The Boiler Room Boys

An Underground Story of Science, Religion,
and the Faith that Fuels Both

Tim D. Smith

Foreword by Francis Capitanio

WIPF & STOCK • Eugene, Oregon

THE BOILER ROOM BOYS
An Underground Story of Science, Religion, and the Faith that Fuels Both

Wipf & Stock
An Imprint of Wipf and Stock Publishers
199 W. 8th Ave., Suite 3
Eugene, OR 97401

www.wipfandstock.com

PAPERBACK ISBN: 978-1-5326-6210-2
HARDCOVER ISBN: 978-1-5326-6211-9
EBOOK ISBN: 978-1-5326-6212-6

Manufactured in the U.S.A. 01/09/19

Contents

Preface

Conflicts between fundamentalist Christians and fundamentalist scientists left me feeling that I had to choose. My youthful search for truth led me towards science and away from religion. Choosing science gave me security, a career, and a sense of value. Further, I had hoped this choice would help me find answers to the big questions of life. My older brother Eric had encouraged me to ask these big questions, perhaps from too young an age, but neither he nor my science teachers nor my church leaders were able to help me answer them. Although science did not immediately answer those questions, scientists claimed that it eventually would. Decades later it hadn't, and I was left wondering.

Here I describe my long journey into and out of atheism, beginning with a group of boys studying science in the boiler room of our grade school in the mountains of Oregon. My journey included studying religion with the leaders in a community church in my valley. The conflicts between the church and the scientists eroded my confidence in the former. However, my confidence in science was also eroded as the events of my life played out. Eventually, I was left working out my answers to the big questions in my own boiler room.

Here I tell the story of coming to my own answers to science and religion, writing in two streams. In the first stream, the odd-numbered chapters, I have described how conflicts between fundamentalist Christians and fundamentalist scientists led me into and out of Christianity, into atheism, and back to theism and finally back to Christianity. In the second stream, the even-numbered chapters, I have described what I now understand to be the truth about science and about Christianity. In the interaction between these two streams, I expose what has been called a "war between science and religion" to be a false conflict promoted by both some scientists and some Christians.

My purpose is to convince you that there is so much more to understand about the universe and God than any form of literalism, religious or scientific, can explain. I also wish to convince you that seeking understanding is a doable task, albeit one that will require study in your own boiler room. I am convinced that God loves his people, and will provide a much better foundation for our lives. Finally, I wish to encourage you to be prepared to help those who are asking life's big questions, younger and older, that they would be free to ask and would find truthful counsel that would help them not wander in the wilderness as long as I did.

1

The Bomb and the Boiler Room: 1955–1964

Fishing pole in hand that Sunday morning, I blushed crimson when Mrs. Lane wagged her finger at us from her car window. I was walking with my brother Eric past a tiny church in the Cascade Mountains of Oregon situated on the banks of Camp Creek, near where it feeds into the McKenzie River. There Missy, as she liked to be called, was my sometimes Sunday school teacher.

"Why am I blushing?" I demanded of myself, embarrassed at my embarrassment. After all, we didn't have to go to Sunday school. Pop and Mom had given us a gift of skepticism about God and churches. They were rebuilding lives twice interrupted as they finished high school, first when Pop was shipped to Europe to fight the Nazis and then when he was shipped to the Philippines to fight the Japanese. Their lives had been interrupted but not shattered, although they never reconciled their war experiences and their ideas of God.

The start of the fishing season seemed a good excuse to skip Sunday school. I was increasingly finding Missy's teaching unconvincing. Also, my brother Eric, four years older than my 12 years, had been challenging me about what he called "big questions." Lately, we had been arguing about the origin of the universe and of life. His high school was on the other side of the McKenzie River, and his science teacher there said that the universe and the earth had always been here just as they are. Further, someone had recently created life in the laboratory. Missy on this side of the river claimed that God created the universe and everything in it 6,000 years ago, including life, and everything would soon be gone when Jesus returned. I

made Eric angry when I quoted Missy and Missy angry when I quoted my brother. Easier to go fishing in the river flowing between these two views.

That year I was in the sixth grade at Camp Creek Elementary School. There had only been six of us since the first grade—all boys. We shared an overcrowded classroom with the much more numerous fifth graders, and the teacher had a hard time keeping up. He was more than happy to let some of us study science by ourselves in the room with the school's diesel-fired hot water heater, the windowless boiler room. We mostly ignored our dreary science textbook and started looking for other things to study, competing to find the most interesting topics. We called ourselves the Boiler Room Boys.

I became the leader because I was oldest by nearly a year. The age difference was due to a birthday anomaly that had delayed my starting first grade until I was almost seven years old. The then-new school superintendent had suddenly begun enforcing a long-ignored birth date cutoff rule. My Christmas birthday meant I wasn't going to start first grade the fall I had expected, but instead would have to wait a full year. I was incensed. Although I challenged my parents to protest this injustice, they either didn't or failed, I never knew. During that year of waiting, I often relived my anger as I played with my toy trucks and my favorite airplane, a B-29 Superfortress, alone on the dirt hillside in front of our home.

Pop had said that this type of airplane had dropped atomic bombs on Japan to end WWII, bringing him home sooner from the Philippines. Unbeknownst to me then, B-29s had just begun bombing raids over Korea.

We Boiler Room Boys copied a periodic chart of the elements from a chemistry book onto a large piece of cardboard. This iconic image of chemistry had been created in 1849 by a less than promising student, Dmitri Ivanovich Mendeleev (1834–1907). He was raised in his grandfather's Russian Orthodox Church, but after he remarried, he adopted deistic beliefs in part because his church forbade second marriages. Mendeleev became a chemist and organized the 63 then-known chemical elements by their atomic weight and chemical properties. He reportedly created this using his fascination with a card game named Patience, one that we knew as Solitaire. Mendeleev studied the patterns among the chemical properties of the elements to conjecture the existence of seven then-unknown elements. Eventually, three of those predicted elements were discovered, validating the power of the patterns in his chart, but also demonstrating that such patterns weren't always reliable.

The Bomb and the Boiler Room: 1955–1964

We especially wondered at the radioactive elements on the chart, each of which we marked on our chart with a carefully drawn radioactivity symbol. One was uranium, an element that has since colored every aspect of my life. We learned that scientists at Los Alamos, New Mexico, had used uranium-235 and plutonium-239 to make the war-ending bombs that American B-29 Superfortress bombers dropped on Hiroshima and Nagasaki. By 1949 Russian scientists had also exploded a plutonium bomb, the reason for our frequent air raid drills. During those drills, we were to hide under our orderly wooden desks. We watched a film called *Duck and Cover*[1] about what to do if, but seemingly when, Russia dropped atomic bombs on us. The film attempted to draw lessons from pictures and films of the devastation in Japan caused by our atomic bombing and to reinforce those lessons using a lilting song about a cartoon turtle ducking and covering in its protective shell. The devastation of Hiroshima was seared into my mind, despite the reassurance that those who survived the blast and the radiation burns soon returned to their normal lives. The Boiler Room Boys thought that this duck and cover drill would only help make our bodies easier to identify. But we quickly learned that our teacher didn't want to hear that; there was no money to make the increasingly popular bomb shelters for school children in the remote valleys of Oregon.

We found the astronomer that Eric's science teacher had quoted, sometimes science fiction writer Fred Hoyle (1915–2001). He claimed the universe was infinitely old and in a "steady state" with its continuous creation of matter. And we learned about an experiment to create life conducted by Stanley Miller (1930–2007). He shot electricity into a hot methane and ammonia soup, thought then to mimic conditions on the early earth. His experiment created amino acids[2] but was often reported as having created life. These were the things of science, and we assumed that they were true, just as Mendeleev's periodic table of the elements was true. Science seemed to be able to answer some of Eric's questions.

