporting on-the-ground implementation of recommendations from remote PFS volunteers. Many are hired full-time by the client companies.

PFS provides volunteers with invaluable international experience in project management, creative problem solving, communication, and more that can lead to meaningful career development. You must work for one of the partner companies to participate.

Amanda Traaseth, PFS's director of operations, offers some tips for those who would like to get involved:

- There is a demand for people in quality management, but there are roles in a wide variety of functions, such as project management and marketing.

- If you interview at any of the partner companies, be sure to mention your interest in PFS and highlight any relevant experience.
- PFS works with universities in Africa to recruit top graduates for the apprenticeship program. If you are in or from Africa, seek out PFS client companies and make inquiries.

Farmer-to-Farmer Program

Another way to volunteer and gain valuable international development experience is through USAID's Farmer-to-Farmer (F2F) Program, officially called the John Ogonowski and Doug Bereuter Farmer-to-Farmer Program.

This program is only open to US citizens and permanent residents. While most of the assignments have traditionally centered around agriculture, there are now many projects involving food processing and other specialties such as marketing, business development, and communications. Most also require at least a few years of experience in specific areas.

Assignments are usually 2–3 weeks, and all travel costs are covered by the program. The list of implementing organizations changes as contracts are won or lost, but a current list of contractors can be found at the Farmer-to-Farmer website, https://farmer-to-farmer.org/about/about-us. There are links to each organization's website, where you can search for opportunities that fit your background. Land O'Lakes Venture37, discussed above, is one. The Institute of Food Technologists also lists F2F assignments from several implementers on its career page under the IFT Foundation's Volunteer Globally program.

Other Volunteering

There are many opportunities to volunteer if you have a general interest in food security or international development. The Peace Corps is where many aid workers get their start.

From global organizations like Action Against Hunger, Nutrition International, The Hunger Project, and Freedom from Hunger to local food banks, there are many nonprofits that can use your support. Food deserts, food loss and waste, climate change, and obesity are just as problematic as malnutrition. There are countless ways you can make a difference to distribute food and positively affect the global or local food system. Do some research, find your interest, and do your part.

The Future of FSRD

Food Science for Relief and Development is an emerging field that can help address the urgent and completely avoidable problem of global food insecurity. Despite the scope of the problem, the options for food scientists to contribute are still limited, as the international development community has been slow to recognize and implement the potential contributions of FST. The FSRD program aims to change that.

As the aid industry incorporates food science disciplines such as food processing, food safety, food engineering, packaging, compliance, product development, and food research into their programs, the demand for food scientists will grow, creating more jobs in humanitarian and international development work. Specialized expertise will be needed. Academic institutions can prepare students for such careers with curricula and experiential courses covering the unique challenges of implementing food science in developing countries with constrained resources.

In my experience, many young people are enthusiastic about FSRD and would welcome the chance to work in FSRD. This is a field in its infancy that I hope will grow to eradicate all hunger and malnutrition.

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Chapter 23
Careers That Combine Culinary and Food Science

Cian Leahy

It was August 2019 when Popeye's launched their fried chicken sandwich with little fanfare or media attention. That was, until rival Chick-fil-A took to Twitter to tout its sandwich as the original. Popeyes retaliated with a gentle tweet dripping with Southern charm, a social media frenzy ensued, and this is where the "Chicken Wars" began (Cobe, 2021). Over 2 years later, the war over chicken sandwiches continues with countless other restaurants joining in. But have you ever thought who is behind new product launches or creates a restaurant's menu? These trends and products all come to be through the intersection of culinary and food science, supported by consumer insights. Let us focus on the culinary portion of this to better understand how and why chefs have become such an integral part of what food gets launched in retail and chain restaurants? I am specifically talking about research chefs, culinary scientists, and corporate chefs.

When Did Food Science and Culinary Science Meet?

They have always been together! Traces of ash found in the Wonderwerk Cave in South Africa suggest that hominins were controlling fire at least one million years ago, the time of our direct ancestor *Homo erectus*. Burnt bone fragments also found at this site suggest that *Homo erectus* was cooking meat, arguably making them the first chefs and food scientists (Lawton, 2020).

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Fast forward to today, and we know that when a chef is searing a steak in a hot pan or on a grill, he or she is creating Maillard browning, the process of applying heat to food that results in the food's sugars reacting with the protein (Johnson & Wales University, 2015). Maillard browning along with seasoning creates the delicious flavor we have come to expect from a properly cooked steak. Food scientists can take this "culinary gold standard" and turn it into a myriad of products: flavors, seasonings, etc. for the home cook or a restaurant to enhance or deliver more flavor to their own steak. It is through this unique combination of culinary skills converted into to food science principles that the essence of the flame, smoke, char, and ash can be turned into a flavor that can be utilized in everything from smoky seasoning to a marinade for a chain restaurants' grilled chicken to a smoky whipped cream on a dessert.

We also have and continue to see the reverse from chefs where scientific principles are transformed into culinary masterpieces, especially in fine dining. For example, Ferran Adria of the famed three Michelin star El Bulli Restaurant near Roses, Catalonia, Spain, was introduced to "reverse spherification" at the Griffith labs in 2003 (Adrià et al., 2014). Spherification (or reverse spherification) is the process of adding calcium carbonate to a liquid or sauce and piping it into a solution of sodium alginate (or the reverse); the invention of spherification is attributed to English food scientist William J. S. Peschardt, who patented the technique in the 1940s. Peschardt proposed the technique for making "edible imitation cherries and other soft fruits and foodstuffs" (Halford, 2014). Chef Ferran went on to utilize many aspects of food science in his cuisine.

What Is a Research Chef and Culinary Scientist?

The term research chef was coined in the late 1990s by the Research Chefs Association (RCA) and the criteria needed to become a Certified Research Chef® (CRC®). The CRC® designation is available to any qualified culinary professional, including members and non-members of RCA. CRC®s are recognized and acknowledged as being among the most knowledgeable in their field. They are leaders in the food industry and have proven competence in both culinary arts and food product research and development. The criteria needed to receive this certification is a minimum of an Associate Degree in Culinary, 1 year of food service experience, and 3 years of research and development experience (RCA).

The term culinary scientist was coined in 2002 by the RCA. Certified Culinary Scientist® (CCS®) certification confers a new status on experienced food scientists and technologists who have augmented their training by learning about the culinary arts and who use this knowledge in the development of superior food products (RCA, n.d.).

Education and Certifications

There are many institutions that offer Culinary Arts (AS, BS [for those who have some college credits and wish to obtain a BS with an emphasis in culinary or baking and pastry art]), Applied Food Science (BS), Hospitality (for those who wish to pursue a career in restaurant or hotel management), Baking and Pastry Arts (AS, BS), Beverage, and hybrid degrees: Sustainable Food Systems (BS), Culinary Nutrition (BS [for those who wish to pursue a career in culinary with an emphasis on nutrition]), Culinary Science & Product Development (BS [for those who wish to go into food manufacturing research and development]), and Culinary Arts and Food & Beverage Industry Management (BS) at Johnson & Wales University and the Culinary Institute of America (CIA) (Explore JWU Programs | Johnson & Wales University, n.d.). The CIA also offers ProChef Level I, II, and III certification. This certification is designed as a career development path for food service professionals and can be a prerequisite for some food industry culinary programs (Culinary Institute of America, n.d.). Finally, there is the American Culinary Federation (ACF) that offers certification in Culinary/Savory (CFC, CC, CSC, CCC, CEC, and CMC), similarly for Pastry, and for Education and Administration (CCE, CCA) (American Culinary Federation, n.d.).

Culinology Degree

In 2002, the RCA introduced a novel concept to the food product development community: a unified academic experience combining both culinary arts and food science training. Students now have the opportunity to learn both disciplines and combine their knowledge and skill set to practice Culinology®—the blending of these two fields. Through RCA-approved undergraduate degree programs in the United States and Malaysia, students learn how closely the two components interconnect. These programs offer a well-rounded, interdisciplinary curriculum that focuses on culinary arts and

food science but also incorporates other elements of food product development, such as business management, nutrition, processing technology, and government regulations to name a few.

These 16 RCA-approved Culinology® undergraduate degree programs each offer unique features and advantages for prospective students. Some programs are offered at a single university, while others are offered through a partnership by two neighboring schools. These partnering models allow students to transfer their culinary coursework to a nearby institution where they can continue their studies in Culinology® and earn their undergraduate degree in the field (RCA, n.d.).

Jeff Cousminer, a chef and founding member of the RCA, maintains that the food industry continuously sees the benefit of having research chefs and culinary scientists as part of the research and development team. Their culinary background brings not only innovation but drives efficiency, shortens development times, and adds a better understanding of back of house (BOH) operations, all of which leads to a better tasting and more on trend products for both retail and food service channels (Cousminer, 2017).

RCA

Founded in 1996 by a group of research chefs dedicated to overcoming challenges facing the food product development professional, the Research Chefs Association (RCA) has grown to more than 2000 members. Even though it is called the Research Chefs Association, it attracted many food scientists from very early on as they were working side by side with chefs (Cousminer, 2017). Today, RCA is the premier source of global and inclusive culinary and technical information for the food industry, with a professionally diverse membership including chefs, food scientists, and other industry professionals who are shaping the future of food research and development.

Chef Jeff Cousminer is one of the founding members of the RCA and cowrote the charter in 1995. At this time, there were chefs working in research and development, but the American Culinary Federation (ACF) would not certify chefs that were not working in restaurant/hotel kitchens (Cousminer, 2017).

RCA is a forward-thinking, vibrant, energized organization whose members benefit by being part of a dynamic community of equitable food professionals who work toward a common goal: the blending of culinary arts and food science. Their mission is to cultivate collaborations between the chefs and food science professionals who develop food to increase innovation, quality, and speed to market (RCA, n.d.).

Innovation Process

The innovation process is integral to food manufactures', CPGs', and food service chains' growth because the outcome of a well-executed innovation process will generate the best and appropriate concept (menu item, ingredient, retail product, flavor, etc.) that is grounded in consumer insights and focus group data and vetted through manufacturing, supply chain, and/or back of house operations. The typical innovation process begins with the consumer as they are the ones who will ultimately pay money for what is created. Marketing will generate an innovation brief that is grounded in the customer-specific consumer insights and the customer-specific operations (back of house or manufacturing). There will be a focus, either on specific trends or new menu categories. From there, supplier Chefs and Research Chefs will generate concepts, and these will be voted on through internal voting or focus groups. Next, the suppliers will create proto-cepts, a prototype of the concept. These proto-cepts will then be voted upon either internally or via a focus group. The proto-cepts voted the highest will be vetted from an operational standpoint and then will move into development and commercialization. If we look at a fried chicken sandwich, for instance, this could involve anything from a new sauce on an existing sandwich to an entirely new menu item: marinated and coated chicken filet, bun, pickles, sauce, etc.

Success here does not come from being a creative chef or food scientist; success comes from the blending of the two. Innovation isn't just a creative idea, it's a creative idea that actually sells (J.Miller, personal communication, January 11, 2015). Successful concepts are innovative and have been created through an understanding of consumer insights, culinary instinct (taste and recipe development and back of house operations), and a commercialization mindset (foresight for taking the concept from kitchen to lab, scale-up in manufacturing, and supply chain). This is how successful research chefs and culinary scientists innovate.

My Journey to Becoming a Research Chef

I was at the University of Wisconsin–Madison doing a Bachelor of Science in Food Science and was getting into the practical or lab aspect of the program. I remember finding it fascinating applying the curriculum to actual food. I had also begun to cook a lot more and experiment with new recipes and combinations for my friends and worked for a local burger bar as a

prep-cook. At this same time, I was simultaneously introduced to the RCA and given a copy of *What Einstein Told His Cook: Kitchen Science Explained* by Robert L. Wolke and Marlene Parrish. I had found my calling; I wanted to be a research chef. From there, I joined the organization and started putting the plan in place.

My plan was to go to culinary school (Johnson & Wales), but before diving in, I thought I had better work in a restaurant full-time to better understand the challenge ahead of me and understand if I have a passion for culinary. The answer was a resounding yes!! I had spend my time between classes and restaurant shifts cold-calling research chefs through the RCA's membership directory, www.culinology.org. Through this networking, I gained a lot of insight on their journey, what it takes to be considered for a role as a research chef, as well as the day-to-day life of a research chef.

After graduation, I worked for another few years in restaurants before I applied for an entry-level food technologist role at Leprino Foods. I got the job, and it was my culinary background that made me stand out. About 6 months later, I became their first chef/research chef and built out a team from there. I had also successfully applied for my CCS and CRC certification. In 1999, I took a role (in the evenings) as an adjunct professor at Johnson & Wales University in Denver to teach a Product Development course.

The most important lesson I learned during my early years as a research chef is the importance of understanding the customer and the consumer and ensuring that all products can be commercialized and re-created on a massive scale. Being a creative chef is only one piece of innovation. As I mentioned above, innovation is creativity that works and sells.

For the past 9 years, I have been at Kerry and serve as the director of Culinary. I am very active in the RCA and being on the RCA's Board. I also continue to learn whether it be trends, insights, flavors, culinary techniques, new manufacturing operations, and business strategy.

Industry Interviews and Commentary

I connected with Cara Dennis, CCS, senior food scientist at Ken's Foods, who has a BS in Forensic Science and Chemistry and an MS in Food Science. I asked her thoughts on if having a CCS/CRC/culinary training/background has a positive effect in new product development (NPD)? Why?

> Having the CCS and culinary background has an infinite effect in NPD. It allows me to ask better technical questions up front for product stability (i.e., holding conditions, reheating practices). I also have a better understanding when a chef describes making a BOH recipe with a roux, rather than cornstarch or fire-roasted

> over stewed tomatoes. I find myself to be more creative and interested in new trends and flavors, which comes through in ideations or brainstorms with customers. (Leahy 7/27/2021a)

One key point here is the understanding of BOH operations. By obtaining culinary training and restaurant experience, whether it is fine dining or working as a short-order cook, you gain a great understanding of and the importance of BOH operations. When a culinary team or a product development team receives a customer innovation brief from a chain/restaurant, many times BOH operations will be listed, and having experience or an understanding of BOH operations and flow really shortens development time. This is even more imperative today as restaurants are trying to survive in a COVID/post-COVID reality; with labor shortages and inconsistent sales, developing concepts/ingredients that simplify BOH operations is paramount.

Another major component of a customer innovation brief is working on emerging flavor trends. The ability to understand new trends and consumer insights, to create the culinary gold standard, and to translate it into a product or ingredient that can be both commercialized and function in specific customers' BOH operations is key to executing an innovation brief properly. I push for every concept that my team and I create to be grounded in consumer insights and culinary instinct.

I also connected with Chris Stein, CCS corporate innovation chef at Brakebush Brother's, Inc. Chris has a BA in Biology. I asked him the same questions: Do you think having a CCS/CRC/culinary training/background has a positive effect in new product development? Why?

> Without question. The impact that Culinology has had on the food industry in the last 25 years is unmistakable. The Culinary piece inherently improves the quality of products being developed as those products are now pushed to meet certain criteria from an organoleptic perspective that may otherwise be missed when things are approached purely scientifically. Chefs help create authentic flavor experiences by ensuring products are utilizing appropriate ingredients and mimicking traditional cooking methods & processes. Conversely, a Chef may be able to prepare an amazing dish, but if that dish cannot be reproduced to scale and maintain quality and integrity, then it won't be successful. That's where Food Science comes in, helping to safely and appropriately bring those Chef-inspired products to life for millions of consumers. Culinology is the bridge between those two worlds and gives you all the tools needed to develop and commercialize exceptional products. (Leahy 8/2/2021b)

Finally, I spoke to Flannery Lucas, CCS, RD & A senior scientist at Kerry. Flannery has a BS in Culinary Science from Iowa State University. My first question for Flannery was, "How has obtaining your CCS helped you in your product development career?"

> My CCS certification has helped me greatly in my career as a product developer. When our culinary team engages our customers on new culinary trends, I can be part of that gold standard development to help translate that on the industrial side.

I followed that up with, "Do you think having a CCS/CRC/culinary training/background has a positive effect in new product development? Why?"

> Yes, as a food scientist in product development I truly believe that the CCS certification and training has a positive influence. Not only does it provide a network and supportive community to engage with but allows me to bridge the world of culinary arts to the science side. It has allowed me to work with marketing, chefs, baristas, and mixologists to show the customer the world of trends and exciting innovation and then translate that for their consumer through application work. Working in the kitchen and the laboratory is seamless and the knowledge of both science and art is imperative to developing a great tasting and functional product. (Leahy 8/12/2021c)

The Future

As mentioned above, restaurants from all levels of dining are trying to survive in a pandemic/post-pandemic reality with labor shortages and inconsistent supply chains. They need to ensure that their menu is streamlined from an executional and financial perspective while also providing the tastiest experience for their consumer. The ability to tap into culinary experience for a product development or culinary team will prove to your customers that your product development team understands trends, consumer insights, back of house operations, and taste development.

Summary

The food industry knows what Culinology is, and many job postings ask for or say it is desirable to have a Culinology degree (Cousminer, 2017). There is no doubt that being at the intersection of these two disciplines will open more doors in your career. The industry sees how efficiency and economy gained from those who are at the intersection of these two disciplines: from creation to commercialization to manufacturing, the development time is significantly less and there is a broader understanding of taste (Cousminer, 2017). As I hire for my team, as well as our broader research and development team, I absolutely agree.

If you are interested in becoming a research chef, I highly recommend joining the RCA at www.culinology.org to understand more and broaden your career in the food business. At a minimum, you can take advantage of the connections gained from the RCA's membership directory and network. As with any discipline, real-world, hands-on experience is key for pursuing a culinary degree as many of the skills, intuition, and instinct can only be gained from working in restaurant/kitchens. To that point, I offer up this quote from Michael Faraday, "It is not enough to know the principles, one needs to know how to *manipulate*" (This, 2012). From personal experience, there is such gratification when I see menu items advertised on media that I created and developed at some of the largest food chains both domestic and internationally!! My advice to you is to network, and if you have the passion, follow it!

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Chapter 24
Entrepreneurship and Consulting: Taking a Different Path

Derek Spors

A food science degree utilizes a wide range of technical disciplines, yet has a narrow application focus on food. The study of multiple disciplines appeals to those with varied interests. The specificity is highly valuable to employers in the food industry for a variety of roles, offering food scientists many career options. The traditional career path of direct employment as an internal resource of a company is followed by many food scientists. Some will follow a different path to their chosen career by being an external resource, often called a consultant, which is the focus of this chapter.

Whether internal or external, the primary function of the food scientist is the same. The way they accomplish this function can be very different and may significantly influence how rewarding and enjoyable their job is to them. To reveal these differences, we need to know why companies need external resources and what options exist to fulfil this need. To accomplish this, we will use the product development function as our example; however, similar options exist for nearly every career path made available with a degree in food science.

This discussion requires a lot of detail to illustrate the options and differences within a specific career path. This level of detail is not needed for everyone. Some readers want assurances that a food science degree offers some options and does not force a rigid career path. For those readers, I invite you to skip to the final section of this chapter, "An Unintended Path to Becoming an Entrepreneur," for a narrative example of a nontraditional career path of a food scientist.

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The Need for External Product Development Resources

Product development is a function of research and development, commonly called R & D. Traditionally, R & D is an internal function for a company. They would have an R & D department and directly hire food scientists for many of these roles. Some companies do not follow traditional models and do not have internal development resources available to them.

All companies need the product development function. Some companies will only use their internal resources, some rely on external resources exclusively, while many will rely on both internal and external resources for their product development needs.

Large, established companies often have their own internal development resources. Many still rely on external resources, often for temporary needs, such as:

- Bandwidth: The internal department may have extra temporary demands placed on them or may have open positions they are trying to fill.
- Lack of internal expertise: If a company wants to expand into a new category, their internal R & D may lack the expertise required to develop the product. For example, if a beverage company wants to launch a candy bar, their internal development group's expertise is likely in beverages and may not be able to develop the product efficiently.
- Speed: Established companies launch new products on a predictable schedule. They build a development cycle around this schedule that often has a process ingrained. These procedures are designed to work well with their standard development cycle. However, a company may need to launch a new product off-cycle to react to a change or opportunity in the market. Their development process may be too bureaucratic to develop the product quickly, forcing them to look externally to launch faster.
- Budgeting strategy: If a manager has excess budget money available to them, they may want to use it to avoid having their budget reduced next year. To use this money, they may hire an external development partner for a "pet project."
- Office politics: A brand manager working in marketing may ask their internal R & D group to explore a new product. If the gatekeeper of the R & D group dislikes the concept, or there are internal interpersonal conflicts present, a brand manager may seek an external resource to circumvent their internal development group.
- Outsider art: Over time, organizations can fall into patterns that make it difficult to innovate. Or a project may have been tried before and failed, creating resistance to trying it again. An external resource may be more willing or may have a new approach.

Startups and companies experiencing rapid growth also rely on development consultants. They need cash flow to operate, which they obtain from investors. In exchange for cash, the investor is given shares of the company, which gives them partial ownership. The cash is used very strategically to retain as much ownership of their company as possible. To be an attractive acquisition for larger companies, startups want unique products without unnecessary investments to get them. These factors require very different business strategies, creating unique reasons to use external development resources:

- Office space: A startup will need to be creative with their office space to minimize their overhead cost. They often want a work environment that is cool and unique to help attract and motivate employees. Commercial rents are based on a price per square foot, so startups will typically utilize shared spaces, a bullpen, and remote workers to allow for a desirable space while minimizing rent. Development work, however, requires significantly more space than other functions of a company, which may make the stunning office space impractical. A development lab usually requires a commercial space that is zoned as "flex space" or "industrial." This restricts options and may not be available in a desirable location.
- Overhead: In addition to the extra space requirements, development also requires equipment that must be purchased, stored, and maintained. Utility costs, such as water and electricity, can be significant.
- Expertise & connections: Startups can attract great employees, often diamonds in the rough or future industry leaders. But they are unlikely to afford the current best-in-class employees. They can essentially rent the expertise they need via consultants. While engaged with the consultant, the startup has access to the consultant's established connections and network. Some startups have an internal R & D job function to develop new products, attend production runs to ensure products are made to their intended design, or perform basic product maintenance. A consultant's role may be to mentor and support the internal R & D employee.
- Risk & unknowns: A good startup is reactionary and nimble. They do not always have the luxury of adhering to a known development cycle. Utilizing external development allows them to increase or decrease their development bandwidth as needed. If they see an opportunity to shift their focus to a new category, they do not need to buy new equipment and hire new employees; they simply engage in a new project with their consultant.
- Staffing: If a startup were to justify building an internal R & D, they would have to financially commit to the space and equipment. However, an inexperienced developer might choose the wrong equipment, imped-

ing the development process, and the cost would be sunk. Hiring the wrong employee is painful; not only do they have to terminate the employee, but they also have to spend time and money recruiting and hiring someone new. Ending a consultant relationship can be as easy as giving the contractual notice to discontinue and stop paying them!

- Acquisition: A purchasing company is unlikely to value the equipment in an R & D lab. The purchasing company typically has an internal development function with an existing functioning lab, likely with superior equipment. The acquiring company may find dealing with the financial bookkeeping of unneeded equipment to be an unwanted burden.

Types of External Development Options

Companies seeking external development resources have many options available to them. Each option has advantages and disadvantages. Choosing the right option depends on many factors. The consultant's ability to complete the project within the time frame needed is the first consideration. For most companies, big and small, cost is a key factor as well. If the consultant will be working closely with the company, the personality and fit with the organization should be considered. Some companies have strong values, and they may want their external resources to share those values. For some, location is important; they may want the consultant to be near them so that they can work together more easily, or they may want a consultant in an area of the country they like to visit so that they can travel to the consultant on the company's dollar.

For external product development, there are three primary options for companies. First, a company may be able to use a vendor's resources, such as ingredient supplier. Second, they may seek an independent consultant. Third, they may use a consulting firm, sometimes called a consultancy. Each of these three options offers advantages and disadvantages.

Technically, an independent consultant could be called a consultancy, and an independent consultant could work for a consultancy. For clarity, I am using the term independent consultant to refer to a single person offering consulting services and a consultancy to mean company with employees offering consulting services.

Two common vendor resource options are ingredient suppliers and contract manufacturers. Contract manufacturers, often called co-mans, are external manufacturing options. Much like consultants, co-mans will manufacture food for several different customers. Utilizing a vendor's

development service will likely require the least amount of up-front cash as the products can be developed with no direct cost to the client. This comes with trade-offs. It may not be the most cost-effective option in the long term. The cost of development is built into the prices the brands pay for the ingredients or manufacturing services. Ultimately, the brand pays for the service, but does so over time rather than up front. It can be difficult for the brand to launch a unique or innovative product because the developer's objective is to use the ingredients their company sells or that will run efficiently on their equipment. Often, they will limit the number of "rounds" of prototypes they will show a client to limit the cost of the service. A vendor service will likely only offer a client a limited number of options to choose from. For example, they may offer to develop a granola bar from a recipe they have already developed, but only let the client choose between a small set of nuts and fruits to combine. Most importantly, the vendor may stipulate that they own the formulation. This allows the vendor to offer the same or very similar formulas to other clients and ensures the client continues to purchase their ingredients or use their manufacturing facilities. If the brand is a startup, this can have a significant impact on the value of the company to investors and acquiring companies.

Another option for companies is independent consultants. Independent consultants may have a legal business entity they operate under, or they may just operate as a person. They are essentially self-employed hired guns. Independent consultants offer narrowly defined services based on their expertise. Typically, an independent consultant will charge lower fees than a consultancy firm, as they have lower overhead costs. There are generally two types of services a consultant will offer; they will help a client with the development process, or they will do the work of the development. A client hiring a consultant to help with the process is buying the consultant's knowledge and expertise. A client hiring someone to do the work of the development process needs someone to be hands-on, with the abilities and equipment to perform the physical work of the development process. Depending on the client's own internal resources, they may need one or both services. For example, if a company wants to develop a new beverage, they may hire a consultant to advise them on proper acidity levels of the beverage, make introductions to ingredient suppliers, and help them find a contract manufacturing option. The company may use a lower-level internal employee or hire a different consultant to do the actual development work.

Consultancy firms are another option for companies needing external development resources. Firms have multiple employees, ranging from a handful to dozens, and internal development labs equipped to create prototypes. This allows consultancies to offer a wide range of services and

product types. Many can be a one-stop shop for brands looking to completely outsource the development process. This can be very attractive to smaller brands with very little internal resources or large companies whose internal resources do not have the bandwidth to develop their desired product. Consultancies have far more overhead than independent consultants, resulting in higher fees, but this overhead allows them to potentially develop better products faster. While all types of consultants can engage in a short-term project with a client, some consultancies will engage in open-ended relationships with their clients, called retainer relationships. Rapidly growing companies might have the need for full-time development resources but do not want to incur the overhead and up-front costs to build their own R & D department. With a retainer relationship, a consulting group can function as the client's R & D department. The retainer allows both parties to develop a relationship over time, just as coworkers would. Retainers are time-based engagements, which allow for added flexibility. For example, growing companies are often planning more than one product launch at a time. If the needs of the company change, they can change the priorities as appropriate. In a project-based engagement, the scope of work is defined, and the consultant only performs tasks within that scope.

Role of the Food Scientist in External R & D

The main objective of a food scientist developing new products is the same regardless of whether they are internal or external; they create new products. There are some distinct differences in how they accomplish this task and different ways in which the work is judged by their employer. A food scientist interested in development should consider the differences between employment options to determine from which they would get the most satisfaction and have the most success, both in the short term and toward their desired career path.

The traditional, internal development role has features that many find favorable. Without them, some may be unhappy with their job. In an internal R & D role, the food scientist is only concerned with their company's needs. They will only develop products their company wants to launch, which is likely a narrow range. Over time, this allows them to gain a high level of expertise in these products, but only these products—they know a whole lot about very little. For some, this high level of knowledge can be very rewarding. In some ways, the job can be easier. Working with a known development process and products they have expertise in can allow a food scientist to develop products with less effort. They know the restrictions placed on

their development, and they know the likes and dislikes of the gatekeepers to the launch. Their company likely has established relationships with vendors and known manufacturing facilities for the developer to utilize. Their path to rewards and recognition is more clear; they need to contribute to the success of their company. After the development process is complete and the new product is launched, the internal developer is often the guardian of their product. This can foster a great sense of pride and emotional attachment to their creations.

For others, these same attributes are not satisfying. Working on the same products may not offer them challenges. The opportunity to work on different products may require them to change jobs. The consistencies of process may become mundane to them. And they may find working with the same vendors and manufacturing options to be restrictive, making it hard for them to be innovative. Being an external resource may bring them more satisfaction. However, being an external resource has unique requirements that should be considered.

External resources may need to manage a client's expectations and their interactions with other resources. Consultants have key relationships with vendors in the industry for things like ingredients, packaging, and manufacturing. While the consultant is representing their client's best interest, these relationships are essential to the consultant. The consultant needs to ensure their client is not being unreasonable with their vendors. External resources will most often have multiple clients at once, which creates unique challenges. An internal resource has priorities balanced based on the needs of their company; if there is a new urgency, something else is likely less urgent. Providing services to multiple companies means you have multiple priorities and urgencies that require triage. From the client's perspective, their project is the priority. Balancing the urgencies without making clients feel like they are a low priority can be difficult.

At any company, an employee's value to their employer is based on their quality of work and how much money they can help their company make. Most developers want to make the best possible product they can. Consultants generate more revenue by doing a project quickly so that they can onboard another project. When the requirements of the project have been met, and the client is happy, an external resource wants to end the project so they can use their time for another project. Internal resources can often continue to improve their products, but an external resource does not have this ability.

One challenge experienced by external developers may be accepting they are making a product for someone else. After working hard to develop a product for a client, many consultants have the same sense of pride and ownership over the product that an internal resource would have. However, it is

not their product; it is their client's product. Some developers are motivated by the accolades they receive from their product being successful in the marketplace. It can be difficult to be detached from this and even more difficult for them to know someone else is getting the credit for their work.

Exploring Entrepreneurialism as an Independent Consultant

Whether a food scientist is employed as an internal or external developer, employees of a company share some commonalities. They typically enjoy consistency of income, benefits such as health insurance, retirement plans, and paid time off. Their company is required to manage their tax withholdings and pay a portion of the employee's income tax. An employee is often given professional training and development that helps further their career. They are provided a space to do their work along with the required tools, such as computers and laboratory equipment.

While an employee is granted the comforts of stability, they also have little control over their work life. The hours they are expected to work are usually dictated by the company, as are the products on which they work. For some, this is a small price to pay. For others, this is a barrier to their professional happiness. Independent consulting may be a good option for them. But there are many considerations before taking that plunge.

Independent consulting is not a viable place to start a career; industry experience is needed. A food science degree provides the base knowledge need for a successful career, but there is much to learn after college by applying that knowledge. Clients want confidence in a consultant's abilities; and the consultant's experience is the proof. Independent consulting is almost always pursued after gaining industry experience as an employee.

Launching an independent consulting career usually means quitting a job, which is a big life change. People tend to resist change, needing a motivating factor. Generally, people are more likely to embrace change to avoid negatives than to seek out positives. Someone frustrated with their current job may daydream of the benefits of being their own boss as a consultant. Their motivating factor could be escaping their frustrations (avoiding a negative) rather than truly believing a career as an independent consultant is the right decision for them. It is important, however, to consider the trade-offs before making the decision to go out on one's own. Most know of the benefits of being their own boss: flexibility and control. They can choose the hours they work and their projects and clients and decide how their work

gets done. Most important for many, they have control over their income; the profits they generate are theirs! The potential for more income is real; however, so is the potential for less income.

Before entering the world of being an independent contractor, one needs to determine if it is financially sustainable. An independent consultant does not receive a regular paycheck. Their pay is the profits they generate, which is a factor of both their revenue and their costs to obtain that revenue. Careful considerations of both revenue potential and costs are very important. To determine if independent consulting is feasible, it may be useful to benchmark current compensation as the desired income and then determine the costs of operating as an independent consultant. Adding these numbers together provides the revenue target needed.

It can be difficult to capture one's total current compensation. Employers incur costs in order to give employees their compensation and benefits, typically an additional 25–35% of the salary offered. An independent consultant will either forgo some of these benefits or will incur the costs to keep them. Employers tend to offer paid vacation time, sick days, and retirement plans, pay a portion of federal income tax, and provide access to health insurance. And the company pays people to manage these benefits for you. Using health insurance as an example, employers often contribute some amount to employees' premiums, which is easy to account for. Less obvious is that health insurance premiums are based on a group rate of all employees in the plan, lowering the cost of the premiums for everyone in the group. The same coverage with an individual plan will certainly have higher premiums. Also overlooked is the time needed to find a health care plan. If someone is only using their salary as their benchmark, they will quickly find that matching their salary is in fact not equivalent compensation.

With a benchmark of the desired income (profit) set, the costs of doing business need to be estimated. A consultant will have both fixed and variable costs. Fixed costs remain the same regardless of how much (or how little) revenue is generated, while variable costs increase or decrease as revenue increases or decreases. Fixed costs are easier to estimate and more important when determining the financial feasibility of becoming an independent consultant. Variable costs become important when setting fee structure as some can be "passed on" to the client as a direct expense or simply built into the fee structure. Common direct costs incurred by food scientists working as independent consultants are computers, software, a website, office supplies, professional liability insurance, and professional memberships. If they intend to purchase equipment, they need to factor in the purchase price, maintenance, and any financing costs. If they plan on renting as needed, the cost of equipment would be variable. A consultant needs a place to do their

work. For some, they may have a space in their home that will suffice, and this cost would be negligible. Others will need an office or lab space, which can add significant costs in addition to rent, such as Internet access, utilities, and likely additional insurance policies. If all costs are not accounted for, the independent consultant's income will be unexpectedly reduced.

