SCIENCE V. RELIGION: UNDERSTANDING HISTORICAL CONFRONTATIONS (GALILEO, DARWIN, SCOPES) TO BETTER SOLVE CURRENT CONFLICTS

by

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td></td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td></td>
<td>v</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>CHAPTER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>THE GALILEO AFFAIR</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>The Aristotle Problem</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>The Protestant Problem</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>The Adolphus Problem</td>
<td>28</td>
</tr>
<tr>
<td>2.</td>
<td>THE TROUBLE WITH DARWIN</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>A Naturalist’s World</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>A Revolutionary World</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Revolutionary Naturalists</td>
<td>52</td>
</tr>
<tr>
<td>3.</td>
<td>THE SCOPES TRIALS</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>American Evolution</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>American Revelation</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>American Crusade</td>
<td>68</td>
</tr>
<tr>
<td>EPILOGUE</td>
<td></td>
<td>78</td>
</tr>
<tr>
<td>CONCLUSIONS</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td></td>
<td>96</td>
</tr>
</tbody>
</table>
ABSTRACT

Despite almost one hundred years of science advocacy, surveys show that many Americans are ignorant of basic scientific facts, skeptical of scientists, fearful of an increasingly scientific society, and threatened by scientific findings, especially Charles Darwin’s Theory of Evolution. Science advocates continually bemoan this appalling situation and work very hard to change it, but have generally failed to produce any improvement in public attitudes toward science. New strategies are needed and this requires a fresh look at the problem.

It is widely assumed that religion and religious beliefs form the biggest barriers between science and the public, a paradigm most often framed as a “war between science and religion.” Within this paradigm, a “Science v. Religion” cannon of three archetypal stories are continually used to rally the pro-science troops: Galileo’s trial before the Inquisition, the conflict over Darwinian evolution, and the notorious Scopes “Monkey Trial” of 1925. With these stories forming the basis of so much science advocacy—and with science advocacy being so ineffective—it is prudent to revisit the cannon to see what has been missed, and what can be better understood and applied toward new science advocacy strategies.

This study reviews recent scholarship about each of these stories and concludes the following: (1) the issue is not about “Science v. Religion,” but is instead about “Religion v. Modernity”; (2) for believers the real problem isn’t science; it’s morality; (3) some of the complaints and fears that believers express about science are reasonable and well-founded, and should be heeded by science advocates; and (4) the Galileo Affair should not be part of the “Science v. Religion” cannon. The implications of these conclusions for science advocacy strategies are explored.
INTRODUCTION

In March of 2009, the members of the Texas State Board of Education met to discuss several proposed amendments to the new science curriculum. At issue were several statements and phrases that, depending on one’s viewpoint, either improved the science curriculum by making it more “honest” or weakened it by opening the door for religious explanations of natural events. The new language included phrases like “analyze and evaluate the sufficiency and insufficiency of common ancestry to explain the sudden appearance, stasis, and sequential nature of groups in the fossil record” and “assess the arguments for and against universal common decent in light of the fossil evidence.”

Scientists and science teachers testified during public hearings that such phrases were unnecessary and even harmful to students because they implied that the idea of common ancestry and descent (i.e., evolution) was still an unproven hypotheses rather than the highly substantiated scientific theory that it had become. This, they thought, was unsound science. Such language weakened science, they said, and there was no place for it in a science curriculum. Unfortunately, many of the Board members were conservative Christians who did not believe in evolution. Weakening science was their specific intent and they voted to add the diminishing phrases to the curriculum.

Despite remarkable advances in scientific knowledge, scenarios like this continue to play out in states across the country, including Michigan, Florida, Missouri, New Mexico, and South Carolina. Parents and school boards have been trying to remove evolution from science

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curricula for almost 100 years, and science advocates have been fighting back almost as long. This never-ending stalemate should force science advocates to ask, “Why aren’t we making any progress? With so much solid evidence on our side, why can’t we convince the public that evolution is real and that it’s good to teach science to our children? We’ve put so much time, effort, and money into teaching science. Why aren’t people getting it?”

I suspect it is the scientists and science educators who aren’t “getting it” and my intention with this research project is to figure out exactly what “it” is.

Throughout my experiences teaching science to the public in parks, museums, and planetaria around the country, I’ve had many opportunities to interact with anti-science and anti-evolution people from many backgrounds. Over the years I’ve come to realize that I have been completely misinformed about the real debate over evolution. Though we science advocates have been fighting to get the good science out there, it’s not really a fight over good or bad science. The argument against science goes back much further and the concern over evolution goes much deeper than the local curriculum.

What’s really driving anti-evolution activism? What can science advocates do to lessen and hopefully stop these perennial assaults on science education? What’s motivating the anti-evolution movement? Where are these people coming from? What’s their story? Why aren’t our efforts affecting the situation? How should we change our strategy to be more effective?

When, on occasion, proponents of evolution and science step outside the science fight and search for causes of the antagonism toward science, they invariably land on religion as the source of the trouble. John William Draper and Andrew Dickson White were the first to use the
“war between science and religion” metaphor in the late 1800s in their widely-read popular science books.

“The history of Science is not a mere record of isolated discoveries; it is a narrative of the conflict of two contending powers, the expansive force of the human intellect on one side, and the compression arising from traditionary faith and human interests on the other.”

White’s version of the Conflict Thesis, as it has come to be called, was even stronger, both against religion and in favor of science:

“In all modern history, interference with science in the supposed interest of religion, no matter how conscientious such interference may have been, has resulted in the direst evils both to religion and science... on the other hand, all untrammeled scientific investigation, no matter how dangerous to religion some of its stages may have seemed for the time to be, has invariably resulted in the highest good both of religion and science.”

Draper and White’s warfare framing is now ubiquitous in popular culture and there is some truth to it, but it is fatally simplistic. By reducing the entire argument to “Science v. Religion” terms, the pro-science side has overlooked the real problem. If we want to end the cycle of attacks on science and science education, we need to better understand what the attacks are really about.

