SHAPING THE WORLD

The Vital Role of Scientists in Industry

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Chapter 1
The Privilege of Being a Scientist

We all wanted to make a difference.

Do you remember realizing what you wanted to be when you grew up? I do.

But this realization was not confined to a single moment in time. Rather, it was an extended process of realizing over and over that I had interests and habits most people around me did not.

For me, realizing I would make a good scientist was more of a pattern of repeated realizations over many years. Every time I described a curiosity or an observation that most people around me didn't seem concerned with, I realized that I was different. And that pattern of repeated moments stands as a single entry in my memory as the realization that I would become a scientist.

The title of this chapter suggests that being a scientist is a privilege. I actually borrowed the idea from a book I found many years ago, *The Privilege of Being a Physicist* by the Austrian-born theoretical physicist Victor Weisskopf.[4] I identify very strongly with that sentiment, but I believe that privilege should be extended to all other scientific disciplines as well.

Most of us became scientists because we were curious about how the universe works, but most of us also wanted to use that knowledge to make a difference. We saw problems that needed to be solved, and we saw that the scientific

method provided a path to a solution. And we wanted to be part of the solution.

The scientific method is truly amazing. It is by far the best way we human beings have found to arrive at a consensus on the behavior of something we initially didn't understand. No other method or practice or discipline we humans have devised has come anywhere close to the success of the scientific method at achieving consensus. It is a great privilege to be one of the lucky few who is skilled in the use of the scientific method and able to practice it in our careers.

And that is the privilege afforded to those of us fortunate enough to call ourselves scientists. That is the reward for all the hard work we put into developing the skills and the knowledge required to understand how the universe works. That is the reward for the challenges we may have faced being a little different as a child. We asked questions that most kids didn't care about, we noticed and took an interest in things that most people simply ignored, and we stopped to wonder why things worked the way they do when most people simply accepted what they saw.

For many of us, those tendencies set us apart. For some of us, being different was a challenge. But in time we found that our unique interests and penchant for asking unusual questions led us to a career path where we could better understand the universe around us and use that knowledge to make a difference.

This book celebrates the value of scientists and of using the scientific method to shape the world. I feel it is a tremendous privilege to have spent much of my own career in that pursuit. So do the dozens of other scientists I have interviewed for my work and the thousands I've spoken with during the seminars and workshops I've given around the world.

I wrote this book to celebrate that privilege and to honor the stories of many other scientists who have persevered to build their own rewarding careers, intent on shaping the world.

No Equations Needed

This is my third book, so I've had a fair amount of experience talking to publishers and editors about the content of my

Top 5: Five things nobody told me in school

1. Stop looking for the "right way" to do things. Look for the way that allows you to win the game with the strengths and constraints that you have.

2. People who take risks are generally happier than those who do not. Rather than hesitating or backing down in the face of a challenge, they lean in and find better ways of doing things.

3. Don't leave it to others to tell the story of your life, your work, or your results. Be the author of your story.

4. Don't worry about what others think. They don't possess your strengths, and they aren't subject to your constraints. Trying to please others is a recipe for mediocrity. If nobody disagrees with you, you probably aren't making a difference.

5. Points are awarded for results, not perfection. Figure out what really matters and do that. Forget the rest. Life doesn't hand out gold stars for "right answers."

Chapter 2
Private-Sector Playbook Themes

It's no longer about finding the "right answer."

In my second book, *It's a Game, Not a Formula*, I outlined why working in the private sector is much more like a game and less a search for the "right answer"—an approach I call the "formula approach"—that we scientists practice in the research lab. I won't repeat that discussion in detail here, but since it is relevant to this book and the stories in it, I will summarize three key aspects of the *It's a Game* metaphor.

First, there are three reasons that I use a game metaphor:

1. There's more than one way to win. As in a game, there is no single right way to succeed.
2. Winning requires taking risks. As in a game, success requires taking decisive action without knowing what the outcome will be.
3. Knowledge alone does not make you successful. Knowing the rules better than anyone is how you become a referee, not a star player.