The final, and most significant, factor of financial sustainability is whether enough revenue (often called sales or top-line) can be generated to achieve the desired income. The consultant's ability to hit their top-line target is a factor of their fees/rate, the amount of time they are willing to work, and their ability to acquire clients. The revenue target is easily calculated at this stage by combining their desired income and their expected expenses. While this is impossible to accurately predict, this is what determines success or failure. I suggest working backwards to calculate a fee structure based on the time you can commit and your revenue target and then benchmarking it against other consultants offering similar services. Then, the potential consultant needs to determine if they can find enough clients to fill their available hours.

An hourly rate is best to use for this evaluation. While consultants bill in a variety of ways, hourly, project, retainer, etc., ultimately, there are only so many hours in a year someone can work. It is easy to determine how many hours one is willing to work, but only a portion of that time will be generating revenue. Time that generates revenue is commonly called billable hours. Time spent on tasks such as accounting, networking, building, or maintaining a website and courting potential clients is necessary but does not generate revenue. Another painful consideration is non-payment. Regardless of how carefully clients are vetted and how much money they have available, there will be some clients that either cannot or refuse to pay. With so many factors, predicting the actual percentage of billable hours that will be paid is very difficult. It can range from 30% to 90%. However, once it is determined, the consultants' hourly fee is simply their revenue target divided by the number of billable hours. This is the minimum rate needed to be financially sustainable.

Benchmarking the hourly rate against similar consultants' rates is a great reality check, but finding a direct comparison is often trickly. Clients will pay for the value of the work performed, not the time it takes the consultant to do the work. If one consultant charges $300/hour and can complete the task in 10 hours, they have more value than someone that bills $100/hour but takes 40 hours to complete it. The independent consultant needs to honestly determine if they feel their work is at least as valuable as their minimum threshold. If they believe their services will be valued at an even higher rate,

they can not only potentially reap the benefits of being their own boss, but they may make more money doing so.

Having the skills to do the work at a rate that offers clients value are not enough to be financially successful. Without paying clients, they have no revenue! They may be an exceptional food scientist, but they are now running a business, and that requires other skills. They can use their network to identify potential clients, but they also need to figure a way for potential clients from outside of their network to find them. If the consultant does not have the skills needed, they can outsource some but that increases costs and reduces income. Some commonly overlooked yet necessary skills are the following:

- Marketing: The product an independent consultant sells is themselves; they need to let people know what they offer and position themselves as the best option.
- Sales: Finding the right potential client is a good start, but they need to close the deal.
- IT: Some basic knowledge to create and publish a website and set up an email via their domain. They will need to be able to install and use software and maintain their computer equipment.
- Risk management: Consultants assume many risks, such as non-payment for their work, damage to a client's property, taking on overhead, etc. To avoid catastrophic events, they must be good at identifying and managing risk.
- Finance: They must have at least basic finance knowledge to track revenue and expenses, invoice clients, and collect payments.
- Legal: A lawyer is often a necessity, but being skilled at reading and understanding contracts and documents to highlight questions can significantly reduce legal costs.
- Design: To look professional, a consultant's website, presentations, promotional materials, and even business cards should be visually pleasing and cohesive.
- Patience: Gaining clients takes time, and there will be rejection along the way. Overly eager consultants may seem desperate or pushy to potential clients.
- Communication: Having knowledge is key, but if that knowledge cannot be effectively articulated, the client does not get value. This can be difficult for technical consultants such as food scientists, especially those focused on development. Often, the client contact works in marketing and does not have a technical background, so there may be a technical language barrier to overcome.

For many, the confidence in their income potential is enough for them to start a consulting career. Income is a big factor in people's happiness in their professional life, but it is rarely the only factor. The life of an independent consultant is very different than the life of an employee. Someone who is frustrated with their job and is confident they can make more money on their own may find life as a consultant to be miserable. Some unique factors that influence job satisfaction for an independent consultant include the following:

- Lack of job security can be motivating, but it can also be stressful.
- It takes time to develop the skills to find clients. When starting out, they may have to take on work they do not enjoy doing.
- The work can be isolating when you are accustomed to have coworkers. This not only has a social impact, but many will informally collaborate with coworkers.
- Not having a boss is a common reason to become a consultant. But with multiple clients, you have multiple people to please.
- Demand is rarely consistent; there will be periods with a heavy workload and periods without much work.
- Variable income is great when the income is higher, but be prepared to ride out periods of lower income.
- Consultants often do not get the satisfaction of seeing a project to completion.
- Regardless of how good a consultant is, they will not get hired for every job. They must be able to deal with rejection.
- Being their own boss means they get to work when they want, and the more they work, the more money they make. This can be a double-edged sword, as it can be difficult to find a work–life balance.
- True vacation time does not exist. An independent consultant can work as much or as little as they want, but no one pays them when they are not working. Even worse, it costs them money to take time off since they still have to pay their fixed expenses.
- The independent consultant is their business, and without them, the business has no value. Selling their business is very unlikely. And some clients feel there is too much risk with a one-person show and will not hire independent consultants.

Starting a career as an independent consultant can be difficult, but there are many success stories. Like many things, getting started is the most difficult part. Very few have the skills to be successful from the onset. Many mistakes will be made, giving the opportunity to learn more. Despite the best planning, most will find major flaws in their strategy—the wrong

pricing model, targeting the wrong client, poor estimations of costs, etc. Over time, the business becomes more predictable and easier to manage. Costs are no longer a guess; they are known. If they consistently have more work than they can handle, they can confidently raise their rates. Once they are established, clients will often find them, saving them the time and money of searching for clients.

Being able to ride out the initial phases of launching consulting career most often means being able to have less income during that period. Very few can simply do without income, requiring planning. Some common options are as follows:

- Drawing on savings or a retirement plan. A confident consultant would consider this as an investment in themselves.
- A working spouse can not only reduce the income dependance on the person launching their new career, but it can also be a source of health insurance, retirement plans, etc.
- Budgeting personal expenses.
- Lifestyle changes such as moving into a smaller living space or taking on roommates.
- Finding sources of other income, such as being an Uber driver.

Many find ways to get past the difficulties of getting started and consistently earn good income yet are not satisfied. The limitations of being a one-person show become frustrating, and they feel like they are treading water. The continued success of their business is entirely dependent on their work, not allowing them to slow down. If they suddenly are unable to work for even a short period of time, their business may fold. They have put in considerable time, effort, and money into building their business but know it is worthless without them. They have learned how to successfully run their business, but their income is capped by the number of hours they can work.

The issues that come from being a successful independent consultant can be relieved by hiring employees, becoming a consultancy. Nearly all of an employee's time are billable hours, allowing for a greater income. Hiring someone with different skills and experience than their own allows them to expand the services offered. With more clients, consistency in workload is easier, and there is less dependance on the revenue from any one client. A consultancy has legitimacy to clients that feel hiring an individual is too much risk. As a consultancy, they have more time to sell to clients. And the owner can take time off work while still generating revenue.

While the consulting firm model addresses many of the independent consultant's issues, it is not an easy decision. If the consultant wants to continue to own all of their business, their income is still the profits. Employees mean

significant increases in overhead. They must pay their employee's salary and a portion of their taxes, provide benefits such as paid time off and health insurance, provide a place for them to work, increase insurance premiums, and pay into their state's unemployment fund. They may need to learn even more new skills and take on more tasks that reduce the time they can bill to clients. The consultant now needs to learn how to recruit and hire the right employees, manage them, train them, process payroll, and be aware of state and federal employment laws. This is a big change to manage. In many ways, they have another startup hump to get over. If they can, the upside is tremendous. As previously mentioned, people are more likely to embrace change to eliminate something bad than they are to obtain something good. Even with the limitations of being an independent consultant, many do not want to risk what they have achieved and will remain an independent consultant.

Food Scientist Entrepreneur

Despite the risks, many independent consultants want to take the plunge and create a consultancy. Their independent consulting career may not even be thriving; but they are confident they could be successful with a different model. An independent consultant has entrepreneurial skills and traits. They are resourceful, accept risks, and figure out how to be successful. Someone that is willing to attempt something like building a consultancy oftentimes embraces entrepreneurialism so completely that it becomes part of their personality. They are not just entrepreneurial; they are an entrepreneur. The difference is subtle and may be semantics. Perhaps, the only difference is finding the idea that excites them enough to fully embrace their calling as an entrepreneur.

Successful entrepreneurs often possess common traits that allow them to achieve great things. They are innovators that create new ways of doing things and are willing to take on the impossible. They choose endeavors they are passionate about and engage in them with great enthusiasm. They have the confidence to undertake daunting tasks, feeling they can succeed where others have failed. Their highly competitive nature drives them to put in heroic efforts to win. Stubbornness, while often considered a negative trait, can motivate the entrepreneur to do things that others say cannot be done. Entrepreneurs do not fear risk, but classifying them as risk takers is erroneous. Their confidence and drive may give them a higher risk tolerance, but successful entrepreneurs are risk managers—they take calculated risks.

Without risk management, an entrepreneur's confidence becomes arrogance; they take foolish risks. As Vince Lombardi once said, "we would accomplish many more things if we did not think of them as impossible."

This combination of characteristics can also lead to failure. Competitive people do not want to fail, but entrepreneurs accept failure as a realistic outcome of trying to do the improbable. If they could not tolerate failure, they would not be willing take on challenges. When failure is inevitable, successful entrepreneurs manage the risk to fail quickly and cheaply. This can be a humbling experience, which allows them to recalibrate. They will analyze the situation and learn from it, using their new knowledge to try again.

Entrepreneurs do not take the traditional, safe path. When someone goes against the norm, the outcome determines how they are judged by others. If they fail, they are viewed as reckless and foolish for not doing something the way they are supposed to do it. However, if they are successful, they are considered bold, aggressive, and innovative. There is a fine line between stupidity and brilliance, and the difference is measured by success or failure. The methods of highly successful entrepreneurs like Steve Jobs are celebrated. They write books about their methods that are studied, sometimes become the new normal. There are far more entrepreneurial failures than successes, but most people never know of them. Who would buy a book about how to make a business fail? Many successful entrepreneurs failed at least once before they found success. Their eventual success gives them license to write about their failures, often being humorous in retrospect. If they did not have the stubbornness to keep trying, their attempts would be considered foolish to the few that know their story rather than celebrated.

If the difference between stupidity and brilliance is success, perhaps some entrepreneurs are too dumb to know they should not pursue an implausible venture or are so overconfident they try anyway, which leads to my story….

An Unintended Path to Becoming an Entrepreneur…

I created the consultancy firm Spork & Ladle over 11 years ago. We are a full-service product development company, and we do it well! Full-service development means being able to complete all the R & D tasks related to launching a new product, making us a fully functional R & D department for hire. Spork & Ladle is now an established consultancy and would be considered successful by most metrics. It would be wonderful to say that my planning and strategies were the engine of my company's success; but that would be a massive lie. Truthfully, I never intended on having a company like this.

It evolved into the company it is today from making mistakes, learning from them, and looking for the opportunities in every situation.

I was always entrepreneurial and liked to do things in a different way. The first time I heard the word "entrepreneur," albeit in a negative way, was from my middle school principal. He did not like that I was selling Pixy Stix candy to my classmates and called me (and my mother) into his office, telling me there was no room in the school for emerging entrepreneurs. The idea of selling Pixy Stix was not a planned business; it evolved from an opportunity I saw. While at the store with my mother, I asked her to buy Pixy Sticks, and she did. A bag of 100 Pixy Stix cost $0.99. I brought some to school, and a friend that did not have a mother with liberal candy policies offered me $0.25 for two Pixy Stixs. I devised volume pricing tiers to entice kids to buy more of them, sold them all, and on my way home, purchased more Pixy Stix with some of my profits.

Like my foray into selling Pixy Stix, I never intended to start a consultancy with employees. It started as a way for me to avoid having a "real job" and evolved as I saw opportunities along the way.

I started my professional career at Ben & Jerry's in Vermont. Formally, I was a senior flavor developer, but since we were allowed to create our own titles, I was known as an ice cream scientician. Like most food scientists, I had internships in my undergrad with more formal companies, places that offered employee motivations like Casual Fridays, cubicles as far as the eye could see, and the executives working out of sight on a different floor. I had also grown up in the food industry; my father worked in the cheese industry his entire life, and I would often go to his office after school. I also have two brothers with food science degrees who work in the food industry. This was my first job out of college, but I knew Ben & Jerry's was not the typical work environment. We had a dedicated nap room, I brought my dog to work with me, and we had a twirly slide in our lobby. We would take "dessert tours" for our research, where our task was to travel across the country to find new and interesting restaurants and order the entire dessert menu. I would be interviewed by newspapers and magazines, and I appeared on TV shows like Unwrapped multiple times on behalf of the company. My father worried I would be disappointed later in my career and wanted me to know my job was not the normal job and that at some point I would need to get a "real job." The work was challenging and rewarding, and I was happy, so I did not worry about the future much.

Over time, I was finding fewer and fewer challenges in my job, and the work became less rewarding. By then, Ben & Jerry's had been purchased by a large international company, and while they mostly let us be us, there was more process and red tape, which I hated. I found myself taking on

urgencies that others found too stressful, simply because I could break the rules and do things my way without getting in trouble, so long as I solved the urgent problem. I was still happy, but less so.

I never planned on quitting my dream job; it came from seeing an opportunity. I had a meeting with the founder of Bear Naked Granola out of coincidence. My boss should have been in the meeting but was unavailable, so I attended in his place to represent R & D. The founder liked my approach to a technical problem and offered me a job during the meeting. I laughed at him. Leaving my great job in Vermont to make granola at a tiny company in Connecticut for someone younger than me was not what I expected to be my next career move. But over the next several weeks, he kept in contact with me, and I decided I should at least consider the opportunity.

I had never thought about working at a startup and, honestly, did not know much about them. As I learned more about the company, the job, and how startups function, it started to appeal to me. First, they offered me the job of director of R & D. I knew the title was inflated, as I would be the only person in R & D. Going from senior developer to director was skipping some rungs on my career ladder, and they wanted me to build out the R & D lab and department. If I could successfully do this, the title would be legitimate. Being tasked with creating the department meant there was no existing process and no red tape to navigate. Any processes put in place would be mine, and I could live with that. They also offered me stock options, shares in the company that were earmarked for me at the current value and that did not cost me any money. If the company were acquired, I could exercise my options, and I would be paid the difference between the price per share the acquiring company paid and the value at the time. All of this seemed intriguing to me, offered new challenges, and certainly was not a "real job," so I accepted the position and moved my family to Connecticut.

The job was demanding, but rewarding and exciting. The company was quickly acquired by Kellogg's, which is the goal of most startups. The sale was too soon for me. My stock options had matured, but I hoped for a bigger payout. More importantly, I was not given the time to build out my department and make my director title legitimate. I knew I was not going to find a job that would offer me a title above director with a short tenure at a small company. At best, I would be able to make a lateral move to director, but even that could be difficult. I certainly did not want to take a job below director, as my resume would appear that I tried and failed at being a director. My options would be limited, and to stay on my career path, I feared the worst: having to get a "real job."

Kellogg's offered me a position, but they already had a director of R & D, and they certainly were not going to give me his job, so it meant a

downgrade in title. I entertained the possibility, visited Battle Creek, and went to all the meetings. During this process, I realized I would not be happy, regardless of what title or how much money they offered. It was definitively a "real job" and seemed to have more process and rules than I thought possible. I did appreciate the offer and the value they saw in me but declined the job. I offered to stay with the brand for short time to help ensure a smooth transition for them—this turned out to be the turning point of my career, as it set in motion the events that led to me starting Spork & Ladle. They appreciated my willingness help with the transition, and in exchange, we negotiated a financial exit package for me that financially allowed me time to figure out my next step. Without this financial cushion of my exit package, I would have needed to find a job quickly from limited options. I could have been forced to take a position with whatever company would offer me the director title or set my career back by downgrading my title.

While the exit package gave me the luxury of having more time, it bought me months, not years. I was diligent in my job search and received several offers. None of the job offers I received felt like the right fit to me, and I found a reason to be unhappy with all of them…the products were not universally loved like Ben & Jerry's, the company was too formal and corporate, the job did not seem challenging, etc. I began to realize this was the disappointment my father was trying to prepare me for. Any job offer I received could not match the fun of Ben & Jerrys or the excitement of Bear Naked. I began to realize that I loved the challenges and energy of a startup. But I had also come to know the risks of startups. I was the only income source for my family of four, and I could not take those kinds of risks again, as my family had become quite spoiled by living indoors.

I had been going to business school part-time to earn an MBA and was nearly done with the program. I was also very confident in my abilities as a developer. With a food science degree and an MBA and experience at a big company and a successful startup, I knew I would be very attractive to startups in the food industry. Finding a startup that wanted to hire me was not my issue. I did not want the risk of putting all my eggs into one startup's basket. I also wanted a better salary than most startups would be able to pay. I saw an opportunity to have my cake and eat it too. If a startup could not afford to pay me what I wanted to work with them full-time, I bet they could buy part of my time. And I could work with multiple startups to mitigate the risk of being dependent on one company. If I made myself available, clients would surely beg me to work with them.

To finish business school and earn my MBA program, I needed to complete a capstone project to demonstrate my ability to incorporate all of the program coursework into a real-world project. Knowing that a business plan

and financial models were important, my project was to validate the feasibility of starting my own consulting business and write a business plan. Between my excitement and confidence (borderline arrogance), I only saw the huge opportunities available to me. I had oversimplified the undertaking, perhaps subconsciously or perhaps out of sheer stupidity. From my exit package, I had the luxury of about 9 months before I needed steady income. I used this safety net as my catchall of risk management. As long as I could figure out a way to get started without spending a large amount of money, I was not risking homelessness; I was giving up the opportunity to save or invest the money from my exit package. I had already been mentally committed to the idea of consulting. Looking back, my business plan was not objective; it was written to make the concept work. This is the scientific equivalent of shooting a shotgun at the side of a barn, drawing a circle around the bullet holes, and claiming bullseye!

The skill I was offering was product development, and that meant I needed a lab to make prototypes. Renting a place for my lab and buying the equipment I needed were too costly to be feasible for me. It would have greatly cut into my financial safety net, reducing the amount of time until I needed regular income. This was a big roadblock, but I was too stubborn to give up. I simply had to find a creative solution. I had just built out my lab for Bear Naked, and I knew that Kellogg's would not need Bear Naked's equipment. There was nothing that Bear Naked had that Kellogg's did not already have; and their stuff was better. I also knew they would incur costs to move and store this unneeded equipment, and they would need to carry the accounting costs of depreciation. I knew keeping the equipment would be a hassle for them, and that it added no value and would cost them money. They had let Bear Naked employees make offers to purchase office furniture for the same reasons. An $8500 water activity meter is very different than an Ikea desk, but I had nothing to lose, so I made them an offer of pennies on the dollar, and they accepted! I now had about $25,000 worth of lab equipment that only cost me $400. For another $250, I purchased all my office furniture too. I still needed a place to put my office and lab that did not cost me money. I was renting an old house in Connecticut that had a third floor, an unfinished attic. It had one-inch gaps between the floorboards, the ceilings were sloped giving limited areas to stand without hitting your head, and it had no heat, no air conditioning, and no running water. But the price was right. I did not think the landlord would give me permission to set up a business in the attic, and it was probably against the rules of the neighborhood. I decided the best option was to beg for forgiveness rather than ask for permission.

This was the start of my consulting career, but not the start of Spork & Ladle. I did not spend the time or money to form a legal entity and simply

called my company Spors Consulting, a factual statement; that was my name, and that is what I was doing. I now call this time "the attic days." It is a near universal truth that we learn more when things go wrong, than when things go right. I can confidently say that I learned a lot from the attic days!

I found consulting to be very difficult for all the predictable reasons. The swings in my workload were difficult to manage from a cash flow perspective. I either had way too much to do or nothing at all. I grossly underestimated how much time it would take to find a client that would actually result in revenue for me. My fees were way too low. I did not have processes for onboarding clients, managing the work flow, or making sure the client did not change the scope of work. The business plan I wrote was laughably wrong.

There were some things that worked and some rewarding work. One steady client was a private equity (PE) group in Boulder, Colorado. They invested in companies but stipulated how the funds would be used. For food brands, they would hire me to reformulate their product. Working with this client made me realize that my target client was wrong. I had targeted early-stage startups. I correctly identified them as being eager to have my services, but I did not realize how little cash flow they had available to pay me. They were so small; they were not a priority, making the work more difficult. Their projects took much more time and I was paid less. In contrast, the companies that were funded by PE groups were further along, had more sales, and had just received cash flow from the PE. Even if their sales were not big, saying they had private equity money signaled to vendors that someone else believed in them enough to give them money, which made the work easier.

Overall, I was treading water at best, and my brilliant concept was slowly failing. I was trying to decide if I could adjust and continue, or if I should finally accept the fact that I would need a "real job." Before I reached a decision, an opportunity with my private equity client presented itself. They had a new concept. Rather than just protecting their investment by stipulating the consultants they hire; they could create their own incubator. The PE group would hire their preferred consultants as employees. They wanted me to be the vice president of operations, R & D, and QA of this incubator concept. This was perfect for me. I would still get to work with a variety of products and brands, I would have job security and steady income, and I would be able to move up another rung on my career ladder. Most importantly for my happiness, it was not a real job. When negotiating my offer, I stipulated that they pay my moving expenses and guarantee me 1 year of salary to compensate for uprooting my family and moving to Boulder.

Less than 1 month into working for the PE group, they found a strategic error in their new business model and decided to dissolve it. I understood the flaw, so I was not upset, but I was very glad I had negotiated the safety net of a guaranteed salary for a year. This gave me time to evaluate my options once again. It also gave me time to reflect on the attic days of consulting. I am very competitive and I do not like losing or failing. At first glance, it seemed clear to me it was a poor decision to become a consultant. It was disheartening to think I had wasted 3 years that I could have used to advance my career, gain expertise, and make more money.

But I realized that I did learn a lot and gain expertise. In fact, saying that consulting did not work for me was not accurate. My strategy and approach did not work. I was willing to try consulting again, if I could figure out a way to do things differently. I wanted a symbolic fresh start, so I did not simply continue Spors Consulting; I wanted to create a new entity. My fresh start was Spork & Ladle.

I spent some money to make Spork & Ladle more legitimate. I hired a graphic designer to come up with a logo. I invested in letterpress business cards that were so thick that they became a conversation piece, turning the typically passive event of exchanging business cards into an active experience. I rented space in an office building, allowing me to have clients visit the lab. I changed my target client to startups with legitimate funding. I had learned from my mistakes and had a better plan. The plan was better, but I had to adapt my plan along the way. My intent was to function like an independent consultant, selling my own skills, but with a strategy of maximizing my billable time by hiring a part-time, low-level employee to do simple tasks for me. As I gained more clients and ran out of available time to offer, I would be able to hire another part-time person to free up more of my time to further increase my revenue. Part-time employees would require some minimal threshold of hours to continue to work for me, but I would always be able to get extra hours from them as needed. This seemed like a great strategy that would let me generate a lot more revenue, while converting the typically fixed costs of employees to a variable cost.

My strategy of part-time employees worked for a while, but it was flawed. I had eased some of the issues of being an independent contractor, but I did not eliminate them. Part-time employees needed me to assign them tasks. All the work had to flow through me, making me a bottleneck. My income potential had gone up, but it was still capped by the amount of time I could work. The services I could offer were limited to my knowledge. The business was still entirely dependent on me. I took on more clients, but not enough to make it normalize the workload. I was able to create a decent job for myself, but if I wanted to make consulting my true career, it became clear that I needed to hire skilled, experienced employees.

The cost of hiring a skilled employee scared me. I knew the right hire would be able to work more independently, easing the load I would have to carry. This type of hire would such a big increase to my fixed overhead costs, and I worried about being able to make payroll. Eventually, I did so out of necessity. After a short period, I saw an opportunity to shift my business strategy once again. Our target client, and the source of most of our revenue, was funded startups. We were (and still are) a good fit for this type of work. The work is project based and typically lasts 4–6 months. While this is profitable, it requires a constant flow of new clients, which requires a lot of my time. When we onboard a new project, we have a learning curve of understanding the client's needs and likes and finding the right flow. This is necessary, but not efficient. If a funded startup has continued success, they enter a phase of rapid growth and receive larger funding to fuel this growth. The growth is fueled by selling their products in more locations and by offering new products. They not only need to develop new products; they need to maintain and improve their existing products. They have a constant need for R & D. With the extra bandwidth and skills of experienced employees, we can address their needs with an ongoing, long-term retainer relationship, functioning as their R & D department. When a supply chain issue arises, we can address it quickly as we already have intimate knowledge of the product and how it is produced. We can develop virtually any product type they want quickly. Our lab is set up for rapid prototyping that still gives clients a realistic view of what their product will be when it is mass produced. We cannot be an expert on every type of food. Instead, our expertise is in the development process. By following a proven development process, we can develop anything the client asks of us. And working on all types of food products, we can apply existing processing technology and our knowledge from other categories to create innovative and unique products for our clients. If someone working on the same food type for a long time knows a whole lot about very little, we know very little about a whole lot! The retainer relationship greatly reduces the inefficient onboarding process. Being a long-term engagement means I do not have to spend as much time looking for the next project. This allows us to operate efficiently. We can offer the client a lower price than doing multiple project-based engagements. This has become our niche.

The shift in our target offerings facilitated by having more experienced employees has changed my role significantly. My role is less about developing products; it is about making sure there is work for my employees to do and money to pay them, keeping clients happy, and deciding when and how to invest in the business. It is a bit odd to me that I started consulting to sell my skills as a developer, but as the business has grown, I am selling my

employees' skills. I still assume multiple roles within my business, but I no longer need to assume all the roles. Continuing to hire the right employees will allow me eventually to only perform one job function. At that point, I will be able to hire someone to replace me and have Spork & Ladle generate income with very little involvement from me.

All of this evolved from being too excited to see that my initial plan was a bad idea, being willing to learn from my many mistakes, being too stubborn to give up, and being willing to adapt and change.

For me, the biggest success is that I am over 25 years into my career and still haven't had a "real job"!

Chapter 25
Careers in Sensory Science

Samantha Bennett

Sensory science is a multifaceted field integrating aspects of psychology, statistics, biochemistry, and food and consumer sciences. In its purest and most practical form, it involves utilizing humans as complex analytical "instruments" to assess and provide feedback on product differences and acceptability.

Sensory scientists working in the food industry support quality control and research and development (R & D) efforts at every stage—assisting with raw material selection, recipe development, consumer acceptance of prototypes, products, packaging materials, and determining shelf-life. With these varying aims, a sensory scientist employs a tool kit of methods, based on the type of feedback required, to glean information to help inform the direction of product development or ensure that existing products remain consistent. Due to the use of statistics to analyze sensory data and the need to have supportive coursework in other fields, many sensory scientists hold advanced degrees in food science.

Their methodology tool kit contains some standard techniques, but the experienced sensory scientist will also have developed alternatives to suit many budgets and project objectives. If working with a sensory scientist as a product developer, consider them a partner in your development path as they are experts in designing experiments to get you the best feedback to move your process forward. They are not simply "order takers" with a menu of feedback options for you to select from.

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What Is the Role of a Sensory Scientist?

At smaller companies, a sensory scientist may do tasks that support both R & D and quality control and may also act as a panel leader for descriptive analysis (this is normally a full-time job in and of itself at larger companies).

At large companies, a sensory scientist working in R & D will work on a cross-functional team with various other disciplines, including marketing, consumer insights, product development, production, and logistics to bring new products to market. Very large companies may have even further specialized sensory scientists in quality control such as those working in-plant and for shelf stability.

Much of the day-to-day work of a sensory scientist revolves around meetings to organize new testing, analyzing the data generated by the different tests, report writing, and, in many cases, evaluating products as a panelist or panel leader!

A Sensory Scientist's Tool Kit

To best illustrate how a sensory scientist spends their time, we will cover some of the more common techniques using various examples from the food industry. Note that this is not meant to be an exhaustive list, but rather an introduction to the type of work typically done by sensory scientists.

Descriptive Analysis Testing Methods

When people think of what sensory science is, they are probably thinking of descriptive analysis—these methods generate some of the most abundantly used and foundational data in this field.

A descriptive analysis panel is a group of trained assessors[1] who evaluate products in order to describe them in a quantitative way. For example, the lemon flavor of *this* cake is significantly more intense than the lemon flavor of *that* cake. Their data can be used to hone in on a target flavor profile for a product, assess differences between similar products, and identify

[1] "Evaluators," "assessors," or "panelists" are all preferred terms to "tasters" as these individuals use all of their senses when evaluating, not just their sense of taste. Particularly true of panelists working with consumer goods or personal care products!

off-aromas and flavors. When used appropriately, they can be more valuable than expensive diagnostic equipment like gas chromatographs. Because your instrument is a human being, they are able to learn, remember, grow, and change to adapt to new challenges and project objectives. They can also provide context and answer questions about their results.

Training these panels is labor and time intensive but is critically important to ensuring that they generate trustworthy data. Most panel training starts by generating shared experiences for the individuals. Maybe this is dissecting an orange and seeing, feeling, smelling, and tasting each component from the zest, to the pith, to the flesh and describing each sensation collaboratively. It could also be assessing sugar solutions at varying concentrations and placing them on a scale from least to most intense. These trainings will focus on the product(s) most evaluated by the panel and will result in a lexicon for their products. A lexicon is a shared vocabulary for describing the product and will be used to demonstrate differences. Most companies will use a "modified" version of either spectrum descriptive analysis or qualitative descriptive analysis, including aspects of both of these panel types to fit their unique needs.

In the food industry, descriptive analysis is a technique regularly used by sensory scientists. For example, imagine your team has previously worked exclusively on bacon products for a major food manufacturer but has recently been asked to take on breakfast sausage as well. To get a better sense of the retail breakfast sausage space, your team decides to do a category appraisal. The first step is to canvas local grocery stores to purchase products that represent the entirety of the breakfast sausage category as it exists today. The team returns with 25 unique products. Next, the descriptive analysis panel does a full assessment of all 25 products and returns a description of the visual, aroma, flavor, and texture attributes for each product and the statistically significant differences between the products. From there, the team decides what subset of products to show to consumers to get their feedback. Twelve products that represented the bounds of the category were presented to consumers to assess overall liking. Analyzing the consumer liking data and the descriptive analysis data together can help the team understand "drivers of liking" or correlations between certain physical attributes and consumer liking. Three liking groups were identified in the breakfast sausage category—sweet/maple, spicy, and meaty/savory. Now, your team can further use your descriptive analysis panel when developing new products to ensure they fit in these liking groups.

Consumer-Focused Testing Methods

There can be confusion for inexperienced product developers on the difference between the role of the sensory scientist and the consumer insights professional, as both can perform consumer-focused research. The difference here is that sensory scientists use consumer research to understand the physical aspects of a product—what does it look like, smell like, taste like, and feel like? And what do consumers think of the look, smell, and feel? Their insights guide product development decisions. On the other hand, a consumer insights professional uses consumer research to understand how a product should be marketed. What do consumers think of the label claims on the product? Does it compel them to buy? Their insights guide marketing decisions. Of course, this is the beauty of the cross-functional team, as none of these roles act entirely independently of each other.

Consumer testing methods utilize untrained assessors and ask for their opinions on new product ideas and hedonic and/or descriptive feedback on a product. Testing can be in primarily three forms—central location testing (CLT), focus groups, or in home use testing (iHUT). CLTs occur in a central location, like a mall, conference center, or contract testing facility. These are for *quantitative* product feedback, where statistics will be applied to determine the best product in either an experimental design or straightforward "horse race" approach. These tests are good for providing information about the product—the appearance, flavor, etc.—but they do not give reliable usage information, as the environment is not conducive to using the product in the usual way that someone would in their daily life.

Alternatively, iHUTs are conducted in the participants' home. The participant is sent the product in the mail, asked to use it for some time, and then provide feedback about their use of the product. These are good for usage information, including packaging feedback, as well as flavor, and have the added benefit of getting information from more than one household member at once.

At large food companies, during the later stages of product development, final prototypes will be assessed in CLTs or iHUTs in *multiple* cities to determine broad acceptability and prevent sampling bias. This can be quite costly, but not as costly as a failed product launch!

If you are a sensory scientist working for a large breakfast cereal company, a typical consumer-focused project might look a little something like this. You have been assigned to a team where the product developer has been asked to develop a line extension for a "chocolate" version of an existing product. In focus groups conducted by the consumer insights professional on the team, consumers expressed interest in chocolate–marshmallow,

chocolate–cinnamon, and chocolate–mint flavor combinations. Partnering with your product developer, you conduct an initial CLT to assess six products in a 3×2 experimental design. The developer produces prototypes with each of the flavor combinations at two usage rates, with the secondary flavor at a low level and high level. You worked with your descriptive analysis panel in early development to ensure that these levels are significantly different in intensity of flavor. The results of the CLT test showed that consumers preferred the high level of secondary flavor significantly more than the low level and preferred the chocolate–marshmallow and chocolate–cinnamon prototypes significantly more than the chocolate–mint. However, there was no significant preference between the chocolate–cinnamon and the chocolate–marshmallow—so, which do you produce? How do you decide? Another CLT! This would be the time if you have only used local testing, to consider a multi-city test and a "horse race" design. Put the two remaining prototypes (chocolate–marshmallow, high level, and chocolate–cinnamon, high level) head to head and see which one the consumers prefer. Many times, this is also a good opportunity to bring in your consumer insights professional, as marketing and branding can sometimes swing the preference and determine the best overall product offering to go to market.

This last detail, the specific marketing and branding of a product, might lead to another set of consumer testing. For example, if you are supporting the packaging team at your company on a project to develop a "better" can soup. Consumer insights testing showed that major pain points for consumers with the existing can soup package are that they are difficult to open and cannot be heated in the microwave. Benefits of the existing package that must be maintained are durability, good flavor, and long shelf life. Your team develops multiple prototypes—all including microwave-safe materials, but with differences to the opening mechanism (twist off, peel off, or pop off) and the ability to heat and eat directly from the container with either a completely removable top or a sip spout. Because your team needs feedback from consumers on their interaction with the product and not just on how the soup tastes, you choose the iHUT method. You send the prototypes to consumers in the mail and ask them to use them how they would normally use canned soup—some will take it to work for lunch; others will use at home—and report back on how easy the product was to open, heat, and eat and also their preference on the removable top or sip spout for eating from the container. Overwhelmingly, consumers preferred the twist-off opening mechanism. It was easy to open, but felt secure, so they knew it would not leak or spill. They also preferred the completely removable top, as eating the soup with a spoon felt more adult. The sip spout made people think that the product was for children. Many comments suggested adding a spoon to the

packaging to complete the product as something to take on-the-go. With these insights, your team has clear direction on product features that add value to consumers in this space and can feel confident that the prototypes do represent a "better" alternative to cans.