The Conflict Theses of Draper and White focused heavily on two archetypal “Science v. Religion” stories, the Galileo Affair and the conflict over Darwinian evolution. Their modern successors have added a third story, the Scopes Monkey Trial, and created a “Science v. Religion” trilogy. Science advocates repeatedly trot out these stories as examples of religious

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interference and they do a great job of rallying the pro-science troops, but like the warfare
metaphor, these stories, too, have been over-simplified. In the popular culture, the stories have
become larger than life, the characters have been turned into caricatures, and the historical facts
and events have been lost in the transposing from real history to “Science v. Religion” archetype.
We’re still stuck in archetype mode today, causing us to over-simplify and misunderstand the
conflicts of our own time.

With this in mind, the purpose of this research project is to study the Galileo, Darwin,
and Scopes conflicts in detail in order to see through the popular but misleading simplifications
to reveal the complex interaction of forces that motivated and affected their stories. Studying
Galileo, Darwin, and Scopes is nothing new, of course. There are many excellent resources
about each of these historical conflicts and my intention is not to over-write them. Rather, the
goal is to distill these tomes, known mostly to academics and historians, into a cohesive
historical survey of “what really happened” with an eye toward using this newfound perspective
as a kind of field guide for identifying and better understanding our current conflicts. With
better understanding comes improved strategies and, hopefully, progress in science education.
THE GALILEO AFFAIR

In 1728, in an essay about Descartes and Newton, Voltaire summed up the Galileo Affair saying: “[T]he great Galileo, at the age of fourscore, groaned away his days in the dungeons of the Inquisition, because he had demonstrated by irrefragable proofs the motion of the earth.”\(^1\) Though colorful, expressive, and widely believed, this scenario is completely false. If the Galileo Affair was just a blip in history, such inaccuracies wouldn’t be a problem, but Galileo’s story isn’t a blip. It has become the iconic moment in the history of conflict between science and religion, a point around which pro-science and anti-religious groups have rallied for over 100 years. Unfortunately, most people today still believe the same story as Voltaire, but with so many modern situations being viewed through the lens of Galileo’s trial, it’s important that we get the story right. This essay is an attempt to revisit the facts of the Affair and the broader context in which it occurred so we may better understand its meaning and relevance to our modern “Science v. Religion” conflicts.

In schoolbooks, theater, and even in PBS specials, the standard version of the Galileo Myth goes like this:

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\text{In 1609, the Italian astronomer Galileo Galilei invented the telescope and with it he proved the Copernican theory that the Earth rotates about its axis and revolves around the Sun. This was contrary to the Bible and the teachings of the Catholic Church, and so poor Galileo was brought before the Inquisition where he was tortured, tried, condemned of heresy, forced to recant his beliefs on his knees, and imprisoned for the rest of his days. Thus began the war between science and religion.}
\]

To begin, Galileo did not invent the telescope, at least not the first version. In 1608 in the Netherlands, Hans Lippershey, the person mentioned in the first written record acknowledging

the existence of the telescope, filed a patent application with the States General in The Hague. News of the invention spread quickly, and by the summer of 1609, simple 3-power spyglasses could be purchased in shops as far away as Paris and Venice.\(^2\) What made Galileo special was his insight and ability to modify the telescope, increasing its magnification to 20-power and turning it toward the sky. What Galileo saw changed human understanding forever, but it did not “irrefragably prove” the motion of the earth. This is an important point to understand, but it will require some background.

**The Aristotle Problem**

At the time of Galileo’s birth in 1564, there was no real concept of gravity, inertia, conservation of momentum, or any of the other physical laws with which we are now so familiar. There was “physics,” however it was an ancient physics based on the prolific and all-encompassing teachings of Aristotle, the Greek philosopher of the mid-300’s BCE. Aristotle’s work, and the work of most other ancient Greeks, was lost to Europe during the Early Middle Ages after the 5th century fall of the Roman Empire (a period sometimes called the Dark Ages), but Classical Greek traditions and writings were preserved in the eastern Roman Empire (the Byzantine Empire), which had moved steadily from Roman/Latin influences back to Greek. In the eastern realm, the works were preserved and studied by Arab scholars, and, after several centuries of Muslim conquests and Christian Crusades, the works found their way back into Christendom\(^3\) carrying a new prestige and heavily influencing the Scholastic universities of the 12-15th centuries.

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Scholasticism, in fact, was created to reconcile the newly “discovered” ancient Greek philosophies with medieval Christian theology. Scholasticism wasn’t a philosophy or theology in itself, but instead was a method of learning that emphasized reasoning and dialogue in order to find the answer to a question or to resolve a contradiction, much like the ancient and famed Socratic dialogues. This technique and the conclusions it fostered became the bedrock of medieval Church theology by strongly influencing the great Church Fathers like St. Ambrose and St. Augustine (who knew Greek philosophy from its previous incarnation in the 4th century before the Roman Empire fell), Albertus Magnus, and most especially Thomas Aquinas in the 13th century.\textsuperscript{4} The works of Plato were adopted by some (most notably the Franciscans and the Renaissance Humanists), but the Herculean efforts of Aquinas to merge Greek rationalism with Christian theology ensured that Aristotle’s system, with its emphasis on reason and argumentation, would become the foundation of the Catholic Church from the 13th century to Galileo’s time and beyond.

Aristotle is rightly known for his tremendous contributions to the study of ethics, logic, rhetoric, politics, and even biology, but his ideas about the substance, motion, and universal order of the physical world sidetracked Western thought for a millennium. As Bertrand Russell noted, “almost every serious intellectual advance has had to begin with an attack on some Aristotelian doctrine.”\textsuperscript{5} Knowing what we now know, several basic Aristotelian principles can easily illustrate why this was the case. For example, according to Aristotle:

1. There are five basic elements: earth, water, air, fire, and the heavenly aether.

2. Each element has a “natural” place. If removed from that place, an element-specific “natural” motion will kick in and cause the element to return to its natural place.