The Boiler Room Boys also reached out into philosophy. I began putting up glossy folded charts from the nearby university's bookstore that explained philosophers' philosophies. The names and pictures of the philosophers were printed down the wide pages, and the characteristics of their philosophies were stretched across the pages. Perhaps here the tension

1. Mauer, *Duck and Cover* (1952).
2. Miller, "Production of Amino Acids."

between Missy's world and what I increasingly saw as my world, science, could be resolved.

Of course, I didn't really understand the charts, but I liked the names, especially the strong-sounding ones: Kant, Spinoza, Hume, Comte, Plato, Socrates, Euclid, Aristotle, Marx and many more. And I was encouraged just by reading the names of their philosophies: positivism, nihilism, dialectical materialism, existentialism and, again, so many more. I was sure that when I understood the truth of all of these philosophies taken together, I would find answers to the big questions Eric kept encouraging me to ask.

Most of the conclusions of the Boiler Room Boys were inconsistent with Missy's Sunday school teaching. Jesus wasn't listed among the philosophers; the earth had always been; life was easily created. In Missy's world, God created the earth, life, and us; we sinned; and Jesus died for our sins so we would love each other.

Yet Jesus didn't seem important because people didn't seem to love each other. For example, we were aware that many civilians had been killed in World War II, Jews in Germany by the Nazis, Poles in Poland by the Soviets, Germans in Germany by our firebombs using the newly invented napalm, and Japanese in Japan by both our firebombs and nuclear bombs. I remember hearing that killing millions of Jews was justified because of who they were, murderers of Jesus. Further, our killing hundreds of thousands of Japanese civilians in an instant was justified because it had been calculated that stopping the war with atomic bombs would prevent the loss of many American soldiers' lives during a land invasion, possibly my father's life and hence my existence.

Such justifying calculations sounded so scientific, but I wasn't quite convinced they were true. They must depend on understanding the value of people, and I already knew that science did not deal well with questions of value. I did not yet know that people valued their own people more than those of other groups, despite what Missy said Jesus taught, to love your neighbors. And I did not yet know how to do such calculations.

One cold day in the spring our teacher visited us Boiler Room Boys. He seemed interested in our philosophy charts but then frowned, pointing at one of the philosophers.

"Didn't you know," he demanded angrily, "that Karl Marx's ideas were wrong and led to the Russian Revolution, and that our air raid drills were because Russia also had an A-bomb?"

We hadn't made that connection between Marx and air raid drills, and I was surprised at the teacher's anger.

"Marx's philosophy was wrong," he nearly shouted, "and you shouldn't have his picture up there."

This bothered me. I had assumed that all the philosophies were true, just emphasizing different things. If Marx had been wrong, what of the others? My hopes began to fade that philosophy would reconcile Missy's world with that of the Boiler Room Boys.

The next week our teacher returned to our Boiler Room but this time with a man in a uniform. We were clustered around our work table, the philosophy posters between us and the hot boiler. Our teacher looked nervously at the uniformed man. The badge on his dark blue uniform read "Fire Marshal," and his scowl and the golden braid looped around his shoulder said he meant business.

"There is a problem," the fire marshal said grimly, looking aggressively at the teacher and then at us. "How long have you students been meeting in this room," he continued.

"Since last Se—" I started to answer when our teacher interrupted.

"Just a few —" he stammered before the fire marshal cut him off.

"I need to hear the students' answer," he continued. "I've heard yours."

I didn't know what to think, but it was dawning on me that the original question wasn't a small matter for the marshal, and he seemed to be accusing our teacher of something bad. I realized that while our teacher had been worried about a picture of Karl Marx, the marshal was only worried about fire hazards.

"We've only had the posters up for a few weeks," I lied to divert the marshal from his original question. "Are they a fire hazard?"

"A fire hazard?" the fire marshal shouted. "Isn't it obvious. Whatever you have been doing in here, you must stop it at once."

"We're sorry," our teacher said, wincingly. "They won't be allowed in here any longer." We collected our periodic chart of the elements, by then tucked up against the boiler and hot to the touch, and our philosophy posters and books. Our time of asking whatever questions we wanted from the safety of the Boiler Room was over.

While we weren't forbidden from studying Karl Marx, our teacher effectively stopped us by bringing the fire marshal, all in the name of our safety. This also solved our teacher's concern about us having a picture of Marx on the wall. I was afraid to bring up the philosophers when we were

back in the classroom. The Boiler Room Boys gradually disbanded as we moved on to junior high school on the other side of the river.

Calculations of War

In junior high, I became enamored with the ideas of mathematics and the possibility of learning what was true using those ideas. I was now riding the school bus 20 miles out of our little valley early each morning, and the world began opening. Soon I was taking classes in algebra, which I learned was created by the Persian Khwarizmi, and geometry, created by the Greek Euclid. I remembered the name Euclid from my philosophical posters, but now Euclid the mathematician stepped in front of Euclid the philosopher. My mathematics teacher described how the word *algebra* had come from the full name of the Persian astronomer and mathematician Al-Khwarizmi (died AD 850). His book was titled *The Science of Restoring What Is Missing and Equating Like with Like*, and I hoped that his secrets of manipulating Xs and Ys would reassure me that the calculations I hoped were behind the decision to bomb Hiroshima were, in fact, possible.

These mathematics classes also led me further from the murky world of the philosophy charts now pinned up on my bedroom wall. I began seeing another way to find the truth: logic. Deductive logic was fascinating and using it I could deduce the seemingly never-ending theorems of Euclidean geometry from a few assumptions or axioms. The axioms were simple and seemed obvious, and the theorems, when accurately deduced, felt true. My teacher loved calling students to the blackboard to prove theorems. One day she called on me:

"So, Tim, would you demonstrate that the interior angles of a triangle always add up to 180 degrees?"

I went to the board and groped my way to complete the proof. I was both terrified that I couldn't and exhilarated when I did. This wasn't the groping for patterns that Mendeleev had used in deriving the periodic chart of the elements. I realized that I could have used that approach, for example, by patiently measuring the angles of many triangles. But how many triangles would I have to examine to assure myself that the angles of all triangles added to exactly 180 degrees? Now deduction proved to me that this theorem was true, not just a matter of conjecture or belief or approximate truth. Euclid's deductive logic was preferable to Mendeleev's

patterns, or inductive logic, because it produced true theorems rather than just predictions of possibilities.

I soon learned that Euclid's deductive logic was like other scientific developments in being based on mathematics. Physicist Isaac Newton (1643–1727), an unorthodox Christian who thought that one could only come to God through the "frame of nature,"[3] had derived the elliptical motion of the planets based on his theory of gravitation and on the three laws of motion developed earlier by the pious Lutheran[4] Johannes Kepler (1571–1630).

Later, deistic[5] physicist Albert Einstein (1879–1955) challenged Newton's model. There was no absolute motion, and, in fact, motion could only be detected relative to something else. I remember one afternoon trying to prove to our mathematics club using Einstein's equations why we could never travel faster than the speed of light. I didn't understand his theory, but everyone could see the problem when zero showed up in the denominator. You can't divide by zero, but this was actually not a proof of anything. I merely demonstrated that Einstein's equations were consistent with what he had assumed, that the speed of light was a constant.

I was a little concerned, however, that Newton's truth was contradicted by Einstein's. If so, I wondered, could the calculations that underlay the B-29 Superfortress bombing of Hiroshima also be wrong? The differences between Newton's and Einstein's calculations were small in the practical world, so I ignored them, but the differences in the relative values of people continued to haunt me.