Second, there are five primary differences between academia and industry. These are generalizations, but they apply very well to most aspects of each environment:

Principle	Academia	Industry
What is created:	Knowledge	Profit
What is pursued:	Understanding	Results
What is rewarded:	Certainty	Speed
How one succeeds:	Independence	Interaction
How progress is made:	Proof	Persuasion

I also list five critical habits in *It's a Game, Not a Formula* that successful scientists working in industry learn quickly. I call these the "Industry Playbook" for scientists interested in making a successful transition from a research lab into an industry career. These playbook habits are as follows:

1. Help the company make money. If your manager knows how you are helping the company be profitable, your job security will be high.
2. Figure out what matters and what doesn't. You will be faced with many pressures, but most things you could spend your time on turn out to be a waste of time.
3. Be effective, not smart. If you know how to get results, people will think you are very smart.
4. Decide quickly with limited data. Don't fall into the trap of thinking that with enough data you will know the "right answer."
5. Persuade others to follow you. If there's no "right answer," you can't rely on proof to convince others of the value of your ideas.

As you read through the interviews in this book, you will find that these five playbook habits are reflected over and over in different contexts.

In addition to these habits, here are some other important themes that the scientists in this book say are particularly important in the private sector:

Learn from Others

The private sector is a team environment, involving many people who possess different skill sets and backgrounds. It's

Chapter 3
Building a Career Outside of Academia

Lessons a lecture can't teach us

Many of us start our postgraduate careers assuming, hoping, or perhaps even expecting that we will become professors and/or academic researchers. Unfortunately, the academic career path is still considered the traditional route for a scientist, despite the overwhelming data showing that the vast majority of us end up in careers outside of academia.

Some of us change our minds when we see how competitive the route to becoming a professor is and how few jobs are available. But many of us realize along the way for one reason or another that we would rather pursue a different career path. For me, the realization came from watching my advisor and the other professors in my physics department and deciding I wanted something more dynamic and exciting than what I observed. Every one of the interviews featured in this section relays the story of a scientist with their own unique version of this realization.

A Broad Spectrum

All of the stories in this section are about scientists who joined established companies and pursued their careers as employees. Although there are many common themes among these stories, each scientist has followed their own unique path

and has their own unique story to tell. The stories are diverse, covering a wide range of technical disciplines, countries of origin, and personal strengths and weaknesses. And yet, they illustrate only a fraction of the unbelievably wide array of possible career paths that await the adventurous scientist.

The technical training we receive from our university education is usually critical to success in our chosen career paths. But we quickly learn that there are many valuable nontechnical strengths that we are not taught by our professors. Some of these nontechnical strengths are known as "soft skills," such as effective oral and written communication, skillful time management, emotional intelligence, and the ability to influence others.

Other valuable nontechnical strengths come from "experiential knowledge," or knowledge we gain through doing things. The experiential knowledge that I've gained from the scientists who I've interviewed has been one of the greatest benefits that I have received from them. And this wisdom has been more useful for my overall career development and my life outside of my job than for any specific job that I've had.

As I pored over these interviews, some common valuable themes emerged:

The Value of Exploration

As much as I appreciate the value of career planning, I need to acknowledge that discovering what suits us best often can't be done with thinking alone. It requires some exploration to try different things and see if they actually work the way we think they might.

Kate Bechtel was very worried about making the wrong career choice, terrified that she might end up committed for life to a career that she didn't enjoy. But her advisor told her that she couldn't possibly know for sure what would or wouldn't work for her without some firsthand experience, and he recommended that she try many different things early in her career. This was a real wake-up call for her, and she began looking for opportunities to try new things and see what she

Chapter 14
The Value of the Private Sector

Where science recognizes its full potential

In my speaking and writing, I focus almost exclusively on the private sector. That's where I've spent my entire career, and so that's the domain where I can speak with authority. I'm not qualified to talk about academic careers because I left academia right after my PhD. But I always point out that I have great respect for academic research and the academic career path.

