

CHAPTER I

The Roots of Conflict

Science and Religion before Divorce

The Religion that is afraid of Science dishonors God and commits suicide.

Ralph Waldo Emerson, *Journal* (1831)

There may be a great fire in our soul, yet no one ever comes to warm himself at it, and the passers-by see only a wisp of smoke.

Vincent van Gogh,
quoted in Cliff Edwards, *The Shoes of Van Gogh*

Great men are meteors designed to burn so that the earth may be lighted.

Napoleon Bonaparte,
quoted in Richard Alan Krieger, *Life's Ideal*

It is winter in Rome. The new year and the new century, 1600, are little more than a month old. In the Campo di Fiori, a popular square near the heart of the city, a crowd gathers, anxiously awaiting the spectacle of an execution. Today Giordano Bruno, philosopher, astronomer, and former Dominican monk, will be burned at the stake. People stand tiptoe and crane their necks to get a good view. The doomed prisoner is

led out. His crime is heresy. Across a lifetime of writing and teaching in many of Europe's greatest cities, Bruno has made many enemies. The men who lead the Inquisition can be counted among them. The specific charges they have raised against Bruno matter little. Today something strange and terrible will occur. In this ancient city shaken by the intellectual upheaval of the Renaissance and the political maelstrom of the Protestant Reformation, a man will burn for his ideas.¹

Bruno's famous *Italian Dialogues*, two books published twenty years earlier, had helped gain him both a reputation as a freethinker and the unwanted attention of the Inquisition. In the first book Bruno proclaimed his support for the intellectually dangerous Copernican model of the solar system. Half a century earlier, the Polish astronomer Nicolaus Copernicus had placed the Sun at the center of the solar system and reduced the Earth to just another orbiting planet. This heliocentric model was considered by many to be in conflict with Scripture. It would eventually be deemed heresy. In the second book Bruno went even further, claiming a "plurality of worlds." All the stars we see at night were, he claimed, just like our Sun. Each was orbited by a family of planets, and each planet was inhabited by intelligent beings. It was a bold assertion made at a time when ideas were just as dangerous as cannons and warships. With half of Europe poised to revolt against papal authority, the Church was in no mood to entertain such freethinking. Although Bruno had not been condemned directly for his astronomical views, his bold support for contentious ideas like Copernican astronomy and the so-called plurality of worlds was a step on the path that led him to this fateful day.

Bruno is pushed to the stake, where he is stripped naked. Alongside him are a small troop of monks. Once again they ask him to recant his ideas. Gagged, he can only shake his head. The torches are lit.

On a spring day in Washington, D.C., 401 years later, the astronomer Geoff Marcy is the focal point of the National Academy of Science's 138th annual meeting. Marcy and his collaborator, Paul Butler, are accepting the prestigious Henry Draper Award for their scientific

accomplishment — the discovery of planets orbiting other stars. Thanks to Marcy, Butler, and others, centuries of debate surrounding the plurality of worlds question have come to a definitive end. There *are* other worlds orbiting other stars. Marcy and Butler are hailed as heroes for their efforts as the cameras flash and the audience applauds.

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The public debate between science and formal religion no longer speaks to the challenges we face as a species. The usual suspects in the conflict have been appearing onstage for decades, only the costumes changing with the times. A new perspective cannot emerge in this setting until the fog of tired definitions, outdated perspectives, and stubborn bloody-mindedness is burned away. Only then can we finally see the original and common roots of both science and spiritual endeavor. The problem is one of imagination and cultural memory.

While its formal roots were put down in the ancient world of Hellenistic Greece, science as both practice and institution came to maturity over the past six hundred years. It is true that a deeper understanding of science and religion requires reaching much farther back into history than this “modern” era, but the events of these more recent centuries are the ones that shape our expectations of their relationship. Before we can envision a new perspective we must understand how our own biases emerged from the tangle of recent historical conflicts.

We have been taught to see the debate between science and religion as a slow burn of simmering antagonism that periodically flares into the realms of open cultural warfare. Textbooks, classrooms, plays, films, and the popular media all paint the background of ideas and preconceptions about the history of science and religion. From these we form our expectations. In my own education as a scientist I was presented with countless stories about heroes and villains in the search for scientific truth. Many of the villains wore religious robes. The question we begin with is simple. How accurate is this vision? How did it emerge and who

benefited from it? To gain higher ground and a better perspective we must first retrace some steps.