Then on May 1, 1960, my questions about truth and reality abruptly changed. That was the day the United States government announced that the Russians had shot down an American weather plane that had "innocently" flown off course over Russian territory. I was outraged until Russian Premier Khrushchev displayed the wreckage of Lockheed's U-2 airplane, a very high-altitude photographic reconnaissance airplane named the "Dragon Lady." President Eisenhower had been lying, and Premier Khrushchev had been telling the truth. If Eisenhower was lying, I began wondering about other political issues. I wondered again about the calculation justifying the bombing of Hiroshima. I had wondered about the difficulty of

3. Hummel, *Galileo Connection*; Iliffe, *Priest of Nature.*

4. Kepler said in 1595, "Behold how through my effort God is being celebrated in astronomy." Quoted in Wertheim, "God Is also a Cosmologist."

5 . In a talk at the Union Theological Seminary in the 1940s Einstein said, "Science without religion is lame, religion without science is blind." Quoted in Isaacson, *Einstein.*

even doing such calculations, but now I wondered about the truthfulness of those claiming to have made them.

Soon after the U-2 spy plane crashed, I asked my history teacher if we might have a class on Russian history next year. I was surprised to find myself immediately marched to the guidance counselor's office despite my protests that I could find my way. I sat in the hallway while my teacher met with the counselor. Then it was my turn.

The counselor began asking questions about why I was interested in Russia, and I explained about the U-2 spy plane and Eisenhower lying. I described our grade school teacher shouting about Marx and the Russians having a plutonium bomb and the *Duck and Cover* film. She seemed not to know about Eisenhower's lying or about Marx's philosophy. She continued asking questions for a half an hour or so.

I thought I made a good case for studying Russian history. Then she sat back and, letting out a deep breath, asked, "Tim, wouldn't a class in Canadian history be more interesting? It is much closer than Russia, after all." I realized that she was the fire marshal all over again, trying to protect me, or someone, from my request. I did not get a Russian history class, but she did put a note about my request on my "permanent record," a note that would haunt me for several years.

Science Fair Fraud

I rushed out to the greenhouse when I got off the school bus that Friday afternoon in April. Dread filled me: the science teacher had reminded us that the science fair would be on Monday. He seemed to shout this fact at me: "It is mandatory for all sophomores, so bring your experiment or get an F."

When the science fair had been announced the previous November, I remember being excited. We were to do an experiment of our choice, and I immediately thought that I could do something in the family's greenhouse. I had been fiddling with the plant growth hormone gibberellic acid and was sure I could do something with that.

As I read the science fair instructions, however, I was taken aback. It began with a long, tedious definition of the scientific method, followed by detailed instructions for making hypotheses and setting up experiments. It described how to collect and record data and compare results. It even described at length how to phrase your answers. I already knew how to set

up experiments, I thought, and this seemed to be written for grade-school children. I bristled at being talked down to, and I again felt my first-grade anger at the school superintendent. I had immediately vowed then not to do a science fair project that year.

That April Friday, however, my vow failed. Science would be my career, I was pretty sure, and an F in a science class was not acceptable. On the long bus ride home, I thought about how to manufacture a science fair project. I remembered that I had sprayed growth hormone on some tomato plants earlier that spring and was relieved to find them still alive in the far corner of our somewhat decrepit greenhouse. I was even more relieved to find some other untreated tomato plants in another corner. Although I had just been messing around with plant hormones, perhaps I could manufacture a science fair experiment after all.

I unearthed the science fair rules that had put me off earlier to make sure I had what was required. Control and treatment groups? Yes, the two groups of tomato plants could qualify. Recorded measurements? Yes, I could still make out my crude notes written using a broad carpenter's pencil on the pine greenhouse benches; the dates were unclear, however, so I'd have to interpret them. A hypothesis? Well, not so clear. I had just been interested in what the hormones would do, fascinated by how I could manipulate the tomato plants at my will. Drawing a simple conclusion from the "experiment" wasn't so obvious either. Although the hormone-treated plants had zoomed ahead, now all the plants were about 18 inches high. All the plants' leaves were beginning to yellow.

That weekend I did manufacture a passable science fair experiment out of the leftovers in the greenhouse. A fancy backdrop, a partially true project description, and then an explanation. I credited the lack of overall effect of the hormones to the experimental conditions, namely the plants becoming pot-bound, so the slower untreated plants eventually caught up with the treated plants.

On Monday I took the backdrop, description, and the treatment and control groups of tomato plants to school, but blushed that afternoon when the principal called me to the front of the gymnasium to receive a first-place award. Although I had often blushed in shyness then, now I blushed in shame. My "experiment" was a fraud regardless of how I dressed it up.

My teacher wanted me to take my experiment to the regional science fair the next week. The instructions said that there I would have a face to face interview with the judges, an interview that would require more deceit.

I confessed to my teacher how I had manufactured my project at the last minute, but he seemed more concerned about our school being represented than with my honesty.

"You illustrated the scientific method so clearly," he said. "It is not important how you got the work done because the truth of science is independent of the scientist. You'll still get an A grade."

This was an attractive argument and would have allowed me to represent my school and myself regionally. After all that was said and done, the results of my "experiment" were nonetheless true, that is, I had made these observations. I hadn't conducted it exactly as I had described, I argued with myself, but what difference did that make? However, I still felt like the science teacher was asking me to explicitly lie to the regional judges just as I had implicitly deceived the local judges.

That evening I took the project description and fancy cardboard backdrop out behind the greenhouse to the family burn pile, and then I planted the tomatoes in our garden. I didn't know what else to do because I suspected the teacher was wrong and because I was ashamed. Just as President Eisenhower had lied about our spy plane, I had fabricated a science experiment. My experiment had been a lie, but my teacher had encouraged me to act like it wasn't. It was my choice to destroy the project, and I acted like the fire marshal to protect me from being exposed.

Collecting Animals

By my junior year of high school, I was allowed a self-directed biology class. I cultured slime mold in the laboratory on baking sheets in a heated rack and learned how to cause the mold to shift in a few days from single cells to multicelled forms, called "dog vomit fungus." I was intrigued by how the individual cells coordinated themselves to form a mass of cells and, in that, to produce a fruiting stalk. It was like controlling the growth of my ill-fated tomato plants; I liked it.

I went with my teacher and a group from a nearby university collecting lizards in the high desert in eastern Oregon. There we collected western fence lizards by stunning them with large rubber bands hooked over our thumbs and shot with our fingers. We quickly gained accuracy, collecting ever-increasing numbers of lizards. The study I eventually learned was to describe the fence lizard population, especially color patterns.

The lizards would mostly wake up from being stunned, and we soon had a box of many dazed lizards. Those that didn't wake up were dumped in the camp garbage cans. A couple of days later, when we broke camp, all the remaining still-living lizards were also just dumped into the cans. I was appalled, nearly crying, but did not speak out. I could not ask about their actions because these were real scientists. I didn't want to embarrass myself.

I also studied skeletons, boiling the meat off to display the skeletons within. The skulls especially fascinated me. I had a good skunk skull I got when we tore a barn down and several deer skulls from hunting trips but didn't have a rabbit skull. One day I took Pop's 12-gauge shotgun and my hunting knife and went up on the hill behind our farm. I was used to hunting deer; this would be simple.

The rabbit startled me when it broke cover, dodging through the thick grass first left and then right. I pulled down on it, expecting it to go left again, and squeezed the trigger, hoping for a clean kill. But the rabbit went right instead, and unexpected tears spurted from my eyes when I saw him lying there badly wounded, breathing hard with fear in its brown eyes. I cut its throat, but I couldn't stop my tears. It didn't die easily, and when its heart had nothing left to pump, something disappeared, something I didn't understand and couldn't quite see but that I knew was gone.

Answering the "Big Questions"

Science's answers to many of the big questions that my brother Eric and I had discussed seemed sensible to me, but I was embarrassed that my church often had different answers.

For example, scientists claimed the universe had no beginning and had always been just as we see it, while my church claimed that the universe had had a relatively recent beginning. Similarly, scientists claimed that they could create life along the lines of Miller's 1953 experiment. In contrast, my church claimed that all life was created just as it is today.