A quick note about focus groups: these are also "central location" tests, but they are used exclusively for *qualitative* feedback. A trained moderator leads a discussion with a small group of consumers, generally in the very early stages of new product development, to come up with ideas for new products or assess very early prototypes to choose a direction for the development process. It is more common for consumer insights to perform these, but sensory scientists are involved when the focus group is heavily based on prototype feedback.

Difference Testing Methods

Difference tests are used to understand whether two products are noticeably different from each other. They are often used for cost-savings work, raw material qualifications, and product matching. The most common are the triangle test and difference from control test. These tests can be performed with trained or untrained assessors; however, the total number of evaluations is most important as data interpretation is heavily reliant on statistical analysis.

In a triangle test, a panelist is presented with three products, two are the same and one is different, and they are asked to choose which is the different sample.

For example, say you work for a beverage company on a team that primarily develops new fruit juice products for kids. New legislation has been passed that says that any food product marketed to children on television has to adhere to a particular set of nutrition requirements. Your team's most popular product hits all the criteria, except it has 12 g of added sugar where the new requirements are set at less than 10 g. Your team would ideally make a silent change to reduce the sugar to 10 g, but without noticeably changing the flavor of the product. The product developer creates a 10 g sugar prototype and you set up a triangle test versus the existing product with 15 kids in your target market and their moms, for a total of 30 assessors. Data analysis is simple here—look up the number of correct responses required for difference based on your statistical confidence level in a statistics table. In this case, 16 at 95% confidence. Only 10 of your consumers picked the different sample correctly in the triangle test, indicating that your test was not able to detect a difference between the 10 g prototype and 12 g product. Your team may be able to reduce the sugar without anyone noticing!

Another commonly used difference test is the difference from control (DFC) method. This method can be used to evaluate new raw materials and also to determine product shelf life. In this method, a sample is compared to a control and a level of difference between the two is scaled. A score of zero indicates no difference, while increasing values indicate a higher degree of difference between the sample and control.

To illustrate, suppose that you work on a team that has developed a new candy bar—nuts, nougat, and caramel draped in milk chocolate. You need to determine the shelf life of the product so you can print a best by date on the package. Your team knows based on experience with other products that a difference from control value greater than four leads consumers to score the product lower for overall liking and decreases their willingness to buy, so they set the best by date at that value. Your descriptive analysis panel conducts a series of difference from control tests where they compare candy bars that have been sitting on a shelf for varying amounts of time to a fresh control. Through these trials, you determine the following:

- Six months of shelf life corresponds to a DFC of 1.5 (just noticeable).
- Twelve months corresponds to a DFC of 3.5 (slightly different).
- Eighteen months corresponds to a DFC of 5 (moderately different).
- Twenty-four months corresponds to a DFC of 7 (severely different).

Using linear regression, you can determine which months will correlate to a DFC score of four—in this case, your team would label the best by date for your new candy bar at 15 months after the date of manufacture.

Sometimes a difference test can produce an unexpected result, such as if your team is confident that two products are similar, yet the difference test shows a significant difference. In these cases, descriptive analysis can be used as an important diagnostic tool to help explain *how* the products differ and indicate where a team should put their redevelopment effort. It is important to remember that due to the nature of the testing, it is difficult to perform a "targeted" difference test, meaning that the products must be similar in every way—if the color is slightly off, but you are most worried about whether the flavor of the product is the same, the color difference could skew the results even if the flavor matches.

Creative, Adaptive Testing Methods

In many ways, being a sensory scientist is an extremely analytical role. You choose tests based on the type of feedback needed, design them to answer your specific questions, and then analyze the data statistically to make

decisions about the path forward. The reality, however, is that using humans to test things is expensive! And resources are limited! Sometimes, you will be told at the outset of an R & D project that you only have funds for a single CLT, no matter where the development takes you. Sometimes the in-house descriptive analysis panel is booked and cannot get to your project in time. These moments are where the job can become quite a creative endeavor. Ultimately, your role is a support role to provide information to help move a project forward. So, understanding the give and take of being principled and being practical can help you do the next best thing, when the best thing is not available. Consider what you are trying to achieve and what biases you need to overcome. For example, in a quantitative consumer test, you would recruit people who use your product regularly, so if you turn to a qualitative check-in (maybe just with the members of your cross-functional team) because there are not funds for a normal CLT, at least prioritize the feedback from the people who actually use your product!

To show what I mean, let me give you a real-life example from my own experience:

After moving to a new state, I took a job for a short time at a company that designed fitness equipment. What was a sensory scientist doing at a treadmill company?! Well, the height and look of the console, where the buttons are placed, how difficult they are to push, the springiness of the tread—there is a sensory component to each of these! I was working with the design team to finalize a new console design that had the numerical miles-per-hour set-point buttons in a keypad format instead of the old ladder format. The idea was to take up less space to maximize the size of the video screen. They needed feedback on how big the buttons should be and the spacing between them. I had no budget—just a $50 allowance for materials. Luckily, we had a staff full of runners! I had the design team print 15 copies of the true-to-size console on transparencies and bought three different colors of finger paint to correspond to groups based on their self-reported comfortable walking or running speed. I recruited people who were walking or running over their lunch hour. I asked the participants to set the treadmill at their comfortable pace, placed the transparency over the console, and stuck their finger in the color paint associated with their speed. Blue = walking (<4 mph); yellow = slower (4–5.5 mph); and red = faster (>5.5 mph). At 2-minute intervals during the test, I gave an instruction to simulate changing the speed to a particular value. The result was fifteen finger paints showing the precision of the button pushing actions at different speeds. We let the transparencies dry overnight and then laid them on top of each other in a stack to see a heat map of the button presses. What we discovered was that the button size mattered much less than the space *between* the buttons. At faster speeds, it was

easy for runners to overshoot and hit the button next to the one they intended if the spacing was too close, but because most people point toward the center of the button, the buttons could be quite small and still be effective. This simple test was enough to finalize the new console design and these findings were also utilized in other projects!

Preparing for a Career in Sensory

Many undergraduate food science programs are beginning to offer introductory coursework in sensory science. This is a great start for translating an interest in sensory to an understanding of the principles and statistics behind different types of sensory tests. These courses also generally offer an overview of the foundational psychological and behavioral science philosophies that explain why the basic tool kit is so powerful. If no undergraduate coursework exists, there may still be opportunities to participate in consumer "taste testing" on campus. Seek out these opportunities to participate in sensory work and then get to know the folks running the tests. There are also departments offering short course and specialized professional programs in sensory science, like UC Davis, that can offer a more in-depth course of study and a certificate that can be helpful on a resume when applying for sensory jobs. Unlike many other science fields, an MS in Food Science is very marketable (not just a consolation prize for those not cut out for the PhD). Graduate study in a food science department with a dedicated sensory program is a great way to get the skills needed for a career in R & D in the food industry. I have also met several product developers who have transitioned to sensory after a few years of doing development work, so lateral moves are definitely possible in the industry!

Summary

Sensory science can be a rewarding career for people who enjoy collaboration, working with data, and solving complex problems. Continuous building on the fundamentals by using creativity to solve new challenges keeps the work exciting and grows internal confidence in your skills. Keep in mind, though, that if you choose this path, you are sure to endure some of the following from your friends and family: "Come check out this weird smell." "Can you see if the milk is bad?" "Does this taste off to you?" "Can you tell my secret ingredient?"

Samantha Bennett holds degrees in food science from both the University of Wisconsin–Madison and Pennsylvania State University. Her graduate work focused on better understanding how humans describe oral irritant sensations, with an aim to help develop better masking technologies for bitter and irritating medications. She has previously worked as a sensory scientist for both Kraft Foods-Oscar Mayer and General Mills, supporting new product development by facilitating consumer research and leading sensory panels. She currently manages the sensory team at New Glarus Brewing Company in New Glarus, Wisconsin, which includes production support and quality control as well as R & D and recipe development. When she is not evaluating beer and being no fun at parties, she is probably home snuggling her dogs, chasing her kids, or vice versa.

Chapter 26
Food Science in Community-Based Food Systems

Federica Ranelli

Far before there was a field called "food science," and humans have been making observations about food and manipulating it to enhance or alter its properties. From processing and making goods out of grain to cutting and curing meat and to preserving vegetables and other foods, the principles of food science have been practiced and shared among people in familial, geographic, and cultural communities for generations. Through the United States' history with settler colonialism, genocide of Indigenous peoples, and human enslavement, the practice of manipulating and moving food through our communities has become largely controlled by industry for profit. Here in what is now known as the United States, food apartheid manifests that history. To work toward food sovereignty and security means to carry the responsibility of acknowledging and fighting the unjust way food is manipulated for profit and moves throughout our communities while simultaneously building new, just pathways.

Bringing the technology, techniques, and knowledge held by the food industry back into the hands of the people is one component of the movement for food sovereignty that food scientists have a crucial role in. It is exciting to be working within a discipline with such a history that predates the violence of colonialism and such clear models to transform and decolonize how we relate to others and the food we eat.

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People drawn to a community-based career in food science might have an interest in education, agriculture, nutrition, community organizing, entrepreneurship, or food justice. This chapter is for people who are drawn to analyze and reimagine society as much as they enjoy analyzing and reimagining a formula for toffee, pasta, or frozen hollandaise sauce. It can be hard to satisfy a combination of such divergent interests, which can lead to a feeling of not belonging in the food science field. However, community-based food science is interdisciplinary—relating to more than one branch of knowledge—and is a dynamic way to build a career that is meaningful both on a personal and community level.

Common Understandings for a Food Science Professional in a Community-Based Food System

Before moving on, let us root ourselves in the big picture: what does it mean to have a food science career in community-based food systems? *Communities* are groups, plain and simple. They are often intersecting and concentric circles of people connected geographically, culturally, and relationally. A *community food system* is one in which "sustainable food production, processing, distribution, and consumption are integrated to enhance the environmental, economic, social, and nutritional health of a particular place" (Garrett & Feenstra, 2002, p. 2). To work in this arena as a food scientist is to use specific expertise to dismantle food apartheid and build toward food sovereignty and food security.

According to Leah Penniman and Washington (2018), *food apartheid* is a "human-created system of segregation that relegates certain groups to food opulence and prevents others from accessing life-giving nourishment" (p. 4). *Food security* exists when people have access to affordable, nutritious, culturally appropriate, and personally acceptable food without the need to resort to emergency food or other coping strategies (Anderson & Cook, 1999). *Food sovereignty* is "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and the right to define their own food and agriculture systems" (La Via Campesina, 2021). This framework puts the aspirations and needs of those who produce, distribute, and consume food rather than the demands of markets and corporations at the heart of food systems and policies. Food sovereignty is a precondition to genuine food security.

Food sovereignty, or being food sovereign, can be a mission and a state for any community group, state, or nation; however, Indigenous people have

largely been shouldering the fight toward food sovereignty in what is now known as the United States. The *Indigenous food sovereignty movement* centers revitalization and reclamation of ancestral practices of producing, gathering, processing, and preserving food that colonizers manipulated and all but destroyed as a method of control and dependency promotion during the genocide of Indigenous peoples on Turtle Island (Maples, 2022). This history has set the stage for structural racism and oppression in the food system, but the work of actively dismantling racism continues. Indigenous nations are fighting the federal government's structures and actions in the form of treaty breaches, pipelines, development, and structural racism to gain autonomy of their culture and food supply. Until all Indigenous nations are food sovereign, no one is.

Identity affects how we all show up in the dismantling of food apartheid and building toward food sovereignty and food security. The experience I share in this chapter is informed by my identity as a white, middle-class, cis, queer woman with US citizenship. If my identity were different, this chapter would be different. No matter your identity, when you are participating in community work, all members of the community should be represented, especially those with the most at stake living under the structural racism that our current food system is founded on. If they are not, throw out your drawing board and find the work that is already happening within your community.

In addition to communing with the people around you, working within a community-based food system involves responding to and working with the specific environmental factors impacting the place you are. Some of these environmental factors are hyper-local, like local legislature and leaders, infrastructure, weather and climate, redlining histories, and transportation. Other environmental factors are regional, national, and transnational, like the COVID-19 pandemic that began in 2020 and climate change. Identifying the environmental factors that impact the community's food system can offer good places to start when assessing needs, organizing responses, or looking for jobs in this field. The increased urgency of the need for change in community health response due to the COVID-19 pandemic will be a recurring theme in the stories I share in this chapter. From changes to supply chains, food prices, increased home gardening and food preservation, and development of small businesses to fill gaps in the local economy, January 2020 sparked shifts in how people interact with their food systems. Though the pandemic will hopefully come to an end, the need for small-scale community food systems that it emphasized will not. As environmental factors force communities and nations to reassess priorities and how we care for one another, the field is and will continue to be ripe for food scientists with an eye for community care.

This chapter will explore many interdisciplinary avenues of community-based food science careers for someone with an orientation toward analytical applied sciences. Sprinkled throughout, I will share my personal experience with a variety of careers in the community food system sector. Finally, I will share what you can do to prepare for a community-based career in food science. I hope this collection of stories keeps your wheels turning and ideas flowing. It is as much a consolidation of ideas as it is an example of how I put together the puzzle of a career in community food systems. Enjoy the stories, take what inspires you, and run with it.

Food Science and Interdisciplinary Research

An exciting variety of research possibilities open up when you think about community food systems across disciplines—food science included. Interdisciplinary research is one way to collaborate across disciplines and address the intersections inherent in complex, relational research questions.

My experience in interdisciplinary research is largely based in government-funded university research. The United States Department of Agriculture (USDA) and their national programs and regional departments are major funders of this type of research. Their money can be funneled to a singular organization through grants or can fund a partnership across many organizations or individuals. It can be confusing to track who are collaborators in projects, who are funders, and how everyone is working together. It can also feel limiting because government-funded or university-based research projects can take a long time, feel conservative in nature, and be limited due to project scope or funder expectations. However, by using access to funding and the infrastructure at universities to build capacity for sustainable food systems, some radical work can be done through conservative institutions.

If interdisciplinary research piques your interest, then a position with a university or college extension program might be the career you are looking for. Extension is the outreach arm of a university or college. Over 100 institutions have such arms, including many tribal colleges and universities. For example, the University of Minnesota (MN) Extension "provides practical education and research to help businesses, communities, consumers, youth, and others solve problems, develop skills, expand knowledge, and work toward building a better future" (What we do, 2022). There are extension specialists and agents in every county of MN and many tribal nations in MN using their expertise in focus areas such as agriculture, food safety, nutrition, conservation, and education to provide resources and research from the

university to the community. All extension programs differ in their focus areas to meet the needs of the community, but a shared thread is the combination of informal and formal education. It should be noted that many extension positions require some degree of specialization, either a Master's degree or a PhD in addition to some field experience, depending on the position.

Sometimes the outreach is interdisciplinary, and sometimes it is not. I held two student research positions during my undergraduate studies at the University of Wisconsin (UW)–Madison, both of which were affiliated with UW-Extension. For a year, I was a lab assistant for Dr. Barb Ingham, a food safety extension specialist on faculty in the UW–Madison Food Science department. As an extension specialist, Dr. Ingham spent her time fielding phone calls from and making site visits to small-batch food processors across the state. When a processor's question could not be answered by previously published research papers, it would sometimes become a project for her lab. I spent one summer inoculating foodborne illness-causing microorganisms into more varieties of mustard than I have ever seen before. Why? A small mustard producer in Wisconsin (WI) had a question about the adequacy of her heat-processing method for her products' shelf stability. The producer wanted to avoid pasteurizing to retain certain sensory properties that high heat could alter and was wondering if her manufacturing process would kill pathogens and provide a food-safe product. She called Dr. Ingham to get an answer to her question and Dr. Ingham combed through research, shared what she knew, and ultimately realized there was not enough research on this topic to advise a food-safe process. We tested the producer's question in the lab with her mustards (and many, many others) and then wrote up our findings for publication. The next time someone has a question about mustard processing in WI or anywhere else, they can refer to this study. This is a quintessential example of extension at work—using university equipment and funding to help small businesses succeed.

After that experiment ran its course, I joined an interdisciplinary project with partners in Dr. Ingham's food microbiology lab, the UW–Madison Department of Planning and Landscape Architecture, and FoodWIse, an extension program focusing on nutrition education. The project in question was called the Safe and Healthy Food Pantries Project (Canto et al., 2018) and was funded, in part, by the Supplemental Nutrition Assistance Program–Education (SNAP-Ed) and the Expanded Food and Nutrition Education Program (EFNEP). My work began in the lab testing the life span of foodborne illness-causing microorganisms on fresh fruits and vegetables. I was attracted to the geographic and social aspects of the project, so I transferred to the Environmental Design Lab run by Dr. Samuel Dennis Jr. within the Department of Planning and Landscape Architecture. There we used the

findings gathered in microbiology lab to geospatially link environmental factors to food safety risks in produce donated to food pantries from community gardens or individuals. We used photos and GPS trackers to map food's travel from garden to food pantry, noting where Good Agricultural Practices (GAPs) were followed and where practices raised safety concerns. We also interviewed folks on the pantry end of this supply chain to learn about their experiences and followed the principles of grounded theory to code the interviews. I did not see the entire Safe and Healthy Food Pantries Project through before graduating, but the microbiological work done in Dr. Ingham's lab, the mapping work from the Environmental Design Lab, the theory informed by coded interviews from food pantry operators, and the expertise of extension specialists in nutrition education all came together to create a free tool kit for pantries to assess, implement, and measure the safety of their operations.

Food Science and Indigenous and Community Knowledges

As I wrote in the beginning of this chapter, humans have been manipulating, experimenting with, and sharing knowledge about food since before we called it food science. There are long-held and evolving traditions in many cultural communities involving gathering together to process foods and share knowledge, stories, and ceremony. The principles of food science do not exclusively belong to Western capitalism. Through colonization, food science knowledge is compressed, ancestral traditions are monetized, and people lose access to defining their own foodways. Through decolonization, food science knowledge is not only accessible to all, but foodways are defined and protected by the people. Although I have little direct experience with the food sovereignty movement to share in this section, a chapter on community food systems would be incomplete without discussing a few of the many examples of the radical and vital work around decolonizing food and Indigenous food sovereignty.

To work effectively and collectively toward food sovereignty, we must recognize the threat to tribes' food sovereignty posed by cultural appropriation and exploitation of traditional Indigenous knowledge of food, plants, and animals. According to John Phillips (2011), knowledge of the Indigenous foods and medicines and how to gather them have been "developed over generations of careful observation and trial and error" (p. 3). While Phillips (2011) explains this knowledge is not "'owned' by anyone in the way that

U.S. law defines intellectual and property rights" (p. 3), Indigenous peoples consider these practices and resources to be held in protection under treaty rights (LaDuke, 2004). Manoomin, or *wild rice* in Anishinaabemowin, is one example.

Manoomin has been hand harvested and cared for by Native peoples like the Anishinaabe in the Great Lakes region for generations. For the Anishinaabe, Manoomin is a more-than-human being that represents their relationship to the land and their cultural identity (Tribal Wild Rice Task Force, 2018). It is also a nutritionally rich traditional food that grows abundantly in the clean waters of the Great Lakes region. The skills of harvesting, processing, and preparing Manoomin have been passed down for generations (Vogt et al., 2020). In the 1950s, researchers from the University of MN took rice samples from across the state without tribal consent, thus breaking treaty rights, in order to create a paddy-grown wild rice variety (LaDuke, 2004). The samples were domesticated through genetic modification and crossbreeding to create a variety that could grow and be harvested for mass production and therefore sold at a lesser price. This is not true wild rice, yet it is labeled as such on grocery store shelves and most consumers do not know the difference. Because the price is less, paddy-grown wild rice often competes and wins against products from Native harvesters and processors.

Similar stories can be told about the domestication of bison, attempts to patent Indigenous chile varieties, and other forms of food appropriation (Phillips, 2011). Tied into these stories is the environmental harm colonization has spurred on the natural landscape and subsequently the traditional foods and lifeways of Indigenous peoples (Vogt et al., 2020). These treaty breaches and patterns of cultural exploitation are examples of where food science principles perpetuate harm in the hands of colonizers. Recognizing and rectifying where this shows up both historically and in the present are vital to building a just and sovereign community food system.

Of course, tribes have been responding resiliently and effectively to the challenge of preserving and evolving their foodways. All tribal colleges and universities have extension programs, and through extension and other institutional work, they are expressing tribal sovereignty (Phillips, 2011). Thirteen Moons, Ashi-niswi Giizisoog, is the Fond du Lac Tribal and community college's extension program that "uses natural resources and related activities as an educational framework and a mechanism to engage community members in order to strengthen the broad, socio-economic network comprised of those for whom natural resources are a vital component of lives and livelihoods" (Fond du Lac Band of Lake Superior Chippewa, 2018). Among many community programs, Thirteen Moons puts on a

Manoomin Camp every fall to teach all interested how to harvest and process Manoomin. These Indigenous-led projects are committed to sustaining, revitalizing, and passing down Indigenous foodways. Fighting and adapting to climate change are the most pressing environmental factor impacting Indigenous foodways, as climate change and pollution from resource extraction threaten the availability of these local foods that have been around for so long.

A fascinating research project called the Decolonizing the Diet Project (DDP) led by Martin Reinhardt out of Northern Michigan University is another example of food sovereignty in action. The study's goal was to reconnect humans with the food indigenous to the Great Lakes region by challenging 26 subjects to only eat foods that existed in the Great Lakes region prior to the arrival of the Europeans. Not only did the physical health of the subjects improve, but they learned to obtain and prepare those regional foods on a regular basis (Reinhardt, 2015). DDP created a cookbook and continues to be a community resource and gathering place for sharing, preparing, and protecting Indigenous foodways.

Food sovereignty benefits all people. The Appalachian Feminist Coalition and Eastern KY Mutual Aid put on canning camp as a "homage to community building and food sovereignty" in 2021 (Appalachian Feminist Coalition, 2021). It was a virtual network of synchronous canning and fermenting projects livestreamed by volunteers experienced with home food preservation. Participants could log in to make food and learn in real time. It was also a physical network of people donating and delivering money, excess vegetables, and canning supplies to participants who could not afford or access them. Some participants made extra goods to give away or donate. This is an example of mutual aid and a harnessing of community power—a structure that could be replicated over and over by communities vast and small. Especially in colder climates, where we cannot grow gardens year-round, manipulating food for preservation is a keystone to food sovereignty. A healthy and sustainable community is made up of people who have the power and resources to share knowledge and define their food systems.

Food Science and Community Health

Organizations that specialize in supporting community health often focus a dimension of their work on food. The COVID-19 pandemic exacerbated deeply rooted social tensions, inequities, and instabilities in our current community health systems. Some organizations built scaffolding for

community health, and some continued their work with a fortified direction or purpose. It is a good time to be a socially conscious food science professional, and it will only become a better time. People passionate about food and community care might find a home bringing their expertise in food science to the community health field.

In January 2020, I accepted a position with an organization focused on community health in rural northern MN. The project was The Finland Food Chain, and I served as their education coordinator. The Finland Food Chain's vision is of a Northeast MN that is food sovereign, climate resilient, and economically sustainable (Finland Food Chain, n.d.). Projects to work toward this vision included coordinating the farmers market, building a community garden, constructing a small grains processing center, writing grants to keep the project going, and providing educational workshops and seminars on local food. By March, when the pandemic began affecting the stability of food supply chains and means of employment, we felt an increased sense of purpose and urgency in our vision. We saw record numbers of people looking for alternatives to grocery stores to buy and sell their goods. While we were planning on providing in-person classes throughout the spring and summer of 2020, we shifted to Zoom seminars and question-and-answer sessions. One seminar focused on cottage food law and how to navigate it as a producer. Another seminar addressed dry corn processing, including nixtamalization, grinding, and storing. Yet another featured a panel of root cellar users and constructors sharing their experience, knowledge, and food storage tips. While I coordinated these programs and others, booking presenters and facilitating the experience, I found myself able to chime in and answer questions as well. Many times, the food safety aspects of certain processes needed to be explained, as well as how folks at home can test the safety of their food. These topics were all things we learn as food science students, applied on a community scale with real people on the other end of the call. Combining passed-down wisdom with scientific answers to "why does this work so well" or "why do we do it this way" empowers those learning this information with the full story. It brings more nuance into the conversation rather than fostering the sense of safety regulations as purposeless bureaucratic impositions due to lack of understanding. And with the full story, practitioners can apply their understanding of food manipulation to other processes. A food scientist is uniquely positioned to fill roles like these.

While this story may feel niche, there are plenty of other opportunities related to this mission across communities that a food scientist is uniquely equipped to contribute to. Community centers, food banks, certified processing kitchens, and even some farms are making value-added or preserved products for their patrons. Having someone professionally trained in food

safety, preservation, manufacturing, and regulations running that program is a great benefit to these organizations.

To get into this field, I suggest looking for organizations doing meaningful work in the community, talking to people doing such work, and getting involved however you can. Sometimes projects are short-lived because they are grant funded, but even time-limited projects have the potential to morph into something more. Some organizations have been on my radar for years, and I check back on them occasionally to see what projects they are moving toward and if my skills and background are suited to those. For instance, here are some that I follow: The Land Stewardship Project in Minneapolis, MN, envisions a local food supply in MN that supports all inhabitants. In addition to supporting projects and networks of community-minded individuals, they also play a major role in changing and shaping food policy, something that those with a specific interest in food law may have a penchant for. The Goodman Community Center in Madison has a variety of social programs, including a food bank and community kitchen. The Latino Economic Development Center in Minneapolis, MN, has a commercial kitchen and offers entrepreneurship mentorship and coaching in a variety of fields, food production being one. No matter where you are, you can find many organizations such as these. If you have interest in community health and the ways community-based food systems work, organizations like these could be for you.

Food Science and Education

Education in all its forms is a way to integrate food science knowledge with community knowledge and local food systems. With a large portion of the population in the United States reassessing how food and other resources move through communities amidst our new normal of a sweeping global pandemic, there are students of all ages who are ready for learning and reimagining how we take care of each other. One of the major ways we care for each other and our communities is through food! Many of the projects I have described in this chapter already could fall under the broad umbrella of education.

A food science degree can bring a great foundation and passion to teaching in formal education settings. In late 2020, I became the coordinator of a school farm in Western North Carolina. The scope of this job spanned farming and education, as I was responsible for growing food that fed into the dining hall of the school and for teaching science classes. One course I

designed was about preservation and dairy science for middle school students. We covered lactic acid fermentation of vegetables through experiments with sauerkraut and kimchi, learned about pickling and thermal processing through recipe development and sensory comparisons, and learned the basics of cheese making and the chemical composition of milk. The school has a dairy cow, so we were able to practice homogenization and pasteurization as we learned about those processes. This course lit a fire in my students. They told me stories of the foods they were making at home, and when school conferences rolled around, they brought kimchi to their conference to unpack the science behind the recipe in front of their parents. I used my notes and textbooks from my undergraduate courses in lesson planning and sometimes distilled the notes, diagrams, and charts in the lessons to share with my students. Students who recoiled at the thought of taking a science course were ignited with curiosity and looked forward to class every day. I could not have taught this course with such depth and creativity without my comprehensive background in food science.

Formal education takes many forms, and the school in the previous example happens to be quite informal in the way it structures classroom education. I designed the course. No one told me what to teach or how to teach it. Many other jobs lack that flexibility. However, if teaching young people is something that interests you, an applied science background could make you a standout candidate for a science teaching position. Some schools, usually private, charter, or STEM-focused schools, offer food science classes to their students. Home economics, agricultural science, entrepreneurship, chemistry, or physics courses could also be good fits to incorporate food science into your curriculum. Non-public schools also are more flexible in their teaching degree requirements. Other teaching options are community colleges, if you have substantial work experience or a Master's degree in food science or another related field.

Learning also happens in informal settings or outside the bounds of a structured classroom or curriculum. I spent a summer as a food science mentor to a group of late high school students participating in a UW–Madison pre-college program (PEOPLE) for low-income and potential first-generation college students. Students in this program spent summers at the university getting to know what they might study if they choose to attend. Through a collaboration with the PEOPLE program and another local organization called Mentoring Positives, I worked with a group of students as they practiced food science and entrepreneurship while designing the perfect frozen pizza for mass production and sale. Over the course of a month, the students visited pizza shops in Madison for inspiration, learned about food safety and shelf stability, and developed their recipes in a test kitchen.

I helped them with recipe development and sensory testing, while other mentors helped them identify their market and prepare their "pizza pitch." The goal of this summer project was to present a recipe and marketing plan for the Mentoring Positives program to adopt, and the students succeeded! Years later, the Mentoring Positives students still spend one day a week producing pizza at FEED Kitchens, a community-certified kitchen, and sell their pizzas to the Madison community (Off the Block, 2018). This mentoring organization got its start with salsa with the exact same model. These are food systems for the community by the community, and they started with a mentoring program and some passion. This is food science education at its core.

Food Science and Agriculture

I would be remiss not to mention agriculture when talking about community-based food systems. Many community organizations and businesses that do work in the focus areas mentioned in this chapter— education, community health, research, and outreach—partner with farmers or have a farm or garden as part of their mission. Though most of the food manipulation aspect of food science happens after food leaves the farm, food safety and quality assurance in harvest and post-harvest handling of fresh produce are aspects of food science that farms practice every day.

I have personally found farming to be one of the most direct and rewarding ways to engage in a community food system. After getting my start volunteering at UW–Madison's student-run farm, I worked seasonally at several different educational farms and farm businesses after graduation. It was not until I worked at a community-supported agriculture (CSA) farm that I realized just how many on-the-ground food safety practices we were using when harvesting, washing, and packaging produce. Farm businesses—like organizational, family, or cooperatively run farms that sell produce directly to consumers, restaurants, or stores—are required by law to handle their produce in certain ways post-harvest to maintain food safety and quality. All farms above a certain size are required to take Food Safety Modernization Act (FSMA) training to ensure they understand the requirements and are implementing them correctly. The United States Department of Agriculture (USDA) and state departments send agents to farms to help farmers figure out how to implement requirements as needed.

Food hubs, or local food aggregators that buy from farmers and then handle the consumer sales, are also in an important position to ensure the safety of the produce coming into their facilities. Oftentimes food hubs have processing equipment or cleaning equipment for the farmers in their network to use, in addition to large amounts of cold and temperature-controlled storage. Tractor Food and Farms is a food hub I sold to in Western North Carolina, and they are an incredible resource for farmers and consumers in the community. The food hub model is a prominent tenant of local food distribution networks, and it works! Well-rounded knowledge in post-harvest handling from a food science perspective is valuable and necessary in these facilities. Whether it provides knowledge that you apply to your own farm or informs a career in upholding, creating, disseminating, or field-testing farm-practical food safety practices, a food science degree can make you a uniquely qualified individual in local agriculture.

Preparing for a Career in Community-Based Food Systems

The best thing you can do to prepare for a career in community-based food systems is to get experience working in groups. Community-based work is humbling and challenging, and it requires bridging chasms of experience and practice. It is slow-paced because coming together on an idea and implementing it takes time and often involves reworking after setbacks. Chances are, if you are reading this chapter with an interest in pursuing work in community-based food systems, you are already juggling many of your own groups and extracurricular activities. That was me in college: I led volunteer groups, participated in product development competitions, cooked meals with kids and adults at a community center, attended roundtable discussions and seminars hosted on campus, and joined as many organizations that were aligned with my interests as possible. Throughout all of that, I experienced group work in many settings and circumstances. If you experience and engage purposefully with as many facilitation and group-work styles as you can, you can build reflection time and learning into those experiences. For all careers within community-based food systems, the most important skill is working in groups, leading groups, and building rapport.

Alongside group work, I recommend engaging in work outside the walls of your university while a student or at least engage in work connected to the

community outside your institution. Working with people culturally, generationally, economically, and politically different than you is vital. Through connections I made outside the community, I was able to attend a multi-day workshop entitled, "Dismantling Racism in the Food System," put on by Growing Power. That training was a launchpad for me as a white person in understanding how to connect intentionally to the work of growing a just and community-based food system.

Building a specific skill set outside of the food science major is the next step.

The applications for food science in community-based food systems are vast and require skill in areas outside what you will study within the degree requirements. In addition to the food science intersections I have already listed in this chapter, grant writing is an invaluable skill in the current community food systems landscape. Taking classes or diving deeper into systems thinking is incredibly valuable as a way to wrap your mind around how systems work all around us. Business, economics, and entrepreneurship are also great disciplines to hone in on. Extracurricular activities, creating interdisciplinary experiences for yourself through research or minor studies, and exploring multiple avenues of food science in summer internships are some common ways you can gain experience that can both help you find where you want to land and gain skills along the way.

Conclusion

A career in community-based food systems is interdisciplinary, dynamic, and rewarding. Food scientists in this field have a role to play, from ensuring a safe food supply coming out of farms and small producers to sharing the knowledge of preserving or manipulating food through education. The concepts that make up food science are co-opted ancestral and communal knowledge. Holding food science in this community context, we can take part in weaving the knowledge held within communities with the research and technology of the profession as we know it. Blending knowledge systems is the start of bringing the power of ensuring a safe, healthy, and culturally appropriate food supply back to the people. Dare I say we are here to work ourselves out of our jobs as they currently function within our food system? Definitely.