- earth elements are naturally placed at the center of the universe and naturally move in a straight line down toward this center;
- water is next up from earth and also moves in a straight line down toward the earth/center;
- air is next up from water, but moves in a straight line up;
- fire is next up from air and also moves in a straight line up, through the air;
- heavenly aether is highest of all and makes up all the heavenly bodies (the stars and planets and the crystalline spheres that carry them around the earth). It is weightless, changeless, and luminous, and it moves in a perpetual circle.

3. Earthly, terrestrial stuff (earth, water, air, and fire) is fundamentally different and separate from the celestial heavenly aether stuff and behaves in fundamentally different ways.⁶

Other problems with Aristotelian physics arose from his inconsistent methodology and over-reliance on reason—even intuition—instead of close observation and experimentation. For example, he was known to dissect animals and even opened chicken eggs to study the development of organs, but in his *History of Animals*, he claimed that human males have more

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teeth than human females, a falsehood that could have easily been corrected by a simple comparison of real, live, un-dissected humans.

In addition to unfounded physical principles and flawed methodology, there was another holdover of Aristotelian thought that would get in Galileo’s way: a weird hierarchy of disciplines that ranked nearly every field higher than the lowly and theoretical studies of mathematics and astronomy. Galileo’s original sin was that he was a mathematician (not even an astronomer) at a time when everyone believed the study of mathematics had less value because it was only about hypothetical entities (like points on a line) and could not be used to explain the actual world. Additionally, the Thomistic/Aristotelian synthesis ranked the status of different bodies of knowledge according to how relevant each discipline was to the preparation for salvation, and mathematics had nothing to do with Heaven or how to get there. Galileo’s work with the telescope brought him into the sphere of astronomy, but astronomy was not considered a reality-based endeavor either. In Galileo’s day, astronomy was about “preserving appearances” and “saving the phenomenon.” It was about describing and predicting the motions of heavenly bodies for calendrical and navigational purposes, but it had no business explaining the actual motion of the heavenly crystalline spheres. At their worst, astronomy and mathematics were the tools of astrology and mysticism, fields that at the time were barely distinguishable from astronomy, but were becoming less and less acceptable to Church authorities. Geometrical constructions used by astronomers were only hypothetical. More sophisticated cosmological interpretations were reserved for the higher disciplines of philosophy and theology. Copernicus

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9 Ibid.
understood this. He dedicated his heliocentric proposal to Pope Paul III and an “anonymous” preface was added by Andreas Osiander, the Protestant reformer of Nuremberg, stating for the record that the theory put forward in the book was simply a mathematical hypothesis and that the reader should not consider it a representation of reality. Galileo understood this hierarchy, but he had bigger plans and was not content to remain in the “Mathematician” box. When he secured the patronage of the Grand Duke of Tuscany in 1610 after the success of his telescopic discoveries, he pushed for and received the title of Philosopher and Mathematician to the Grand Duke.\textsuperscript{11} Galileo was making—and would go on to make—very real discoveries, not just hypothetical ones. To be taken seriously, he needed to join the ranks of philosophers, the people who tried to understand the real universe and man’s place within it. Soon, of course, the Church would begin to take Galileo very seriously.

This sometimes-brilliant and sometimes-ridiculous Aristotelian paradigm was very much in place when Galileo started questioning the actual immobility and centrality of the earth. In this way, Galileo and his heliocentric/geokinetic theories weren’t just a challenge to Church theology and the Bible, as is normally emphasized; they were a challenge to 2,000 years of Greek philosophy as well.\textsuperscript{12}

It should be said, though, that not all Greek philosophers held a geocentric, geostatic worldview. From the writings of Archimedes, we learn that Aristarchus of Samos mapped out a sun-centered universe around 270 BCE. As far back as 530 BCE, Pythagoras held that a great fire occupied the universal center (although he did not think it was the sun) and believed the earth and everything else revolved around this sacred point. Though the Church Fathers focused

\textsuperscript{11} Finocchiaro and Galilei, \textit{The Galileo Affair: A Documentary History}, 298.

\textsuperscript{12} Feldhay, \textit{Galileo and the Church: Political Inquisition or Critical Dialogue?}, 279.
on Aristotle who rejected heliocentric ideas, other European scholars were exposed to these ideas as more and more Greek writings were translated during the High Middle Ages. The realization that not all Greeks agreed with Aristotle meant that not all medieval Christian Europeans had to agree with Aristotle and a period of inquiry and questioning ensued. This presented a conundrum for the Church leaders of the 1500s, the traditional Dominicans and the new order of Jesuits, who were responsible for the education of young priests and peasants and would have to decide which Greek philosophies to teach.  

The biggest advantage of Copernicus’ heliocentric system was that it simplified the math and made astronomical predictions easier and more accurate, but under the Aristotelian hierarchy of disciplines, this argument was hardly strong enough. Besides, no matter how much simpler the math was, even the low-level field of astronomy had several very valid objections to heliocentric and geokinetic theories. For example, if the heavens operated as Copernicus hypothesized, the apparent size of Mars should increase and decrease as the earth approaches and then recedes from it. This was not observed. Also, if Copernicus was right, earth-bound observers should see Venus move through phases just like the Moon, but this, too, was not seen. Additionally, as mentioned above, Aristotelian thought held that the heavenly bodies were made of aether and that this was a fundamentally different substance from the four baser elements of earth. If the earth was circling the Sun like the other planets as Copernicus claimed, it would technically be a planet and would therefore have similar aethereal properties, e.g., it would be changeless, weightless, and luminous. Clearly the earth was not like this. Finally, and most convincingly, if the earth was really whizzing around the sun every year, there should be a

13 Ibid., 208.
14 Finocchiaro and Galilei, The Galileo Affair: A Documentary History, 15-25. The astronomical and physical objections in the following paragraphs are based on Finocchiaro’s helpful breakdown of the many intellectual factors blocking the wide acceptance of the Copernican heliocentric system.
visible shift in the position of the stars called stellar parallax, and this was definitely not observed. These very clear and obvious objections kept many of Galileo’s peers and fellow scientists—and even Galileo himself—from holding the heliocentric worldview until he began using the telescope to improve his observations. Even still, with the telescope of his day, Galileo could only directly answer the first three objections pertaining to the size of Mars, the phases of Venus, and the substance, perfection, and changeability of the other heavenly bodies (e.g., by observing spots on the sun and mountains on the Moon). Because the stars are so far away, the evidence of stellar parallax couldn’t be seen until 1838 when much more powerful telescopes were built.