But there were many more questions where science's answers were less clear. What disappeared when my rabbit died? Science claimed that nothing really happened, while my church claimed that at least when people died their "spirit" continued to exist. But for rabbits, the church's answers were less clear.

"What is true?" was the question that perplexed me the most. My brother had often posed this question about the nature of reality. "What is

really out there, outside ourselves?" was a favorite question of his. In Sunday school we had memorized John 8:32, where Jesus seemed to be saying that when you study the Bible "you will know the truth, and the truth will set you free." That is, everything you need to know is in the Bible. In science classes the claim was more modest: we don't know everything, but science is a method that will eventually reveal all truth.

A different question that my brother often asked was if it was always important to tell the truth. I remember memorizing Ephesians 4:25: "Therefore, having put away falsehood, let each one of you speak the truth with his neighbor . . . " However, my science teacher encouraging me to continue to lie about my science fair project suggested that science was less demanding on truth-telling.

Similarly, I had seen that church members sometimes seemed to be telling different stories to different people. I knew that I had lied to the fire marshal when he discovered the philosophy posters the Boiler Room Boys had hung around the boiler. But that hadn't seemed so bad, especially compared to President Eisenhower's lie to Premier Khrushchev about the US spy plane. I knew that after I had first lied about my science fair project I did not feel right, wondering if I would be found out, and I wondered about what Eisenhower had felt when he was found out by Khrushchev.

Both religion and science claimed to have answers to these big questions, but in fact they weren't the same answers, and I couldn't reconcile their inconsistency. That left me in a dilemma: I couldn't tell whether science or religion would best help me answer the big questions, but I felt I had to choose one or the other. By the time I chose a college I had turned increasingly towards science. Plus, science didn't lie, and even when it seemed to falter, science offered the hope that it would eventually be able to answer such questions. What I wasn't prepared for were the untested touchstone beliefs embedded so deeply within it.

2

Touchstones

Looking back, I see that there were underlying problems with how religion and science arrived at their answers. Those problems included untested touchstone beliefs that are themselves used to test conclusions about the world. The Merriam-Webster dictionary describes a touchstone as a piece of slate formerly used to test the purity of gold, and thereby metaphorically defines a touchstone as "a test or criterion for determining the quality or genuineness of a thing." Science teachers of my era tended to have an overly simplistic definition of science that didn't recognize those underlying criteria upon which scientific exploration is actually built.

The definition of science is contentious, something that I should have seen when my science fair project went askew. One dictionary understanding of science is "a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through the scientific method."[1] That definition relies on a definition of "the scientific method," the bugaboo question asked of high school science fair contestants. And that definition leads the unwary into defining concepts such as experiments and testing hypotheses. The complete dictionary definition overall runs to several paragraphs.

Despite the complexity of such definitions, many science practitioners like the idea that they are contributors to a system of knowledge.[2] This is often incorporated into many exclusive "societies of learned persons," elected by their own members, such as the National Academy of Sciences,

1. There are many definitions of science; I've used Merriam-Webster's online dictionary here and more generally: http://www.merriam-webster.com/dictionary/science.

2. Dalrymple, *Ancient Earth*, ch. 1.

authorized by President Abraham Lincoln in 1863 and often seen as "a body of established opinion widely accepted as authoritative."

This approach to defining science is flawed, however, because it leads to the concept of "scientific" versus, pejoratively, "nonscientific" thinking. Thus, scientific thinking has usually been reserved for those who have bona fide credentials (candidly, an earned PhD degree). Such credentials give practitioners authority in interpreting observations that have been made on almost any topic, regardless of the discipline in which they were trained.

There are, however, other approaches to defining science, some that avoid forming "a system of knowledge." For example, C. John Collins (1954–) suggested defining science as many "discipline[s] in which one studies features of the world around us and tries to describe his observations systematically and critically."[3] Although the disciplinary practitioner pursues his observations of nature based on his own understanding, this definition doesn't necessitate having an exclusive credentialed group of scientists to make or approve of such interpretations. This approach leads to the much more satisfying distinction of logical versus nonlogical thinking in interpreting the disciplinary observations.

Interpretation in this approach is not limited to a self- or culturally appointed elite but becomes a free-for-all, including practitioners of all disciplines, of course, but also philosophers of all persuasions, theologians of all beliefs, logicians and mathematicians of all stripes, and artists of all visions. Anyone who will expend the energy to understand the observations being made and employ logical thinking to evaluate plausible interpretations, not easy tasks, would be welcome. The criterion for truth becomes logic, not pronouncements by priests, neither those ordained by churches nor those ordained by academia.

Looking back at my career in science, this approach to defining science fits the reality of how science is actually practiced much better than the science fair definition.

Types of Observations

Repeatable observations are especially valuable when sufficient details of what was actually observed are reported. One well-known type of observation is the results of experiments constructed to compare the effects of varying one or a few conditions thought to affect the outcome. We depend

3. Collins, *Science and Faith.*

on such experiments to determine the efficacy of chemical treatments, for example, when comparing the growth rates of tomato plants that have been treated with growth hormones or the survival rates of cancer patients treated with experimental drugs.

Patterns in observations are also useful, as exemplified by Mendeleev's periodic table, which had fascinated me, along with the other Boiler Room Boys, in grade school. The patterns that Mendeleev saw in his array of chemical elements suggested to him, through the logical process called induction, the existence of some additional although then-unknown elements. Such patterns suggest but do not themselves prove anything, as seen in the fact that some of Mendeleev's predicted elements have been confirmed while others have been shown not to exist.

The seemingly most reliable conclusions are deduced from certain starting assumptions.

A classic example is Euclidean geometry, where for example triangles can be shown to contain exactly as many degrees as half a circle. While such properties of shapes could be suggested using induction based on patterns obtained from examining many such triangles, much stronger conclusions could be possible using deduction. Such conclusions depend entirely on the assumptions made; in this case, that the triangles are flat rather than, for example, spherical. The validity of such assumptions is always a matter of conjecture and knowing if they fit reality is often difficult.

Interpreting Observations

The above types of observations, repeatable inductions from patterns and deductions, have been used in many ways to learn more. I first remember feeling joy with mathematics when I figured out my first proof in Euclidean geometry in junior high school. Something fell into place inside me, and I felt satisfied, excited about "getting" deductions. That satisfaction led me from Euclid's geometry to algebra, trigonometry, calculus, differential equations, Boolean algebra, and statistics, each one proceeding from or branching from the others. I have been fascinated ever sense of how logic and mathematics are so useful in describing the physical and biological worlds.

I remember feeling not quite so satisfied with Mendeleev's inductive analyses that identified gaps in his table of elements. Logical deductions can be derived from premises, but inductions could only be seen in the

patterns. The validity of deductive and inductive logic in geometry and chemistry can be tested by repetitive experiments. For example, the implications of Euclid's logic have been tested by repeated observations that the interior angles of a triangle do sum to 180 degrees. Similarly, Mendeleev's prediction of yet unknown elements was tested by experiments when most but not all the predicted elements were ultimately found.

There is, however, another type of observation, those that logically cannot be repeated. One example was the observation by Chinese cosmologists of a "guest star" that appeared suddenly in AD 185 near the star Alpha Centauri. They reported that the brilliant star was visible for eight months and then disappeared. That observation was not the result of an experiment, and, of course, could never be repeated. But it was nonetheless valuable because it was reported in sufficient detail to allow confirmation using modern telescopes, which have detected remnants of the explosion of a star near Alpha Centauri some 8,000 light years from the earth.

Intrigued by how we study nonrepeatable events, the logician Charles Sanders Peirce (1839–1914) in the late nineteenth century defined the logic of "guessing," which has been dressed up with a dignified title, "abductive logic." Peirce thought that arguments about nonrepeatable events fundamentally involved guessing possibilities, which, if true, would be consistent with some "surprising fact" that already had been observed or could be observed in the future. In the case of the Chinese observation of the "guest star," one of the many guesses was that some explosion had occurred. The "surprising fact" that gave cosmologists "reason to suspect" that this was true was the recent detection of cosmic debris near Alpha Centauri using modern telescopes. Not a deduction and not an induction from a pattern, but a guess that was eventually found to be consistent with other observations.