> There's a new world comin', everything is turning over. Where you gon be standin' when it comes? —Toshi Reagon

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Federica Ranelli is a curious farmer, educator, and environmental naturalist living in Teejope (day-JOPE) on ancestral lands of the Ho Chunk people, in what is known now as Madison, Wisconsin. She holds an undergraduate degree in Food Science from the University of Wisconsin–Madison and a master's certificate in Environmental Education from Antioch University New England. Federica has had a passion for community-based food systems since she was an undergraduate and has grown in that passion both figuratively and literally. Her life's work is at the nexus of food production, education, and ecological stewardship and has practiced it in a variety of ways: environmental educator, interdisciplinary middle school science teacher, school farm coordinator, among others. Preserving the harvest has always played a large role in her teaching and personal life, and she loves to share the craft (and the delicious results!) with students of all ages. Currently she works at Rooted as the farm manager, stewarding a three-acre urban vegetable farm and guiding farm curious individuals through an Urban Farmer Training Program. Humbly participating in and facilitating collaborative spaces with groups of people is a skill Federica is always honing, for it is one she deems necessary for anything based in generative community building.

Chapter 27
Working for a Startup Company

Samantha Rudy

Introduction

A food science degree can take you almost anywhere within the food sector, as you are learning throughout this textbook. As a young professional, I applied to jobs within quality, research and development (R & D), and sensory groups at companies big and small as I had little idea of exactly what I wanted to do. It is no secret that applying to jobs and internships can be a grueling and unrewarding process. Sadly, it is not uncommon to hear back from 3 of 25 applications, which is why working smarter is essential. This starts with valuing your own time and making sure you are not wasting energy on applying to positions that you do not want. Within this chapter, I break down what it takes to work in a startup environment in the hopes that readers can reflect and learn about how startups work and if it is a comfortable fit as a young professional.

A Brief Intro to Me

During my time in UW–Madison's food science program, I was exposed to different types of work settings. After spending a year in ice cream manufacturing at Babcock Hall, I had an itch for a more dynamic day-to-day job. I transitioned into the role of assistant research cheesemaker at the Center for Dairy Research, which opened my eyes to what consultation R & D can be.

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I loved working on new projects anchored in serious cheese science and technology innovation with clients from large cheese makers to small Wisconsin dairy farms. Over these 2 years, I fell further in love with cheese (if that was even possible) and knew my ideal workplace would include a group of tight-knit, innovative minds. That being said, after a summer interning at one of the largest companies around, Bon Appetit at Google, I recognized the benefits of a global corporation. On the Nutrition and Food Choice Architecture team, I worked closely with a brilliant group of people on food choice behavioral science studies and saw firsthand how much can be accomplished with a big company's resources. However, the Bon Appetit team faced a lot of red tape to implement global projects making it hard to connect effort to tangible outcomes. After graduation, I stumbled into what brings you here today—food startups. Meati Foods gave me all I could ask for in an entry-level position. Meati uses biomass fermentation of mycelium to create whole-cut alternatives to steak and chicken with unbelievable nutritionals. I began as a food technician just after they closed series A funding and currently serve as an associate food scientist on our rapidly expanding team as we aim to launch our first product into the market.

I am the first to admit I am no expert when it comes to startups, yet here I am, attempting to provide a guide to everything I wish I knew before diving headfirst as the 16th employee at Meati Foods. While my experience at Meati is indicative of the bones of startup culture, I turned to two other food science graduates for their startup experience while researching this chapter. The first is Cole Bielen, who began his career at Perfect Day as an intern for the Food Product Development team just after series A funding closed. Over his 3 years at Perfect Day, he was promoted to research associate and then to process development engineer while the company grew from under 20 employees to over a hundred with international locations (C. Bielen, Personal interview [Written interview], 25 June 2021). My second expert is a fellow chapter author in this very book, Leann Barden. Her experience as research manager of R & D at RX Bar and innovation manager at a plant-based startup called Ish Foods highlight both teenage and seed years of food startups exceptionally well (L. Barden, Personal interview [Phone interview], 28 June 2021). I fit somewhere in the middle, with my experience more aligned with Cole's when he joined Perfect Day. Each stage comes with different expectations, challenges, and cultures I will uncover throughout this chapter—as well as questions you may be embarrassed to ask like what a stock option is and how do I land a job at a startup with no posted job openings.

This chapter begins with the basics, defining the startup funding stages and how this impacts you as an employee. Next, I will guide you through some unique aspects of the interview process for startups including the

structure (and sometimes lack of) from point of contact to some smart questions to ask your interviewer(s). Following the interview tips, I flesh out day-to-day expectations—in my experience, some controlled chaos—to give a sense of what your career in startups may be like. For all those thinking about the perceived risk of joining the startup ship, no startup is the same; I will review Cole's, Leann's, and my perception of this risk and some advice on how to maneuver it.

Brush Up on Business: What Dictates a Startup?

Most envision a startup as a tiny group of under 10, creating benchtop versions of their product at home or a small lab if they are lucky. This may be the case in ideation or seed funding rounds, but not forever. Before you begin your startup journey, it is crucial to understand some of the funding terminology and implications that set the framework for your day to day. Even though I entered Meati with next to no startup knowledge and did a lot of learning on the job, it is helpful to have some idea what you are getting yourself into. Each funding stage term refers to a phase of outside investment in the company to propel growth. While not every startup needs all of these rounds to fully launch and bring in revenue, the starting point is similar. Below I outline the major funding stages and what this implies for you as an employee.

Seed Funding

This is the first official equity stage and evaluation of the company (Saghafian, 2020). Often money is coming from friends, family, founders, or incubators for some equity in the company. Here the company is valued by assessing the market size, management, business strategy, and product development, among many other things. This is when a target product is solidified (no one is expecting it to be scalable quite yet) and the target market is fleshed out. Seed money is used to create the initial team beyond the founders and to start much of the actual work. In my experience, Meati's team was just the cofounders, a few fermentation scientists, a microbiologist, and two food R & D members. Prior to team formation, the cofounders spent years researching the mycelium as a replacement electrode for lithium-ion batteries before pivoting to food and expanding when recognizing the nutritional value. This groundwork was essential to early product development success in seed

funding. It is also common at this point for consultants to be brought on part-time for expertise in food engineering, marketing, or finance depending on the founder's knowledge and team's knowledge gaps. This is what joining at a seed funding round may mean for you:

- Scrappy testing with any equipment you can get cheap to spec out potential larger purchases. Maximizing time, often with very little, is the reality.
- Long days, weekends, and potentially nights devoted to work. Process optimization takes a long time; you will not be walking into a place with "production hours" or have pilot plant trials.
- Be ready to get close to the people you work with. In Leann's experience as the first employee at Ish, she emphasized relationships are more important at startups than large companies by a landslide.
- No built-out company structure like an HR department. This is why those relationships are so important; you will get close to and rely on your coworkers in a unique way. Moving to a new state for my job, I felt lucky for the startup environment bringing so many wonderful people into my life and Cole highlighted this as well (C. Bielen, Personal interview [Written interview], 25 June 2021).
- To quote Leann, "One year at a startup is seven at an established company." With things moving so quickly, there is little room for retesting and a large demand for results (L. Barden, Personal interview [Phone interview], 28 June 2021). There is no "red tape" to get your test on schedule at this stage; you just make it happen the next day if you find a new lead to chase.

Series A

The first larger venture capitalist funding round has shown the company has a minimal viable product rather than just a cool idea with some passionate people behind it. This is a huge milestone as less than 10% of companies that raise a seed round get to a series A funding point (Bryant 2021). This round is all about further developing the product, process, and scalability. At Meati and many other food companies alike, there may not be any customers or revenue yet. Meati had a test market of our steak in a Bahn Mi sandwich at Salt, a local Boulder restaurant, just to get market feedback. In-home usage tests (IHUT) may happen at this phase too; it is all about dipping your toe in and gauging your market. Expect some growth in the team as well; here the goal is getting the key team in place to take the company to the next

level and is where I began my journey at Meati. In a day-to-day translation, this is what you can expect:

- Testing days will be long. You will likely just get thrown in, expected to learn a lot quickly, and make the most of each day. You are at the mercy of your current process, and if that means you get in early and stay late, you do it. Just before I started, Meati acquired the space next to headquarters to develop a pilot plant and to have the ability to rent larger-scale equipment. This was an empty chocolate production area, not ideal for Meati since it was previously used as a dry plant (we had lots of floor flooding since it was not sloped correctly for wet production), but you have to make it work. In my first few months, I scrubbed walls and pushed water toward our drains next to a vice president of the company after a small mycelium explosion—it will always be all hands on deck.
- Meetings will be extremely casual. At Meati, there was not much formality in general as a new employee with only 15 coworkers in total. This coincides with a lot being expected of everyone on board, and your ideas being valued as company culture is refined. A perk of this is the vertical transparency; you get to have a voice to the top even if you are just starting out in your career. You were brought onto the team because the founders believe you have something to offer. At Perfect Day, Cole spoke highly of the flat hierarchy and was frequently able to chat with the cofounders about his work and the company direction (C. Bielen, Personal interview [Written interview], 25 June 2021).

Series B

Now that we are getting down to business, with the large growth from series A, the startup has likely grown as a company and nailed down their processing. At this point, heftier venture capitalist firms become involved. At Meati, this meant Bond Capital came on board and there were larger deliverables expected, goals to be met, and hopefully customers to be served. In terms of day to day, I watched these things change as a member of the food team:

- More legitimate meeting structure, company goal charting and processes, branched out teams like HR, marketing, finance, and new benefits packages will likely become available.
- Innovation pipelines start to get developed; it is not just about what you started anymore. All eyes are on the future.

- Huge growth in employees, team sizes, and building out spaces for research and production. As one of the earlier members in Meati's first growth phase, I helped train all new hires. Quickly I became an "expert" when it came to our product and processing. As a young professional, this can be overwhelming but is common in startup culture. Everyone on the team carries responsibilities and these increase as you move forward. Luckily, you will have a bigger team to help. When Meati brought in an additional food technician, I helped get him up to speed just 10 months after I started. This pushed me to be a better leader, communicator, and strategist in ways I may not have otherwise had this early in my career.

Series C

If you get to series C, the company is already a success in some form. The goal here is to continue to scale as quickly and cleanly as possible. To give you some perspective, Perfect Day raised 300 million dollars in series C with ice cream products utilizing its technology already in stores (Watson, 2020). Joining at this time will be more similar to an established company. While Meati is not quite there yet, Cole and Leann have been at startups during series C funding. RX Bar was acquired by Kellogg's as Leann joined the team (L. Barden, Personal interview [Phone interview], 28 June 2021). While it already had millions in sales annually, it was still a startup where she knew all the employees well and workplace politics were minimal since it existed as a subsidiary under the Kellogg's umbrella (L. Barden, Personal interview [Phone interview], 28 June 2021). Following are key notes about companies at this stage:

- More money to build new products that were vetted out in series B.
- A possible route to scaling at this level is by acquisition; this is up to the founders/board and the direction they want to take the company. Anything is possible if/when this happens; not all of the original team may be acquired but big changes are likely. Always read up on the new parent company to assess if the changes will be something you like as an employee at the new corporation.
- This may be the last stage of outside investment, but some companies move on to series D and E funding. Companies here are valued on hard numbers rather than projected valuations in the earlier stages. It is officially the big leagues.
- Cole emphasized that as Perfect Day grew, your role "will likely become more specialized and interaction with other teams will be limited, more

in-line with a larger organization" (C. Bielen, Personal interview [Written interview], 25 June 2021).

No matter what stage you join, be sure to look into who is giving them the money, as this matters! You can gain huge insight into the expectations for the company's pace of scale-up based on where the money is coming from. In my experience, the biggest difference was tech vs. food-based funding. By "based" I mean the food industry experience of the venture capital (VC) or funding source. This can lead to different expectations of the R & D team and timelines of scale. Personally, I was attracted to Meati even more after learning series A investors (Acre) were involved in the food world and have an understanding of the timeline and resources needed to develop food companies successfully. This is often not as quick as a tech company can scale. There was ample collaboration on top of just giving us money. This was the same for series B where Bond Capitol served as our main funding source and teammate. We all need to want Meati to win. It is important to remember that no matter the quality of an investor at a startup, you will still be asked to do wild things in a ridiculous timeline. That is just the name of the game. This being said, tech funding is not to be shied away from; this is just my experience. Many companies have successfully launched with tech-focused VC funding.

How Much of This Do You Actually Need to Know?

Now that you understand the basics of startup funding rounds, realize that all of this is not essential to know before beginning at a startup—take it from someone who knew 0% of it. If I could go back, with Cole and Leann backing me up on this one, it may have been a good idea to enroll in a general business class at school if this is something you really want to pursue, or at least do some research. I found most of this information easy to catch up on with online resources, having older and experienced food veterans for coworkers, and a transparent executive team that welcomed questions from startup newcomers. Especially in the startup world, it is all about helping the team—this is not a solo journey.

Startup culture will evolve from one that is more playful and laid-back (fun happy hours weekly—albeit with the pressure to always show results) to a more structured company. There still is a fun and laid-back nature, but some of this falls away to real onboarding programs and personal quarterly goal tracking. This is a good thing, and the fun is still there. Getting in on the ground floor has given me the opportunity to be a part of creating the culture

at a brand-new company. An early start also means you get to be a contributor showing the value of the company through funding rounds and helping to deliver early on. There was definitely a rush while helping prepare for Bond Capitol's representative luncheon at Meati headquarters.

All this being said, the "right" time to join a startup is based on you. Someone who needs more structure should look toward later funding rounds and established business practices. If you want some daily chaos and thrive even with a lack of structure, the building blocks employee team could be for you. Chef Dave Chang once said, "We're hoping to succeed; we're okay with failure. We just don't want to land somewhere in between." As Chef Chang alludes, failure is almost as important as success. At a startup, it is all about quickly turning failures into usable learnings. If this is something you struggle with, I would not advise a career in startups. In the next section, I will outline the "startup" personality to shed more light on if this could be for you.

Startup Personality

> Skills can be taught. Character you either have or you don't have. – Anthony Bourdain (Bourdain, 2018)

Bourdain may have said it best; startups are for a certain character and not just for any expert food chemist or engineer. It is not for everyone and learning if it could be for you is why you flipped to this chapter! How handy. While the fast-paced, scrappy idea of life at a startup can be alluring, it is better to know beforehand if it is an environment you would thrive in. If interviewing in the seed or series A times, it is important to know you will wear many hats within the workday. Cliche, I know, but everyone at a startup, especially early on, is a flex player. Cole, Leann, myself, and anyone who has worked at a startup would likely agree with this. Being adaptable, quick thinking, and a risk taker is crucial. Fail forward (L. Barden, Personal interview [Phone interview], 28 June 2021). Everyone on your team is counting on you to learn from all failures and not to get down on yourself.

In the presence of daily failures (yes, they will happen daily), you cannot be ashamed. The team needs to know the root causes of errors and deviations immediately to learn; it is no secret we learn far more from failing than we do from small successes. Beyond embracing failure, someone who does not like to work outside of their job description may struggle at an early startup. You are building something from the ground up, and this includes jobs outside of your job description in food/quality/engineering/scientist. In

my first week at Meati on top of helping run experiments to optimize and vet out processing, I took out the trash, cleaned out fryers, and restructured R & D inventory. I washed dishes with food industry veterans 35 years my senior, as a sanitation team does not exist this early on. This also means learning new skills and performing tasks you never thought would be a part of your job such as the following:

- Creating a data management/tracking system. I had no experience in this but saw a need for optimization here and figured out what would work for us internally. It is all about the ability to see gaps and fill them.
- Helping to develop quality parameters through our unit operations, even as they change monthly, to trend with our sensory data.
- Working odd hours (Saturdays, coming in to run production at 6 am or staying until 8 pm).
- Shipping packages to investors/advisors.
- Ordering equipment and supplies.
- Organizing and preparing for sensory training sessions.

If you are unsure if you are the right fit for a startup, I have outlined some traits I have observed in coworkers and found essential to success while working at Meati:

- Self-motivated: Start optimizing a process without being asked; come to the team with new ideas regardless of your role. You are on the team for a reason—bring all ideas to the table.
- Not afraid to work independently.
- Ability to prioritize quickly and recognize when something is no longer important. You cannot get offended or flustered if a project you are working on gets scrapped after weeks of work. Time and resources can be limited so every day needs to be put to use, and working fast is crucial. I spent many days working in production executing tests alongside my entire team, all of us running around from 8 am until 6 pm—or whenever the work for the day was done. It is always all hands on deck.
- No idea is a bad idea—you cannot be afraid to sound dumb. Do not be afraid to share your crazy ideas. Some of the craziest ideas at Meati are focal points now.
- If you believe in something, go the extra mile; they need you to be innovative and are counting on it. Run a test with extra material or reach out for ingredient samples, especially if you think there is a small chance it could change the game.

Before wrapping up, it is crucial to share that we are all different and by no means does everyone on my team have all these qualities. Each team member brings different traits to the table, and it is a diverse team that wins. Be

ready to rise to the challenge. Despite this, there are a few characteristics I have noticed that thread the team at Meati together: everyone is inherently curious, innovative, and has a mind that enjoys solving problems. Teamwork is taken to the next level at a startup. If you have made it this far and still want to dive into this crazy world, let us chat about how to score an interview and get that job offer.

Landing an Interview: What to Expect and What to Ask

You have set your sights on working at a startup. How do you make it happen? Since there may not be open positions or a career section to browse through, reaching out on LinkedIn or the company's website with an elevator pitch and your resume is encouraged. Even if they are not hiring for your desired role quite yet, having your resume on hand is helpful as roles usually need to be filled quickly. Startups view interest and passion as essential as experience and will respond positively to it. Cole applied to Perfect Day for an internship in the company and got an interview after a few months. Both Cole and Leann interviewed over many rounds. While this can be common in the food industry for higher-up roles, it is not as common for an internship. At Perfect Day, Cole was interviewed by both founders, the chief technology officer, and team members, which is uncommon for an entry-level position. This round of interviews summed to a 4–5 hour ordeal after an initial 45-minute interview (C. Bielen, Personal interview [Written interview], 25 June 2021). This is not unusual. My story is a little different; always remember there is no one path to a startup career! Initially, I was contacted by a recruiter who found my resume online after noticing my cheese and beer research experience in addition to manufacturing, which overlapped with some of Meati's processing at the time. I interviewed with the innovation manager, and a few days later, I had a job I did not even apply for myself!

The Interview

Now that you have an interview, let us chat about preparation. Technical knowledge is crucial of course, but culture fit is taken to new heights when interviewing at a startup. Especially in the earlier stages, these are people you may work weekends and nights with so they want to make sure that on top of your technical skills you would make a good teammate. Even if you're

the most qualified food scientist for the job, you may be passed over if the personality of the group is a total 180. Trust me, it is better off that way anyways. When a group is so small, synergy is just as important as capability. They also want to gauge if you can bring more to the company than just the role they are interviewing you for—yet again, everyone must be a value-added flex player at the start. Be ready to answer questions about your adaptability, flexibility, and nearly all personality traits earlier mentioned. They also want to ensure you are in it for the long haul and you believe in the company; there is no room for dead weight.

In my experience, I was asked to discuss my cheese technology knowledge and elaborate on my approach to the sorghum beer capstone I completed at university. During the interview, I was surprised that the time spent on technical aspects equaled the number of personality questions. After the fact, I learned they were sold on my experience from my resume to bring me on hourly to start and the interview was to confirm and determine if I would get the job done well and fit in with the current team. Culture fit is everything.

Questions to Ask

Whether you have startup experience or not, it is helpful to have some smart questions ready to gauge company progress. Here are some topics to cover that will help you see where the company stands, especially if interviewing at an early stage:

- Do they have a HACCP plan or quality program? This can help determine how far along they are in becoming a real company.
- If you can sample the product—while I did not get the chance to do this—I recommend asking if you can.
- Ask about where their money is coming from, as I mentioned before, this can tell you a lot.
- Determine what type of team they are trying to build and how they plan to fill potential knowledge gaps. At Meati, the founders are two PhDs from the University of Colorado Boulder, one with a foundation in mechanical engineering and the other in environmental engineering, both with no food industry experience. I followed the company on LinkedIn and saw they prioritized bringing industry R & D, manufacturing, engineering, and fermentation veterans on top of young talent to (I hoped) ensure a thorough development from an extremely young age of the company. I am biased toward Meati, but trusting your cofounders is vital.

Potential red flags: A few things to watch out for when going through the interview process. Some of these points may not be the end of the world but deserve a follow-up question or two:

- Lack of organization and direction.
- Inability to recognize things that they do not know and seek out those who do.
- Cash flow management: Try to gauge if you trust the founders.
- Lack of adaptability: If all of a sudden a cereal company is found to make better granola bars, would the founders be okay changing in order to continue the company?

At the end of the day, you need to be inspired and impressed by the company mission just as much as you need to nail all the classic aspects of an interview. If you come in with solid research and are not sold on the team, it is okay to decline any future offers. They are looking for people who will be as committed to the company as the founders; if this is not something you can offer, it is likely you may not last long anyways.

Landed the Job: Let Us Dive in

A Note on Offer Letters for the Young Professional

I had no clue what my stock option plan meant within my offer letter. At startups, you are often given a stock option offer in your contract upon hire. Your option price is set based on the current company valuation and is fixed once you are hired. Getting in on the company earlier means a lower initial value per option and often a larger cut of options. This can lead to the "payoff" you hear about when a company goes public and you can sell those options. Employees vesting their options also show future investors the employees believe in what they are doing. Here is an example of a typical option schedule: After 1 year, you can vest 25% of your total X shares, and each month after that, you get a fixed percent over the next 3 years. This is to motivate employees to stay with the company if you want to eventually try and sell the stock should the company go public. You will have to accept the agreement to ever exercise it, but there is no penalty to never using your options. If you are thinking startups may offer far lower salaries than big companies, this depends. In my experience, Meati gave me a competitive salary for an entry-level food science position and in doing so continues to attract talented individuals for these types of positions. Based on the time

you join the startup and amount of funding they have, the starting salary may be lower, but this is something you can gauge fairly easily with research even prior to your interview.

Day to Day

Coming in as a food technician, I learned quickly that the job description is not always what you end up doing. Cole and I observed you have a lot of added responsibilities at startups and have to address problems as they arise. Commitment to the team and the mission you are working toward, not just what your job is in the description, is essential. Furthermore, the product development and company must move very quickly. You have to be motivated to explore the unknown for the good of the team. Personally, I learned more about texture analysis technology than I ever thought I would in order to develop analysis techniques for our product. Overall, be ready for every day to be different. The emphasis here is that you must be open to a range of projects rather than what you may enjoy most.

Some Difficulties

Things will not always be easy at any job, but startups come with unique challenges. For example, strict procedures for executing tests will not be set in stone at the start. Larger companies often put resources into young employees to close gaps in experience that startups do not have established, like senior mentorships. Additionally, in Leann's experience (and mine as well), you do not always have the equipment to run analyses that are easy to do at other companies like HPLC, GC, or even water activity, at the beginning (L. Barden, Personal interview [Phone interview], 28 June 2021). There can also be a "get it done at all costs" mindset, which leads to longer than 40-hour weeks and employees not utilizing vacation days at the same rate of larger companies. While work–life balance is strongly emphasized at Meati, they do expect us to put in the work necessary to get the job done. In my experience, that meant shifting work times to begin at 6 am or 1 pm if the fermentation schedule required it. The desire for a typical, clock-in/clock-out, 9–5 job is not what you are getting into with a startup.

All this being said, Leann, Cole, and myself all found the startup experience extremely rewarding. It is important to remember each company, no

matter the size, will come with challenges. Your commitment to the team's success is what makes the wins that much sweeter.

Risk Analysis

It is impossible to talk about startup careers without covering the risk involved. Obviously, there is a chance that the startup could fail, and you will be out of a job. Ninety percent of startups do not make it to series A, many never get past that, and the toughest years are often 2–5 as the company matures and scaling is demanded from investors and hopefully clients (Bryant, 2021). Leann offered some excellent perspective to this, highlighting that there is always risk involved at food companies outside of the startup sector. Company purchases, sales, mergers, and trades are so common that you must be prepared for shifts no matter where you end up and she did not perceive the startup risk to be greater than other jobs she has had (L. Barden, Personal interview [Phone interview], 28 June 2021).

The bottom-line advice here is as relevant even if you never enter the startup world: a safety net is good to have, and if that is not a possibility due to loans and life demands, always have a plan of action. With Meati being my first job out of college, I had some savings and a family who I knew would support me with a place to live should all else fail. This is a privilege; be sure to ask those finance questions in your interview to gauge how much you trust the founders with your job and assets as an employee. Many are not lucky to hit the jackpot of timing, product quality, and strategic launch team from R & D to marketing.

Startups: A Chapter Distillation

If you made it this far, I hope you have learned something. If you just flipped to the end for the highlights of food startup knowledge to see if you want to read the rest, here it goes:

- Research the funding stage of the company to better understand the level of company development. The earlier the stage, the scrappier and less workplace "professional" the structure will be from meetings to testing.
- Do not ever work for a startup you do not believe in (it also seems like a waste of everyone's time to do this). I have had conversations with nearly all my coworkers at Meati Foods about lying awake at night thinking about work. We are all a bit obsessed because we need to be.

- This is not the industry for someone who shows up to work for a paycheck alone or expects a repetitive, predictable day to day.
- Startup employees respond well to those with passion, reach out, and sell yourself if you want to land an interview. If you do, be ready to be judged not only on your skills but if you would fit in with the company culture—trust me this is for the best.
- Take a business or finance class while in school (Or research after!) if the startup world is one you want to enter. It is not hard to catch up but is helpful to have some of the basic terminology down going in.

My main takeaway after a year at Meati is that above all else, you must believe the product will succeed; this was echoed by both Cole and Leann. To be a successful startup employee, you should enjoy thinking through tough problems, ask a lot of questions, and keep a level head within a constantly changing environment. Should your startup time come to a close prematurely, this is not a failure or waste of time. Other companies will value startup experience on your resume and know all it takes to work at one—even if it does not succeed.

As a 24-year-old still figuring out where I want to take my career as a food scientist, I found diversifying professional experiences is essential to finding answers. From my time at Babcock Dairy to the Center for Dairy Research, Bon Appetit at Google, and now at Meati, the startup work has been the most challenging, but the opportunity to be next in the wave of sustainable, alternative protein options is a gift. No matter what you choose, follow opportunities that push you to think in new ways and grow as a young professional. Your career will thank you.

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Chapter 28
Careers in Sustainability

Carolina Leonhardt

Introduction

With each day that passes, we see more and more headlines about the impact that people, and society at large, have on the natural environment. Our planet, and more specifically our food system, is facing an unprecedented set of environmental challenges. From the climate crisis to plastic pollution in our oceans to toxins in groundwater supplies poisoning entire communities, we know that our actions have significant impacts on our planet and the natural resources we depend on. Additionally, the health and the well-being of our communities are intimately connected to the health of the environment and our planet. This connection is especially evident when it comes to the food system. The way we grow, harvest, process, transport, store, and dispose of food is all a part of our food system. And this system is wholly dependent on a complex network of natural resources and critical ecosystem services that we must work to protect, restore, and sustain.

This chapter focuses on careers at the intersection of food science and sustainability and provides advice for those interested in pursuing a career in this space. Working in sustainability can open your mind to new ways of thinking and require you to be a critical problem solver and persuasive communicator. A career in this field can be personally and professionally challenging yet extremely rewarding.

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What Do We Mean by Sustainability?

The most commonly used definition of sustainability is "to meet our own needs without compromising the ability of future generations to meet their own needs." This comes from the Brundtland Commission created by the United Nations in 1987 in an effort to encourage international cooperation in support of a more sustainable future.[1] Although a seemingly simple statement, sustainability is a multifaceted concept that often includes sustaining the three "pillars" of economies, society, and the environment, and all three pillars are important when considering the longevity of a business, an industry, or society. This chapter will focus specifically on environmental sustainability; however, it is important to understand that environmental sustainability is inextricably intertwined with social sustainability and a holistic sustainability framework encompasses both.

Sustainability and the Food System

Second only to clean air and clean water, nutritious food is critical to sustaining human life. This is true for both current and future generations that will depend on natural systems and resources to feed themselves. The United Nations predicts that the global population will grow to over nine billion people by 2050, which will result in an increased demand for food and the energy, water, and other resources required to support our food system. An important question to consider is how will we feed all of these people and maintain a healthy environment?

Below is a list of key environmental sustainability challenges for the food industry. This is by no means exhaustive; however, it is meant to provide a sampling of some of the issues a professional in this field would be working to address. It is also important to understand that these issues are all interconnected.

[1] Brundtland, G. H. (1987). *Our common future: Report of the World Commission on Environment and Development*, UN-Dokument A/42/427. Geneva.

Climate Change

Climate change is one of the greatest challenges of our time. Our food system is responsible for as much as 40% of global greenhouse gas emissions[2] with animal husbandry, land-use conversion, and transportation as leading contributors. Climate change is also disrupting food supply chains and putting staple commodities, and food production as a whole, at risk. There are many career opportunities that focus solely on mitigating the food industry's impact on the climate.

Biodiversity Loss

The industry is paying increased attention to the important role that biodiversity plays in supporting a stable food system. Food production is one of the primary drivers of global biodiversity loss, primarily through the conversion of land for agriculture and the resulting loss of wildlife habitat. In return, reduced genetic diversity makes food systems less resilient and susceptible to a host of challenges including changing climates and extreme weather events, pathogens, and pests.

Pollution

Pollutants such as artificial fertilizers and chemical pesticides are widely used in conventional farming and are often leached into the environment as run-off. These pollutants have a variety of consequences such as eutrophication of aquatic systems and bioaccumulation of persistent chemicals in the food chain, which, in-turn, have far-reaching effects on complex and delicate food webs. Research in food science is driving innovative ways of producing food to lessen or avoid these types of environmental impacts.

[2] Tubiello, F. N., et al. (2021). Greenhouse gas emissions from food systems: Building the evidence base. *Environmental Research Letters, 16*, 065007.

Circular Economy and Waste

Currently, much of the food system follows a linear path of take, make, use, and dispose. However, to support growing populations and in response to regulatory pressure, the food industry is moving toward circular economy principles that eliminate waste and pollution by keeping products and materials in use for as long as possible. The industry has seen exciting innovations in the areas of sustainable packaging materials, extended product shelf life, and products featuring upcycled by products from the manufacturing process.

Food Waste

One of the biggest sustainability challenges and the most exciting opportunities within the industry is the issue of food waste. Food loss and waste occur at every stage of the value chain, and in the United States alone, it is estimated that approximately 30–40% of food is wasted.[3] Food waste has significant implications on other key issues including food access, resource use, and climate change. Waste can be avoided through improvements in product development and in storage, retail, labeling, cooking, and disposal methods.

Foundational Knowledge and Skills of a Sustainability Professional

For those pursuing a career at the intersection of food and sustainability, there is important foundational knowledge and skill sets that should be developed. Below is a summary of a few key areas to keep in mind when considering a career in this field.

[3] Buzby, J. C., Wells, H. F., & Hyman, J. (2014, February). *The estimated amount, value, and calories of postharvest food losses at the retail and consumer levels in the United States, EIB-121*. U.S. Department of Agriculture, Economic Research Service.

Technical Knowledge

Sustainability professionals in the food science industry are expected to have a broad knowledge of sustainability concepts and be scientifically literate, understanding general principles of environmental science and ecosystem services. Similarly critical is a deeper understanding of the food system and more specifically the environmental implications of the production and processing, transportation, consumption, and disposal of food. This will complement the knowledge you have developed as a food scientist and help you draw connections to the impacts and opportunities resulting from the chemistry, microbiology, engineering, and nutritional aspects of food. Additionally, you should expect to develop a deeper technical knowledge of the topics that are material to your interests, industry/food, organization, market sector, or career path. This includes an understanding of relevant terms, leading non-profit organizations and industry coalitions, reporting standards and frameworks, commitment platforms, and related legislation. The type of organizations and frameworks that you engage with are dependent on your industry and focus area; however, there are a few key programs driving sustainability within the food industry including the UN Sustainable Development Goals and World Food Program, World Resources Institute, and World Wildlife Fund, among many others. It is also the responsibility of a sustainability professional to stay abreast of new technologies, potential partnerships, and other opportunities that might arise in support of your organization's sustainability efforts.

Collaboration and Communication

As a sustainability professional, you will quickly learn that your role requires you to understand, engage with, and influence a variety of stakeholders at all levels of your organization. As mentioned earlier, sustainability can be integrated into each facet of the food system and should be considered a lens through which decisions are made. This includes how food is farmed and livestock is raised, how food is processed, packaged, transported, sold, marketed, prepared, consumed and even ultimately disposed. This system relies on a complex network of stakeholders, including the farmer, food manufacturer, distributor, retailer, consumer, and policy maker, to name a few. As a food science and sustainability professional, your role may require you to engage with many, if not all, of the key stakeholders in this system. To be successful in this space, it is critical to have a strong ability to both listen and

communicate effectively. This will be essential as you will likely be charged with educating and persuading those around you. Similarly, sustainability professionals are often tasked with leading cross-functional teams in support of complex, organization-wide initiatives. This requires strong organizational, team management, and leadership skills.

Systems Thinking

As a sustainability professional, your role will require you to think holistically, taking a systems thinking approach to your work. Hunger, poverty, economic instability, and environmental degradation are all intrinsically systemic issues that require a broader perspective and understanding of all of the elements, patterns, connections, and complexities of a system in order to enact positive change.[4] Similarly, many of the sustainability challenges facing the food system require transformative change that takes into account all of the system's complexities. For example, when developing sustainable packaging materials, one must consider both the upstream and downstream implications of those materials. Where are the raw inputs sourced? How is this material produced? How will this material ultimately be disposed of or recycled? Are the systems (consumer education, infrastructure, policies, and industries) in place to successfully capture and process this material? Or perhaps you are a product developer choosing between two ingredients with a similar nutritional profile, but one requires less water, fertilizer, or land to grow. Another example might be the opportunity to reduce energy use by developing a more efficient food processing system. How do you make an informed decision and consider all the impacts of these decisions? Understanding the basic concepts of systems thinking and developing this mindset will be very beneficial for any sustainability professional.

Where Does Sustainability Show Up in a Food Company?