GIORDANO BRUNO RECONSIDERED

If Giordano Bruno were allowed to return to Earth four hundred years after his death he would be pleased with his legacy in spite of his life's fearsome end. In the centuries following his execution, Bruno's reputation has been rescued from the ignominy of his death. His redemption did not come about by a pope's edict but by advocates for free thought and science.

In the last half of the nineteenth century progressive forces in Italy embraced Bruno's story as a clear example of the Catholic Church's domination and recalcitrant hold on intellectual power.² Through their efforts a memorial to his memory and martyrdom was erected in the square where he was burned. In the United States during this same period Robert Ingersoll, a popular orator, politician, and self-described agnostic, praised Bruno as a champion of the intellect's search for the True. "He was the first real martyr," wrote Ingersoll, "neither frightened by perdition, nor bribed by heaven. He was the first of all the world who died for truth without expectation of reward."³ In our own era the extent of this influence can be seen in the SETI League's Bruno award. The SETI League champions the scientific search for extra-terrestrial intelligence. Each year it hands out a facsimile of Bruno's monument to worthy scientists who advance the search for intelligence on other worlds.⁴ For my part, I read about Bruno many times during my education as a scientist. His tragedy was recounted in the books I read as teenager and in my introductory astronomy class onward. He is a martyr, a fully ordained saint of free inquiry.

In truth, Bruno's story is not so simple. As much as one has to admire Bruno for the strength of his convictions and his courageous refusal to back down to power, the historically accurate story is more complex

than the beatification homilies. More important, the standard Bruno martyr biography exposes the weight of cultural baggage we carry on the issues of science and religion. Within his story and the story of his legacy we can find a narrative of science and religion that is more subtle and surprising than a simple tale of warfare.

Recent scholarship shows Bruno's execution had more to do with theology than astronomy. The Inquisition's documentation of Bruno's heresy has been lost. It is difficult, then, to know exactly what offenses led to his condemnation. A reconstruction of the charges from Vatican archival documents shows that the majority of counts against Bruno concern theological juggling on issues like the nature of the human spirit and the doctrine that the earth itself has an intellectual soul.⁵ These are hardly concerns that would raise a modern scientist's hackles. On top of these facts comes the inescapable conclusion that Bruno was an ass of epic portions.

Bruno fled from one European city to another, often escaping just ahead of the latest angry benefactor. Bruno possessed a genius for driving those who helped him into dark and retributive moods. As an example consider his short stay in Geneva in 1578. After finding work as a copy editor, Bruno entered the University of Geneva hoping to find a place to teach and write. Three months later he published a mocking tract outlining twenty mistakes made in a lecture by the university's chair of philosophy. Bruno's target of ridicule was a close friend of the university's deacon, who quickly had Bruno, and his printer, arrested.⁶ Within days Bruno was back on the road. Seven years later, during a stay in Paris, Bruno published a list of philosophical and theological "principles" and publicly challenged anyone to refute them. The challenge was answered by a young student who was so successful in his lecture that the audience demanded a personal response from Bruno. Bruno failed to show up. Paris soon became as dangerous for him as the other cities he had fled, and within the year he was once again an intellectual refugee.

Clearly, Bruno had difficulty making reasonable choices for himself. As Pogge puts it,

Bruno was brilliant, contentious, and ultimately self-destructive. . . . His actions . . . reveal the very hallmark of folly, namely repeated failure to act in his own best interests even when reasonable alternatives were available. His final return to Italy (which resulted in his arrest in Venice a year later) can be seen as being motivated in part by the fact that by 1591 he had effectively burned most of his bridges behind him and thus he had little choice. In many ways, Bruno thrust himself into the flames that rose into the winter skies of the Campo di Fiore on the 17th day of February in 1600.⁷

Pogge's view passes far too light a sentence on the Church (like claiming the theft of your bike is your own fault because you forget to lock it up). Still, his perspective on Bruno's martyrdom sheds light on our own preconceptions about the early relationship of science and religion. Though Bruno may have been a brilliant thinker whose work stands as a bridge between ancient and modern thought, his persecution cannot be seen solely in the light of a war between science and religion. That is the critical point. During these years when science was just establishing its modern practices and principles there was no well-defined war. The majority of the most fervent practitioners of science considered themselves deeply religious, and the institutions of religious power were divided in their support of their work. In the beginning it was not so much a war as a difficult but passionate marriage.