Applying Collins's Definition of Science

The logical, mathematical, and philosophical tools that Collins identified provide a firm basis for interpreting our observations of the universe and the world, both doing science and doing theology. In addition to those tools, however, Collins emphasizes that there are many "touchstone" beliefs that we adopt in order to use these tools, for example, that we exist.[4] We

4. Ibid., 22.

will take up the importance of such truths in chapter 4 under the concept of worldviews.

But a more concrete example of a touchstone belief that has influenced cosmology is that the universe is unchanging. Holding this belief affected the development of our understanding of the basic nature of the universe, and it was held for centuries despite the observation of the "guest star." Surely we see now that the appearance of a bright star for eight months implied the universe was changing, but cosmologists up into the twentieth century couldn't see this because it was contrary to their belief that the universe was not changing.

It wasn't until 1925 that the unchanging nature of the universe became a problematical belief when the cosmologist Edwin Hubble (1889–1953) showed that many of the galaxies he observed were moving away from the earth at an ever-increasing speed. That is, the universe was changing. His moving galaxies were a "surprising fact" that was inconsistent with the long-standing assumption of an unchanging universe. In terms of Peirce's abductive logic, the implication can be spelled out as: "If the universe were expanding, then Hubble's observation that galaxies are moving away would be 'a matter of course.'"

That cosmologists believed in an unchanging universe long after the evidence in retrospect at least was clear. Not only did that delay the development of cosmology but it also caused the biblical claim in Genesis and elsewhere of a changing universe to be rejected out of hand. At the very least, that difference affected the relationship between religion and science negatively. We will consider the development of cosmology further in a later chapter.

Lest this problem with cosmology appear as an isolated incident, geologists long held that the earth had also been unchanging. This belief affected how they interpreted geological observations, for example, the layers in the soil and the fossil sea shells on mountain tops. However, geologist Alfred Wegener (1880–1930) in the early twentieth century argued that the continents of Africa and America looked as if they had been pulled apart. Only after World War II did geologists recognize that the world had been changing, allowing geology to develop. As per cosmology, though, the persistence of the assumption the earth had not been changing delayed the science. It also contributed to conflicts between geology and biblical claims in Genesis and elsewhere, for instance about interpreting the flood story.

The acceptance of an unchanging universe and unchanging continents are examples of giving insufficient attention to the touchstones that scientists hold. This acceptance resulted in apparent conflicts across disciplines, including between science and religion. Collins's definition of science recognizes that touchstones are just assumptions and encourages people from many disciplines to engage in interpreting the observations that are made using a wider variety of touchstones. In effect, the success of different touchstone at explaining our observations serves as a test of the touchstones themselves. As I would soon discover, however, scientists aren't the only people struggling to examine the touchstones of their beliefs.

3

Growth and Form: 1965–1967

On August 2, 1964, just as I was preparing for my senior year in high school, four North Vietnamese sailors were killed in a brief sea battle. Although at the time I didn't notice this "Gulf of Tonkin affair," it would prove to have a tremendous impact on me and more so on many others in my generation. The next spring, I began the rituals of finishing high school. I took college placement tests, began applying to universities, and registered for the military draft. I had no reason to suspect the surprises that were coming.

The first surprise was that, although my test scores were excellent, the nearby University of Oregon advised me not to bother to apply.

"You have an excellent application," the college recruiter began, "but there are so many students applying this year that we state schools won't be giving many scholarships."

My jaw dropped.

"But I need a scholarship. We don't have the money for the tuition, and I've worked so hard to earn a scholarship," I said, shaken.

"Well, yes," the recruiter replied, "I understand. But there are many more students finishing high school this year, those born just after the end of World War II. And this is just the beginning of a big baby boom. Too bad you didn't finish high school last year."

His comment reminded me that I would have finished high school the previous year if the school superintendent hadn't begun enforcing the birthday cutoff rule when I was five years old. I wondered if that arbitrary decision would keep me out of college.

As a seeming afterthought, he added, "You might try a smaller private college."

Another surprise occurred when I applied for a student deferment from the military draft I had just registered for. College draft deferments had been routinely given by the Selective Service System, but I instead I got a letter from the local draft board asking for more specific information about my college plans. Even though there were more young men available because of the baby boom, more draftees were expected to be needed because of the Gulf of Tonkin affair. I wondered if four North Vietnamese sailors would keep me out of college even if I could get a scholarship.

These problems were resolved by my girlfriend, Margene Sorenson. I had first seen her when we were in an American history class the year before. She was new to my school, whip-smart, and pretty; we began arguing in class debates almost immediately. She seemed taller than she was.

Eventually, I invited her to go bowling, there being little else besides movies in our town, and was surprised when she said yes. But that night the old ladies' bowling leagues had taken over the only bowling alley, and we ended up at the pool hall down the street.

She handled the pool cue well, getting a good opening break. I noticed her long red fingernails complementing her red hair.

"What do you want to do after high school?" I asked after a couple of games.

"I want to go to Pacific Lutheran University and then be a medical missionary to China," she replied immediately, sounding edgy.

I was surprised that she had such definite plans, impressed. I had never heard of that university.

"You'll not be able to keep those pretty fingernails if you do that," I responded, a little aggressively. What was I doing? I wondered.

"And you," she snapped back. "What do you want to do?"

All I knew was that I wanted to go to college and maybe become a scientist and especially to not live in this little town. I was a little embarrassed that I couldn't be more specific.

When the college recruiters came, she interviewed with the one from Pacific Lutheran University. She said that it was a good school and had a good biology program; maybe I should just talk with the recruiter. Reluctantly I did, and I got a scholarship and a promise of participating in one of their biology department's summer research programs. And with that admission, I also got a deferment from the draft board. My fears fell by the

wayside, and Margene and I were off to school together, one of the best decisions I ever made.

We began college that fall, and I focused on biology and mathematics. The biology and mathematics lecture classes and the biology field trips were invigorating. The biology laboratory classes, however, were tedious and boring; everything must be arranged *just so*. But I loved the library. I remember climbing the stone stairs of the library in old Xavier Hall to the top floor where there were cozy study carrels and archives of old books. The treads of the first steps leading into the building were irregular, the soft stone worn with deep grooves. The grooves were less pronounced on the second floor and especially on the top floor. We would rush there after dinner, my now girlfriend Margene and I, to claim two of the coziest carrels wedged under the sloping roof.

I had failed to read the biology department's summer reading assignments before classes began. One was Julian Huxley's (1887–1975) *Evolution: The Modern Synthesis.* I knew a little about Charles Darwin's (1809–1882) theory of evolution but was worried that I didn't know enough and was expecting to be asked about my summer reading any time now. I was concerned as well because I had seen in Julian Huxley's table of contents the phrase "The Eclipse of Darwinism," and so began reading that book in earnest.

I had learned in high school that life had emerged from amino acids created by electricity striking a warm pond and that all organisms had diversified and evolved from that first life by natural selection. The teacher had especially emphasized that Darwinism had triumphed over creationism. Darwin's natural selection was simple enough at least in broad strokes. Individuals vary but usually look mostly like their parents. Some of these varying offspring would tend to reproduce more than others so that gradually more and more individuals in the population would come to be like those who reproduced more. If conditions changed, the population of organisms would gradually begin to change, generation after generation, with individuals with characteristics that were more useful under the new conditions becoming more prevalent.