Academic research plays a pivotal role in our comprehension of the universe we inhabit, and a career built around fundamental science research can be extraordinarily rewarding. But the resulting journal articles and the new knowledge they contain have no intrinsic impact on the world. Our lives aren't improved until we use that knowledge to devise solutions to the problems that we face.

The private sector is where science realizes its fullest potential. Technology commercialization is where equations are transformed into tangible products and theories materialize into practical solutions.

In this section, I'm excited to feature academic researchers who collaborate with industry. They are the bridge builders between knowledge creation and innovation. Their work often entails navigating two distinct cultures—academia and the corporate world. As you will see in these interviews, it's not

easy to operate on both sides of this culture divide, but it's absolutely worth it.

There are two primary reasons that I hold these researchers in such high regard.

First, by blurring the lines between academia and the corporate world, these researchers work to mitigate the unfortunate "us versus them" mentality that exists between these two cultures. By embracing industry, they build bigger and better research programs that blend fundamental research and practical solutions, demonstrating that cooperation is not just possible but often incredibly productive.

Second, by exposing their students to the private sector, these individuals are training the next generation of scientists for the industry careers that most of them will actually have, rather than continuing the long tradition of training PhD scientists for a career in academic research. There are many studies showing that the majority of science PhD holders pursue careers in industry, and only a small percentage will become professors.[19] Unfortunately, many science departments have been slow to embrace this reality, and both the students and their future employers suffer as a result.

So, join me as we dive into the stories of these researchers and explore the insights that they've gained from navigating a border that few are willing to cross. The people who dare to make this journey are some of the most influential scientists, even though their unique impact may not be recognized by the accolades traditionally awarded for scientific accomplishment. Unlike most researchers, these scientists can operate in and communicate effectively with people from two very different worlds. They learn to play both the academic research game and the industry game, and they pull from both playbooks to broaden their impact. And in doing so, they inspire their students to follow their example and reach further than most even imagine.

Isn't that the goal of education?

Top 5: Five quotes that remind me how I want to play the game

"Just because it didn't work doesn't mean it was the wrong choice. The world is full of probabilities, not certainties. Find a game where the probabilities favor you and keep taking shots."

— James Clear, author of *Atomic Habits*

"Success can usually be measured by the number of uncomfortable conversations we are willing to have, and by the number of uncomfortable actions we are willing to take."

— Tim Ferriss, author and podcaster

"The braver I am, the luckier I get."

— Glennon Doyle, author of *Untamed*

"Don't minimize risk, maximize opportunity."

— Fortune cookie in Antwerp, Belgium

"If you feel safe in the area that you're working in, you're not working in the right area. Always go a little further into the water than you feel you're capable of being in.

Go a little bit out of your depth, and when you don't feel that your feet are quite touching the bottom, you're just about in the right place to do something exciting."

— David Bowie, English singer-songwriter and musician

Chapter 15
Collaboration Wisdom

What I learned from these academic researchers

In Section 1, I mentioned that the wisdom shared with me by the scientists I've interviewed has been one of the greatest benefits that I have received from my work. This is just as true in this section, even though most of the scientists in this section have built their careers in academia, a career path that I departed more than two decades ago.

I'm confident that you will find a huge amount of value from these interviews, even if, like me, you have built or intend to build your career in industry.

But before I leave you to read them on your own, I want to provide a guide to some of the things that I found to be the most valuable in this section. Like the rest of the book, this section is designed to be read in any order—one at a time when you have time. With this type of book, I've found that it helps to have a guide to point you to the chapters that might interest you on any particular day.