THE WORLD DOESN'T REVOLVE AROUND YOU: COPERNICUS, PTOLEMY, AND THE CHURCH

Like Giordano Bruno, Copernicus found himself at odds with the Church. There is one particular story of Copernicus and the publication of his world-shaking astronomical theory that bears on the questions I am exploring. Like Bruno's, this narrative tells us a lot about our own views of science and religion.

It took Copernicus a long time to publish his heliocentric theory. The reasons for the delay are features of the shifting way in which “conflict” appears in our view of science and religion. The story as told by my introductory astronomy professor was that Copernicus hesitated to publish his great work, *De Revolutionibus*, because he feared persecution from the Church. For me, this called to mind the vision of a fearless nonreligious scientist leading a kind of secret life beneath the thumb of the Church. Once again, however, the story is more nuanced and interesting.

Copernicus’s ideas were radical. The notion that the Earth revolved around the Sun was in direct conflict with commonsense experience and a millennium of scientific and philosophical thinking. The dominant, established, and “obviously true” picture of the heavens at the time was the geocentric (Earth-centered) model of Claudius Ptolemy. Ptolemy wrote his textbook on astronomy sometime around 150 C.E. For more than 1,300 years his vision of the Sun and the planets orbiting around the Earth held sway. Throughout those long centuries, Ptolemy’s geocentrism provided astronomers with the tools to calculate and predict the motion of the planets through the night sky. Those calculations proved useful enough even if they were somewhat inaccurate. It was with good reason that the Arab astronomers, who moved science forward during Europe’s descent into the dark ages, called Ptolemy’s book *The Almagest — The Greatest*. Although Ptolemy’s theory was wrong, it was, in its way and in its time, very successful. It was both foolhardy and daring to go against Ptolemy’s authority. Nicolaus Copernicus knew what he was up against.

The irony of Copernicus’s story is his motivation. He did not propose his new, heliocentric model simply to make better astronomical predictions. He was striving for beauty, simplicity, and the right place to locate God. His theory that the planets, including Earth, traveled around the Sun was correct, but it was also rudimentary. His biases led him to describe the planets’ orbits as perfect circles (Johannes Kepler would later discover that planetary orbits take the form of an ellipse). This mistake meant that Copernicus’s model did not predict the movements of the planets any better than Ptolemy’s.

The geocentric model was ungainly in Copernicus's eyes. It was not a plan that God in his wisdom would have sanctioned. Clearly, the Sun, as the source of light and warmth, was the perfect image of the divine. It, rather than the lowly Earth, had to be the center of the universe. As Copernicus wrote, "In this most beautiful temple who would place a lamp in another or better position than that from which it can light up everything at the same time? For the sun is not inappropriately called by some people the Lantern of the Universe, its Mind by others, and its Ruler by still others."⁸

Copernicus's heliocentric universe matched his sense of divine aesthetics. Others felt the same way. Honoring and glorifying God by means of the heliocentric model had the backing of many within the religious establishment, among them a number of highly ranked officials.⁹ From his own writings it appears Copernicus was just as concerned about other scholars as we was about Church authorities. In the dedicatory letter to the pope at the beginning of his book, he writes of fears that his new ideas will be drowned out by the cries of others still in the thrall of the 1,300-year-old Ptolemaic system.

Thus the waters are muddied. Many Church intellectuals embraced Copernicus; others opposed his ideas to the bitter end. There can be no doubt that there were dangers from members of the religious orthodoxy, and these were already apparent for Copernicus. When *De Revolutionibus* was finally published, Andreas Osiander infamously added an unapproved preface to make it more friendly to Church doctrine.¹⁰ But Copernicus's ideas were radical for *many* reasons. They would only grow more religiously dangerous as the decades (and the Protestant Reformation) wore on. At the time he published his book they were not, however, illegal. This would not happen until 1616, after the great astronomer Galileo Galilei had had his more famous ordeal before the Inquisition. Only then, more than half a century after its publication, would *De Revolutionibus* be added to the Church's index of forbidden books.