The aim of a sustainability professional is to facilitate their organization's sustainability goals. Some examples include targets to reduce greenhouse gas emissions or use renewable energy, reduce waste, or improve sourcing practices, to name a few. To do this, sustainability professionals must guide

[4] Meadows, D. H. (2009). *Thinking in systems: A primer*. Earthscan.

stakeholders in applying a sustainability lens to decision-making across the organization. Below is a sampling of some of the key departments that sustainability professionals may find themselves working in or working to influence.

Innovation

Decisions around new product development including ingredients, packaging, and processing methods are all critical levers or intersection points for driving sustainability in innovation. This is a perfect opportunity for someone with a food science degree to leverage their skills in both food science and sustainability to participate on product development teams early on in the innovation process to champion sustainability and reduce the environmental impacts of new products.

Ingredient and Packaging Sourcing

Sustainability professionals often partner closely with sourcing teams to influence and steer sourcing decisions toward responsibly and sustainably harvested, processed, and packaged ingredients or packaging. This can include assessing supply chain partners based on social and environmental practices, geographical locations, transportation modes, processing methods, and third-party certifications to name a few. A food scientist with training in sustainability will be well-positioned to think critically about sourcing decisions, especially when it comes to ingredient processing methods.

Operations/Manufacturing

Sustainable manufacturing practices are critical to reducing operational impact. Sustainability professionals work hand in hand with facility, manufacturing, or production teams to ensure energy efficiency, reduced resource and water consumption, and zero-waste practices are in place. Many sustainability professionals began their careers working in a manufacturing setting and have used this experience as a valuable foundation for developing and implementing successful sustainability programs.

Voices from the Field

A sustainability lens can be applied to all parts of the food system, resulting in a wide variety of potential career opportunities. Many organizations have dedicated sustainability manager roles or even created teams focused solely on sustainability. Some organizations have gone so far as to assign executive level or c-suite roles responsible for leading an organization's sustainability strategy. These roles can live in any major department across an organization including operations, innovation, communications, and marketing or within a dedicated corporate social responsibility team.

Sustainability professionals are tasked with identifying and assessing material impact areas such as natural resource use, greenhouse gas emissions, waste generation, etc. and developing plans or finding innovative opportunities to reduce their organizational footprint, ultimately aiming for a net positive impact.

The day-to-day experiences and career paths of sustainability professionals can vary, and there is much to be learned from professionals in the field. The spotlights below represent a sampling of experiences and insights shared by sustainability professionals working in various facets of the food industry. These spotlights include a description of a typical day, responsibilities, key collaborators across the organization, and advice for those beginning in the field.

Spotlights

Jessica Vieira, Vice President, Sustainability, Apeel Sciences

My role is focused on driving decision-making across the organization that enables Apeel's operations and business practices to be as environmentally and socially responsible as possible while maximizing the positive impacts of our current and future products. I spend a portion of my day in meetings with my team members to review analyses on specific sustainability topics, strategize on how to best communicate a recommendation, and discuss their insights on how parts of the organization they work closest with are evolving and ways for us to proactively manage the sustainability impacts. Additionally, I meet with various external stakeholders to explore opportunities to collaborate and other teams internally to ensure that their teams and processes have enough support and input from the Sustainability department

to achieve our goals. Lastly, I spend some "head down" time preparing recommendations for Apeel's Executive Team on key sustainability opportunities and risks for the business.

What Teams Do You Interact with Most Regularly in Your Role?
My role is in Apeel's Strategy Division to ensure that we are incorporating environmental and social considerations into all upstream decision-making. I work with every division within the organization but spend most of my time focused on Product, Marketing, and the Executive Team these days. To ensure that the Sustainability Team is in the loop and can best support all divisions at Apeel, other members of my team are assigned to be the primary liaison with other key functions, including Technology and Operations.

Describe Your Career Path or What Led You to This Role
I am an environmental engineer by training, and I first got excited about corporate sustainability when I was in college. It combined my love of system-wide thinking and incorporating externalities into decision-making with an opportunity to drive fast-paced change aligned with market incentives. I saw this type of career as an opportunity to do well while also doing good. I started my career as an environmental specialist at the Dow Chemical Company, where I worked on environmental footprint solutions, including by-product synergy, green infrastructure projects, and analysis to support development of Dow's next generation of environmental sustainability targets. After getting exposure to life cycle assessment (LCA) at Dow, I went back to school to do a PhD at the Bren School at UCSB, with a focus on improving the usefulness of life cycle assessment and other environmental tools for decision-making in organizations. I spent two summers during my PhD working on life cycle assessments in the Environmental Technologies group at Apeel, gaining additional experience in an equally large but totally different type of organization from Dow. I became really interested in how organizational structures and strategies for incorporating sustainability into business decisions could differ depending on the organization, so I was incredibly excited to have the opportunity to join such an innovative and impactful organization like Apeel and build that sustainability muscle from the ground up.

What Advice Would You Give for Someone Interested in Pursuing a Similar Career?
I think leaders in corporate sustainability are able to balance a strong technical background with business acumen and emotional intelligence to influence decisions. The technical education and the ability to learn new science, understand novel products, and see the opportunities and pitfalls of innovation creates a strong foundation that can allow you to dig deep into pertinent

issues and build trust with a variety of stakeholders. At the same time, gaining enough business experience to learn how to contextualize your analysis, ask the right questions, and approach problems with an understanding of competing priorities will be essential in using that technical know-how to drive real change.

Joseph Button,Vice President, Sustainability & Strategic Impact, Straus Family Creamery

I am a catalyst for long-term strategic resilience of the business and the agricultural producers who provide us with ingredients that allow us to do what we do: make nutritious organic dairy products for consumers. Sustainability is so much more than environmental stewardship. Sustainability initiatives that have lasting impact must value and address all relevant economic, social, environmental, and political intersections of any given opportunity facing the business. It is my responsibility to make sure that our business considers all of those elements within the strategic plan and also empower my colleagues to be good at making sustainable decisions within their own roles. At the executive level, I help set the strategic vision for sustainability at our company. For our supply chain, I partner and engage with the dairy farmers that supply us with milk to ensure that their farming operation is both environmentally sustainable and economically viable for the next generation. Within our operations, I partner with all my colleagues from manufacturing to marketing to provide them with the insight, tools, and resources they need to operate sustainably. This role truly covers all aspects of our business and our mission, which is to sustain the long-term viability of our dairy farmers' livelihoods.

What Does a Typical Day Look Like for You?
A typical day is very dynamic. It may include hosting a training on a particular topic like zero-waste manufacturing processes, to working with packaging vendors to improve the sustainability of the materials we source, to participating in important policy dialogues with lawmakers and industry stakeholders. My favorite days are spent on organic dairy farms talking to farmers about soil health practices, taking soil core samples for lab analysis, or discussing the farmers' next big farm investment and hoping it is something that I have been encouraging them to adopt like an anaerobic methane digester or on-farm composting system.

What Teams Do You Interact with Most Regularly in Your Role?
Ideally, I interact with every team throughout the business. Human resources, sales and marketing, manufacturing, purchasing and supply chain, executive leadership…no team is exempt from engaging on sustainability at Straus Family Creamery. In reality, a lot depends on our goals and priorities of any given business season. That said, I tend to interact the most with the creamery manufacturing and operations team and, next, with our marketing and communications team.

Describe Your Career Path or What Led You to This Role
My career path was not linear and I think that helps me to be more effective in this role as it enables me to see things from a much broader perspective. I started my career in policy before transitioning to sustainable humanitarian development. Later on, I transitioned to the business consulting field and also spent time working for government agencies on critical environmental and climate issues. Finding success in a role in farming and food system sustainability requires diverse experience and the ability to engage with professionals from all different sectors and backgrounds. Thankfully, my own career path has provided me opportunities in many of those areas.

What Advice Would You Give for Someone Interested in Pursuing a Similar Career?
First, acquire skill sets that will be valuable in a business setting. Organizational communication, project management, financial management, and marketing management are a good starter set of skills. It does not matter how much passion you have for the environment or social justice issues if you do not have a set of hard skills to help effectively bring sustainable ideals to life within your organization. Second, take the time to understand both global and local environmental issues from a political and science-based point of view. This depth of knowledge will not only help you identify where you might want to work but what type of role you might most enjoy. There are many different types of sustainability-related jobs in the food industry, and finding something that you truly want to pursue is a critical first step to starting your career in this field.

Mandi McKay, Director of Sustainability and Social Responsibility, Sierra Nevada Brewing Co.

How Would You Describe Your Role? What Does a Typical Day Look Like for You?

My role is multifaceted and touches every aspect of the company from operations and employee education to supply chain and marketing. In general, my work is centered on understanding the company's environmental and social impact, implementing initiatives that reduce resource consumption, waste and greenhouse gas emissions, and advocating for policies and legislation that align with a more sustainable and resilient future. Most of my time is spent researching specific challenges or issues, evaluating potential programs or processes, reviewing data and metrics, meeting with internal and external partners and stakeholders, and thinking strategically about long-term commitments and goals for the company across our value chain.

Describe Your Career Path or What Led You to This Role

At Chico State, I enjoyed a couple geography and geology courses that highlighted the interconnectedness of earth systems and human impact, which led me to joining campus organizations related to environmental sustainability. I then created my own degree program for Environmental Conservation and Protection since there were not any degrees offered in sustainability at that time. One of the organizations I was involved in connected me to a program that provided recycling and composting education for elementary schools. I directed that program for a couple years as I finished school. That role provided me with a solid foundation in the principles of zero waste, behavior change, and program management. After graduating in 2008, I was hired as an assistant to the sustainability coordinator at Sierra Nevada and I have continued to grow and evolve along with the company ever since.

What Advice Would You Give for Someone Interested in Pursuing a Similar Career?

Internships and hands-on work experience are invaluable and in many ways superior to multiple degrees and certifications. I would strongly recommend finding ways to gain experience that builds skills related to program development, sustainability metrics, and business acumen. That said, an educational background in the fundamentals of sustainability and earth science is also essential and basic concepts in related fields like climate, energy generation/management, and manufacturing are extremely helpful. Working in sustainability requires systems-scale thinking, an eagerness to learn, tenacity and passion, and a strong ability to communicate effectively with all individuals in an organization from bottom to top.

Rebekah Moses, Vice President, Impact Strategy, Iron Ox, *former* Director of Impact Strategy, Impossible Foods

How Would You Describe Your Role? What Does a Typical Day Look Like for You?

My role is a blend of impact research, operations, and support for the communications and marketing functions working to raise awareness of the impact of livestock on the environment.

There is no typical day to day, but there are some consistent workflows that address one of those three channels. On one day, my team might be working with external research partners to model out what climate and land-use scenarios look like under plant-based meat replacement of livestock through the year 2050. On another day, we might be looking to operationalize Impossible's corporate climate targets in our owned manufacturing facility and our co-manufacturing facilities. At the same time, we may have any number of consumer insights studies ongoing that aim to understand how consumers in the general population understand the relationship between climate and their diet choices. It is a major priority right now to help people align their values to their food choices, and the information we get from those studies informs our external marketing and communications programs.

What Teams Do You Interact with Most Regularly in Your Role?

The sustainability and impact strategy team is one of the most cross-functional teams in the company—so we work with everyone from accounting and finance to manufacturing. We have to engage to make sure we are helping our teams "walk the sustainability talk," while answering strategic questions like, "How do we align business growth with sustainability progress?" Another great example is our product road map—how do we think about climate impact and aligning our product team toward our overarching goal of setting the clock back on climate change.

Describe Your Career Path or What Led You to This Role

I started my career in a very different place. My educational background was in Arabic and Middle East studies and I began my career in the defense industry. During this, I spent a lot of time in places that were very water constrained with regard to food production, ranging from Yemen to Egypt to Iraq. At the end of that experience, I became much more interested in the ways food was produced and in the natural resource inputs required.

This led me to go study international agricultural development at UC Davis, in California. From there, I thought I would go into water policy but ended up going into ecosystems services research specifically focusing on

farmer adoption of wildlife habitat and on insect ecology in agricultural systems. I stayed in academic research for a number of years working for different universities answering questions on how nature and food systems interact and how we value those systems. That eventually led me to Impossible Foods, because I began to understand that no matter how sustainable any given practice was on a limited acreage, the sustainability of the food system in general was constrained by the livestock industry's use of land globally. It is just opportunity cost: do we want to eat lots of meat from cows and push the global landscape past planetary thresholds or do we want to leave room for nature, even if we are bad at financially assigning value to it?

What Advice Would You Give for Someone Interested in Pursuing a Similar Career?

My advice would be to never assume that you need to have the exact right things on your resume in order for any given role to be a good opportunity for you. Be willing to take risks and follow your interests in potentially strange and new ways without following some predetermined formula. For those working in sustainability in general, an interdisciplinary background that allows for strategic thinking around complex systemic issues is very important. If you are focusing very narrowly, you will probably miss opportunities, and you will also miss the bigger picture.

Jeroen Heck, Senior Scientist, FrieslandCampina

How Would You Describe Your Role? What Does a Typical Day Look Like for You?

I work as a milk expert within FrieslandCampina innovation. More specifically, this means I am working the whole day on the composition, quality, safety, and sustainability of our main starting material: milk. My role is to come up with new ideas, inspire others, and brainstorm on problems. Additionally, it is part of my job to start new projects internally and externally, advise colleagues with raw milk–related issues, give presentations, and coordinate educational courses on milk. My role is to provide the content and I try not to be occupied with the management. A typical day could start by giving a presentation on the results of a project. Throughout the day, I would likely have multiple project meetings with my coworkers to be updated on the status and any issues that have come up. I would round out the day by answering questions from colleagues and brainstorming on new ideas.

Describe Your Career Path or What Led You to This Role
It all started when I was young and I did not really like to eat vegetables. At the time, I had the idea to make a pill that contains everything you need so you do not have to eat vegetables. This led me to considering pursuing either pharmacology or food technology. I went with food technology. During my studies, I subconsciously chose all my topics on dairy. This was simply because dairy interested me and milk fits into my curious nature. My last internship was at a dairy company and I decided to keep on working for this company after my internship was done. I always had the idea that I wanted to do a PhD, and after a while, I was offered a PhD position at the Dairy Science and Technology group at Wageningen University. The topic was milk genomics. During the first month of my PhD, I flew business class to the United States to attend a symposium fully dedicated to milk. At this conference, I met a very inspiring professor who talked about milk in such a way that I got absolutely fascinated on the topic. After my PhD, I only had to choose which Dutch dairy company I wanted to join. This problem was solved quickly by a merger and I started working for FrieslandCampina. Since then, I have been working in innovation on the topic of milk but gradually in more senior roles. Over the last 10 years, sustainability of milk is one of the important topics I work on, and 2 years ago, the company started a group fully focused on the farm, milk, and sustainability. Overall, I really enjoy working with a product that provides complete nutrition by nature, and I can feel assured if my son drinks a glass of milk when he does not want to eat vegetables.

What Advice Would You Give for Someone Interested in Pursuing a Similar Career?
Try new things and be open for any opportunity that will appear. Focus on the things that you enjoy and that give you energy.

Lauren Brey, Managing Director, Farmers for Sustainable Food (FSF)

How Would You Describe Your Role? What Does a Typical Day Look Like For You?
I am leading the development of an organization that supports farmers and their partners in the food and agricultural value chain in their sustainability efforts. FSF is the only collaborative non-profit that provides resources, advocacy, support, and empowerment for farmers who are innovating and

demonstrating sustainable farming practices during a time of increased interest in agriculture and food origins. We support farmer-led conservation groups with services to help them achieve their goals, including communications, administration, event planning/execution, strategic services, fundraising, project management, and more. We also develop and manage sustainability projects with farmers and partners in the value chain.

A typical day consists of checking in with farmers and contractors on projects and with the farmer-led group leaders on their needs. I usually have in-person or virtual meetings with prospective members of FSF to talk about our work and opportunities for engagement. I spend quite a bit of time exploring grant opportunities that fit our projects and will work on writing grant applications and reports. I support and direct our efforts to help the farmer-led groups achieve their goals and promote their outcomes. For example, each year, many of the groups have their members complete a member conservation practice survey to document the conservation practices they are using on their farm. We manage this program through developing the form each year and an online version, promoting it to the memberships and reminding them to fill it out. We then aggregate the data and our partners at The Nature Conservancy in Wisconsin model the impact the groups are having on reducing phosphorus runoff and sediment loss to show their improvements year over year.

I spend a lot of my time developing relationships: coordinating discussions with sustainability project partners to garner in-kind and financial support to assist farmers in using tools like Field to Market's Fieldprint Platform to document the practices they are using on their fields and demonstrate their sustainability. I am spending more of my time promoting project outcomes and encouraging others to use our Framework for Farm-level Sustainability Projects (a free resource we developed) to create their own projects to demonstrate farm-level sustainability that also provides information food companies are interested in. This includes quite a bit of travel to different events to present and network with others in the sustainability space. I enjoy attending different meetings to learn what other organizations are doing and making connections to further our work.

What Teams Do You Interact with Most Regularly in Your Role?

Our team is very small—we are technically staffed by employees of Edge Dairy Farmer Cooperative, an organization that is a founding collaborator in FSF. We have one team member who manages the needs of the farmer-led groups, including board administration support (they are all volunteer-led non-profit organizations) and event planning. Another team member manages communications for the groups and FSF, including multiple social

media platforms and websites. Besides our three-person team, I work closely with the CEO of the co-op on strategy, our government affairs team for legal counsel and policy-related topics, and our finance team for support on project management and financials. We have quarterly board meetings and I spend time developing board packets and meeting topics to get direction from our board members on our initiatives, so I spend some time interacting with our volunteer board. I interact a lot with our contractors at an engineering firm for project updates and development plans and other organizations like The Nature Conservancy who are key partners in our effort.

Describe Your Career Path or What Led You to This Role

I graduated with a BS in food science and life sciences communication from UW–Madison. My internships were all with food companies (cheese and confectionary coatings), and I worked in a whey processing plant for a cheese company my first year out of college where I managed the lab and field representative. We made a liquid animal feed with the whey and dried lactose powder. I transitioned to working directly with the dairy farmers supplying that company in adopting the Farmers Assuring Responsible Management (FARM) Animal Care program and then took a job with Edge Dairy Farmer Cooperative to work directly with their farmer members. At first, my role was farmer relations and communications, which morphed into marketing and events (print and digital newsletters, website, event planning and execution, partnership development, etc.). After several years of managing those initiatives for the co-op, I was tasked to lead our sustainability initiative, which is Farmers for Sustainable Food.

I grew up on a dairy farm and am married to a dairy farmer as well, so my life outside of work is very connected to agriculture. Our family also raises beef cattle that we market directly to our local community, which has given me an outlet for some of my food science and marketing passion.

What Advice Would You Give for Someone Interested in Pursuing a Similar Career?

Often a challenging experience that is not the right fit is still going to have value in the long run. A new career move may seem daunting, but you never know where it will lead. I never imagined I would be working in the space I am, but it has been a rewarding opportunity to grow something new and learn a lot of different skills like grant writing and how to manage big projects. My food science education and experience provided me with great insight into the food processing side of the supply chain, which really helps me see more of a full picture when we are developing supply chain projects. I have knowledge from the farm through food processing, which helps with our big picture goal of uniting the agriculture and food value chain in

sustainability efforts. You just have to start somewhere and take opportunities to travel, network, and explore other options.

How to Get Started as a Sustainability Professional

For many sustainability professionals, the journey to landing a position in this field was not linear nor expected at the start of their careers. For others, corporate sustainability and environmental science were integrated into early studies and an intentional career choice. Whichever position you find yourself in, there are ever-increasing opportunities to build on your food science degree with a skill set and foundational knowledge in sustainability. This includes certificate programs that offer light-touch learning, professional accreditations, or more in-depth degrees in sustainability. The choice of which program or certification depends on the industry or area you are interested in working in. Or as you begin your career and gain experience in a food science–related role such as product development or quality control, you will see the opportunities for applying a sustainability lens to your position or department. A good first step would be to identify any gaps between your existing skill set and the knowledge or skills required to do the work you are hoping to do next. The combination of an education in food science and sustainability can be a powerful tool for change in the food industry.

Also remember that professional certifications are not the only way to gain knowledge or credibility in this field. They should be one part of your broader development plan, which might include internships, skills-based volunteering, or participating in student-run projects. It is also important to build your professional network and stay up to date on news and opportunities in the field. This can be done by joining relevant sustainability networks and signing up for sustainability news briefings. There are likely sustainability courses and organizations or clubs to join while in school to get you started on your journey. Below is a short list of certifications that may be of interest to those pursuing a career in sustainability connected to the food industry.

Organizations and Professional Certificates

Net Impact is a network of over 435 global chapters and a grassroots movement of students and emerging leaders aiming to connect, learn, and make a positive impact on people and the planet. Focus areas include leadership,

social diversity, equity and inclusion, circularity, the environment, and climate change. Net Impact offers internship and job postings and resources for developing your career.

International Society of Sustainability Professionals (ISSP) is a professional association of sustainability practitioners that provides educational content and development resources, networking opportunities, and access to job postings. The ISSP also maintains a network of local chapters and offers professional accreditation programs. ISSP manages the *Sustainability Excellence Associate (SEA)*, a credential for those new to the sustainability field, including students, recent graduates, or professionals interested in understanding core sustainability concepts.

The *Association of Climate Change Officers (ACCO)* is a non-profit membership organization for executives and officials worldwide in industry, government, academia, and the non-profit community. Although this network is geared toward advanced career professionals, they offer a *CC-P Candidate Pilot Program* for young professionals or professionals transitioning to a career in climate change.

Conclusion

The roles discussed in this chapter are at the intersection of two exciting and rapidly transforming fields. Sustainability professionals are in higher demand than ever before as a result of evolving consumer preferences, growing awareness and commitments from governments and the business community, and the integration of sustainability metrics into investor decisions and financial markets, to name a few important factors. To face the challenges that lie ahead, working in sustainability requires you to have determination and passion for the work and enthusiasm for your role as an agent for positive change.

Recommended Reading List

Behrens, P., Bosker, T., & Ehrhardt, D. (2020). *Food and sustainability*. Oxford University Press.

Meadows, D. H., & Wright, D. (2008). *Thinking in systems: A primer*. Chelsea Green Publishing Company.

Naeem, S., Lipton, S., & van Huysen, T. (2021). *Sustainable food production*. The Earth Institute/Columbia University Press.

Carolina Leonhardt is the senior manager of Environmental Stewardship at Clif Bar & Company and has been on the company's sustainability team for the last 6 years. In her role, Carolina leads strategy development, integration and implementation of sustainability programs, communications, and employee engagement in the areas of climate and clean energy, zero waste, organic, and sustainable sourcing and natural resource conservation. She also leads cross-functional efforts in support of the company's goals to transition to sustainable packaging and reach net zero emissions by 2050.

Carolina has worked in the sustainability field for over 15 years with experience in the non-profit, private consulting, and government sectors. She holds a Bachelor of International Studies from American University and is a TRUE Zero Waste Advisor. Carolina is based in the San Francisco Bay area where she and her dog, Finn, like to explore the beaches and hike the hills.

Chapter 29
A Career in Management

Leann Barden

Introduction

As a student, or even as a newly hired young professional, you do not need to know if you want to be a manager. The point of this chapter is to expose you to typical manager responsibilities and opportunities you can seek early in your career to determine if management is the right fit for you.

Career Ladders

Originally, the path for career advancement was linear. It was assumed that someone who was skilled in his/her/their work would make an excellent manager of people doing the same work. As Carter Cast explains in his excellent book, *The Right-and Wrong-Stuff: How Brilliant Careers Are Made and Unmade*, that was a poor assumption. Managing a team of scientists requires an entirely different skill set than working at the benchtop. Scientists are analytical and curious and have technical depth; while they should be good communicators, many are not. Managers, in contrast, must primarily be good communicators—storytellers even—to both technical and non-technical audiences, and they must understand how the greater business operates because the bulk of their job entails convincing leadership and boards to give their team resources to pursue the most strategic pipeline initiatives. Much time and cross-functional input go into creating these

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pipelines after assessing current assets and market white spaces. (White spaces are areas of opportunity because few products are competing in that area. In the 1980s, for example, plant-based milk was a white space, but now that market is nearing saturation.) But in order to make sure they have the right people on the right project, managers must also take the time to know their teams. For every individual on their team, good managers know:

- What motivates the individual.
- His/her/their language of appreciation, communication style, strengths and weaknesses, and growth/career plans.
- His/her/their personal commitments like volunteering or caring for elderly parents and young children—things that will affect performance or flexibility in the workplace.

Because managers are focused on business metrics and people development, they often lose technical depth—they do not remember how to run particular assays and may not even enjoy benchtop work anymore. Simply put, being a good scientist does not mean one will make a good leader or manager. Thus, most companies have shifted to a Y-shaped career ladder. This allows people to pursue technical development *or* management. Compensation is meant to be similar at equivalent points on the ladder so that individuals are encouraged to develop themselves based on their strengths and the company's needs.

Of course, even the Y-shaped ladder is not straightforward.

*multiple *salary bands* likely exist for each title here, and some titles have sub-levels, e.g. Scientist I and Scientist II

Companies offer employees opportunities for numerous roles, especially in large companies with numerous business units ("BU"). For instance, product developers can work on different brands in different BUs, or they might explore roles in quality, regulatory, or sensory. Many individuals transition to entirely different careers in marketing, project management, or procurement. Scientists are often successful in a wide variety of roles because of their finely tuned critical thinking and analytical skills. Nevertheless, this chapter is for scientists who want to explore research and development (R&D) management.

What Is a Manager?

The term "manager" may be used in many different ways:

1. Managers/supervisors of people.
2. Managers of platforms, projects, or strategy pillars.
3. Managers of spaces.

Traditionally, the term referred to a *people manager* or *supervisor* who oversaw a team and was responsible for the team members' productivity and personal growth and development. The team might be made up of direct reports (those who report to the manager directly) and sub reports (those who report to the manager's direct reports), but most companies cap the number of people a manager oversees at 5–8 direct reports to ensure each direct report receives sufficient attention. An upcoming section will discuss roles and responsibilities in greater detail, but generally, a people manager is responsible for the following:

- Managing people's growth.
- Executing upper management's vision (delivering/executing on projects, implementing new ways of working or changes in values, enabling smooth transitions through reorganizations).
- Developing business strategy (This task falls more heavily on senior management and leadership teams, although middle management may be involved at smaller companies.)

However, now that many companies follow a Y-shaped career ladder, someone who has a title of manager may actually be a *project manager*. This individual often does not have any direct reports but may have one or two who support the manager in achieving a very specific project-related goal. It is analogous to a graduate student who oversees one or two students. These managers are more common in the technical space because they likely

manage a platform. For example, there may be a manager of plant-based proteins who develops the strategy and manages the company's budget for everything related to testing plant proteins. This individual oversees testing of the said proteins, provides guidance on which brand or products within the company would most benefit from researching new proteins, and allocates a budget to universities for parallel research while also overseeing the universities' progress and patentable results. Of course, while some companies call this individual a manager (the *project* part of the name is implied based on the role), other companies may assign this workload to a principal scientist. In both cases, the individual may oversee the work of junior scientists or product developers, but the person may or may not be directly responsible for overseeing those junior scientists' professional development or involved with approval of vacation, quarterly performance reviews, etc. The career of Elieke Kearns, PhD, RD, exemplifies this title variability. She has held the title of "manager" or "lead" at the National Dairy Council, RXBAR, PepsiCo, and Bobbie, but her work "varied a lot from company to company--sometimes it included managing people; other times it was more focused on managing projects (internal and external), or managing company relationships with vendors, agencies, professional associations, and external experts."

Finally, there are managers of spaces like pilot plants and labs. Again, these individuals may or may not oversee one or two direct reports, but they likely spend a lot of time managing budgets for their space and developing protocol for how others use their space (e.g., how does a scientist book time in the pilot plant for trial).

This chapter will focus on people managers, although there is much overlap with the other manager categories.

What Is in a Name?

So, when might you expect to become a manager? Title changes occur at different rates at different types of companies. Often, small companies and startups may bestow loftier titles to employees at a younger age; this occurs for a number of reasons:

1. These companies may hire younger employees for particular roles, so advancement is naturally obtained at an earlier age. An entrepreneur who starts a company at age 30 hires his/her/their similarly aged friends for other executive roles (e.g., chief financial officer, chief marketing officer, and other C-suite roles). The vice president (VP) and managerial titles cascade similarly.

2. Small companies and startups require employees to wear many hats due to the limited number of people, so the scope of work is simply broader and may warrant a higher title.

Similarly, employees at non-profits, trade associations, and similar organizations may reach higher titles sooner because they need the proper credentials to organize conferences or interact with the VPs at their client companies.

The greatest mistake any job seeker can ever make is to pursue a role based on title alone. You must be passionate about the job description. Furthermore, pay does not always translate across titles—a manager at one company may earn less than a principal scientist at another company, particularly if we consider the aforementioned Y-shaped career ladder and the salary bands each company sets for a particular title. (Salary bands are pay ranges for a given title. They are analogous to school titles: freshman, sophomore, junior, and senior are different *bands* in the *position level* of "high school" or "college.") This chapter will help you understand whether you would enjoy working as a manager.

So, What Does a Manager Do?

There are numerous similarities between professors and managers: both must get the work done (publish papers, deliver business goals) while also looking out for the mental health and well-being of their students/direct reports. Both professors and managers also create a unique culture and tone—think Mrs. Trunchbull vs John Keating.

Aaron Bennett and Darryl Riley both have more than 20 years of experience as a manager/director/senior VP at food companies of all sizes and said the job of a manager is essentially three things:

1. To develop the team—capabilities, people, resources.
2. To set direction for the team and create or strengthen the functional organization.
3. To remove barriers for the team.

"Developing a team is the single most important job of a manager," said Bennett. Development occurs at both an individual and team level. For instance, each individual team member should be competent in presenting recommendations to leadership, executing multiple projects on different timelines, and developing a design of experiments. Some of these competencies, like setting up a shelf-life experiment, are specific to research and development (R&D) roles, whereas others, like making an informative

PowerPoint, are essential skills for all employees. Many companies reference the book *For Your Improvement* by Barnfield and Lombardo when dictating specific competencies they want every employee to develop. Development also occurs at the team level. For instance, if the overall job of a product development team is to launch new products, a manager may develop one expert in ready-to-eat foods, another in frozen foods, and another in condiments such that the collective team demonstrates all the critical competencies. Finally, a manager develops all the resources the team needs to succeed such as access to pilot plants, a budget for consumer testing, and a lab outfitted with essential analytical equipment. Team development is constantly in flux because of the needs of individual team members. If the expert in frozen foods wants to develop extrusion skills for ready-to-eat foods, for instance, the manager must simultaneously look for ways to develop that individual while also covering all frozen food projects. And if the company has a year of poor sales or high costs, then operating budgets will be reduced, and the manager will have to reprioritize projects or find ways to operate on a smaller budget. For instance, when budgets for consumer testing are slashed, entrepreneurial managers may turn to Facebook surveys to gain the feedback their team needs to assess interest in product launches. Managers must develop both the people and the resources within their teams to meet company goals.

Managers must also set direction for the team, and the type of direction will vary depending on the manager's own seniority. For instance, managers at the top of the organization, like VPs, will set strategic direction—what categories of products to launch and when to take advantage of white spaces in the marketplace and consumer trends while also balancing availability and resources at the factories. Some leaders set "big bets" in which they focus on only a few, key projects, while other leaders pursue a larger number of projects worth less revenue individually. Middle managers must execute the directives from senior leadership. If leadership says the company must launch products A, B, and C, the middle management figures out how many people to put on each project and when in the year to kick off each project based on when the previous year's projects finish. Much of a middle manager's job involves inspiring and motivating their team, particularly when the directives from the leadership team seem daunting or even impossible. Middle management will also determine how to reward the team. This can happen at an individual level (promotions, raises, new projects that address development goals such as the previous extrusion example for the frozen foods expert, etc.) or a departmental level (special recognition programs, team happy hours, a volunteering event to build team rapport, etc.). Low-level managers are often the project managers that make sure execution

happens on a daily basis. These managers collect the raw data and determine the best way to report both good and bad news up through the leadership ranks. These managers ensure timelines are met. They also make sure their team members are connected with essential personnel—does my direct report know how to schedule time in the pilot plant, submit analytical samples, or even set up a proper design of experiments? If a team member is frustrated or unhappy, the low-level manager will be the first person to hear about it. Low- and mid-level managers must also set cultural directives, including setting a tone of inclusivity and equity. In addition to demonstrating and living those values, managers may have hiring power and must be sure their recruiting practices pull a diverse pool of candidates; that all employees feel welcomed, included, supported, and valued; and that all employees are paid and promoted equitably. Periodically, the leadership team will update the company's mission, vision, and/or values. Low- and mid-level managers must promote this "change leadership" and ensure compliance. For example, a company may decide to adopt a zero-based budgeting (ZBB) strategy. Previously, budgets may have rolled over annually—you get $X every year. Now the leadership team says you must create a new budget from scratch every year and justify why you are asking for each dollar. It is up to middle and low management to (1) ensure their team understands the rationale for the change, (2) feels good about the change, and (3) actually adopts the change. No matter their level, managers are responsible for setting expectations and direction that deliver business goals.

Bennett described the final role of a manager as "providing insulation." Many blogs call managers the analogous and more visceral buzzword, "the shit umbrellas." In short, the executive team is always swimming in discussions that do not immediately impact—let alone improve—productivity. For instance, maybe revenue has continued to decrease in the last 5 years, and leadership needs to weigh the pros and cons of selling off a brand, getting rid of the internship program, laying off employees, or selling the downtown office building and buying a new one in a cheaper suburb. The average product developer does not need to worry about these discussions since the decision may require months of deliberation and would only serve to worry and distract the employee. Managers become an umbrella to shield their team from information that has no actionable outcome, thereby allowing employees to focus on the work that actually grows the company's top (new product development) or bottom (cost-out and continuous improvement projects) lines. Similarly, managers insulate their team by providing thoughtful messaging. The facts from the executive team may be that revenue was down $33MM (a business notation for "millions") so no one is getting a bonus. The manager humanizes this fact by acknowledging individual and team

wins from the past year, stating the unfortunate news and recognizing the impact it will have on people and their families, and then sharing plans to ensure the following year is better.