So far, at best, Galileo was able to solve three of the four major astronomical objections to a heliocentric system. Once again, however, in addition to diminishing the value of Galileo’s mathematical “proofs” and astronomical observations, Aristotle’s hierarchy of disciplines provided the strongest arguments against Galileo’s theories. As mentioned before, in Aristotle’s system, physical truths were arrived at through reasoning or intuition and not necessarily by experiment. In this way Aristotelian physics was qualitative, not quantitative, i.e., it was unconnected with lowly hypothetical mathematics. In a way that made perfect sense to Aristotle and the Church Fathers but seems very strange to us, this made physics more “real,” and it meant that physics outranked both math and astronomy. The problem was that Galileo’s ideas of a rotating and moving earth—strongly supported by his equations and astronomical observations—challenged both the principles and the primacy of Aristotelian physics.

1. The first objection was the most obvious: a moving earth is contrary to common sense, as in “sensory experience.” If the earth was truly moving, surely we would
sense it just as other motions are sensed. Was Galileo asking us to believe that our
senses could be lying to us?

2. The second objection had to do with the very observable fact that objects fall to the
earth in a straight vertical line, i.e., they fall and land directly below the place from
which they are dropped. If the earth was rotating on its axis as Galileo proposed, a
falling object would not land immediately below its original position, but would
instead land to the side as a result of the earth turning below it during its descent.
This doesn’t happen.

3. Objection three was a reasonable variation of objection two and involved the motion
of projectiles. Projectiles travel through the air in a straight line (minus the effect of
wind.) Again, if the earth is rotating on its axis, a projectile would land not along a
straight line from its point of origin, but would instead appear to curve and land off-
set because the earth turned below it while it flew through the air. Again, this doesn’t
happen.

4. A fourth objection was similar to objections two and three, but instead of disproving
the earth’s rotation, it disproved the earth’s revolution. Called the “ship analogy,” it
was reasoned that a stone dropped from the top of a ship’s mast would land at the
bottom of the mast if the ship was motionless, but it would fall away from the mast if
the ship was moving. Likewise, if the earth is moving through space around the sun,
an object dropped from a tall tower (riding along with the earth like a mast rides
along with the ship) would fall away from the bottom of the tower. This didn’t
happen, so the earth couldn’t be revolving any more that it could be rotating.
5. Like objection one, objection five also appealed to common sense. It carried the charming name, “Argument from the extruded power of whirling,” i.e., if the earth is spinning, why isn’t everything flying off it?

6. Objection six, most obvious to those steeped in Aristotelian thought, was based on the previously mentioned principle that earthly elements moved in a straight line toward the center of the universe and once they got there they stopped moving. This was their natural motion and their natural place. Even if the earth circled the sun, it couldn’t keep doing it and would eventually succumb to its natural motion, a straight path right back to the middle of the universe where it belonged. Continuous orbit simply wasn’t possible.

7. Finally, in an odd dismissal of three-dimensional space, the last of the main physical objections came back to the Aristotelian principle that every simple body or object can have one and only one natural motion. Holding this belief, there was no way to accept that an object falling to the earth could at the same time be rotating around it and hurling with it on its orbit around the sun.

The first objection (“Are our senses lying to us?”) was as much an epistemological problem as a physical one. Our senses, after all, are the primary way we learn about our world. Under normal conditions, we expect them to function properly and to deliver reliable truths about reality. According to objection one, to accept Copernicus’ geokinetic model would mean giving up this basic source of knowledge and very few people were willing to take that plunge. This problem, both “sensory” and epistemological, was also related to a conundrum caused by Galileo’s telescopic observations. Today we happily marvel at the great new things Galileo discovered with his great new invention, but it’s important to keep in mind that the telescope was
the first artificial instrument ever used to learn new truths about the world.\(^\text{15}\) It didn’t so much replace the natural sense of sight, but it improved it greatly, and like every “performance enhancer” that would follow it, there was a degree of trepidation about its first use. Could it be trusted? Were the images seen in it real or just distortions of the glass? De Santillana put it best, as he imagined an appalled Aristotelian assessing the situation:

“The heavens remain inaccessible, even with the telescope, and we know already far too much about tricky optical effects. Should we now subvert the vast and documented discourse of the schools, which allows us to account in orderly manner for nature and life and the soul itself—and fits in so handsomely with revealed Truth—to launch ourselves in a sea of paradoxes and unnatural conclusions, simply because a man has come forward with two lenses in a length of pipe?”\(^\text{16}\)

Anyone familiar with our modern-day understanding of physics in general and motion in particular will recognize the remaining six objections as complete non-issues. Each one of them is answered by one of the cornerstones of modern physics: the Law of Inertia, the Law of Gravitational Force, or the Law of Conservation of Momentum (linear and angular). These laws were of course unknown in Galileo’s day—to everyone but Galileo. As mentioned earlier, Galileo was not primarily an astronomer. In fact, his main area of study was mechanics, the science of motion, which he taught along with mathematics, geometry, and astronomy in his early years as a lecturer at the University of Pisa (1589-1592) and then as the chair of mathematics at the University of Padua (1592-1610).\(^\text{17}\) From lecture notes surviving this period as well as his later writings, we know that Galileo was at this time already studying the speed of falling bodies, Euclidian geometry, the pendulum (in connection with natural accelerated motion), and the parabolic paths of projectiles—all using the tools and models of Archimedes,