Julian Huxley's phrase "eclipse of Darwinism" sounded like evolution had been disproven, which Missy Lane at the Camp Creek Community Church would have loved to hear. But it wasn't evolution that had been disproven. Rather, Julian Huxley was just describing how Darwin's original ideas about natural selection were rejected by biologists over the 50 years or

so after he published his *Origin of Species* in 1859. Darwin's idea had failed to impress many biologists then, especially because they and Darwin had continued to believe in blending inheritance, where the differences among parents were averaged out in their offspring. I knew immediately that this contradicted Darwin's natural selection, and so did most biologists at the end of the nineteenth century.

Reading on, however, I was relieved to find, despite this initial rejection of Darwin's theory, that Huxley still felt that all life had evolved from simpler life because the monk Gregor Mendel (1822–1884) had developed a better theory of inheritance. Thus, my basic belief that biology did not require God to explain the origin and diversity of life still sounded true.

Darwin's theory had gone into decline because he had failed to embrace Mendel's theory, which Julian Huxley saw as eventually rehabilitating Darwin. He had not embraced Mendel's theory perhaps because he never became aware of it, but more likely because Mendel used mathematics to interpret his very careful experiments with pea plants. Darwin stated in his autobiography that mathematics "was repugnant to me," and was "like a scalpel in a carpenter's shop—there was no use for it."

Although the biology department never showed any interest in its summer reading assignments, there were several topics that I continued to investigate on my own. These included how mathematics related to biology and the definition of life.

D'Arcy Thompson's Mathematics of Life

I was concerned with Darwin's rejection of mathematics and beginning to understand why my college biology professor was concerned over my interest in mathematics. Even though nearly a century had passed since Darwin's rejection of mathematics in biology, there were still many who agreed with him. More importantly, if mathematics was not useful for studying biology, what of the calculations I still supposed were behind President Truman's decision to bomb civilians?

I was relieved when I began finding others who had disagreed with Darwin. For example, the mathematician Karl Pearson (1857–1936) stated in 1901: "I believe the day must come when the biologist will—without being a mathematician—not hesitate to use mathematical analysis when he requires it."

Growth and Form: 1965–1967

A Scottish biologist, mathematician, and classics scholar, D'Arcy Thompson (1860–1948) described how to use mathematics in biology in his book *Growth and Form.* First published in 1917, the slim volume had grown to more than 1,000 pages as he revised it in 1942.[1] He wrote then, "My sole purpose is to correlate with mathematical statement and physical law certain of the simpler outward phenomena of organic growth and structure or form."[2] I grew increasingly fascinated as Thompson described the spirals of the chambered nautilus and the patterns in the leaves of plants with the same equation based on the Fibonacci sequence. This same series could also be used to describe the growth of a population of rabbits, at least simple rabbits. This was like Euclid's or Einstein's equations that described mathematical or physical features of the world, but Thompson's equations described biological features.

One of the features that he described mathematically was the growth in the size of individual people from birth to death. He used French census data to introduce concepts such as changing rates of individual growth and the difference between the growth of individuals and average growth of the population as a whole. But Thompson showed how similar mathematics could describe the growth of many types of organisms: microscopic algae (*Spirogyra*), crocus from the garden, giant tortoises from the Galapagos, cod from the Firth of Forth, and blue whales. He even described how the age of cod could be approximated from analysis of repeated measurements of the size of the fish caught over a few years. Curiously this involved looking for "baby booms," like the post-WWII glut of college students that had kept me out of the University of Oregon.

Importantly, in his second edition, Thompson included newer examples about the growth of the number of individuals in a group or population. He focused on one population in particular: humans. The Reverend Thomas Malthus (1766–1834), an English economist and demographer, estimated that human populations tended to double in numbers every 25 years and famously claimed in 1798 that with this compounding growth, the human population would outstrip growth its ability to produce food,

1. Thompson, *Growth and Form.*

2. Gould quotes several laudatory statements about Thompson's book, including Peter Medawar: "the finest work of literature in all the annals of science that have been recorded in the English tongue." Thompson's description of the mathematical beauty of nature was influential for many scientists and mathematicians and even artists. Gould, "D'Arcy Thompson."

the so-called Malthusian dilemma. Little did I know that my career would be tightly linked to Thompson's book and Malthus's dilemma.

Herbert Spenser's Definition of Life

One evening I got up from my favorite library carrel and wandered along the shelves of old books in a reading stupor. In the gloom, I happened to see a name I recognized from grade school, from the discussions of the Boiler Room Boys: Herbert Spencer. The book was one of a series titled *The Synthetic Philosophy of Herbert Spencer.* I wiped the dust from the cover of the first volume, *The Principles of Biology.*[3] It was published in 1865, just a few years after Darwin's *Origin of Species*.[4] In Spencer's preface, I read: "The aim of this work is to set forth the general truths of biology as illustrated by and as illustrative of, the laws of Evolution."

I was instantly hooked, just as I had been by Thompson's book on mathematical biology. Spencer wrote about general biological truths from philosophy but also from mathematics. His book seemed like a way to answer questions, to find truth. So, I began reading Spencer at the beginning, where he began by trying to define life.

I had experience with many kinds of life by the time I got to college. I recalled my tears over the rabbit whose life I took to get its skull as if the essence of life was in its head. I remembered my shame at my deceit in manufacturing a science fair experiment using tomato plants that I manipulated through hormones. I remembered making slime molds come together to form a fruiting stalk. In the far corner of our farm, I kept several hives of honey bees; capturing new swarms, burning hives that became diseased, and harvesting sometimes too much honey. I knew how to manipulate life, but Spencer's book showed me that I didn't really know what life was.

For example, he worked step-by-step through a series of definitions of life that he had encountered, identifying the limitations of each before moving onto another. After 73 pages he finally arrived at the best he could do. For him, something was alive if it was a "definite combination of heterogeneous changes, both simultaneous and successive, *in correspondence with external co-existence and sequences*." That is, life involved making internal changes in response to external changes.

3. Spencer, *Principles of Biology.*

4. Darwin, *Origin of Species.*

That life could be seen this abstractly surprised me. He seemed to be saying that there were different things inside a living organism that were changing, like digestion and growth. Those things were connected to external things, such as eating food. The essence of life is that the food was digested into chemicals and energy and those then into growth.

Maybe this kind of definition would be sufficient for plants, like my science fair tomato plants, but it missed something that I had seen when I was collecting lizards. The professors dumping the leftover lizards instead of releasing them had brought up feelings that embarrassed me. But especially this definition did not describe what disappeared from the eyes of the rabbit as it bled to death.

I didn't know how to reconcile my experiences with Spencer's definition, and his style was becoming verbose and slow-going. I didn't have time then for a close study of the many volumes of Spencer. I read enough, however, to realize that he had taken on the task of answering many of the questions that my brother and I asked as children, so I tucked Spencer away in the back of my mind, certain that he could help me later when I had more time.

Aldous Huxley's Perennial Philosophy

The philosopher Aldous Huxley (1894–1963) was a cousin of the biologist Julian Huxley, mentioned above relative to Darwin's evolution. Both Huxleys were grandchildren of the biologist Thomas Huxley (1825–1895), a defender of Darwinism known as "Darwin's bulldog." Aldous Huxley described his quest to understand the effects of a derivative of a cactus plant called mescaline in his 1953 book *The Doors of Perception.* He was interested in the chemical similarities to adrenaline and the reports that mescaline possibly caused symptoms of schizophrenia. More than questions of the cause of mental illness, however, Huxley was interested in understanding more about the mental experiences of others. Thus he wrote, "I was convinced in advance that the drug would admit me . . . into the kind of inner world described by Blake." He was referring to the poet William Blake (1757–1827), who wrote in his poem "Heaven and Hell": "If the doors of perception were cleansed, everything would appear to man as it is, infinite."