Therefore, here is an overview of the most valuable lessons that I've pulled from these interviews:

Companies need solutions, not science

This is perhaps the number one rule for academic researchers who want to collaborate with industry. Most companies are

not looking for new ideas to turn into products. They already have product development plans and probably many commitments that they've made to customers. And there's a really good chance that they are having problems meeting those commitments. That's because commercializing technology is hard. If it were easy, someone else would have already done it. Companies that want to make a difference take on aggressive projects and make commitments that they are pretty sure they can deliver on, but they often don't know exactly how they will do it. They start with a plan, but along the way, things don't always go quite the way they expect.

Some of these scientists learned the hard way that pushing their research discoveries simply doesn't work well. They went in hoping that industry would embrace their amazing research and jump at the chance to commercialize it. That's what Hugo Thienpont was expecting when he began building his research program at Vrije Universiteit in Brussels, Belgium. "I started out thinking that we could develop some great ideas and then be able to find a company that would be interested in turning them into a product. But in 40 years of research and innovation, I have never seen that work ... I learned the hard way that 'technology push' doesn't work." But what he found was that they had problems that he could help solve. And that, as he realized, "was the opportunity that I'd been looking for."

When Cather Simpson moved from a tenured position at Case Western Reserve University in Cleveland, Ohio, to a professorship at the University of Auckland in New Zealand, she needed to identify new sources of funding to help pay for the expensive research equipment she needed to rebuild her lab. Starting with a company that was facing challenges developing an early touch-screen device, she also realized that the answer to partnering with companies was to identify problems that she and her students could solve. As Cather tells it, "We built a reputation of being a laboratory that used high tech to answer questions for industry... . That focus helps keep you out of technology push because your purpose is solving other people's problems."

In this appendix, I outline the five career design steps that I teach in my workshops and that I've used to design my own career path:

Step 1: Determine Your Strengths

What are you good at (and what are you not good at)?

The key to designing a career that you enjoy and perform well in is to have a solid understanding of your strengths. Once you know what you can do well and what you don't do well, you can begin to plan a path that leverages your strengths and doesn't demand too much from the areas you are weak in.

I like the strength categories used by Marcus Buckingham and Curt Coffman in their book *First, Break All the Rules: What the World's Greatest Managers Do Differently*.[34] They describe three categories of strengths: skills, knowledge, and talents. I teach these same categories in my career workshops, although I prefer to use the word "attributes" rather than "talents" (see below). Here is a breakdown of those three strength categories:

Skills

These are "how-to" strengths, and they are characterized by things we get better at with practice. Skills might include using a spreadsheet application, aligning a complex optical instrument, or flying a plane. The more we do them, the better we become.

Knowledge

This is information that we know or are familiar with. Buckingham and Coffman split the knowledge category into

two subcategories: factual knowledge and experiential knowledge. Factual knowledge can be taught or learned from a book, such as the rules of calculus, whereas experiential knowledge must be learned from our own personal experiences and cannot simply be taught. Examples of experiential knowledge might include how to give patients bad news or understanding how we perform under pressure.

While both types of knowledge are valuable in our careers, I encourage career designers to focus more on experiential knowledge than factual knowledge because the things you have learned from your unique experiences are what make you stand out from others who may be looking at the same jobs. Anyone who has taken a course in complex differential equations can claim the same factual knowledge, but only someone who takes the extra time to sit down with struggling students every week gains the experiential knowledge that may lead to a creative new instruction approach.

Talents/Attributes

These strengths are related to how your brain operates, or one might say, "how you are wired." They determine what is important to you, how you think, and how you relate to others. They cannot be taught or practiced and tend to remain stable over one's life. Buckingham and Coffman use the word "talents," but I prefer the word "attributes." The word "talents" suggests something that is necessarily positive, whereas "attributes" describes a feature that might be an advantage or a disadvantage depending on the situation.

The authors describe three categories of talents/attributes:

1. Striving attributes are related to your motivations and why you do what you do.
2. Thinking attributes are related to how you process information and make decisions.
3. Relating attributes govern how you interact with other people—who you befriend, who you trust or distrust, and who you tend to build relationships with.