\(^{15}\) Ibid., 8.
\(^{17}\) Helden, “The Galileo Project.”
another ancient Greek, not Aristotle. As would be discovered by other early scientists of the Enlightenment, as soon as one started applying math and experimentation to physics, Aristotle’s theories quickly lost all substance, and Galileo was the first and most prominent thinker to start this process in the modern age. Though he was far from grasping the formal laws as we now know them, he was way ahead of the Aristotelian curve. As he worked, he realized his mechanical research had important consequences for the physical objections to Copernicus’ heliocentric theory. By combining his fields of expertise (mathematics, astronomy, and physics) Galileo was moving to overturn the Aristotelian hierarchy and Aristotelian physics. Essentially, he was ready to rewrite reality.

The problem was that none of his research on motion had been formally published before Galileo switched gears and began focusing on his telescopic research. In 1610, when he published his telescope discoveries in his *Sidereus Nuncius* ("Sidereal Messenger"), Galileo’s contemporaries were solidly and comfortably entrenched in the worldview that there were two kinds of matter, celestial heavenly aether and terrestrial heavy earthly matter. Thanks to his earlier research, however, Galileo himself was already well on his way to formulating a unified theory of matter that would eventually erase the celestial/terrestrial distinction. This meant that when he started to speak out in favor of the Copernican heliocentric/geokinetic system, it made a lot more sense to him than to anyone else. Unfortunately, he completely underestimated the learning curve. In one hand, Galileo had a telescope which he used to answer the astronomical objections to a heliocentric system, along the way smashing the perfect and crystalline heavenly spheres. That was bad enough, but in the other hand he had a pendulum and an inclined plane which he used to answer the physical objections to a moveable earth, thereby undermining the

\[^{18}\text{Ibid.}\]
\[^{19}\text{Maurice A. Finocchiaro, "The Church and Galileo," Catholic Historical Review 94, no. 2 (2008), 261.}\]
bedrock of Aristotelian physics. Galileo had a twenty-year head start on his contemporaries when it came to grasping, accepting, and internalizing this monumental paradigm shift. He tried to cram years of understanding into the words of Salviati, the pro-Copernican voice in his most challenging book, *Dialogue Concerning the Two Chief World Systems*, but it was too much. Some people appreciated Galileo’s monumental discoveries, including many strong and influential supporters within both the Church and the secular world, but most would need even more evidence before they’d be willing to “launch into a sea of paradoxes and unnatural conclusions.” To them, the entire affair was scandalous and needed to be stopped.

The traditional telling of Galileo’s story as seen in our opening myth faults the Catholic Church for the suppression and eventual denunciation of Galileo and his heliocentric, geokinetic theories because they were seen to contradict the Bible. As our review so far has shown, however, there were other very valid objections to a sun-centered system that preceded the Church, and blame can only be extended to it in the sense that the Church Fathers threw in their lot with the wrong Greek philosopher. Yes, Galileo did represent a challenge to the Church and it was ultimately responsible for what happened to him and his research, but he was hardly the great threat we now hold him up to be. The Church was embroiled in a war, but not with Galileo; it wasn’t even a war between “science” and “religion.” It was a much more tangible conflict we now call The Thirty Years War, and a complete understanding of Galileo’s real story requires that we understand this critical and devastating event.

**The Protestant Problem**

No attempt to explain the relationship between the Church and Galileo can be made without first explaining the Protestant Reformation, the subsequent Catholic Counter-
Reformation, and the disruptive wake that followed each side as they blazed across the whole of Europe alternately converting or condemning their subjects. Much like it is hard for us to grasp ancient Aristotelian physics, our modern-day, pluralistic, separation-of-Church-and-state sensibilities make it difficult to imagine the effect that Martin Luther and his followers had on Europe, but the consequences were everywhere and ever-present. Remember that before the Reformation, every European Christian was Catholic. The leaders were Catholic, the followers were Catholic, the laws were Catholic, the education was Catholic—everything was Catholic, even the scientists. All of Christendom was united under the Catholic Church.

Of course this is an oversimplification. Prior to 1517, there existed all kinds of disagreements, conflicts, different schools and philosophies, factions, fringe groups, separatists, and heretics. There were continual arguments about Church teachings, Biblical interpretations, Papal authority, ancient philosophies, education and ethics, so-called universal truths, and, yes, even how many angels could dance on the head of a pin. The Augustinians disagreed with the Dominicans, the Dominicans worried about the Jesuits, and the Humanists thought all the Scholastics thought too much. There were also conflicts between secular authorities, the kings, princes, and dukes of the ruling class. The point, however, is that all of these people were still under the domain and influence of the Catholic Church. The Church stepped in whenever necessary to maintain its authority, but there were also many cases where discussion and debate were tolerated and even encouraged. It was into this milieu that Martin Luther cast his concerns from Wittenberg that October day in 1517. Luther’s complaints about the selling of indulgences and other Church abuses were intended to bring reform to the Catholic Church thereby

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strengthening it, but in just a few years his message spread throughout Europe and instead rent Christendom in two. This challenge forced the Catholic Church into a doctrinal lock-down that would be formalized at the Council of Trent, a series of twenty-five meetings beginning in 1545 and finally concluding in 1563. The Council served several purposes, but two especially would directly affect Galileo:

1. The Council defined the doctrines of the Catholic Church and condemned the principles and doctrines of Protestantism.
2. The Council confirmed that the Church’s interpretation of the Bible was final and that the Bible and Church Tradition were equally authoritative.  

In other words, “There will be no more discussion and debate. From now on, this is how it is.”