During the crucial time of Copernicus, Bruno, and Galileo, the war between science and religion was not something they, each deeply

spiritual men, would be able to clearly recognize. What they did see was a battle over the religious worldview. Each man saw his scientific work as part of that worldview. Each man saw in his efforts an attempt to honor what he felt was the world revealed more clearly in its sacred grandeur and majesty.

Thus the image of an *eternal* and intractable war between scientific and spiritual perspectives must be seen as suspect. Most people, especially scientists like me, were raised on a steady diet of antagonism between science and religion. Recent work by historians forces us to reevaluate this long perspective. The narrative of battle we have been fed is a story of one particular religion and its institutions, namely, the Christianity of Western Europe, locked in conflict with science. The result has been entrenched attitudes that affect all discussions about science and spiritual endeavor. Reclaiming a more creative vision will, therefore, require a more nuanced telling of the tale.

Let us move forward a century or so, to the emergence of an all-out battle between science and religion during the Enlightenment. It is during this remarkable period of history that the first seeds of the warfare we recognize so easily were sown.

REVOLUTION IN THE AIR: THE AGE OF REASON

The Enlightenment was an extraordinary philosophical movement of the eighteenth century that grew into a potent political and cultural force. This unique moment in history has been seen as many things to many people, but a useful definition is as follows: The Enlightenment was a constellation of writers, politicians, and philosophies that “rejected traditional ideas and values, emphasized the notion of human progress, and promoted the use of reason and direct observation in science.”¹¹

During the Enlightenment the world we recognize was given shape. It took a form that was a radical in its departure from the past and traditional sources of learning. Throughout this period writers across

Europe and the New World formed a chorus of voices that rose up in opposition to authority.¹² As Jeffery Stout observes, “Modern Thought was born in a crisis of authority, took shape in a flight from authority, and aspired from the start to autonomy from all traditional influence.”¹³ The importance of the Enlightenment to debates about science and religion hinges on the fact that churches of all stamps were seen as the authority needing to be overthrown.

The church was a symbol of the past, and the past was a fetter. “For writers sympathetic to the revolution, the past was merely something profoundly oppressive, wedded to ideas and values which merely perpetuated the interests of those in power.”¹⁴ Institutionalized religion’s resistance to change, jealous protection of wealth, and entrenched privilege made it a magnet for dissent.

Science and religion first began to be distinct cultural forces during the Enlightenment, but we do not yet find broad discussions of “war.” That language had yet to be created because no need yet existed. As in the fifteenth and sixteenth centuries most “scientists” of this period still saw themselves as overtly religious and carried forward their work to glorify the divine.

A slow but exorable shift in attitudes began in the wake of the successful American and French Revolutions. A new spirit of liberation was rising. That spirit would find its hero in Prometheus, who stole fire from Mount Olympus and gave it to humanity as a tool for its betterment. As punishment for his crimes, Prometheus was chained to a rock where each day an eagle came to feed on his liver. The myth of Prometheus was resurrected as the gears of the industrial revolution, driven by scientific discovery, began to catch. He was the perfect cultural icon for his time. Beethoven dedicates an entire overture to the mythic hero. And in his play *Prometheus Unbound* the poet Percy Bysshe Shelley captures the ideal:

The nations thronged around, and cried aloud,
As with one voice, Truth, Liberty, and Love!¹⁵

Prometheus was the spirit of the new age embodied. As Alistair MacGrath writes, Prometheus “had a natural affinity with the notion of a freedom gained by the advance of science. Might not the natural sciences make available the fire necessary to liberate humanity from bondage to superstitions and irrational traditions of the past? And was not the Christian church the chief institutional embodiment of traditional beliefs and values in western culture.” What is important is that the story of Prometheus is one of conflict and war. The times were changing.