Huxley was disappointed in the effects of mescaline, however, and I was thereby discouraged from doing my own experiments, even if I could have. But I stumbled on another of Aldous Huxley's books, *The Perennial*

Philosophy, written in 1944. Aldous Huxley drew together his observations of the writings from many religions, immediately referring to both the Bible, which said, "Blessed are the pure in heart, for they shall see God," and a Sufi poet, who said, "The astrolabe of the mysteries of God is love." The wide variety of religious experience all seemed to be one, all tied together through love, and all pointing toward "the one divine Reality substantial to the manifold world of things and lives and minds."

I was taken with the conclusions that he drew from these many observations, especially that all religions point toward the one and same God. And I stopped just there, for he also said that God, the "Mind at Large," could only be understood through a systematic program of meditative experience. Based on such experience, he claimed that we could work out "a system of empirical theology," and thereby understand God. I could see that such experiences would require a lot of time, as he assured his reader, and his book was long. I stored away what I thought was his message, that there was a Mind at Large, and put the book back on the library shelf for another time.

Flavius Josephus's Jesus

"He is going home to North Dakota now. I don't know if he wanted to be successful," she added, watching my eyes.

I was still dumbfounded and couldn't respond. I didn't understand. I had never known anyone who would do this.

"He wasn't very good at it," she half-joked, betraying her Scandinavian dourness.

I had seen her walking my previous roommate across the university commons, his wrists obviously bandaged. I had started to cut across the grass toward that them, but she caught my eye and shook her head ever so slightly. I continued toward the library where she later found me in my favorite study carrel. She explained that he had slashed his wrists the evening before, but she had found him in time.

"His father was flying in to take him home, and I didn't think him seeing you would help just then."

"I intended to look him up this fall," I said lamely. "But I guess I hadn't tried very hard. He spooked me, you know."

"Yes, sometimes me too. But I think last year he was looking for your approval, do you know that?" she asked.

I started to reply "No," but my word came out a hoarse "Yes," not quite a sob. At some level, I knew what she was saying and was ashamed.

"He spoke of you as if you were Jesus," she continued. When you didn't seek him out this year, he was devastated."

She left me in my carrel, hidden away and full of regret.

That evening, still wondering about her words, I wandered down the library's shelves of old journals and books and saw the title *The Antiquities of the Jews* on the spine of a large volume by Flavius Josephus (37–100). A bell rang. Somewhere I had heard that a Jew named Josephus wrote about Jesus not long after his supposed death and resurrection. As I focused more and more on biology and mathematics, I had increasingly believed that Jesus was mythical. But now I had in my hand something that had been written about him over 1,800 years ago. There were 20 volumes of Josephus; how could I ever check to see if Jesus really was mentioned?

I returned the next night with more information: the campus pastor was familiar with Josephus and told me where to look. Blowing the dust from the cover of volume 18, I fumbled to the third chapter, and there in the third paragraph I read, "Now there was about this time Jesus, a wise man, if it be lawful to call him a man." I remember feeling a chill from the possibility that Jesus had been a real person, not just character in yet another Bible story. I read on as Josephus seemed to echo Missy Lane's Bible stories. The words sounded too much like they were written by a believer, a Christian, but Josephus wasn't. Were these words authentic, or had they been Christianized subsequently? I was jolted by the last line of the paragraph: "And the tribe of Christians, so named from him, are not extinct at this day." It sounded so anticipatory, like Josephus meant they were not *yet* extinct, but that he expected them to die out.

Of course, Christians are still not extinct today, although Jesus had not appeared on my philosophy charts from grade school. Spencer's and Aldous Huxley's philosophies were very different from each other, and Jesus' words in the Gospels were even more different. But they all addressed big questions, the kind my brother Eric and I had talked about. He and I had not answered these questions then, and now there were many more of them.

I returned to the philosophy folders from grade school, now on my dormitory room walls, and found the word that I was remembering, *Weltanschauung*. This harsh-sounding word is easier to pronounce in English: *worldview*. This was a way of approaching our big questions that was

described by the German philosopher Wilhelm Dilthey (1833–1911). He had been inspired by Immanuel Kant's (1724–1804) argument in his eighteenth-century *Critique of Pure Reason* that objective and certain knowledge was possible, and he was seeking "an experiential science of spiritual phenomena," especially "laws governing social, intellectual and moral phenomena." This focus on laws, like Kant's objective knowledge, appealed to me. Dilthey, however, thought that worldviews based on natural law were too restrictive. There was much more of the human experience that we needed to account for. Dilthey's idea had been picked up by Abraham Kuyper (1837–1920), a Dutch Calvinist, who argued that "all knowledge proceeds from faith of whatever kind."[5] It is this faith that underlays the modern sense of worldviews, which can be defined as the fundamental beliefs people hold. Although a Christian, Kuyper realized that people other than Christians formed worldviews that they had faith in as well.

As I continued to wonder at the calculations about killing Japanese civilians in World War II and, more recently, why I felt so badly about failing my roommate, the idea of worldviews seemed promising. I tried to list some of the fundamental beliefs of Thompson, Spencer, Aldous Huxley, and Jesus. This quickly became overwhelming because everyone used the words differently; eventually, I put my lists aside. Thompson's mathematical approach to biology seemed like a secure route to knowing truth, while Josephus's Jesus reminded me of the uncertainties of Sunday school. I had chosen science, of course, and remained unconvinced about Jesus, so I suppose I was somewhere between being an agnostic and an atheist. But sometimes I couldn't help feeling nagged by the possibility that just maybe Missy Lane had been right about Jesus all along.

5. Bratt, *Abraham Kuyper.*

4

Breaking Down Belief

My first two years of college had introduced me to more questions than answers, especially questions about the church's answers to the big questions of life that my brother Eric and I had struggled with. I had succeeded in ignoring those problems, and especially the role of Jesus in all of this, for many years. Later my attention was drawn back to the concept of worldviews by a pastor whom I had been complaining to about my childhood Sunday school and the confusion between science and religion. I was acting like I understood the problem, that I had come to grips with it. After all, I was a scientist and should understand such things. When I responded somewhat vaguely to his question, "Have you read about worldviews?" he reached out to his bookshelf and handed me his copy of James Sire's book *The Universe Next Door*. "Read it," he said, a little curtly. The book began with two these two short verses:

> A man said to the universe:
> "Sir, I exist."
> "However," replied the universe,
> "The fact has not created in me
> A sense of obligation."
> —Stephen Crane, "War Is Kind," 1899[1]
>
> When I consider your heavens,
> the work of your fingers,
> the moon and the stars,

1. Crane, *Prose and Poetry*.

which you have set in place,
what is man that you are mindful of him,
the son of man that you care for him?
You made him a little lower than the heavenly beings
and crowned him with glory and honor.
—King David, Ps 8:3, circa 1000 BC

Those passages contrasted the worldviews of a Hebrew theist 3,000 years ago and an American nihilist 100 years ago. In contrasting such ideas, James Sire (1933–2018) was pointing out the differences in underlying beliefs, and his book effectively revealed to me the presuppositions, the beliefs, inherent in different answers to fundamental questions. I was quickly back to my yet unanswered childhood questions.

Sire was doing what I had tried to do in the university library when I first encountered worldview thinking, listing the underlying beliefs of different philosophers, but he developed these ideas much further. While I had long ago assumed that all the philosophies on the Boiler Room Boys' charts were true, Sire now showed me how to boil down a worldview into its parts by describing the answers to eight basic questions and by examining people's practical views of the world, views on which we base our lives.

The book proceeded systematically, beginning with his definition of what he meant by worldview: "A commitment, a fundamental orientation of the heart." I thought of my questions in grade school about the value of Jesus, Jews, and Japanese, in high school about honesty in science, and in college about the adequacy of science and my responsibility to my roommate. These were important questions, and they did engage my heart.