Thus began the Catholic Counter Reformation, a time of Catholic revival that would be defined by strict and conservative doctrine, administrative reform (for example the creation of the Roman Inquisition and the Index of Forbidden Books), the foundation of seminaries for the proper training of priests, the creation of new religious orders dedicated to the spiritual life and the protection of the faith, and, most importantly for our concerns here, the beginning of an entirely new political landscape across Europe.

At a time when the first large nation-states were beginning to consolidate in Europe, the divide between Reformation and Counter Reformation increased tensions and complicated loyalties, especially within the Holy Roman Empire. Other European powers spent the latter half of the 1400s consolidating and centralizing authority under very powerful monarchs, namely

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21 Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue?*, 77.
Henry VII in England, Louis XI in France, and Ferdinand and Isabella in Spain. Their reigns marked the end of more than a century of fragmentation and the beginning of a revival of royal power that would drastically weaken their rivals and create the bureaucracies we now associate with the modern state. This unification, however, did not happen in the Holy Roman Empire, a region covering what we now call Germany, Denmark, The Netherlands, Belgium, the Czech Republic, Austria, Slovenia, Northern Italy (but not Italy proper), and parts of Poland, Slovakia, Hungary and Croatia.

While England, France, and Spain were gathering their resources and therefore gathering in strength, the Holy Roman Empire was a disorganized mess. In addition to about 2,000 imperial knights, some of whom ruled over no more than a few acres, there were 50 ecclesiastical and 30 secular princes, more than 100 counts, about 70 prelates, and 66 “free cities,” all more or less politically independent even though they were officially subordinate to the Holy Roman Emperor. Though affiliated by their common Catholic faith, the leaders of the Empire’s territories were far more concerned with their local autonomy and control than with following the orders of the Emperor, at this time Charles V. When Lutheranism began to spread across the land, it moved quickly and effectively through the Empire because local princes saw the Reformation as an opportunity to oppose imperial power. There was also a great deal of money at stake since ecclesiastical property was abolished when reform was introduced. Princes who converted their territories to Lutheranism could confiscate the land and riches of the Churches and monasteries in their domain. With such incentives, conversions were common.

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22 Chambers and Rice, The Western Experience, 464-78.
23 Ibid., 479.
24 Ibid., 500.
By the 1550’s, nearly half of the Catholic Holy Roman Empire was Lutheran. In 1555, a diminished Charles V had to accept a compromise settlement with an alliance of Lutheran princes. Known as the Peace of Augsburg, this remarkable agreement set the legal basis for the co-existence of Catholicism and Lutheranism within the Empire by allowing Lutheran princes to maintain their faith and their territory. Though flawed (it said nothing of the other new Protestant groups, the Calvinist and Anabaptists, who were also rapidly gaining converts), the Peace of Augsburg initiated a period of relative calm in the Empire while the rest of Europe began to gear up for a century of religiously-fueled bloodshed.

Like the Holy Roman Empire, Galileo’s Italy remained a collection of kingdoms and city-states, including Naples in the south, Venice to the northeast, Milan in the northwest, and Florence and the Papal States in the middle. No region had its own military or the ability to defend itself and each relied on other Catholic powers for protection. Throughout the first half of the 1500s, much of Italy was a football tossed between the ever-dueling Habsburgs of Austria/Spain and the Bourbons of France, but by 1558 the Habsburgs had gained control and dominated the region for the next hundred years. This meant that Spain, the greatest power in Europe, was the major influence on the papacy during this time and it exercised almost total control over Roman policy. Italy, and especially Rome, was therefore able to avoid many of the physical conflicts that were occupying the rest of Europe. Galileo and his contemporaries—including the Church leaders of his day—could live a relatively stable life, safe at home, though occasionally disturbed by news from abroad concerning the Protestant advances.

This comfort is seen in the openness and respect Galileo received from Cardinal Robert Bellarmine, perhaps the most influential Catholic churchman of his time (1542-1621). Besides

25 Ibid., 501.
being a cardinal, Bellarmine, a Jesuit, had also been a professor at the *Collegio Romano* and the Pope’s theologian. He was a supporter of Galileo despite his (Bellarmine’s) belief that the Copernican heliocentric system was counter to the Bible and therefore heretical. Bellarmine’s respect for Galileo is most evident in the way he handled Galileo’s first brush with the Inquisition in 1616. Galileo was famous by this time. His astronomical discoveries and sunspot research had been published and both gained wide acclaim, if not agreement (*Sidereal Messenger* in 1610 and *The Sunspot Letters* in 1613). Galileo had also written three important letters explaining not only his findings, but his views about the relationship between science and scripture, including ways to reinterpret troublesome biblical passages to be consistent with Copernicanism (letters to Castelli, 1613, Monsignor Dini, and the Grand Duchess Christina, both 1615). These letters weren’t formally published, but they circulated widely. Because they dabbled in theology and Biblical interpretation, a practice forbidden since the Council of Trent, they quickly became a liability for Galileo. In 1614, Tommaso Caccini, a Dominican friar, preached a sermon in Florence against Galileo and mathematicians in general who subscribed to the Copernican worldview, which he believed to be heretical. In 1615, another Dominican, Noccolo Lorini, filed a written complaint with the Inquisition against Galileo citing Galileo’s letter to Castelli. About this time, a Carmelite friar named Paolo Foscarini published a book about a “new Pythagorean World System” supporting Copernicus and arguing that heliocentrism was compatible with Scripture. Sensing a problem, Cardinal Bellarmine wrote to Foscarini cautioning him to treat Copernican theory as only a hypothesis and indicating that his comments applied to Galileo as well. Caccini, the anti-mathematician preacher, next gave a deposition to the Inquisition charging Galileo with suspicion of heresy based on the content of his letter to Castelli, his *Sunspot Letters*, and a little hearsay. In December of 1615, Galileo, having followed