At the beginning of the nineteenth century scientific investigations were often carried out by members of the clergy. “Scientific parsons” were so common during the century that they were regarded as a well-established stereotype.¹⁶ But during this period a profound shift in the nature of scientific activity occurred. Science became professionalized. A growing emphasis on university-based education and training shifted the gravitational center of science as an institution. As the decades progressed the model of the professional scientific investigator emerged completely distinct from the clergy. Science was in the process of establishing its authority, and the two groups were destined for struggle. Sometimes the issue came down to academic positions in the growing fields of physics, biology, chemistry, and astronomy. As MacGrath points out, “In the early nineteenth century the British Association for the Advancement of Science had many members who were clergy. . . . By the end of the century the clergy tended to be portrayed as the enemies of science and hence of social and intellectual progress.”¹⁷

WARFARE MADE EXPLICIT

From the scientific side the explicit language of warfare between science and religion can be traced to two distinct and influential publications in the late nineteenth century. First came the 1874 publication of *The History of the Conflict between Religion and Science* by John William Draper, an English chemist. Through fifty reprintings and publication in ten languages the book solidified the vision of religion and the Catholic

Church driving the continuous oppression of science.¹⁸ Then, in 1896, Andrew Dickson White, first president of Cornell University, published an influential two-volume work, *A History of the Warfare of Science with Theology in Christendom*. White was unrelenting in his condemnation of the Christian Church for its centuries-long attacks on the scientific enterprise. As the twentieth century opened White's work became the textbook description of the antagonism between science and religion. As David Lindberg has written, White's *History* was "treated as an authoritative source by readers who had no access to contrary opinions blessed with scholarly credentials equal to White's. [It] shaped the views of generations of educated Americans and Europeans in the twentieth century. Further defense of the warfare model was apparently unnecessary as the historic warfare of science and Christianity became an article of faith, achieving the status of invulnerability merely by virtue of endless repetition."¹⁹

Apparently, endless repetition works well. In the warfare between science and religion some war stories, retold as history, appear to be a kind urban myth. When I was sixteen my grandfather gave me a copy of Bertrand Russell's *History of Western Philosophy*. Published in 1945 by the cranky but brilliant British philosopher, the book takes readers on a breathtaking journey through three millennia of human thought. Russell's tome became an instant classic and was used in classrooms as an introductory text. I poured over the book, relishing its accessible style. Russell's high regard for science and his sweeping and devastating criticisms of its opponents made those sections especially juicy for me.

In his description of Christianity's reaction to Copernicus, Russell levels his sites on the Protestant firebrand John Calvin and his famous quote, "Who will venture to place the authority of Copernicus above that of the Holy Spirit."²⁰ I loved this quote. Here was the fully embodied foolishness of a religion blinded, resisting the bare facts of nature. I have presented Calvin's words to my students in almost every introductory astronomy course I have ever taught. Now I find there is a small problem with Calvin's words that will force me to change my lecture notes: Calvin never said them.

While writing a book on the Copernican Revolution, the philosopher of science Thomas S. Kuhn attempted to find where or when Calvin made his infamous statement (Russell does not provide the source in his *History of Western Philosophy*). Kuhn was unable to find the quote in any primary sources. The only place he did find it was White's *History of the Warfare of Science with Theology in Christendom*.²¹ After further literary sleuthing historians have concluded that the quote must be considered suspect.²² In fact, a detailed review of Calvin's writings reveals that he never made any specific comments on Copernicus. Whatever Calvin's feelings were about the heliocentric model, this quote appears to be propaganda in a war that started long after his time.

Of course, it would be foolish to argue that the past five hundred years have been conflict-free in the domains of religion and science. I am certainly not going to act as an apologist for the religiously inspired persecution of supposed heretics (scientific or otherwise). But we are all victims of our history. The lessons of renewed historical research in the field of science and religion must be heeded. There were other forces, other social contexts, at work that would make conflict into a self-fulfilling prophecy.²³

White and Russell show us how modern science's inherited antagonism to religion took hold. The history of the twentieth century provides a sad, ongoing narrative of the warfare metaphor made real in politics, policy, and power. This time the finger of blame points squarely to the narrow religion of a vocal but powerful minority.