Worldviews can be expressed in two ways, as a story and alternately as a set of presuppositions. I wasn't sure about a story, but a list of suppositions that we hold about "the basic constitution of reality" sounded good; I could deal with a list. So I persisted with the book, buying his latest revised version to avoid marking up my pastor's copy of Sire's earlier edition. Sire listed a variety of possible answers to questions about the definitions of "prime reality" and "external reality," making a subtle but crucial distinction. He described ideas about the nature of humans and human death, central ideas that we rely on daily. He also spelled out ideas about where knowledge and ethics come from, and finally about the nature of history. The philosophical haze that I had encountered when I studied individual philosophers began to clear, and the attractiveness of comprehensive systems, such as Aldous Huxley's "Perennial Philosophy" began to fade.

But Sire's worldview analysis was more than just studying lists of possible answers to a series of questions to find correct answers. These were basic questions because there did not seem to be a way to prove the answers to any of them to be true. Instead, one had to choose answers that seemed right, answers that one could believe were true. To the degree we believed a set of answers to these basic questions, we made what Sire called a "core commitment" to a worldview.

Faith vs. Belief

Sire's description of worldviews included the many presuppositions that could be conveyed through a list or a story. Our belief in one or the other of the several worldviews based on those presuppositions provides "the foundation on which we live and move and have our being."[2] Such a foundation is not based only on an intellectual assessment of the likelihood of each of the several presuppositions being true. It is also based on our faith.

When Niagara Falls was first crossed on a high wire in 1859, the funambulist, or rope walker, was Jean Francois Gravelet, recently arrived from France. When he first stretched his two-inch hemp rope across the gap between the U.S. and Canada, most people who were able to inspect the rope stated that they did not believe he could do it. At 5 p.m. that day he picked up his 26-foot-long balancing pole, stepped off the United States onto his rope, and a few minutes later stepped off his rope and onto Canadian soil. Gravelet believed he could do it, and he made believers out of the thousands who came to see him repeat this feat over and over again.

Once, after pushing a wheelbarrow across Niagara Falls on his rope, he asked people in the audience if they believed he could cross back over Niagara Falls with a person in his wheelbarrow? Although many people expressed their belief that he could do that, when he asked for a volunteer to get in his wheelbarrow, no one stepped forward. Believing that Gravelet could walk the rope was easy; they had seen him do it repeatedly. Stepping into his wheelbarrow, however, required something more than belief. It required faith in Gravelet himself. Belief and faith to act are not the same things.

It is faith that is required, and everyone who embraces any worldview does so by thoughtful belief in the presuppositions. But to fully embrace it,

2. Sire, *Universe Next Door*, 20.

one must have faith to get in whatever wheelbarrow is on offer. We must be willing to act on our beliefs.

People put their faith in the beliefs that constitute their worldviews, whether or not they have thought through them in terms of Sire's basic questions. We live our lives based on that faith, getting in Gravelet's wheelbarrow again and again.

Once, on the last leg of a trip home, I sat next to a young woman on her way to one of the seven sacred mountains of the world.

"So, Mount Shasta is a sacred . . ." I fumbled.

"Mountain," she supplied. "It is where we can more easily access, well, they say the spirit world. God, I guess."

Realizing I was stepping in deeper, I asked, "What is your religion?"

"Mount Everest is another, and then there is Inyan Kara in the Black Hills in Wyoming," she continued, ignoring my question.

"What makes them sacred?" I ventured, following her lead.

"Well, they are like portals or a vortex concentrating energy, which makes you feel good," she replied brightly, but without enthusiasm.

As my airplane acquaintance demonstrated to me, we make people uncomfortable when we address their worldviews. Indeed, to challenge someone's worldview can be an act of violence.

I continued trying to sort out that young woman's worldview, sifting through Sire's array of answers to basic questions. Closest I could get was New Age, but Sire included many variations in describing that worldview. There are many answers to Sire's eight questions, but unlike the various New Age beliefs, these answers group into a few combinations, a few coherent worldviews.

In comparing worldviews, I quickly learned some surprising things. For example, although I was aware that some of the Beatles had sought out Eastern pantheistic monism, I was surprised to learn that the version they brought back to the West was different. They abandoned the deep futility inherent in the Hindu and Buddhist ideas of karma and reincarnation in the circle of life. For the Beatles, it became a positive opportunity rather than a negative point of despair. Similarly, I had also been unaware that the transcendentalism of Walden and Thoreau, which intrigued me in high school, was related to Eastern mysticism.

I remember a long conversation with a historian about the futility of another worldview, postmodernism, in the academic community. I embarrassed myself and frustrated him with my ignorance. He was forced to

speak from within that worldview to explain to me how wrong it was. I came away confused then, but it all fell into place when I got to Sire's summary of the postmodernist worldview. For example, Sire noted the postmodernist belief that "truth about reality is forever hidden from us. All we can do is tell stories."

Two Opposing Worldviews

What Sire helped me identify was my question of how we know anything, the source of knowledge. People have an innate desire to know why, and I pursued such questions for years without wondering how we could know an answer. Not everyone believes that we can obtain objective knowledge, some arguing that there is no such thing, and some arguing that real knowledge is beyond rational apprehension.

My main question—what is really *real* and how can we know it?—began at an early age. I remember when my brother Eric told me that atoms are 99 percent empty space. The protons, neutrons, and electrons in atoms are like planets in the solar system, solid but with large gaps between them. These gaps in the solar system are so large that the most distant planet, Pluto, was long thought to exist only based on its gravitational effect on the movement of other planets. It was not visually observed until 1930, after a year of searching by the astronomer Clyde Tombaugh (1906–1997). That there were similar gaps within atoms freaked me out for a while.

So, what is reality? Some claim that reality is only these atoms and all their gaps. That is all there is, and everything that happens is determined by them. Further, matter is eternal and uncaring. Stephen Crane's poem "War Is Kind" rightly describes the implication of this belief about matter: our existence has not created in the universe a sense of obligation to care about us.

Sire attempted to answer this question by distinguishing between prime reality and external reality. For those who believe that prime reality is that atoms are all there is, external reality tends to be a closed system ordered by cause and effect. This was modeled by Newton and later by Einstein. The closed model belief is that external reality can at least conceptually be described by a mathematical model, albeit an enormously complex one. This group Sire terms atheistic naturalists.

In contrast, others believe that reality is better described as an open system. This is usually connected to a belief that this open system was

created from nothing by God and, while ordered by cause and effect, is also open to his intervention. For this group, the answer to my initial question is: *yes*, matter is real and not an illusion, and it was created by God, who is eternal, infinite, and personal. Sire calls this group Christian theists.

Atheistic naturalists and Christian theists both believe that we can obtain authentic knowledge but differ on where that comes from. Both beliefs speak of human mental faculties allowing us to interpret our observations of the world to obtain knowledge, but naturalism would limit us to that source of information and often limit us to the methods of science. Christians, however, go further in believing that we can also obtain knowledge through other methods, including a special revelation from God and internal revelation from within us.

Besides knowledge, these two worldviews also differ in their understanding of human death, ethics, and history. They both see knowledge through reason and observations, but Christian theism also sees knowledge through communication with God. Atheistic naturalism sees ethics as being based on human ideas, as opposed to God's ideas. History then becomes either a purposeless or a meaningful sequence of events, the latter fulfilling God's purposes for us. Finally, the core commitments of these two worldviews are either oriented toward one's self or toward God, although the specifics here will vary among worldviews and among people's unique interpretations of their worldviews.

These two conflicting worldviews, atheistic naturalism and Christian theism, resonated with me, as I saw that I had chosen a road toward Christianity as a child, turned toward atheistic naturalism as a young man, and then back toward theism and finally Christian theism. The answers to Sire's basic questions inherent in atheistic naturalism included that matter is all there is, that there are only three dimensions plus time, and that humans are machines, albeit complex ones, whose behavior could conceptually be predicted based on physical processes alone. The answers for Christian theism were less concrete: that there is a personal God creating things like the universe and people and operating in the same three dimensions and time, plus an additional spiritual dimension. Thus, God created us in his image, with cognitive faculties that supersede the physical.