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the events via his contacts in Rome and Florence, left Florence and traveled to Rome to clear his name and prevent the condemnation of Copernicanism.²⁷

The outcome of the 1616 Inquisition meeting was a mixed blessing for Galileo. In February, a committee of eleven consultants reported to the Inquisition the unanimous opinion that the heliocentric and heliostatic thesis was “philosophically absurd and formally heretical” and that the geokinetic thesis was “philosophically absurd and theologically erroneous.” To our modern understanding, this opinion is wrong, but given what we’ve learned so far about the Aristotelian arguments against the earth’s motion, it is at least somewhat understandable that this was their conclusion at the time. Additionally, given what we’ve learned about the Protestant Reformation, the Catholic Counter-Reformation, the doctrinal lock-down of the Council of Trent, and the subsequent prohibition of any new and individualistic interpretations of the Bible, this conclusion was all but inevitable. What is very interesting, however, is that despite the unanimous opinion, the Inquisition did not issue a formal condemnation, but instead took two milder steps. First, the very next day, Pope Paul V ordered Cardinal Bellarmine to warn Galileo to abandon his Copernican views. Bellarmine invited Galileo to his home the day after that, relayed the news as ordered, and reported back to the Inquisition that Galileo promised to obey. Second, the Congregation of the Index, the Church department in charge of book censorship, issued a public decree with four main parts:

1. It stated that the doctrine of the earth’s motion is false, contrary to the Bible, and a threat to Catholicism;

2. It condemned and prohibited Foscarini’s book, the one showing that the earth’s motion is compatible with the Bible;

²⁷ Ibid., 300-01.
3. It suspended Copernicus’ book until corrected. (This happened in 1620 and essentially amounted to removing about a dozen parts that either contained religious references or made it sound like Copernicus was taking the motion of the earth literally instead of just as a trick to make the calculations more accurate);

4. It ordered similar bans on similar books.\(^{28}\)

Most importantly, the decree didn’t mention Galileo at all. Given that he was the focus of the initial complaint to the Inquisition, this is nothing short of remarkable and can only be interpreted as a sign of respect from the Church leaders. This is further supported by two additional facts. Before Galileo returned home to Florence, he asked for and received an audience with Pope Paul V. We don’t know the details of their discussion, but we know that Galileo later reported that he was received “warmly” and was “reassured” after spending approximately forty-five minutes with the leader of the Catholic world.\(^{29}\) Next, having heard from friends in Venice and Pisa that rumors were spreading saying he had been tried, condemned, and penalized by the Inquisition, Galileo asked Cardinal Bellarmine to write a clear statement for the record about exactly what happened and how Galileo was affected. This Bellarmine did, noting that Galileo was fine and not condemned, but was simply informed he could no longer hold or defend the geokinetic worldview. Hence Galileo’s mixed blessing. Thanks to his good standing with Cardinal Bellarmine and Pope Paul V, his name was cleared and his reputation was intact. The bad news was that he and the rest of the Catholic world were hereby prohibited from teaching or supporting the heliocentric worldview.

\(^{28}\) Ibid., 30-31.

\(^{29}\) Ibid.
Some have interpreted this leniency toward Galileo not as a personal favor to him, but as the outward result of inward battles between the two orders dominating the Church at that time, the older and more conservative Dominicans and the newer, more progressive Jesuits. In many ways this is a plausible argument. The Jesuits had been challenging the Dominicans for decades and there is a pretty clear line dividing Galileo’s early supporters (almost all Jesuit) from his early detractors (almost all Dominican). This divide reflected the different approaches that each order took toward interacting with and educating the public. The Dominicans, founded in the 13th century, favored the ideal of the secluded, contemplative, monastic life and stressed the importance of speculative knowledge as the best means of achieving it.\(^{30}\) Growing from the writings and influence of their most prominent member, Thomas Aquinas, the Dominican order became the keeper of the Thomistic synthesis between Aristotle and the Catholic Church. They defended the old boundaries between the intellectual and the practical, the celestial and the terrestrial, and they protected the Thomistic doctrine by prohibiting any deviation from his philosophical and theological ideas. The doctrinal definitions formalized at the Council of Trent were heavily Thomistic, and the Dominicans became more and more dogmatic during the Counter-Reformation. Knowing this, it’s no wonder they were the first to challenge Galileo. By contrast, the “new” Jesuits, founded in 1540, favored the active life as the best approach to salvation. They believed it was best to be involved in the world, especially through educational efforts, and this made them focus far less on speculative contemplation and much more on practical knowledge and applications.\(^{31}\) The Jesuits saw knowledge and study as a bridge to salvation, so they opened schools that anyone could attend—even secular students—and added humanities and classical studies to the curriculum, even Greek philosophers other than Aristotle.

\(^{30}\) Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue?*, 175.

\(^{31}\) Ibid., 176.
Much to the chagrin to the Dominicans, they even advocated for more math classes. In fact, though it wasn’t approved and was even considered heretical by some, the original *Ratio Studiorum* of 1586 (the program of studies for Jesuit schools) elevated mathematics to the level of philosophy, a huge shift away from the Dominican/Thomistic/Aristotelian plan. (Incidentally, the *Ratio*, by means of its influencing effect via Jesuit schools, was seen as an important tool in the Jesuit’s plan to educate the world and prepare it for salvation. In this way, they considered it not just an educational curriculum, but a document for the construction of cultural and spiritual realities. In other words, a “curriculum fight” over the place of science in schools was taking place in 16th century Italy for the same reasons it now takes place in 21st century America.)

Jesuits were also tied to the Thomistic tradition and they were fiercely dedicated to the absolute authority of the Pope. The thirteenth Rule of Loyola (from St. Ignatius Loyola, the order’s founder) expressed it this way, “If we wish to be sure that we are right in all things, we should always be ready to accept this principle: I will believe that the white that I see is black if the hierarchical Church so defines it.”