Tracie Screven intimately understands what it means to be a good manager and the consequences of managers who fail in these responsibilities. Screven has 11 years of manager/director experience with both big food companies and with SMASH, a non-profit, college prep program that prepares high school students of color for STEM careers. "I was first a project manager [and] then a people manager--a role I took very seriously. As a woman of color I was unfortunately moved around from manager to manager most of my career (8 different managers in less than 6 years; 18–20 over 16 years at the same company). Oftentimes I was the 'guinea pig' (i.e., the first direct report for most of my managers). Most of my managers were learning to be managers as they were managing me; very few if any had been people managers previously, and definitely most had biases based on my color and gender."

"As a result, as I took my first management role in 2010, I chose to come to work daily and do the opposite of what had been done to me. I requested training and onboarding but this was not a skill that was cultivated nor was I provided training until after I became a manager. I took time to get to know my direct reports and understand their personal lives, career and personal goals and motivations. My team was hired because they were capable of doing the technical work involved with product development; it was up to me to enhance their skill set with tools and resources for them to achieve goals as effectively as possible," commented Screven (written interview).

The Good, the Bad, and the Ugly

While a few managers are only in their jobs because there was no other option for career progression or because they were chasing a lofty title, Bennett, Kearns, Screven, and Riley all agreed the best part of their job was developing people. Kearns was equally motivated to develop people and the business. "[My favorite part of being a manager is] working with others--whether that was helping direct reports grow and achieve their professional goals or working in collaboration with external partners to achieve common goals."

Riley derives great satisfaction from developing individuals but also from recognizing the bigger impact that development has on the broader community. His favorite parts of management included "helping to lead teams and

individuals and watch them grow, develop, and meet/exceed expectations; [h]elping provide opportunities for people and their families; [and] [h]elping to contribute to the food industry" (written interview).

Screven immediately said that her favorite part of being a manager involved "seeing the growth my direct reports made when we discussed an opportunity and putting a development plan in place to achieve their goals."

Bennett expressed similar sentiments to Screven, saying "My favorite part by far is watching, observing, and rewarding people who grow and advance in their careers. It energizes me way beyond successfully launching a product or hitting [some KPI (Key Performance Indicators are success metrics. Getting a C or better in Food Sci 101 is a KPI towards earning your degree. Making $x in sales might be a KPI in someone getting their annual bonus)]. Watching someone I've been working with start to gain and exhibit the confidence to succeed or see their career grow in a direction they envisioned, etc. And being able to reward them [for that]. People have different rewards--title, salary, etc.--[and managers balance that]."

However, the worst part of being a manager can also involve people if those individuals do not want to grow in the company. This may be because of a misfit in motivations, values, culture, or simply the relationship with one's manager. Personality differences (opposites on the Myers Briggs, for example) and management styles (hands-off vs. hands-on, for instance) may contribute to the latter. Employee underperformance forces the manager to identify the root cause and take action. If the employee is struggling with personal issues, they may need short-term leave or flexibility in their working hours. Typical levers to address demotivation include more responsibility, fiscal rewards, and praise, but it is difficult to offer these to an underperforming employee, which means the manager must think critically and carefully about options and the impact of each action on both the employee in question and the team at large. Human Resources may be involved in putting the employee on a performance improvement plan or PIP.

"If the favorite part is watching people develop, what's most difficult is when you watch someone who's not [developing]," said Bennett. "And as a manager, you have to make some kind of decision on that individual, which goes back to the same issue as organizational change but on a different scale because you know the individual personally. It starts with a PIP, but at some point, you realize they're not going to come around. And a manager's role is to put together a team that achieves the organization's goals. And if you know your team isn't doing that, it's on you to change it. Have I provided enough resources to the individual, or do they not care? It's emotionally draining and not a fun period for anyone."

Such situations are never pleasant for anyone but are one of the many reasons good managers have high emotional intelligence (EI; see below) and are comfortable with uncomfortable situations. Other uncomfortable situations that come with the territory of being a manager include defending unpopular positions and/or telling reports "no."

As senior leaders within their respective companies, Riley and Bennet were both involved in communicating organizational changes even if they were not part of the team that made the decision. Both agreed that layoffs/downsizing and restructuring are among the worst parts of being a manager. "It's emotionally draining because you've befriended the individuals [who are impacted] or see the value each person brings," said Bennett.

Managers face a number of other challenges that are not inherently "bad" but do force the manager to make tough decisions and engage in difficult conversations. "Whenever you're working with other people, there are going to be times when you'll disagree and need to stand up for something you believe in," said Kearns. "These conversations can be challenging, but I've found that when they're approached with curiosity and humility, it makes disagreements a whole lot more pleasant."

Other difficult conversations may arise for managers who have inherited a team versus hiring their own. It may take more time and energy to develop great ways of working with inherited team members who question your authority, do not understand your new vision or methods, or flat out do not respect you because of your age, jealousy (some may have also applied for the job you got), or other matters. Inherited teams also come with emotional baggage from the previous manager. That manager may have allowed or even fostered dysfunctional dynamics and ways of working that must be addressed and overcome. So, in addition to balancing workloads, understanding their direct reports' personal goals and motivations, and executing good science, managers must also master tremendous communication skills and possess high emotional intelligence. It is no easy feat!

Finally, the toll of being that umbrella that shields your team is exhausting, especially if the corporate culture is exclusive, intentionally or unintentionally. "The politics and the microaggressions--and direct racism--that employees of color (specifically black employees) experience" are the worst part of being a manager, said Screven. "There was a general lack of support [or] opportunities, [and] more obstacles. As a woman of color, it was not a level playing field." These internal barriers make it difficult to not only advance one's career but also to find opportunities for your direct reports if they are also part of classically marginalized and underrepresented groups. These challenges are layered onto the classic workplace politics surrounding resource allocation, setting an R&D- vs Marketing-led directive, and other issues.

Managing a Cross-Functional Team

Management is never easy, but it is easier when your team looks like you. It is easier when your team has a similar background and is younger so your position of authority seems legitimized. But easy rarely makes for great teams, and diversity is the key for business success for many reasons. While managers should focus on hiring teams that are as diverse as their customer pool and making sure every team member feels comfortable expressing their authentic selves at work, the purpose of this section is to discuss when managers oversee functions about which they have no prior knowledge. For instance, a director with experience in product development may suddenly have to manage a team of packaging, processing engineers, regulatory, nutrition, and product development. In many companies, R&D reports up through the Marketing department, where the CMO may have little or no scientific background. Do not fret! This is not different from any other part of a manager's job. At the end of the day, managers must…

1. Influence. This involves flexing to your audience to accommodate their time/attention span, technical background, and personal motivations.
2. Remove barriers for the team. Regardless of their role, every employee needs certain resources and needs a manager that serves as an "umbrella" (see above).
3. Ask open-ended questions. Employees often already have answers to their problems or ideas on how to solve them. They need a manager who can help guide them through critical thinking.

Managers who practice the above can effectively lead teams of any educational background. Someone with a BS in food science can successfully lead a team of packaging engineers and vice versa.

Emotional Intelligence

So, what is emotional intelligence (EI)? According to the Oxford online dictionary, it is "the capacity to be aware of, control, and express one's emotions, and to handle interpersonal relationships judiciously and empathetically." Dr. Daniel Goleman popularized the term with his seminal book in 1995, and since then, there have been countless books, podcasts, websites, blogs, and webinars devoted to the topic. In short, there is no shortage of material out there to help you understand what EI is and how to develop your own.

If you reread the definition, you will see that EI is about knowing yourself—what motivates you, what demotivates you, what stresses you, how

you think (big picture vs. detail oriented, fast vs. slow and methodical, risk averse or risk tolerant, etc.), and how all those things about yourself register in your day-to-day interactions with other people and potentially stressful situations. As you can imagine, knowing more about yourself and your tendencies is helpful for your relationships and career advancement.

EI is even more important for managers. It is not enough to excel at a task because managers do not deal with tasks; they deal with people. Good managers can flex their communication preferences and working styles to accommodate other people, especially their direct reports. Good managers are able to separate performance from emotion, which is particularly helpful when trying to determine how to motivate an underperforming employee. People do not work in silos. For better or for worse, they step through the office door with the baggage of family issues (good and bad); diversity in education, thought, and upbringing; different communication preferences; and more. Good managers know how to balance emotional needs, personality differences, and workloads—in themselves, their employees, and their colleagues—so that every person feels heard, valued, and supported. EI is critical for workplace success; managers must master this skill.

What Experiences Will Help You Know If You Want to Become a Manager?

Here are a few questions to guide you:

1. Are you comfortable delegating tasks (or is it easier to do something yourself)?
2. Do you like working on teams (or would you rather have a solo project)?
3. Do you get more satisfaction from something you have achieved yourself or from helping someone else overcome a challenge?
4. Does it drive you crazy when people misstate scientific principles, or are you OK as long as people get the gist of it?
5. Do you abhor corporate politics or can you navigate them, even if you do not love them?
6. Do you need to be liked by everyone to be happy?

Note the above list does not ask if you are an extrovert. New studies show that great managers and leaders can be either extroverts, introverts, or ambiverts—it takes all types!

Do not fret if you find a learning curve once you become a manager. Some companies offer training programs, and there are thousands of books, blogs, vlogs, external training programs, and online courses on the subject,

but there is no substitute for experience. Every manager made mistakes in the beginning, but each found their way eventually.

As mentioned, you do not need to know if you want to be a manager while you are still in school or even early in your career. In fact, most managers eventually grow into the position, but they likely had a certain aptitude for leadership when they were younger. Maybe they volunteered with IFTSA in a leadership capacity, led their Food Science Club, or were a teaching assistant (TA) in graduate school. Nevertheless, you should regularly evaluate your passions and seek experiences that guide you in that direction—with the help of your current manager and mentors, of course.

"I've always enjoyed working with others versus working alone," said Kearns. "Being a manager--either of people or projects--requires collaboration. As a student, I was able to hone in on this by doing various internships, being a TA in grad school, managing interns, and seeing myself thrive when managing big projects."

"Interacting with people and teams was always my dream job," said Riley. "I gravitated into management after working as an individual contributor for nine years. I observed what others did and initially learned through observation before formal training. I believe it took some time, but I became a better manager through my career with others helping coach, mentor, and guide me."

Bennett found it is equally important to discover what you do not like as it is to find things you do like. As an undergraduate, he worked for a grad student and did not enjoy the mundane, repeatable tasks that research requires. "I thought I was going to like that, and I'm so glad I had the opportunity to realize that it's not for me. I need the face-to-face interactions. I didn't know [then] if I wanted to be a manager per se, but I did know that I did not want to be an individual contributor for all of my career… In college, I was the president of our Food Sci Club, but I kind of slipped into it. It wasn't an objective. A professor was pushing me. When I had that opportunity, I realized I kind of liked this ability to work with people and influence, negotiate, and be able to kind of push and pull. To say, I'm willing to change my mind on this because you have a different point of view, and I think your point of view is better than mine." Nevertheless, Bennett never imagined he would eventually become a director of R&D, and he was not prepared to take on that responsibility until he was older and could accept "making decisions [when] people are looking up to me."

Bennett further added that one of the best, albeit hardest, experiences you can have is "having a bad manager. You'll learn a lot more from having a bad manager. It doesn't mean they're abusive or anything, but you realize they may not be what [you] need at that point in [your] career. The bad managers are what really turn you into the type of manager you want to be." For instance, you might learn how to better delegate or not overanalyze other people's work because you once reported to someone who micromanaged.

Or you might learn to accept out-of-the-box ideas because you had a manager who would never listen to new ideas pitched by employees. Or maybe you had a manager that made performance demands but did not remove the barriers (resource constraints, etc.) you needed to deliver.

For Screven, this means having a manager who makes the workplace a better environment for everyone regardless of race, ethnicity, gender, or background. It also means fighting for your own career path and finding mentors. "I was told within my first year that I would not be management material--and I believed this person for over five years," said Screven. "Over time I began mentoring employees--initially black employees, and then word got out to non-black employees that I actually had 'sound' advice--and I found people sought me out for my advice. I was also hearing from these mentees [that] the coaching their managers were providing [was] oftentimes … quite different than what I would direct them to do. I would assist with development plans and suddenly these employees moved from low/average to high-potential... I sought out my own opportunities and was forced to discover how to own [them] oftentimes. I had one phenomenal mentor who was a person of color, and if not for her, I would not have survived or succeeded… Looking at our organization, it wasn't very often that people of color made it to higher positions let alone management. I therefore took a personal interest in mentoring, coaching, and managing people of color." As previously mentioned, Screven now works with SMASH as an effort to encourage more Black, Indigenous, and People of Color (BIPOC) youth into STEM careers. (Author's note: since this chapter was written, Screven has pursued a new job as Associate Director of the CPASS Foundation.)

What If You Realize You Do Not Like Managing People?

Many people pursue a management track later in their careers because (1) effective management requires a certain level of maturity and experience, and (2) many younger people are more passionate about benchwork early in their career but desire new opportunities mid-career. One person, who wished to remain anonymous because he is still currently employed with his company, learned he did not like being a manager after he had assumed the role. He had not, in fact, sought out the promotion, but after many years of excelling in his job as a scientist, the company wanted to reward and promote him—and the company also needed someone they trusted in that management role due to a growing, thriving business.

As a senior scientist turned manager, this person has a mixed role. He trains new hires, organizes the flow of the lab and project assignments, orders equipment for the lab, and conducts salary reviews. "I am a lab manager + people manager + task executor," he said. "Management makes up only 25% of my role. The rest is more project management. I manage a smaller group of scientists and lab technicians, whereas other managers in the company might have eight direct reports and no project responsibilities." Because of this mixed role, the company felt it needed to promote an internal candidate to take on some management responsibilities while still delivering on customer projects rather than hiring an external candidate who functioned exclusively as a manager. "I could've switched to a Principal Scientist role," said this individual, "but someone here has to be the manager."

The management role is a poor fit for this person for a number of reasons. Some are professional. He was thrust into a role with little management training even though the company has long desired to start a management training program. He also struggles to find time to do all parts of his job well: delivering on customer projects in a timely manner in order to keep the company profitable, but also spending hours on performance reviews because he cares deeply about developing his team. "It could be that I have too many things on my plate, so the management portion seems the least important. I'd rather be helping the company in other ways. When I have to prioritize, our customers come first. It stresses me out that I don't have enough time to do all parts of my job well." (Incidentally, at the time this chapter was written, employee burnout has been a major discussion due to the extra demands layoffs have put on the workplace during COVID.) However, some of the reasons the management role has been a poor fit for this individual are also personal. "I'm bad at delegating, which is part of the problem. I'd rather just do it myself. I like people, and I like training [them], but when it comes to the other responsibilities, I'm less interested. I don't like being responsible for other people."

Nothing is ever black-and-white though. While this person does not like some aspects of management, he likes brainstorming with leadership about how R&D could run more efficiently and developing an overall strategy. In addition, "I like training people about product development and production lines; I enjoy doing optimization behind the scenes… Maybe I was managing and didn't know it. My co-worker pointed out that everyone was already coming to me for training, etc." Like Bennett's experience with the Food Science Club in college, this person was nudged into a management role they were not explicitly seeking. While Bennett thrived after the nudge, this person realized it was not the right path.

This individual deserves kudos for being a stellar employee and for pushing himself to grow. He stepped into a new role because his company needed him, and he learned things about himself along the way that will help guide his overall career journey. The critical next step is to have honest conversations with his own manager about his experience and interests. Employees are most productive when they love their jobs, so both the employee and the employer have a vested interest in finding the right role for each individual. This person and his manager can do a work inventory that involves listing every task he is currently doing, the criticalness of that task, and his passion for the task. Together, they can shift the less important and less enjoyable tasks off his plate to make time for the "highly critical but less enjoyable" and "maybe less critical but highly enjoyable" tasks. These conversations may seem daunting, but they are essential to making sure the employee and employer have the best fit and enjoy growing together.

Promotions

The previous story also illustrates the nature of promotions: they only happen if both the individual and the company are ready for it. Young employees often express frustration that they have received high marks on their performance reviews but are not being promoted. Unfortunately, there are fewer jobs as you climb the corporate ladder because companies need more doers than managers. Furthermore, your peers are growing their careers and skills at the same time as you, which means the company must identify areas of opportunity for each person. However, all is not lost! Companies reward stellar performance in many ways: promotions, merit/salary increases (refer to the discussion on salary bands above), growth up the technical ladder, and/or ownership of new projects that set you up for future success and future promotions. Never pursue a mere title as your ultimate career goal.

As a director/VP/SVP, Bennett often had to look at his team's growth and determine who should be groomed for future promotions. When asked how he handled that task, Bennett said, "[It's] a good question but something that can befuddle the best managers from time to time." Bennett focuses on personality more than anything when screening candidates. "I'm looking for key personality traits. Very seldom am I looking for a technical solution or asking about the greatest innovation. Tell me more about your team atmosphere. When are you most energized or drained when working with a team? Personality is key for many reasons… The best managers are finding their replacement. So it's about personality. For scientists, it's trying to balance

the analytical thinking--numbers are king; black and white data--with being an influencer--can they influence their marketing counterparts; can they engage with the salespeople out in the field; can they understand why the Operations team doesn't want to make this change. If they have the right balance of analytical problem solving and are an influencer and are empathetic, then I have someone that I think could be a really, really good manager someday, whether it's now or in the future." Bennett attributes the inability to influence and empathize with cross-functional roles as one of the reasons there are so few *good* managers in scientific fields.

Riley has also worked in senior management and been responsible for growing teams. "In many ways, most scientists have a bend towards management or staying as a specialist," said Riley. "I've watched some scientists move to management early in their career while also seeing some do it after 20+ years. I think it depends on whether someone feels [or] thinks they can make the biggest contribution for a cause or for themselves. Grooming for manager roles should start early and be consistently improved. Having a refreshing appetite for learning agility helps managers become even better."

PhDs, MBAs, and Other Letters

You do not need any special academic credentials to be a good manager; experience and empathy are sufficient. However, certain levels of upper management, like VP positions, may require some additional certification; this is especially true of larger, more "traditional" companies. The good news is that these companies almost always offer tuition reimbursement, so you can always pursue a part-time MBA at night and on weekends for little out-of-pocket cost if that is required.

It can be difficult for scientists to learn the financial side of the business, but the best managers do understand both worlds. To address that deficit, ask questions, especially early in your career. Listen to the quarterly earnings reports and make note of the things you do not understand. Google the answers, find a buddy from your Finance team, and take some free financial MOOCs (LinkedIn Learning and Coursera are good starting places). If you are still in school, take a finance for non-finance major class. Some companies even offer such classes internally. If you are currently employed, learn all the parts of a profit & loss statement, talk to your sales counterpart about how coupons and discounts work, and ask your procurement counterpart about contracts to source ingredients for the products you are developing. Use your food science knowledge as currency and trade answers for

questions. People are always thrilled to talk about their jobs for half an hour (come prepared so you do not waste anyone's time), and most of them do not understand R&D and would love the chance to ask you questions in exchange for answering yours. Use meetings with your manager to ask questions and identify ways to minimize your knowledge gap. While you may not need special credentials for a particular management role, you will need to understand business metrics if you want to advance, but there are many different ways to gain that knowledge.

Summary

No one needs to decide on a management track as an undergraduate or even as a recent graduate. Career paths are rarely linear these days, especially because of the prevalence of 401 k retirement plans, which allow individuals to pursue opportunities with different companies throughout their working lives. Generally, good managers exhibit four basic aptitudes:

1. *They are good communicators*. That means they can speak technically with their team and non-technically. They are persuasive.
2. *They are comfortable being uncomfortable*. In order to help their team members grow, managers must deliver honest feedback about weaknesses and areas of opportunity. Kim Scott calls this "caring personally" while you "challenge directly" in her excellent book *Radical Candor: Be a Kick-Ass Boss Without Losing Your Humanity*. Managers are also placed in uncomfortable positions as they lobby for team resources, roll out change management to their team, and/or influence upper leadership on the best strategies. Sometimes managers have to bear the burden of upcoming bad news (like reorganizations and layoffs) alone, and they act as umbrellas.
3. *They have high EI*. Good managers understand what makes themselves and others tick, and they can flex to other people's personality styles.
4. *They are more passionate about leadership and strategy than benchwork*. Managers often do not spend much time in the lab or on the plant floor. If benchwork excites you more than long meetings, then consider pursuing a technical path.

If you are excited about a career in management after reading this chapter, then tell your current manager and identify ways you can gain leadership experience within your company or outside organizations (volunteering, Institute of Food Technologists, etc.) today. And know that your career path is never set in stone—the world is your oyster!

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Leann Barden has always been a science nerd and stumbled upon food science as the perfect application of chemistry, microbiology, engineering, nutrition, psychology, physics, and her favorite pastime: eating! She earned her undergraduate, Master's, and doctorate degrees in food science from the University of Wisconsin, North Carolina State University, and the University of Massachusetts-Amherst, respectively. She interned at Danisco, General Mills, a lab in France, and the Institute of Medicine. She volunteers with the American Oil Chemists Society and Big Brothers, Big Sisters. She worked as a subject matter expert in fats and oils for Kraft Foods, a product developer in Breakthrough Innovation at Kraft Heinz, and a manager at RXBAR, where she built the ingredient research, packaging, and sensory arms of the company, among other things. She recently began a position as VP of R&D at The ISH Food Company, a plant-based seafood startup focusing on innovation, sustainability, and health. In her spare time, Leann enjoys traveling, cooking, eating her way around Chicago's restaurant scene, spending time with her nephews, and trying new hobbies like rock climbing, Spartan races, and SCUBA diving.

Part V
The Graduate Student Experience

Chapter 30
Is Grad School Right for Me?

Annika Madler

Background

As the glamour of the final year fades for seniors and the reality of entering the workforce approaches, many students find themselves facing the difficult decision of choosing between continuing their education in graduate school or beginning their career in industry. Neither choice would be considered, in the classical sense, a bad one, making this decision—despite what one might think—extremely difficult. Fortunately, food science offers lucrative prospects and attainable options for both sides of this difficult choice. One of the greatest appeals of food science is that further education is not necessarily required to pursue the career path of your choosing. The question that weighs on many students, however, is which decision is the best one for them and their professional goals. Before grabbing that cap and gown and walking across the stage, there are some hard choices that must be made. The decision-making process begins with an understanding of what one has to gain from pursuing either track.

Going into Industry

The food industry offers a variety of options including beginning a career immediately after graduation and joining the corporate jungle in the food industry. Leaving the years of schooling behind to venture off to start your

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career can be daunting; however, it may be the perfect choice for many new graduates, including myself. Many find themselves driven by the application of topics, rather than the in-depth research that graduate school offers. If this is what drives you, then success and passion will be found in the industry side of food science at this point in your career path.

Even if you are certain going into industry is the right choice, it can be an equally difficult decision to decide what area of the food industry you would like to enter (e.g., dairy vs. frozen food). Luckily, working in the food industry is a great way to explore the world of food science, and many people decide what they wish to specialize in later. With a bit more experience and industry knowledge, it is easier to find what you are passionate about and where you hope to go next. It may make more sense for some to start in industry to simply gain a better understanding of the field and obtain valuable experience that can later be used as a stepping-stone to their true passion. There may be a slight learning curve if you find that you have to switch to an entirely new field, such as from chocolate to dairy, but the basic principles (chemistry, microbiology, etc.) can still continue to be applied to future trajectories. Whether in industry or in academia, the knowledge gained from early industry experience is invaluable, giving important insight into future career goals.

The primary knowledge that many hope to gain from starting their career right after graduation is the perspective on their best path forward. Industry gives students the time and flexibility to discover what path is the right fit for them while providing a stable lifestyle. Although there is a wide range of job descriptions (see Chaps. 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, and 29), the two primary routes for new graduates in food industry are quality assurance and research and development (sometimes called product development). They are both equally valuable roles in the food manufacturing industry; however, they require very different work styles. Quality assurance is assuring that the quality of the food and the production facilities are continuously monitored to ensure that the food produced remains safe and up to specifications. This generally involves a more standard day-to-day routine with tasks, such as daily checks, monitoring, and an in-depth understanding of the regulations in the company. Conversely, research and development generally will have more variability in the tasks that are required, as the duties generally concern the development of new products, which is always changing. Although quality assurance also has development projects, research and development will always be completely project driven, based on the needs of the company at the time. If you find that you enjoy methodical work, then quality assurance would be a great fit; however, if you enjoy fast-paced, project-based work, then research and development is

likely the better fit. This is—of course—dependent on the company that you choose to work for. These generalizations may not be universally true, as some companies will put greater stress on either department. It is important though to understand the complete job description prior to making a decision about where you would like to begin.

The connections that you can gain through either job can help drive projects forward in the future as well. The food industry, as many say, is very small, which means that the people that you meet in your industry experience will likely have connections in your future career path. Learning networking skills in industry early will only help, as you can apply them to all future career paths, and they may even open future opportunities for you. Furthermore, the people that you meet early in your career may over time advance to higher positions such as directors, VPs, etc. That being said, getting to know these people early on will allow these connections to foster into even more influential ones in the future. A "previous boss in industry would help me get a job again if I ever needed one" and "was incredibly vital to the quick success of my current project," says graduate student, Lindsey Doring. This is just one of the many ways that you might be able to utilize industry experience in a future path to achieve your goals.

For some, the allure of industry may be less of a pull and rather a push away from continuing education in graduate school. After 4–5 years of undergraduate education, many may find themselves ready to apply the vast amount of knowledge that they have learned in a tangible way. Food science departments are heavily focused on teaching the application of the concepts, as it would be within an industrial setting. Knowing this, it becomes enticing to put these newly learned skills to the test. Along with this, many may find themselves exhausted from school and wish to take some time to refocus while also gaining valuable experience that will help their careers. The combination of all of these feelings may push students toward industry, and it is a valid decision for those that are feeling this way. Undergraduate education is long and hard, meaning that burnout is a real challenge that many face and should be considered when making a decision. The choice to go into industry, due to the feeling of mental exhaustion, is one that many undergraduates have made and there is no shame in making this decision for yourself. Everyone has their own paths, and choosing personal well-being should be at the forefront of all decisions.

Another driving factor for many people to choose industry over graduate school is based on basic needs such as an income. This is a logical, acceptable reason to make the decision to pursue industry after graduation and one that played into my own personal decision. At the University of Wisconsin-Madison, for example, most students see offers around $55,000–$65,000/

year with a lucky few being offered even more. After years of paying college tuition and even more years of paying those loans to come, a job in industry clearly offers stability and plenty of upward mobility with only a bachelor's degree. If the point comes where a graduate degree is necessary for further promotions, many companies offer programs that subsidize or pay for relevant further education. This is a phenomenal way to continue working and paying off any student loans or other expenses while also ensuring that any further, job-related education will come at little expense to you.

A career in the food industry will give students valuable knowledge of the food manufacturing world and help them find and achieve their goals. It will give them direction into where they hope to see their future careers go and show valuable application of the knowledge that has been gained from undergrad. Coinciding with this, it will help build a network that will aid your future career, and many may find that industry is exactly where they belong. Knowing this early will save time and money that may otherwise be wasted on graduate school. It is important to remember that graduate school will always be there and always be an option in the future. You are at the start of your career, there are so many experiences to come, and the world of food manufacturing is huge. Take the time you need to explore it and find your path. You may find yourself in a place that you never even expected.

Going into Graduate School

Many students will find themselves pulled toward graduate school and all of the benefits that it can offer in their future career. Although not as wholesome as The Great British Bake Off, graduate school helps develop vital project management skills as well. It may even open doors in your field of choice, but there are—as in all decisions—many variables to consider prior to making this choice. Although further qualifications initially sound like a great decision for any path, it is important to understand that one of the most important factors affecting your future career is the subject you choose to study in graduate school.

Prior to making the decision to go to graduate school, one needs to be relatively sure on the topic that you are interested in studying and your goal in studying it. "There are so many options nowadays too" says Christine Nelson, graduate of Northwestern University, "don't be afraid to explore a niche program if you have a passion." The specific advantages of the different graduate degrees will be discussed further in the "PhD Versus MS" section later in this chapter. A PhD though will give a student a very

individualized skill set, while the master's degree will teach your project management and development with less focus on the specifics seen within a PhD. With either option though, it is important to remember that you will be spending years and countless hours with the topic that you choose. In graduate school, the students have the responsibility and privilege of being able to build the research project along with the overseeing professor. Without a significant income, the main driver to complete this project must come from individualized passion and desire to succeed. Although—especially with a master's program—it may not be the topic you explore for the rest of your career, it will be a taxing few years in graduate school if it is a topic you do not enjoy and can even lead to burnout if the student is not mindful. That being said, enjoying the topic that you choose will lead to much more success and overall enjoyment of your path for the next few years of your life.

Once a specific topic is decided, then the next question that needs to be asked is where you would like to see your career go once your graduate education is completed? For example, is the research and development trajectory the path that is in mind? Research and development is a large portion of the world of food science and is intriguing to many students, as it is the innovation of new products. Although it is possible to work in research and development without a graduate degree and many find themselves doing so, it is significantly more difficult than if they had obtained a graduate degree and gained the skills that accompany it. Many recent BS graduates find themselves more qualified for positions in quality assurance and may be directed toward a career path that they were not initially intending to follow. It is logical that employers may look for applicants with graduate degrees, considering there are many skills that one has to gain from conducting their own research that apply to a role in research and development.

No matter the subject area that one chooses to study, the soft skills that one is able to gain are transferrable to any future projects that are given to you. A reason that various postgraduates for this chapter gave for going to graduate school was that they felt that they lacked the basic skills that were required to manage their own projects immediately following undergraduate graduation. The ability to create an experiment, manage the timeline, and present conclusive findings are skills that will make one's research—whether in academia or industry—more convincing. Graduate school requires an independent individual and forces students, in an unstructured environment, to conduct individual research, compile it, and convince a panel of decorated academics that their research holds scientific value. These are skills that can be applied to a future career within industry, considering that scientific findings in a food manufacturing facility will have to be run past various members of upper management, such as a manager, supervisor, director, etc., and

your job will be to convince these people that your research holds validity. If all goes well, some may even find themselves in those upper management positions and will be responsible for making the choices of whether the findings within the company should be scaled up and applied to the whole facility. The background knowledge from having your research undergo careful examination will also give you the skill set needed to understand the validity of other projects as well. These high-impact choices will create and define career paths and overall performance; therefore, the ability to understand the background research that needs to be done and how that is effectively communicated will only put one in a better position in the future.

From my interviews with former graduate students, it seems that the most important skill gained during a master's or PhD program is critical thinking, which is not always emphasized in an undergraduate education. After years of memorizing and applying information, undergraduate students are accustomed to there being a right answer at the end of a series of experiments or, at the very least, following a protocol and getting the expected outcome of the experiment. This, however, is not the true reality of science. The path to discovery is often riddled with technical issues, unexpected outcomes, and—frankly—dead ends. A research project for graduate school requires students to be able to independently troubleshoot these issues and find a path to answer the question that they set out to solve. The transition to critically thinking about the knowledge that has been learned is a difficult leap for many students to make, especially in the fields of science. Graduate school provides a tool kit that can be used to synthesize information and scientifically solve a problem in a timely and independent fashion, all characteristics that will help you in your future career.

The communication of your findings in graduate school will also prepare you to persuade others that the solution you are proposing is truly the best decision for the problem at hand. By giving various presentations, teaching courses, and eventually defending a thesis, graduate students gain an in-depth knowledge of presenting difficult, scientific topics in an effective and informative manner. An important aspect of working in any field of science is presenting very technical, specific information to a panel of specialists in a manner that communicates your findings while also persuading others that your experimental design provided accurate results. A thesis defense will prepare students to compile their findings and present them both orally and written to then, as many termed it "be torn to shreds." That being said, proceeding to do the same to a director that will analyze the big picture, rather than the finite details, will come with much greater ease to someone that has had the experience of defending a thesis.

Overall, there are many reasons why an undergraduate student would choose to attend graduate school rather than entering industry directly after graduation. This is, however, a very personal decision that must be made with great consideration. As mentioned, if one is not completely sure about the field of study, industry is a fantastic avenue to discover what part of the food manufacturing industry is the right fit. If that decision is already clear after completion of undergrad though, graduate school is another valuable avenue to hone the skills that were learned in undergrad and apply them to a specific topic that can advance your career before it even begins. It is, however, a personal preference and decision. Both opportunities will advance your understanding of the food industry; therefore, if presented with either option, always remember that there is not a wrong choice and to do exactly what will push your career forward in the manner that you need it to.

PhD Versus MS

If graduate school is the right choice, you will need to make the decision whether a master's or a doctoral degree would be the right fit for you and your career goals, as previously discussed. Both tracks offer positives and negatives that must be weighed prior to making a decision. The most important aspects to consider are what exact field you would like to study, the skill set that each path will give you, and how that will influence your future career trajectory. Throughout these deliberations, be sure, as previously mentioned, that you choose a subject area that you feel passionate about building upon.

A master's degree is generally the route that is most commonly taken when the end goal is to return to industry and continue a career there. As previously stated, a master's degree can help better your career and give you valuable skills that are directly transferable to a route in the food manufacturing industry. Many professions will often even require a master's degree to enter the field, such as certain research and development positions. Although many undergraduates are able to break into the field of research and development without a master's degree, the path may be more difficult and could lead to fewer promotions in the future compared to someone with a graduate education. Many, in industry, find themselves having to return to graduate schools to receive an MS, if they hope to be promoted further along their trajectory. As graduate school gives students valuable knowledge, such as presentation skills, confidence, organizational skills, and business acumen, employers will often place value on graduate degrees, as it is an indicator for future project success.

Furthermore, a master's degree will be advantageous no matter what career field they pursue. A professor at UW-Madison even noted that he has "seen many students go from confection MS projects to working on dairy or meat." There are benefits to pursuing both degrees; however, the goals and skill sets gained will be different. As will be discussed later in this section, the main benefit to a master's degree is learning how to complete a "detailed research project, in general." Liana Rodier who holds a master's degree focused on chocolate, for example, started in confection and switched to a brewing company that held "the values and prospect that were right" for her; however, she was still able to apply the skill sets she gained from her master's degree. What this means is that future employers will not always find PhD applicant to be more competitive than a master's degree applicant, unless the field of study directly relates to the job opening and its requirements. If you are unsure, however, what sector you hope to spend the rest of your career in, a master's degree is a more logical degree choice in the short term.