THE MYTH OF PROMETHEUS:
FRUITS OF CONFLICT

A mighty lesson we inherit:
Thou art a symbol and a sign
To Mortals of their fate and force;
Like thee, Man is in part divine,
A troubled stream from a pure source.

Lord Byron, *Prometheus*

The giant eagle circles overhead in the empty sky. It is not time yet for today's horror. The mighty Titan shifts his weight and strains against the chains binding him to the living rock. Here, at the edge of the world, there is no respite. There is never any respite.

Prometheus stares across the mountains and hot dry plains beyond them. He has had time to reflect on his choices. Time passes even for a god, and in the solitary anguish of Zeus's punishment Prometheus has spent uncounted hours questioning his decision. It was not just the fire. That was simply a symbol. The fire was something concrete that humans, in their simplicity, could directly comprehend. Prometheus had not only given the poor creatures fire; he had taught them how to use it too. He had given them the tools to become more than they were. He had taught them to throw off the animal skins that stank of dried fat and blood and create something mighty, something grand for themselves. No, it was not simply the physical fire he had given them, burning torches to light their caves and cook their food. It was the fire in the mind that mattered more. Prometheus had taught humans the arts of civilization, "made them acquainted with architecture, astronomy, mathematics, the art of writing, the treatment of domestic animals, navigation, medicine, the art of prophecy, working in metal, and all the other arts."²⁴ He had given them the vision of what they might build when they understood how to shape the world around them. That was his real crime. That is what drove the god-king Zeus into such a rage that he cursed thunder and spat great streaks of orange fire.

Prometheus was a Titan, one of the elder gods. When Zeus rose up against his father, Chronos, in the great battle for Earth and Heaven, Prometheus joined the rebellion. Victorious Zeus had often favored Prometheus, whose name meant "forethought," seeking his wise council. Then Prometheus and his brother Epimetheus (afterthought) were chosen to populate the Earth with animals and give them attributes from the gods' own store of gifts. But Epimetheus mistakenly exhausted all the gods' gifts, leaving humans without benefit of speed or wings or other aids. It was then that Prometheus's loyalties shifted. Zeus had

never favored humans and had even once tried to wipe them from the Earth. Zeus had ordered that humans be denied the knowledge by which they might better their lot. But Prometheus saw the creatures with compassion and looked to the future. He alone saw humankind's potential. So he stole the fire of Heaven and all the ideas that went with it and gave them to the race of men.

For this crime Zeus banished Prometheus to eternal torment, first sending him into the depths of Tartarus, the gods' own Hell, and then, later, having him chained to this mountain waiting each day for the great eagle to drop upon him and tear open his belly. Gods suffer pain just as do mortals. The raptor's claws never fail to sear as they find Prometheus's liver for its daily feast.

But in the moments just before the blinding rush of pain Prometheus's defiance rises up again and again. He is the one god who recognized what humankind could become. His gifts to the simple creatures were just; even Zeus's authority could not diminish that potential, that truth. As the eagle begins its dive toward him Prometheus burns with his own fire. "For knowledge I resisted," he reminds himself. "Till eternity, I will continue my resistance."²⁵

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In the early years the practitioners of science would not have recognized the notion of warfare between their work and the domain of the sacred. Their aspiration to know the world more fully was one dimension of their own spiritual (for lack of a better word) sensitivities. For them the world and its workings were a manifestation of the great power that supported all that was visible. For them the physical world was imbued with a structure that was nothing less than divine. During the Enlightenment, the practice of science became more widespread, and science became an institution in its own right. It was at that point that the story of Prometheus was remembered (as great myths always are) and given an updated narrative that fit the needs of a new age. In its struggle with religious authority science became estranged from spiri-

tual endeavor. The story we have covered in this chapter is one of an emerging conflict as the fledgling practice of science struggled to separate itself from an aging authority. Science established its own codes, its own norms of behavior for generating truth. But while its practices were a remarkable innovation, the aspiration from which it emerged, the deeply rooted desire to draw closer to the world by understanding it, was not new. It was, instead, a continuation of an age-old imperative, a constant fire in the mind. We must now continue to follow the bright line of this fire.