That being said, another question that is frequently asked is what form of master's degree, if any, would make the most sense moving forward in your career? There are various programs to choose from, and in a broad sense, there are two types of master's degrees, a professional master's degree and a thesis-based master's degree. Both can be advantageous and offer skill sets that can promote your future career but in different ways. Professional master's degrees will focus on the development of broader subject areas along with professional connections through coursework. These master's degrees will generally be slightly shorter, require more coursework per semester, and less time, if any, on an independent research project. These are a great option for those looking to simply expand their knowledge of food science as a whole, without getting overly specific and with less of a time commitment. It must be noted, however, that these degrees are not for building a future PhD and cannot be transferred to this career trajectory. Employers in the future may also offer to pay for a professional degree, if they feel it will increase your performance at a company; furthermore, they can often be completed while working full-time as there are online offerings for this degree as well. Both of these should be considered prior to beginning the program immediately after undergrad. As these degrees are generally paid for out of pocket, it may be more beneficial to look into whether a company would help fund this degree in the future.

A thesis-based master's degree, conversely, will allow students to build the skills that are generally associated with project development, management, and presentation. These include the ability to develop a project, dictate timelines, utilize resources, and compile data in a logical format that is

later presented to a committee. These skills, specifically, are what allow students to be able to continue on to PhD work after completion of the master's degree; however, the same skills are also transferable to industry. Thesis-based students will gain more technical knowledge and soft skills that can lead to future success; furthermore, these types of master's degrees generally offer full tuition coverage with a small stipend allowing them to be more accessible than the former. During the thesis-based master's, students will also have the opportunity to gain connections to industry and government agencies while developing knowledge of a specific subject area. In summary, a thesis-based master's degree will give students more in-depth knowledge of a topic and skills associated with project development/management; however, they take more time and may be overly specific depending on the knowledge hoping to be gained. The questions that must be asked when deciding on the type of master's degree to pursue are how much time do I want to spend in graduate school, do I feel that the skills gained from thesis-based master's would be beneficial to me, and what are my future goals? Once these are answered, you will be able to decide what is the best trajectory for you and your future goals.

A PhD, however, will open other fields that are less directly related to the food manufacturing industry. One of those routes that can be taken is within the field of academia. Many will find themselves intrigued by the idea of becoming a professor and exploring the world of research immediately after completion of their undergraduate degrees. Considering many professors would prefer to have a PhD student join the lab as they will be staying longer, this will also possibly allow for there to be more options when choosing a lab in which you would like to study. If research is your true passion, then a PhD is essentially the only way to stay in academia.

A second option that requires a PhD would be the government route, which is another opportunity for undergraduate students. There is a vast amount of food laws and regulations that are developed, mitigated, and implemented by a highly trained group of food scientists. In order to enter this field, a PhD that specifically relates to the government—the FDA, USDA, etc.—would be the most advantageous path to help you achieve your goals. Although a PhD can further your career in industry as well, depending on the company, a PhD is rarely a requirement to enter the field. For example, a former PhD student joined a large, international company following graduation and stated that she found her PhD was valued heavily at the company; however, that is not always the case and you may find yourself in a similar position as someone holding an MS. A PhD does take 4–6 years to complete, and prior to making the decision, one should be completely sure that this is the route that you would like to pursue. If you do change your

mind, many graduate schools will allow you to leave the program with a MS degree after a certain amount of time; however, that should never be your intention when entering the program, and this part of the program should be clarified prior to beginning it.

Clearly, deciding to attend graduate school is more complicated than simply deciding that industry is not the right fit at this moment. It is important to remember, however, that these degrees are very specific. As mentioned, this means students must be 100% sure on the subject area prior to making this decision. All three of these degrees are incredibly beneficial to a career, if they align with the goals of said career. Graduate school will always be an option; therefore, if you are not certain, take the time that you need to be sure about what foundation you wish to build for yourself.

Making the Decision

After obtaining all the background information mentioned above, it comes down to making the decision that is best for you. Having been there myself, I understand how difficult it can be to have to choose between two incredible opportunities. Prior to making the decision, it is important to remember that there is no wrong decision, to be grateful that there are opportunities presented to you, and no choice is forever. Completion of the BS degree is simply the beginning of a long and lucrative career, and the choices you make now influence your future, but they do not define it. What is done with the opportunity that is chosen is what defines careers and future possibilities.

Keeping this in mind, there are a few more concrete tips that can help make this decision clearer to you; however, this decision-making process is personal and may not be effective for all. First and foremost, a pros and cons list may be able to give you the clarity that you need when making this decision. Sitting down and definitively writing out what is important to you and your career goals will help clarify and force you to take a critical lens on both choices. Many find this helpful, as it gives a visual representation of the points and their outcomes. Although it may not always be as clear as one side having more points than the other, it may give clarity on the subject and give a sense of control when making the decision. If this does not make your choice clear, talking to a trusted advisor or mentor may also give you another perspective on the topic. They may be able to provide a perspective that you did not consider yourself that could shed light on the issue. Furthermore, advisors and mentors tend to have a relatively good idea of who you are and

how you work as an individual. That being said, they may be able to give input on the route that they could theoretically find you to be suited for. Ultimately, it is your decision, and you should only take their advice for what it is—advice. You should always do what is best for you and your career. If you do not agree with the recommendation that they made, that could even give you the answer that you have been looking for. If neither of these routes bring clarity though, a simple coin toss may answer your question. You assign sides—one for graduate school and the other for industry—and let fate decide. Once fate has decided though, then you can determine how you feel about the side that it landed on. Whether you feel positively or negatively about that decision, may also bring you clarity.

There are various ways to reach a decision, but at the end of the day you have to decide what path is right for you and your career. From personal experience, I chose to not go to graduate school immediately following undergrad although I was offered the opportunity to pursue both. I was given an opportunity in industry that would help me grow as a professional, and I knew that graduate school would always be an option later in my career. That being said, I deferred my offer for graduate school for a year to gain further experience in industry. I wanted to also keep the option open, in case I desired to later switch the course of my career, as previously discussed. This was my decision for my career, and I am happy with the one that I made.

The transition from undergrad into either the food industry or graduate school is an exciting time where the whole world of food science is open, and you can take any direction you want. Although it can be daunting, it is a unique time and—considering there is a choice—it is obvious that your hard work from undergrad is paying off. That being said, congratulations and remember, there is no wrong path, just the one that is right for you.

Annika Madler graduated from the University of Wisconsin-Madison in 2021, where she majored in food science and minored in global health and German. During her time at UW, she was active in the Food Science Club, performed undergraduate research with Dr. Bradley Bolling, and was part of the product development team. During the summers, she was also able to complete an R & D internship with Glanbia Nutritionals and a quality assurance internship with Lindt & Sprüngli. Immediately following graduation from UW-Madison, she started a full-time rotational position as an international trainee in operations with Lindt & Sprüngli. After an extremely valuable year with the company, she decided to return to school to pursue her Ph.D. at Cornell University.

Chapter 31
Finding and Getting into the Right Grad Program

Nigel Kang

Introduction

Searching for a suitable graduate program can be daunting, which is no surprise given the multiyear commitment graduate school requires. The decision to pursue an advanced degree itself is one that demands an ample amount of thought and consideration. Yet, the next step of finding the right graduate program can be just as taxing. That said, much of the rationale behind the decision to commit to a graduate degree informs the graduate program selection process, meaning that they both go hand in hand.

Setting Yourself Up for Graduate School

A cliché heard often is to start early. This applies even if you think beforehand that graduate school is not right for you. As almost all undergraduate students have their future career in their best interests, it is always worth entertaining the thought of obtaining an advanced degree. A solid job right after graduation is the most obvious end goal for college students, and that is what students typically strive for. However, the extra commitment and possible financial strain of graduate school can turn out to be a great investment to bring about improved career prospects and further personal growth. In this regard, pursuing a graduate degree is ultimately a career choice as

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well—albeit one that necessitates more time to actually begin a full-time job. Given the costs and benefits, one cannot prematurely know for sure if involvement in a graduate program is right for them. For this reason, it is important to consider the options thoroughly and take calculated risks as necessary. If you do not hold a graduate degree and are reading this chapter, it is most likely that you are already considering a career that involves obtaining an advanced degree.

The first step is to recognize the resources available that can help with the graduate school decision-making process. For those who are currently enrolled in college, a great example would be the school's career services department or center. Counselors and career experts are available for guidance according to needs and goals. Students can obtain support through the entire process such as exploration, research, planning, personal statements, applications, interviewing, and deciding. Many workshops, events, and alumni panels about graduate education are also typically organized by these departments. Making use of the resources offered on campus not only connects students to knowledgeable people and other considering students but also prompts students to evaluate their career goals.

If such campus resources are not accessible or available, the Internet would serve as an excellent starting point. A wealth of information can be found, including school and department specifics. Actively using these tools will help you develop clear and defined goals, by which the graduate program search is facilitated.

The search may not be active, per se. On a day-to-day basis, information on graduate school can be exchanged within social circles. Ask questions to those who have experienced graduate school or are applying to one. Listen to their stories. Gain as many perspectives as possible. Consult your advisor, faculty members, and graduate students (i.e., teaching assistants). When you have the opportunity, bring up the topic at networking events, career fairs, internships, volunteer opportunities, and competitions. More often than not people are willing to share their experiences. In fact, these people might share details about graduate school that would not be typically brought up in a workshop or talk, for example. This way, better-informed decisions can be made.

Through the process of gathering information from various people and resources, one can better reflect and evaluate how to move forward with the decision-making process. It will be easier to respond to the following questions:

- Where do you see yourself in the years ahead?
- What is your motivation, drive, and reason for graduate school?
- What do you expect out of graduate school?

How these questions are answered are important because (1) it informs you on which graduate programs are in alignment with your career plans and, additionally, (2) it will likely be one of the key talking points in your personal statement or application essay.

How to Identify Graduate Programs

Picking the right graduate school or program can be demanding. With many to choose from, one can easily fall victim to decision fatigue. Hence, having a firm idea of what to expect and is desired out of graduate school will help prioritize the factors deemed most important. That said, priorities may change as you explore different programs. Most graduate schools open up applications a year before the program start date and evaluate applications as they are received. To improve the chances of admission, students are recommended to begin their search at least one and a half years ahead of time. This also allows time for students to make educated decisions and prepare effectively. There are a multitude of factors to consider for food science graduate programs, but what is deemed most significant is up to the individual.

A good way to get started is browsing through the list of graduate programs approved by the Institute of Food Technologists (IFT), which is available on their website. The IFT is an international, non-profit scientific society of professionals engaged in food science, food technology, and related areas in academia, government, and industry. IFT-approved programs are a marker of quality and a comprehensive food science curriculum. These programs also tend to have strong affiliations with the professional body, which can be a boon to one's professional development as a food scientist.

From this list, learn about individual graduate programs of interest. Information on faculty, research activities, facilities, resources, curriculum, and accreditations can be easily found on their website. During this search, it can feel like a trip to the mall, in that one can either be objective or not; something specific might be sought after, or something interesting might simply appear.

What to Look for

Chances are that the choice of faculty is going to be one of the most important considerations. Graduate students are expected to conduct research on a particular topic. Expectations, motivation for graduate school, and career

goals should be in parallel with research interests. Survey faculty members to get an idea of their research foci. Simultaneously, note down professors whose research are of interest. Knowing the kind of expertise possessed by the faculty will determine whether the program is a good fit. For example, it will not be easy to carry out sensory research of meat products if there is no research group that studies sensory. Although a big part of graduate school is thinking and working independently, ultimately, the support and tools from faculty members will be the anchor to the graduate student's research. Hence, the goal would be to find the right academic advisor who can provide appropriate guidance.

Once possible advisors to work with have been identified, look for information on their research group's website. This is because the work of graduate students likely falls within the context of the group. Accordingly, it would be helpful to know about ongoing projects or collaborations with other labs, companies, and organizations. Taking advantage of contacting current students via email, LinkedIn, etc., to hear out their perspectives on lab culture and the professor's advising style will help determine one's fit for the group. It is also an opportunity to get important details on funding and lab space availability for incoming students.

A school differentiator is the facilities. Many food science departments are known for specific areas of research—and these indicate the type of facilities available to carry out such activities. For instance, one school might have a reputation for dairy research, while another might have a reputation for wine or plant protein research. These schools tend to be at the forefront of their respective research areas; accordingly, many of them will have a department or center dedicated to that domain.

The next consideration would be related to the program itself. It may be useful to know the program curriculum (i.e., courses offered). The list of available courses should help meet educational and professional goals. If one is not from a food science background, it would be wise to be on the lookout for courses with prerequisites. Some programs consider the applicant's history of courses taken during undergraduate studies. Having taken fundamental food science courses not only speeds up meeting the course requirements of the graduate program but also improves the prospect of admission.

To succeed as a graduate student, it is imperative to achieve a healthy work–life balance. Learn about the university campus and student life. Geographical location can be a strong determiner of well-being. Factors such as campus setting (urban, suburban, or rural) and climate can be important considerations. Perhaps one thrives better in a given student demographic; universities tend to have these types of data available on their website. If possible, a university visit may be warranted.

One's prospect of admission would be the final consideration. Graduate programs have different requirements such as degree background, minimum CGPA and official test scores, completed coursework, and other specifics. Some programs have admission statistics found on their website, which can allow students to gauge their prospects. Although it is important to keep an open mind throughout the graduate school search, being selective may keep you focused and happy with your decision at the end of the day. Besides that, application fees also add up.

Applying for a Graduate Program

The next course of action after identifying graduate programs of interest would be to start applying. Applications for graduate programs consist of a list of requirements and generally have fixed timelines. Requirements vary by program, but it is not uncommon to be asked to submit the following: recommendation letters, at least one essay, GRE test scores, and a resume or cover letter (CV). Hence, it is always smart to prepare ahead of time. This may also improve the prospect of obtaining departmental funding such as assistantships.

Undergraduate students are encouraged to build a diverse range of experiences during their studies. A significant part of the undergraduate experience is getting involved in activities such as research, work, internships, student organizations, volunteer opportunities, and personal interests or hobbies. These experiences will be the bedrock of one's graduate school application. Having multiple experiences not only demonstrates that the applicant is well-rounded, but it also allows applicants to write stimulating essays, find recommenders, and produce solid resumes/CVs.

Throughout such experiences, it would be prudent to frequently reflect on the activities, tasks, and responsibilities carried out. Document the challenges faced and how they were overcome, what was learned, and what was liked and disliked. These written accounts can help provide relevant yet adequate details in your application essay. It could also be a way to relate to the reasoning for entering the graduate program.

Meanwhile, fostering relationships is essential to getting admitted into graduate school. Letters of recommendation are important considerations in an application. These are written and submitted by recommenders, individuals who know the applicant well enough to provide an evaluation of their ability to perform and succeed at the graduate level. Recommenders are typically professors, employers, or academic advisors. A convincing letter from a credible source has the power to impress the admissions committee in a

manner that the other application materials cannot. Therefore, make efforts to develop close, professional relationships with potential recommenders and approach those who are likely to write a good letter. It would be helpful to provide relevant details about the applicant and application itself.

Additionally, identifying other applicants may also help with the preparation. Most schools require applicants to submit GRE scores. The GRE is a standardized test consisting of a verbal reasoning, quantitative reasoning, and analytical writing component. Like most standardized tests, practice makes perfect, and organizing study groups can facilitate preparation. If you know of other applicants who have completed the test, reach out for advice, tips, notes, or other materials that they may be willing to share.

How to Reach Out to Professors and Prepare for Interviews

Students are recommended to reach out to the professors they seek to work with before submitting an application. This can be done by sending a *personalized email* containing the following: (1) a short and concise subject line; (2) an introduction of one's self; (3) a statement of interest, a thoughtful comment on professor's work, and a possible reference to a previous related work/experience; (4) a resume or CV; and, most importantly, (5) a clear and simple inquiry. As professors have tight and busy schedules, emails should be kept brief, including only absolutely necessary information and inquiries.

Contacting professors in advance guides the graduate school application process. It is important to acknowledge that sending out emails does not guarantee a response. Professors can be very busy and may not be able to respond to the sheer number of similar emails from potential students. If there is no response, give the professor the benefit of the doubt and send a follow-up email after at least 2 weeks. After two emails with no response, it is highly likely that the professor is not taking on new students. In this situation, the application may not be worth pursuing, and this can save money and time. Suffice to say that this common outcome is the reason why one should consider several professors of interest instead of just one. While a student might even hear back to be informed that the professor is not looking for new students, they might recommend opportunities with other faculty members. If the professor is interested, the applicant takes on an advantageous position in the sea of other applicants—in which case, a follow-up meeting is likely to be scheduled.

The purpose of the meeting for both parties is to learn about each other's background, research interests, and work style. Generally, the goal is to

gauge compatibility. Therefore, it is best to remain authentic and honest, as both professor and student will work closely for at least a few years. For the student, the meeting is an opportunity to sell oneself and ask questions. Professors might be interested to learn more about the prospective student's experiences, for which preparation will be necessary. Perhaps it may be useful to review the resume/CV sent out and reflect on those experiences should questions arise from there. In addition, prospective students should be well-acquainted with the professor's work and research interests. Look up content found on the department and research group's website, on which titles of published articles would be displayed. With adequate background research, one is less likely to ask research-related questions that are accessible online. The individual would be perceived as genuinely interested, resulting in a more serious consideration.

Prior to the meeting, prospective students are encouraged to reach out to students currently working with the professor. This is particularly important as their experiences and perspectives are going to be the most relatable information available. One may ask details about their funding situation, ongoing projects and involvements, relationship with the professor, and other questions that can facilitate a more fruitful meeting with the professor later on. With the information learned, name-drop the students contacted during the meeting to show initiative has been taken. Professors like to know that their students get along with one another. In fact, it is not rare for some professors to arrange an informal follow-up meeting between the prospective student and current students.

How the first meeting plays out may differ depending on the professor. The degree of formality can be as casual as a simple conversation or as formal as an interview. The meeting can also either be in person or virtual. Regardless, it is always important to be professional and objective, as in most academic settings. Professors are likely to guide the flow of first meetings. They may explain more about their work, in which case acute attention is expected. Taking notes is a good way to demonstrate this. Simultaneously, students should be prepared to answer questions regarding their research interests, experiences, motivation, goals, expectations, ability to handle difficulties, etc. While accomplishments are good selling points, professors are generally more interested to learn about the student's potential and their fit into the research group.

The meeting is also an opportunity to have an intellectual conversation revolving around the professor's work, emphasizing the need for adequate preparation in advance. The purpose is not to sound smart necessarily; rather, it is to display enthusiasm toward their area of study and some knowledge of it. Other examples of important discussions to have are the practical details such as the following:

- What open projects are available to take on? How is funding going to be secured?
- What is the degree of ownership on the project? How much supervision will be given?
- What are the expectations of graduate students in the lab?

Try to avoid technical inquiries that can be answered by current students or visiting the program website as they may be perceived as trivial and unproductive, at least for the first meeting. Such examples may be classes to take, weekly hours spent in the lab, vacation days, and graduation requirements.

As the meeting concludes, both professor and student should have a feel for each other's compatibility. If both parties are interested, there should be a discussion of the steps to take next. Take the initiative to request materials to read in the meantime or the opportunity to attend lab meetings. Finally, just as it is with any job interview, students are advised to send out a thank-you email after the first meeting with the professor.

Summary

Attending graduate school may not be suitable for everyone. With many options and scenarios, finding the right program is a challenging process. This also makes the approach to finding a suitable program, applying, and getting accepted not easy or straightforward. Depending on the individual, multiple approaches can be taken to achieve these goals. Recognizing one's academic interests and career goals, utilizing resources, and seeking help from others are good stepping stones that lead to getting into the right graduate program. As applications tend to operate within a structured timeline, preparation in advance is crucial to ensure a smooth process with desirable outcomes.

Nigel Kang earned his BS degree in food science at the University of Wisconsin–Madison in May 2020. He was an international transfer student, hailing from Malaysia. As an undergraduate, he worked in a microbiology laboratory, where he completed a summer research program under the mentorship of Dr. Tu Anh Huynh; completed an R & D internship at Profile Food Ingredients, a dry food blending company that focuses on stabilizer/emulsifier systems; worked as a caterer and bartender; volunteered as a teacher in a middle school; and competed in an IFTSA product development competition. He is currently pursuing a PhD in food science at the University of Minnesota–Twin Cities, focusing on oat protein research.

Chapter 32
Transition from Undergraduate to Graduate Student

Lindsey Doring

Introduction

Graduate school is an exciting endeavor many students choose to take on to advance their careers in food science. Although exciting, it is a completely unique experience compared to that of undergraduate studies. Many students may find themselves ill-prepared for the learning curve that comes with beginning graduate school. Undergraduate programs are typically very structured with the curriculum and requirements for graduation clearly outlined. Graduate programs are almost completely independent with a loose structure that gives students the opportunity to take ownership over their academic learning and career advancement. Due to the autonomous nature of graduate programs, it can feel like there is a lack of guidance and direction, especially at the beginning. Whether pursuing a thesis-based master's degree or a PhD, graduate studies are an entirely different experience that requires a different skill set. The transition to graduate school can be a challenge; however, it can become easier to manage when armed with knowledge of how graduate programs are run and the general expectations of students.

A graduate program in food science typically requires students to complete prescribed coursework, exhibit a general knowledge of food science, and demonstrate the ability to perform research in a specialized area through completing a thesis or dissertation. A student may also need to complete a teaching assistantship and/or a research assistantship. The exact requirements for graduation vary between departments and universities. Depending

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on the school, students may choose their major professor, also known as an advisor or principal investigator, during the first semester or prior to entering the program. The role of an advisor is to guide students as they progress through the program and their research. They may or may not assist with the adjustment to the new environment of graduate school, but a good advisor will help students learn the structure of the program and understand what is needed to graduate. However, more often than not, learning those specifics may be left up to the student by seeking the help of other students and departmental staff members.

Taking this into account, it is helpful to note that the requirements for the coursework will vary between universities and whether a student enters the program with a bachelor's degree in food science. Most classes will be related to specific research interests or the further development of an overall understanding of food science. If a student has a bachelor's degree in a field other than food science, they will likely have some additional required courses in basic food science concepts and applications. However, the true purpose of a graduate degree in food science is to show mastery of specific subject matter by independently developing and completing a research project. Therefore, the research requirements are the most emphasized aspect of the program. Students are required to both develop and manage a research project, write a thesis or dissertation, and finally, defend to a graduate committee of faculty members.

Given these requirements, it is often challenging for many students to know the expectations of the department and their advisor; how to develop a project, handle setbacks, and balance work with physical, mental, and social needs; and career advancement opportunities. This book chapter serves to give insight and advice from current graduate students, including my own personal knowledge, to assist new students in the transition from undergraduate to graduate school in food science. This chapter is only meant to provide insight and advice and may not reflect all experiences and expectations. It is important to know, especially when first entering a graduate program in food science, that it is your own personal journey. Everyone has a different path for completing their degree, and it is almost impossible to compare your progress directly to another student's.

Expectations of Graduate Students

Graduate students are held to high expectations, and misunderstanding those expectations can impede or delay a student's progress. A common note from current and former graduate students is that the department may not fully or

effectively communicate expectations, but they instead are often learned along the way. This section outlines what new graduate students should expect when entering a program, some of the expectations held for them as they progress, and some advice about how to help manage and meet those expectations.

The best way to understand the strict departmental expectations and requirements is to read the graduate student handbook. Every department likely has a version that outlines the general requirements to graduate including important deadlines and additional resources available to students. If the department does not have an effective orientation or introduction into their program, the handbook is a vital resource to have as a reference throughout your graduate studies.

One common misconception many students have when starting a graduate program is the role their advisor plays in their graduate education. An advisor is not a manager; conversely, they act as more of a mentor to guide you in your progress. Graduate students are expected to take total responsibility over their graduate study. An advisor is there only to act as a guide, give advice, and point a student in the right direction when necessary. Students are expected to manage their time and schedule, to meet any and all deadlines, and to manage the direction and completion of their program requirements almost entirely independently. The level of independence involved in graduate school is the most challenging aspect for many students in the transition from undergraduate to graduate studies. Strategies and suggestions for managing the transition to this level of independent learning are provided throughout this section.

Advisors typically have additional requirements and expectations separate from those held by the department. It is strongly recommended that students discuss these expectations and requirements with their advisor early on or even prior to starting the graduate program. These requirements may include additional teaching assistant (TA) or research assistant (RA) work, training in the lab, attending or presenting at conferences, publishing a certain number of journal articles, and so on. Different labs have different expectations of their lab members. It is vital for your success to know what your advisor expects of you at the beginning so you can plan and prepare accordingly. It is also helpful to communicate to your advisor your personal goals and expectations for graduate school. That way you and your advisor can start your studies on the same page and develop a plan that satisfies both parties.

Although expectations can vary between departments and labs, there are some that are relatively universal across all food science graduate programs. These universal expectations include designing your coursework, taking ownership over your research project, forming a committee, and writing and defending a thesis.

The required coursework will likely vary between universities. Some may require more courses than others, but ultimately, you will be able to choose, or work with your advisor and committee to select, the courses that best reflect your area of interests and will give you the most value toward your continued education. It is understood by all parties that the courses you take in your graduate studies are important, but they are not the main priority. Many students look at their classes as a break from research and are used to help build their knowledge base. Graduate courses are often also taught differently from undergraduate courses. Typically, they involve more independent learning and comprehending the material than completing assignments or exams. They often involve fewer, larger assignments compared to undergraduate courses and include a bit more flexibility. However, the format of each course completely depends on the university, department, and individual professor.

In addition to completing coursework, graduate students must also take total responsibility over developing, managing, and completing a research project. In taking ownership over a project, a student is expected to design and manage their own experiments. If they do not have prior experience, they are expected to learn the details and methods from literature or from other students. Some labs may designate the first semester to training under another student or lab manager to learn how the lab runs and to develop specific lab skills. More often than not, a student does not receive formal training in the lab, and it is left up to them to learn the necessary lab skills and methods required for their own project. In addition to being able to perform an experiment successfully, a student needs to be fluent enough in their research methods to train others. They should be able to accurately describe their methods in detail and present them at a high level.

The previous expectations mentioned lay the groundwork for another major component of graduate school, writing your thesis or dissertation. It is recommended that one of the first things students do when entering a program is to review other students' theses or manuscripts to gain a fair indication of what is expected of them in terms of their research project and writing requirements. Once the thesis is complete, graduate students must then defend it to their committee of faculty members. Students are typically required to form their committee within the first 6 months to a year of their program. It may be difficult early on to know which faculty members to invite to a committee, especially if a student moves to a different university or department from where they attended undergrad. In this case, an advisor and other students should know the department and the faculty members well enough to make suggestions on who would be best suited in terms of background, expertise, personality, and availability. The committee

members are the ones responsible for the candidate's fate at the end of the program; pass, pass with revisions, or fail. That being said, it is beneficial to choose committee members that are well suited for your specific project and will support you as you progress.

There are a lot of moving parts to graduate school, and there is a lot expected of graduate students. Therefore, it is good to remember that many others were in the exact same position before you and have done it successfully. There are many ways to approach graduate school and to not only survive it but to thrive at it. The key factors that have helped graduate students be successful in the past include goal setting, time management, to maintain strategies to stay motivated, and to develop a good working relationship with your advisor.

One of the first things you should do when starting graduate school is set goals. Whether they are small or large, short-term or long-term goals, it is important to understand what you want to gain from this experience and where you want it to lead. You should aim to set manageable, practical goals and then work diligently to achieve those goals. Some examples from current and former graduate students are determining when you want to complete your degree, what organizations you want to get involved with, if you want to present at conferences, if you want to publish in a journal, and what skills you want to gain from this experience. In addition to considering those examples, creating short-term goals, like when to complete data collection, when to finish your literature review, what test you want to complete that week, or even how many articles you want to read that day, is a great strategy for staying motivated and on track to make progress and meet any deadlines. One way to help keep yourself accountable is to share your goals with others. Support from your peers and advisor will help keep you on track throughout your journey and help avoid allowing these goals to slip. Keeping your goals in mind, it is important to remember that research projects can change as they progress, timelines are often altered, setbacks occur, and sometimes you may even have to completely start over. Therefore, expectations of meeting your goals should be considered fluid as many short-term and often long-term goals change as you progress through a graduate program. The key is to figure out a type and styleof goal that works best to keep you accountable and motivated. Each student's progression is unique, and students hit their personal goals and milestones at different times and in different ways. You should never directly compare your progress with someone else's. When a goal or milestone is reached, it is important to celebrate and take a moment to acknowledge what you have accomplished so far.

An essential component for accomplishing your goals and meeting your requirements is effective time management. A graduate student is typically

in charge of their own schedule, which includes many different components outside of classes and research. Students will need to factor in assisting on additional research projects or teaching and any other extracurriculars and responsibilities taken on. Good time management also involves developing a work–life balance and factoring in your physical and mental health. This can be hard to maintain during graduate school as it can feel all-encompassing at times. Learning how you work best is key, as this schedule can look different for everybody. Whether that is breaking tasks into manageable chunks or specifically blocking out periods of time to work on specific things. Some students are more productive and successful with a structured schedule and may try to treat graduate school like a typical 9–5 job. This could mean they try to keep all schoolwork and research to a typical workday and leave nights and weekends for free time, friends, and family. Other students may thrive in a more varied schedule, taking it day by day, where every day looks different. This could mean going into the lab nights and/or weekends, switching off between lab work and coursework, or determining what to focus on each day depending on the priorities in that moment. With any type of schedule, it is important to know and manage the priorities for that day, week, or month in order to stay on track.

It is important to remember that—if you allow it—there is always something to do during graduate school and the deadlines can often be vague, ambiguous, and seem very far away. For example, depending on the nature of the research and the funding for the project, your only deadline may be to submit your thesis and to defend prior to your planned graduation date. That sort of deadline can make graduate school seem overwhelming at times and can make it so that there is always something to do and always something to work on. In order to avoid burning yourself out, it is essential to remember that life does not pause during graduate school and to celebrate holidays, spend time with friends and family, take breaks, and overall enjoy the time you spend in graduate school. Many students schedule their holidays and major life events first and then manage research and school time around those events. However, with ambiguous far-off deadlines, it may also be hard to work effectively and find enough dedication to get everything done in a timely manner.

It is vital to remain motivated, if not passionate, about your research project. It is easy to burn yourself out or to lose excitement. You will be more effective and consistent with your research and schoolwork if you are enjoying yourself throughout the process. Everyone has different strategies for staying motivated. Motivation can come from anywhere. Some students remind themselves of why they chose to come to graduate school, what their ultimate career goals are, and how graduate school is a major stepping-stone on their way to their career and life goals. One student, when she starts to

feel unmotivated, reframes her perspective by reminding herself of what a privilege it is to be in graduate school and researching something she is passionate about. Another strategy for staying motivated is to create a well-managed schedule by building in variety to a workday or workweek and building in breaks. This can help break up the monotony and repetition that is very common within research. Motivation can also come from other students, mentors, friends, and/or family. Creating a support system can help provide reassurance and advice and give a new perspective when you become frustrated, overwhelmed, or unmotivated.

One of the best support systems you can build is a great working relationship with your advisor. It is important to remember that your advisor is there to guide, evaluate, and monitor your progress. They should be able to give feedback and help answer any questions. However, if an advisor is not responsive, you should seek out someone who is willing to act as a stand-in mentor throughout your graduate studies. This could be a fellow and more experienced lab mate, one of your committee members, or other professors.

Your advisor is responsible for ensuring that you show an understanding of the relevant material and the requirements of the research. Every advisor has a different management style and may require or expect a certain amount of time or communication from you. Some expect or require weekly meetings and can be very involved in the development and progression of the research project. Others may be more, or entirely, hands off, and you must seek them out if you have questions or need advice. It is important to learn how your advisor best communicates, whether that is face to face or through email. Either way, when you do meet with your advisor, they may not give you all the answers or a direct answer. It will be helpful to identify what sort of communication meets your needs, for guidance and direction, but also meets your advisor's needs and respects their time.

Graduate school can be difficult and daunting. It is important to remember that departmental and university resources are always at your disposal and should be used regularly. During this difficult transition, you should learn what resources are available and start to truly build your graduate school network and support system to help succeed in graduate school.

Project Development and Project Management

All students in a thesis-based master's program and/or PhD program will need to complete a research project. As previously mentioned, graduate students need to take complete responsibility of their project in its entirety. No one, including your advisor, will know more about the project details,

timeline, and expectations than you. There are certain skills involved in both developing and managing a project, and everyone has a different approach to doing so. This section outlines the different parts of a research project and gives advice on organization and time management and discusses the advisor's role in the project and research preparation and expectations.

First, it is important to understand that the nature of each project is different. Everyone's progress and requirements will vary depending on multiple factors. Some programs or advisors will hand students a project or project idea when they enter the program, while others give students the opportunity to develop their own research topic. Either way, the basic steps involved in developing and managing a research project are more or less the same.

The first step will always involve reading literature to develop a strong knowledge base on your area of focus and to find gaps within the literature and opportunities for future research. This knowledge base is vital in developing a project, creating a research hypothesis, and building an experimental design that uses the right tools to properly answer a novel research question. Once a research topic is selected and well understood, the next step is to create a research hypothesis, followed by developing an approach and outlining the experimental design that tests the hypothesis. Once this is complete, you will then need to learn or potentially develop the methods outlined in that experimental design. This is followed by actually performing the experiments to collect the data, analyzing the raw data, interpreting that data, making conclusions, and finally putting it all together into a manuscript.

This is not a linear process. Research is dynamic and varies for every project out there. The experiments, expected outcome, or even focus of the project may change as you learn new things along the way. Some experiments may lead to the development of another opportunity that was not originally foreseen. Some parts of the project may not work out as planned and will need to be adjusted. In some cases, a project may even develop insurmountable obstacles and need to be scrapped and replaced with a new focus.

With that in mind, it is good to know that there are many ways to approach the massive undertaking that can be a graduate research project. It may be pertinent to use learnings and experiences from prior undergraduate research projects, undergraduate research assistantships, and senior design/thesis project experiences to help guide you as you begin the process. It may also be helpful to gain insight from what other students have done, although you should not use others' experiences as a mold for your own approach. The three factors that most former and current graduate students agree can help new students stay on track for their project are organization, time management, and communication.

The first phase of a project, where you are simply reading the literature and learning about a topic, can take a few months or a full semester and sometimes even longer. It is recommended that you keep all the relevant articles you read, document them, and keep them organized so you can easily refer back to those articles whenever necessary and reduce wasted time rereading or refinding articles. Many students use reference managers such as RefWorks, Zotero, or Mendeley to manage their numerous articles and sources. These reference managers also provide the ability to format references into a bibliography. Although it should be noted that this feature does not always format the references correctly. When reading the literature, it is sometimes difficult to comprehend the material. It is easier to build comprehension of a subject area by discussing the material with fellow students, your advisor, or other faculty members. People tend to learn better through teaching; therefore, explaining the literature to someone with little to no background in food science may be helpful in gaining comprehension of a difficult subject matter.

Once you have an idea of the research topic, hypothesis, and experimental design, many students stay organized by creating a timeline of known and/or external deadlines for their project. Some students create their own deadlines based off their personal goals. Graduate school is a relatively short period of time to accomplish all of the goals and requirements for the degree. It should be noted that if a student slacks off or gives too much liberty to their schedule during their first year, they will likely need to spend long days and nights in the lab making up for the lost time as the pressure to complete their thesis grows. Creating a timeline and calendar outlining the project, deadlines, and expected timing can help students stay on track.

As you progress through your project you should try to keep detailed notes at every step. That way thoughts, ideas, results, events, and occurrences are not forgotten when trying to plan the next step or trying to write your manuscript. There is always something to do in graduate school, and some of these tasks may not have an explicit deadline. Keeping a list of "tasks to do when there is nothing to do" is a good way to stay on track and make sure certain things are not forgotten along the way.

A lab notebook is a useful tool for staying organized and keeping notes when developing methods, performing preliminary experiments, and collecting data. Some labs may require you to keep a detailed, organized, and up-to-date lab notebook. Other labs may not require a lab notebook at all and allow students to use their own strategies and methods for organization. Some students keep their own version of a written lab notebook, while others may keep everything entirely on their computers. Students who keep documents, notes, and data on their computers highly recommend that all

important files are backed up on an external hard drive just in case the unthinkable happens and your computer crashes, is damaged, or is even stolen. That way you will not lose months or even years of work in a single moment. All in all, you need to find what organizational system works best for you and your project.

Good planning can go a long way. Carefully planning experiments beforehand can help minimize unnecessary mistakes. Successfully developing and managing a research project and performing experiments are skills that are developed over time. Things will get easier as you learn and practice and progress. You should not be afraid to ask for help when learning something new. You will have numerous resources available to you including your committee members, your advisor, lab mates, and other students in and outside of your department. Your number one resource will be your lab mates and fellow students. The students are the ones in the trenches performing the experiments and know their methods inside and out. They are the ones that will train you on the equipment and know how the lab functions. Their projects may be different from yours, but your fellow students are a great place to start when building a project. Another good way to minimize mistakes is to maintain open communication with your advisor throughout the planning and progression of the project. Your advisor will have experience and understanding of research that can help guide you in the right direction and avoid making similar mistakes to others in the past.

A research project can be an intimidating endeavor, but there are ways to make it more manageable. One way is to break it down into chunks that make sense for your project. It is always a good idea to start early as it takes time to figure things out. Beginning your literature review early can help you get ahead on writing your manuscript and help you build an understanding of the subject area and details surrounding your research topic. Some students recommend writing your materials and methods sections as you complete your data collection. That way small, important details are not missed when you go back to write. Documenting thoughts, expectations, and conclusions along the way may assist you later on when writing your discussion and conclusions. Besides breaking down the writing portion, it may also be a good idea to map out your expected milestones and break the method development and data collection into chunks as well, especially if your experiments build off one another.

It is good to know that due to the nature of research, timing for a project may be different than expected. It may take a while to learn about a specific topic and find gaps in literature. It may take time to outline a project and determine and subsequently learn specific methods. Methods can be more difficult to learn and to develop than originally expected as it takes time to

become proficient on any piece of equipment and equipment and software may not function in the same manner as shown in the literature. You may have to account for differences in equipment, lab space, and environmental conditions, for example. Due to these discrepancies, most research projects involve preliminary experiments to determine if a method is feasible or to perfect the method and its parameters. There can be a lot of trial and error, and it may take time to begin collecting usable data. Throughout this process, it is recommended that you test yourself to ensure your measurements are consistent before beginning to collect data. Research is slow and everything takes time; therefore, it is important to manage your expectations or at least set a goal for when you want to graduate and adjust the project accordingly.

Celebrating the small victories and milestones along the way can make the task of completing a thesis or dissertation manageable and helps make you feel like you are making real progress throughout the process. It is easy to lose perspective and feel like nothing is really getting done at certain points, but allowing yourself to celebrate your progress can help alleviate some of that anxiety.

How to Deal with Research Setbacks

Research can be unpredictable, dynamic, and is always evolving. More specifically, it can be slow with inevitable setbacks, no matter how well you plan and prepare. Setbacks can be difficult to handle and can even break your confidence, but there are a number of factors to consider when a project does not go quite the way you expected. It is important to be patient, to not get discouraged, to stay positive, and to look at the setback as an opportunity.

Setbacks happen to everyone; therefore, you should not take them personally. Research is hardly ever successful at first. It takes time, persistence, and practice to get your methods to work, set the right parameters, and collect valid results. Research is slow and the entire process often takes more time than originally anticipated. It is to be expected that your timeline will change according to the way the research naturally progresses. Research and graduate school are flexible and can change and evolve, as necessary.

It is common to encounter problems early on in a research project or when developing a method. It is easier to make changes to a project early and to adjust the plan accordingly than to try and fix a problem or make sense of invalid results at the end. Sometimes the problem encountered may be too large and too significant to overcome by simply adjusting a plan. It

could indicate the need to move in a completely different direction. Knowing this earlier makes it easier to make this change. It is common to work your way through a few research ideas before settling on the one you will pursue fully in your thesis. But as you progress, it is important to take it one step at a time and document everything, including some ideas for alternative projects and methods.

When something goes wrong or simply does not work out quite right, it can be helpful to take a step back from the project, review the literature, and talk to other students, your committee members, and/or your advisor. The first step in overcoming an obstacle is to rethink the problem and use the resources around you to find a solution. This could mean simply returning to the literature, reviewing the basics, and looking at different strategies and approaches from related studies. It could also mean talking to other students, listening to how they overcame their own research difficulties, or just getting some reassurance from your cohorts. Once you have put some thought into why the setback may have occurred and put some consideration into alternative solutions, if you are still unsure about how to proceed, you should go to your advisor for guidance. Your advisor may not tell you explicitly what to do next but will guide your thinking and point you in the right direction. This also gives you the opportunity to discuss the project as a whole with your advisor and make sure you are both on the same page in terms of progress, goals, and timeline. If you plan to make changes to the experimental design of your project and change methods or direction, it is vital that you discuss any and all project changes with your advisor first.

It will likely be beneficial to document the process of both encountering and overcoming the setback. It is important to document the thought process, possible alternative solutions, the things that worked, and the things that did not. This may help you and other students overcome similar setbacks in the future.

Sometimes it may be pertinent to change your perspective on the project as a whole. It is difficult to do so while constantly and/or obsessively working on a single task. Many students, when they encounter a setback, take a step back by refocusing their attention on their coursework, other organizations they are involved in, and other projects and maybe even taking some time for family and friends. Refocusing your mind for even a short period of time can help you shift your perspective, to look at the problem with new eyes, and maybe find a solution you did not previously consider.

A positive attitude can go a long way in overcoming a setback. It is easy to get caught up in the problem and to become discouraged, but maintaining a positive attitude and getting reassurance from other students can help you to see the opportunities associated with taking a step back to reevaluate the

problem and avoid losing confidence in yourself, project, or plan. Reevaluating your project or parts of your project can be beneficial and create new opportunities. The setback can give you the opportunity to discuss the project with your advisor or to go back and review the literature to learn more about the topic in greater detail. It can bring to light new research opportunities for the future. It may even be a clear sign to rethink your strategy or topic.

Sometimes it becomes clear that a research project cannot progress any further, and it is necessary to change topics and projects. When this happens, the research goals of the advisor, the funding stream, and the student may not coincide. In this case, a student can usually change projects or, if necessary, advisors. This is not the most desired outcome for a graduate student; however, it is better to make that change early before more problems arise and precious time is wasted.

Other Skills Needed for Succeeding in Graduate School

Graduate school is about much more than just classes and a research project. It is a whole experience that will last roughly two or more years of your life. Similar to how an undergraduate experience is about more than just classes, graduate school provides a plethora of opportunities to students for both professional development and social interaction. While graduating should be your primary focus, graduate students should take the opportunity to get involved in clubs and other organizations, to meet new people, and to build a network. A major theme throughout transitioning from undergraduate to graduate studies is the newfound independence in developing the knowledge base and skills required to champion your research project and your own learning. One skill that you must have going in, or at least develop quickly, is the ability to be your own advocate.

You are the driver of your own project and learning; therefore, you cannot be afraid to speak up, ask questions, and reach out to others for help when necessary. You should be able to seek out resources and specific expertise when needed. The three basic tenets of self-advocacy are to know yourself, know your needs, and know (or figure out) how to get it done. This applies both to managing your project and graduation requirements and maintaining your physical and mental health. Some students point out, especially those pursuing PhDs and doing longer graduate programs, that at some point graduate school may take more from you than you are getting from it. This means that you need to know your own limits, what is manageable, what is feasible,

and what is not. You should be able to say no if what is asked of you may threaten the timely completion of your degree, or your physical or mental health. Graduate school is hard, but it can be easier when you are able to advocate for yourself and when you have other students, faculty, and resources supporting you along the way.

Imposter syndrome is a common phenomenon in graduate students. Imposter syndrome is defined as the persistent inability to believe that one's success is deserved or has been legitimately achieved as a result of one's own efforts or skills. It disproportionately affects high-achieving people and is commonly used to describe women and especially women of color as feeling insufficient. It is simply a universal feeling of discomfort, second-guessing, and mild anxiety in the workplace. Many students feel as if they do not belong in their academic environment and are intimidated by the more experienced lab members. Imposter syndrome should and can be overcome. We often falsely equated confidence with competence. I was once told that if you are uncomfortable, it means you are learning. It is important to remember that most people started in the same position, with very little prior knowledge or experience. Graduate school is a learning experience and is designed for students to practice and develop new skills, to make mistakes, and to learn how to overcome them and where they are given the tools to grow as a scientist. Therefore, you should not hesitate to ask for help or clarification when necessary. The nature of research and academia is that we are all learning along the way. No one has all the answers or knows the perfect way to do things at the beginning. Everyone goes through trials and errors. One strategy for overcoming imposter syndrome is to have a support system in place or a mentor or role model that can help validate your achievements over time.

In addition to building your knowledge in a specific area of food science, graduate school also provides an opportunity for professional development. Most of the skills developed during graduate school are transferrable skills. This does not necessarily mean the specific lab skills you artfully craft but rather skills that can be applied in almost any other professional setting. These transferrable skills include the ones previously highlighted such as effective organization and time management, the ability to be open-minded and flexible, project development and management, and general problem solving and critical thinking. You will also need to develop skills throughout your program such as effective communication, both for simple project management and presenting and discussing complex scientific concepts. Graduate students are often required to present their work or teach a class and will need to develop public speaking skills in conjuncture with effective communication. Speaking to others, either in a small or large environment,

with a specific goal in mind is a skill developed over time and through a lot of practice. These transferrable skills are what employers are looking for when hiring graduate students. The specific research project may not directly apply to future career opportunities; therefore, developing these transferrable skills is a necessity for career advancement.

Networking is a large part of professional development. The food industry is small and only gets smaller when you go into specific areas within the industry, such as meat, dairy, plant-based proteins, confections, ingredients, and sensory. Each person you connect with throughout your graduate studies may help you either directly with your project or later in your career. Many students receive job offers and opportunities for career advancement through the network they build during graduate school. Building and maintaining professional relationships can be a challenge. You should not be shy when in a new environment and with new people. Take advantage of the opportunity to step out of your comfort zone and talk to anyone and everyone. Most people in food science, especially those doing research, are usually passionate about what they are working on and will take any opportunity to talk about it with others that show an interest. Your network may include fellow graduate students, lab mates, and/or faculty and staff members; however, it is also a good idea to expand your network outside of your lab and department when possible. A great way to do this is to explore and to take advantage of different opportunities throughout your time in graduate school.

A variety of opportunities are available to graduate students that can be dependent on your advisor. Some advisors focus heavily on having their students attend conferences and present their research at a variety of academic events, while others may focus more heavily on industry connections and pursuing either internships or industry partnerships. A student or advisor may pursue a research project in partnership with a specific company or the lab may have a program in which they offer services to companies and industry professionals. An internship is an easy way to gain experience and expand your network and may even directly lead to a job offer. However, it is relatively uncommon for an advisor to allow their students to do so because it may require taking time off your graduate studies and delay your graduation date. Another way to get involved outside of your lab or department is to join a club or professional organization. There are many different professional organizations for the food industry, including the Institute of Food Technologists (IFT) and their student association (IFTSA). There are also a number of organizations that are directed to specific areas of the industry, for example, the International Association for Food Protection (IAFP), National Confectioners Association (NCA), American Dairy Products Institute (ADPI), and so on. These organizations typically provide

opportunities to attend meetings, participate in competitions, get involved in a committee or resource group, and/or take on a leadership position. They also provide educational opportunities such as webinars and short courses in addition to networking events. Either way, it is important to weigh the pros and cons of taking on opportunities and ensure that it means the best possible outcome for your own personal and career goals.

Participating in a conference or internship and/or getting involved in an organization can help to apply and further develop those transferrable skills in addition to exposing you to new people that could become a connection. The connections made throughout these experiences will become your network if you put in a little effort to maintain the relationship. Continually attending events associated with an organization or conference and connecting on platforms such as LinkedIn are both great ways to maintain professional relationships.

Graduate school is also about more than professional development. The social component to graduate school is also an important factor. You will spend two or more years as a graduate student, so it is important to enjoy the experience. Think about your undergraduate experience and the most memorable parts of it. You should not spend every night and weekend in the lab. You need to make time for friends, family, and life events. People reach graduate school at different points in their lives, and it is important to remember that life does not stop while you are in school. You should take the time to attend university or departmental events, make new friends, and meet new people. It is arguable that a graduate student will be more successful when they enjoy school and their research and the overall time spent in graduate school.

Summary

This chapter focused on what to expect and how to succeed when transitioning from undergraduate to graduate studies in food science. There are many expectations for graduate students both inside and outside of school, most of which involve taking personal responsibility for your own research project and learning. A graduate student needs to be their own advocate and independently build their knowledge base and develop and manage their research project. The key factors that can influence the success of your graduate studies include good time management, organization, and communication. Students should be aware of the resources available to them, know when to take a break, and have a support system of fellow students to help gain a fresh perspective and develop solutions to the cause of the setback. Graduate

students should also take advantage of the opportunities available to them, including joining organizations, making industry connections, and presenting at conferences to help develop transferrable skills and advance their careers. Graduate school can be an intimidating endeavor, but the experience should be an enjoyable one and can be a vital step to reaching your personal and careers goals.

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Chapter 33
Faculty Expectations of Graduate Students

Richard W. Hartel

When looking for a new student a few years ago, I considered an international student who was not available for me to interview personally—something I generally require before I accept a student into my research group. After some preliminary discussion, I asked her my "behavioral" questions by e-mail to give her an opportunity to provide me with some insight into her qualifications and character. I asked her to describe experiences where she had to resolve a conflict with someone else and where she had faced and overcome a hurdle and to describe her motivation for graduate school. In her response, which started by noting a particular interaction she had had with her father, she presented me with a well-written documentary of her skills, into which her responses to my three questions were woven. Being the sort of person myself who would have bullet-pointed a response and detailed specific activities to document those skills, I was greatly impressed with her ability to think more broadly than my specific request, yet still get at the heart of my questions in a creative approach. I accepted her immediately into my group because those are the attributes in a graduate student I value most highly.

Her response convinced me that she could handle the rigors of an independent graduate research program. That is, she would be able to deal with the usual setbacks in research in a creative way, and most importantly, that she was highly motivated to succeed on her own while still being willing to

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learn from me. And she did this with a personal touch that struck a chord with me. However, other professors may not have taken her response the same way I did—faculty are all different and we look for different things in our students.

All Faculty Are Different

Each faculty member has his/her own expectations of graduate students. Mine, as noted above, relate to motivation, creativity, independence, and the ability to resolve problems and conflicts, in addition to having a good technical background. I look for someone who will work within my system of mentoring because I have learned over the years that if I accept students who do not fit within my system, we both have huge problems. Although I only had to let one student go from my program (out of 86 or so), there have been several students that have required what I considered to be too much of my time and energy and given back less than I expected in terms of research productivity. To be fair to those students, it was no picnic for them either since I had trouble giving them what they needed. The importance of both professor and student in understanding the needs and approaches of the other person cannot be stressed enough. Without a good student–professor relationship, graduate school can be a horrible experience, for both people.

And each faculty member is different, so it is difficult to generalize things completely. At one extreme are professors who give daily guidance to each graduate student, essentially telling the student what to do. On the other extreme are professors who either do not have the time for daily interaction or expect that students will be able to work by themselves. Most professors fall somewhere in between, but with a leaning one way or the other. It is important that the needs of the graduate student match those of the professor; otherwise, there will be continual battles—battles that students generally cannot win.

I think differences among faculty arise, at least in part, from their outlook on what a graduate program should entail. At one end of the spectrum are faculty members who consider graduate students to be the vehicle of their own research success. Since high-quality research publications mark faculty success, professors are interested in generating substantial amounts of high-quality data for such publications. These professors tend to guide every detailed step of what the student does to ensure it meets their high standards. Unfortunately, students in such a system are generally not given

the opportunity to expand and think for themselves since they are carrying out someone else's detailed guidelines. Some students thrive in such an environment, where they are given detailed guidance at every step of the way. Although perhaps this is an easier route for students (being told what to do), this approach typically does not foster independent research skills in the student, something that is a highly desirable outcome of graduate school. We often grow fastest by experiencing failures and learning from them.

On the other end of the spectrum are faculty members who never seem to have time for individual graduate students and essentially leave them unguided for long periods of time. This lack of direct contact may be forced due to other commitments (i.e., department chair/head responsibilities, excessive teaching or advising load, substantial extension activities, etc.) or may simply be due to a philosophy that students develop best when forced to manage on their own.

In my own personal experience, I had a PhD advisor who quit midway through my research (he found selling real estate to be a more lucrative occupation), leaving three graduate students in the lab to fend for ourselves. Our department found a replacement advisor to oversee our project, but the three of us had to train this new faculty member in our research topic while still trying to get useful guidance from him about completing our research. When I was hired after graduation, the company noted that being able to complete my PhD under those circumstances showed that I was clearly capable of independent work. In the long run, it was a good experience for me, although in the middle of it, there were many frustrating days and much grumbling about how "life is not fair" (the comment made by our advisor as he left).

Ideally, a faculty member would recognize the needs of each individual student and provide exactly what they need when they need it. Each student is different and needs a different amount and type of guidance, and their needs may change over the course of a program. A faculty member who can provide the support needed, at the appropriate time, and then back away to let the students perform (and even struggle) on their own is doing the best to help students develop their individual research skills. But this is a skill that professors do not learn in school. Professors develop their own style over the years by trial and error, often starting with the model experienced in their own graduate programs. Like new parents learning how to be a parent (or new teachers learning how to teach), advising graduate students is something that professors must sort out for themselves.

Finding the Right Professor

Most graduate students have some amount of control over their selection of faculty advisor, and it is highly preferable that students select their advisor based on that person's reputation in dealing with graduate students. Having a good working relationship with your advisor is just as important as working on a topic of interest to you or getting a degree from a certain school. Incoming graduate students should honestly assess their needs in an advisor (e.g., do you need more guidance or less) and then try to find a person who will help them make the most of their skills.

Some questions you might consider include the following:

- How much freedom will he/she give you in your research project? Will they require that you do as your told or encourage you to make the project your own?
- What expectations does the professor have for his/her students? For example, is there a policy on vacation time or does he/she have specific requirements for time spent in the lab?
- Are there any unwritten performance expectations?
- How much time will the professor spend with you and what will be the nature of that interaction?
- Are there regular group meetings, and if so, what happens at these meetings?
- How does the professor express a personal interest in your success? All professors will say they are concerned with student development, but each professor expresses that interest in different ways.
- Does the professor respect his/her students, and how is that respect demonstrated?

As a prospective graduate student looking at different programs and faculty, interview each faculty member to make sure that his/her approach works for you. You absolutely need to interview the students in the lab, since they are the ones who really know what that faculty member is like. If the faculty member is unwilling to share the names of past and present students, that is not a good sign. And then carefully consider the responses you get from the students. If a student says the professor is good to work with, find out exactly why, so you can tell if their reasoning matches your personal needs. If a student says a professor is not good to work with, again find out exactly why, because that students' reasoning might not be the same as yours (their mentoring needs might be different than yours).

Typical Faculty Expectations

Once a student is accepted into a professor's research lab, there are certain expectations of that student. Again, there are variations among faculty members, but for the most part, all faculty want students that are hard workers and can think independently and who generate a lot of high-quality data. The following points are my personal perspective on what faculty look for in students, mixed with some advice about how to make the most of your graduate experience:

Work Ethic I have heard of professors who expect graduate students to be in the lab every day before they arrive and leave after they leave at the end of the day. Since most faculty work 8 to 10 hours a day, graduate students are expected to put in long hours. Other professors are not so concerned about time spent in the lab, especially now when Internet opportunities mean productive work can be done from almost anywhere. However, all faculty expect to see high levels of productivity, regardless of where that work gets done. A student that does not produce results is in danger of being put on probation and eventually being let go. All universities have policies regarding "satisfactory progress," and a student's appointment can be terminated if they do not meet these expectations. Fortunately for students, the process of letting a student go for lack of progress is formalized so that they get a fair hearing.

However, a hard worker is more than someone who puts in a lot of hours. What about those hours between classes or experiments, when there is nothing urgent to accomplish? How do you spend that time? I have seen students surf the Internet, "chat" with friends online, do the crossword puzzle, and even play computer games because there was "nothing to do." Do not think your professor does not know when you are not focused on research (or classes)—he/she might not say anything at the time (although some professors have been known to rant and rave about how students spend their time), but you can be certain this will be reflected in how he/she supports your search for a job when you graduate. Remember, your major professor will be the primary person you turn to when it comes time for letters of recommendation.

A hard worker fills their time in productive ways. Got some extra time? How about studying the literature, perhaps even getting a start on the Literature Review chapter? Good researchers scour the literature for anything and everything that has been done before related to their research area (and explore very widely at the start of your project). Before you start any project, you should do a complete literature search and carefully read anything and everything related to your project. Do not just take your

professor's word about why your project is a good research topic—learn it for yourself. Make it your own personal project by adding your own insight based on a literature survey and add your own opinions about what needs to be done. Furthermore, consider submitting a literature review for publication, something that benefits both student and professor.

How about exploring other fields to see how other scientists approach problems similar to the one you are working on? You could even explore what others in your lab, or other labs in your department and beyond, are doing. Can you come up with a valuable side project to work on during the "lulls" in your main project? If you run out of options, feel free to ask your professor for a side project to keep you busy. He/she will be thrilled with your work ethic and will undoubtedly find side projects that enhance your skills and background. These activities require internal drive and motivation but are highly valuable in many ways (learning, experience, good recommendation letters, etc.).

Internal Drive Graduate school is so much different than undergraduate school. As an undergraduate, courses are generally structured to provide enough details to complete assignments and tasks. Research does not work that way. Research requires an intrinsic motivation and innate curiosity to get up each morning and get into the lab to run experiments (or to the computer if you are modeling). It is easy as a graduate student to say "I can do that tomorrow" because deadlines are less structured than in undergraduate class obligations. The drive to get to the office or lab and collect some data has to come from within the student. And again, if there are "extra" hours in the day, find some useful/beneficial way to spend that time.

Motivation Many years ago, I accepted a student into my lab because he seemed like a good guy, had a good background (decent GPA and excellent interns) in a particular area of my research, and came from a good undergraduate school. For some reason, however, I missed the point that he wanted to work with me because his girlfriend had taken a job in the area and he wanted to be close to her. In hindsight, after a year or so with him in my program, it became evident that his main motivation to be in my program was to be near his girlfriend (now wife) and not to work on a graduate degree. At the start, he did not have the drive and passion for research that I expect in a student. Another time, I took an international student into a PhD program without a personal interview because he challenged my questioning him about his motivation. He bristled at the thought that a graduate student at this level would not be motivated. I took him instantly, and he finished a PhD in 2 years, whereas the student who came to graduate school to be near his girlfriend took 3 years to finish an MS degree. Although the MS

student ultimately did some very good work, the process to get to that point was often challenging for both of us. Motivation to do graduate work is one of my highest priorities now when evaluating which students to take into my lab.

Natural Curiosity Research is about exploring new ideas and principles. By nature, a scientist should have an exceptional level of curiosity to learn new things, explore new concepts, and develop new knowledge. How do you advance your level of curiosity? How can you become more curious about things when that is not your nature? Here are several tips (https://www.lifehack.org/articles/productivity/4-reasons-why-curiosity-is-important-and-how-to-develop-it.html):

- Keep an open mind.
- Do not take things for granted.
- Ask questions relentlessly.
- Do not label something as boring.
- See learning as something fun.
- Read diverse kinds of reading.

Typically, creativity in research (or science in general) means reading everything and anything, both within the field and in other fields, which might relate to the research topic. Note that this approach also helps with the next important graduate student trait, knowing how to get past research roadblocks, and can help fill in "lulls" in your research in highly productive ways.

In addition to reading a variety of things and talking to a variety of people, look for ways to apply that information to something specifically of interest to you, like your research.

Creative Solutions to Research Roadblocks Perhaps the main attribute that separates good researchers from others is their ability to deal with experimental setbacks. There will always be times when methods do not work right, equipment breaks down, or something happens to stall a research project. How you approach things when this happens is an important characteristic. Perhaps your first response is to run into your professor's office to explain the problem and ask what to do. Fight that urge! I have kicked students out of my office for asking me what to do, with the advice that they come back after they can pose five different possibilities for us to discuss. My aim is to get students to think through the problem themselves and come up with multiple creative solutions. At that point, I am happy to discuss the problem with the student, and undoubtedly, we will come up with even more solutions (or maybe just approaches to get to solutions).

Where do you come up with ideas and potential solutions to get around research roadblocks? That takes creativity. Reading widely in the literature, both within the field and outside, is one way to find ways that others have found solutions to certain types of problems. Expanding your thinking and knowledge, beyond foods, can often lead to creative ways to resolve problems in your own research (sometimes creativity is simply taking a tool or concept from another field and applying it into your own field). Another approach is to learn every detail of how equipment works, especially in cases when equipment malfunctions provide roadblocks. However, each situation requires its own unique creative approaches.

You might consider developing your creativity through reading books, attending creativity workshops, or taking creativity courses (either online or at your university). Although many of these books, courses, and workshops are very general, some of the approaches they use to developing creativity may work for you.

Attention to Detail and Being Thorough Good, reproducible research is done by people who pay close attention to every little detail of what they are doing. People who haphazardly approach their work are much more likely to get variable results that are difficult to interpret or do not prove/disprove their hypotheses. While developing a method or technique for your research, you should think about every detailed step to consider if a variation in that step will influence the outcome. How does the time taken for each step affect the results? Does the temperature in the lab affect your methods and thereby affect your results? What other influencing factors must be controlled to minimize variability?

For many years, I had two experienced researchers in my lab that had developed superb lab skills. They knew almost intuitively which parameters were going to have a significant impact on the results. In one study, they figured out that our results were being affected whenever a truck drove past the building on the road outside our lab. The variability caused by the vibrations from trucks passing outside was sufficient to make the results meaningless, and it was not until we installed a vibration table (for damping motion) that we could make sense of our results. Developing a careful approach to your studies will go a long way to optimizing your research results or at least getting the most out of your methods.

Being a thorough researcher means making sure you “dot all the i’s” and “cross all the t’s” at every step of the way. From doing a complete and

extensive literature search to checking out each and every assumption, pay attention to details at every step of your project. A thorough researcher stands out from the crowd.

Know How to Get What You Need from Busy People It is an important skill to know how best to approach your very busy research advisor to get the input and feedback you need to do your job and make satisfactory research progress. This is a skill that will translate very well into a future career, especially in industry where you will need to interact regularly with your busy supervisor. Even though it is your professor's responsibility to give you feedback and guidance, the daily pressure of deadlines (class preparations, proposal due dates, meeting preparations, etc.) often means there is not enough time in a day to meet with every graduate student. Scheduling weekly meetings may be a good approach, although flexibility will still be needed since travel pressures mean he/she might not always be there for your regularly scheduled meetings. But suppose you are really stuck or, on the other hand, have a great inspiration that you need to discuss first with your advisor—how do you get into their schedule to get their time?

The skill of knowing how and when to knock on your supervisor's door is an important one to master. One of my least favorite phrases when a student appears at my door to get some of my time is "are you busy?". Of course, I am busy. I work 10–12 hours per day because that is what it takes to get all the work done that I need to get done (and even then, I am usually behind). From writing papers and proposals (and even books) to preparing for classes or advising students, there are more things to do than there are hours in the day—that is true for every faculty member. However, unless your professor is up against a critical deadline (like getting ready for class in the next 15 minutes), he/she will usually be willing to spend some time talking, as long as you approach them in a way that allows them to put down what they are doing and attend to your needs. Develop a pleasant tone of voice and politely ask for some of their time—that will go a long way to getting the time and input you need from busy people.

Also, recognize that at the moment of your interruption, he/she is focused over a task that probably does not involve your research question. Help him/her switch gears to now think about your situation by clearly yet concisely setting the stage for your question or inspiration. A few minutes of setting the stage properly (emphasis on brief and concise) will go a long way in getting your needs met.

Satisfactory Progress

Each institution has regulations for what constitutes "satisfactory progress" of a graduate student. Often, it simply comes down to the assessment of the major professor to decide whether a student is making good progress or not, although in some cases, a faculty committee may be involved in directing a student's program and evaluating whether satisfactory progress toward the degree is being made. Either way, each student is expected to make satisfactory progress in both coursework and research. Satisfactory progress in coursework is relatively easy to assess. The student must have a coursework plan in place that will allow them to complete all course requirements in a reasonable time and attain a grade of B or better in all courses. Satisfactory progress in research, however, is not always so easy to define.

From a faculty perspective, satisfactory progress in research typically means the student is spending adequate (and productive) time on their research project and generating enough meaningful data to fulfill the needs of the funding agency. Meeting the expectations of the funding agency with significant, usually publishable, results is certainly one critical outcome of satisfactory progress. However, some projects are more difficult than others, particularly if they require developing new techniques, and a student may spend months futilely trying to develop methods. In this case, it is sometimes a judgment call as to whether the student is making satisfactory progress since there is no hard data as the output. The "output" may simply be that a certain method or idea does not work. But at what point is that decision made and who makes that decision? The student might say the challenges are unreasonable, whereas the faculty might say the student is not capable of completing the task. There is no simple answer here, which is why the student–professor relationship is critical.

Another aspect of satisfactory progress is the professional development of the student, especially as an independent researcher. All faculty expect that students will improve their research skills: developing hypotheses, performing literature searches, statistically designing experiments, performing experiments with due care to reduce variability among replicates, analyzing results using appropriate statistical methods, drawing conclusions, and proposing future work. Typically, students enter a graduate program with only rudimentary skills in these areas and are expected to become self-sufficient, independent researchers when they leave. Yet, there is a balance between student development and research progress. Funding agencies typically do not care about student development—results are all they care about. Thus, faculty often are faced with the dilemma of supporting student development even when research results are not forthcoming. Again, a good student–professor relationship is critical to make the best of an undesirable situation.

Summary

In my opinion, the student–professor relationship is probably the single most important factor that will determine the success of a student's graduate experience (and beyond). For a faculty member, taking a new graduate student is a risky thing. There is a commitment made for 2–5 years (MS or PhD) that isn't easy to get out of. If a student does not match a professor's mentoring style or for some reason is not performing at a satisfactory level, there are options for releasing the student from the lab. However, the process of firing a graduate student is not easy (and it should not be, to be fair to the student), and the loss of research productivity when a wrong choice is made can be devastating. For the student, it is critical that the advisor provide satisfactory guidance. A lack of adequate directions and guidance from the professor, particularly at the start of a MS program, can lead to a very disappointing graduate student experience.

It is important to recognize that much of a student's success, both during the graduate program and when seeking a job, is dictated to a large extent by the major professor. It is important that the professor provide the necessary guidance during the graduate program; however, it is the student's responsibility to meet the needs of the professor since a strong letter of recommendation from the major professor is an essential part of getting a good job upon graduation. As a student, think carefully about how you meet the faculty expectations discussed above since these are likely to be the primary basis for that letter of recommendation.

Careful consideration on both sides is needed to ensure that the graduate experience is beneficial for both student and professor.

Richard W. Hartel is a professor at the University of Wisconsin–Madison since 1986. Dr. Hartel has plenty of experience working with students of all ages, including directing the research projects of more than 80 graduate students over his career. In addition to teaching numerous classes, he has an active research group funded through USDA, commodity boards, and private industry. He counts many of his former grad students still as good friends. Although his wife thinks he needs a hobby, he responds that writing books is his hobby.