But the more experience the Jesuits gained “out in the world,” the more they realized the traditional long-form process of using logic to prove theological doctrines was not working as a conversion tool. Wanting to be more effective, they studied the ways of the fast-spreading heretical Protestants (e.g., pamphlets and popular appeal) and realized they needed a shorter, faster theology based on rhetoric. The plan was not to either give in or to confront heretics directly, but to convert them by persuasion, civility, and exemplary behavior—a stark contrast to the Dominican playbook. Given this moderating approach, their openness to the world of ideas, and their increasing role in the Church hierarchy,

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32 Ibid., 219.
33 Ibid., 223.
it made sense that the Jesuits would be supportive of Galileo, if for no other reason than to opposed the Dominicans who opposed him.

In 1616, Galileo was comfortable. He was not allowed to hold the heliocentric worldview, but he was free and highly respected by both Church officials and secular leaders, especially his patron, the Duke of Tuscany, Cosimo II de’ Medici. Things seemed only to get better when, in 1623, the Jesuit Cardinal Maffeo Barberini, a liberal and highly educated early supporter of Galileo’s theories on floating bodies, was elected Pope Urban VIII. After Urban’s election, Galileo traveled to Rome to offer his service and support. The visit was wildly successful; he received an amazing six interviews with the new Pope and was given permission to write about Copernican theory as long as he treated it as a hypothesis. This was all the encouragement Galileo needed. He returned to Florence and began to work on his first masterpiece, the *Dialogue Concerning the Two Chief World Systems*. He would once again be denounced to the Inquisition in 1624 for supposedly holding a heretical doctrine (the theory of Atomism in his 1623 book, *The Assayer*), but the charges were referred to a friendly Inquisitor and quickly dismissed. Galileo was still respected and protected by the Church leaders.

It took Galileo seven years to finish the manuscript for the *Dialogue*. During the course of those years, it is no understatement to say the entire world as Galileo knew it shifted. The question is did Galileo, focused on his own endeavors to prove a moving earth, know that it had in fact moved? One would have to say no, for if he knew, he surely would not have tried to

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36 David Marshall Miller, "The Thirty Years War and the Galileo Affair," *History of Science* 46, no. 151 (2008), 57. The following discussion of The Thirty Years War and its impact on Pope Urban and Galileo is based on Miller’s concise and illuminating historical perspective.

publish his book upon its completion in 1630. He did try, however, and the rest of the story is one of the greatest examples of “poor timing” in the history of science.

The Adolphus Problem

The growing conflicts between the Protestants and the Catholics, seething in the Holy Roman Empire since the Peace of Augsburg in 1555, erupted again in 1618 in a barely believable event now called the Defenestration of Prague. Essentially, some Bohemian aristocrats, upset by an order to stop building Protestant chapels on land claimed by Catholic clergy, rebelled by throwing two imperial governors and their scribe out of a 90-foot-high window of Prague Castle. (“Defenestrate” literally means “to throw someone or something out of a window.”) The governors landed in a pile of manure and survived, but the peace of Augsburg did not. The incident provoked open revolt in Bohemia which had powerful allies and thus began the Thirty Years War, one of the most destructive periods in European history.

At first the conflict remained local and simple with Emperors Matthias and his successor Ferdinand II fighting the revolt of the Protestants within the Holy Roman Empire. The first years went well for the Catholics, and they continued to hold the upper hand when Pope Urban VIII was elected in 1623. But though the election of Urban was a boon to Galileo and other progressives of his day, it actually signaled a host of problems to come. As mentioned earlier, Spain (the House of Habsburg) had been in control of Italy since defeating Francis I and the French Bourbons in 1558. Since then, France had been embroiled in internal conflicts and was not powerful enough to challenge the Habsburgs again, but in 1622, King Louis XIII managed to reach a peace with the Huguenots (the French Protestants) and France was once again free to

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38 Miller, "The Thirty Years War and the Galileo Affair," 57.
play on the European stage. Urban became fond of France when he was a cardinal. He served as Papal Nuncio (envoy) in Paris and had even baptized Louis, so he was the favored choice of the French cardinals. They elected him Pope and they did it by overcoming Habsburg opposition. This brought an end to the Spanish domination of Roman affairs practically overnight and it seriously threatened Habsburg control of Italy. Previous popes favored and honored the Habsburg dynasty, but Urban felt threatened by their dominance. His planned to use French power to balance Spanish power. It proved to be a bad plan.\textsuperscript{39}

Emperor Ferdinand II suppressed the original Bohemian revolt within a few years, but more and more countries became involved with the war. In 1627, when the Duke of Mantua (a province of northern Italy) died, the war took a surreal turn. The Duke’s rightful heir was a French nobleman, but the Habsburgs couldn’t allow a French ally to control the territory. Mantua was a hub along the famed Spanish Road, the route used to link Spain to northern Europe, via northern Italy around the eastern border of hostile France, and the Habsburgs couldn’t risk losing access to it.\textsuperscript{40} So, in 1628, the Habsburgs, Italy’s guardians for seventy years, attacked northern Italy. Accordingly, the new Duke of Mantua asked for assistance from the French. The Bourbons thus crossed the Alps and reignited the long-quiet but long-standing French/Spanish rivalry. This put Urban in a terrible bind. He continued to fear Habsburg dominance and therefore quietly favored the French in Mantua, but the Spanish understandably viewed this as a betrayal. Agonizing over the situation, Urban reportedly slept so poorly that he had all the birds in his garden killed so they wouldn’t wake him with chirping.\textsuperscript{41} Adding to Urban’s concern was the effect of the Mantuan conflict on his relations with Florence. Back in

\textsuperscript{39} Ibid., 58.
\textsuperscript{40} Ibid.
\textsuperscript{41} Ibid., 59.
1494, Charles VIII of France had kicked the Medici family out of Florence, but the Spanish Ferdinand of Aragon brought them back in 1516. Eventually, the Habsburgs set up the Medici family as the hereditary dukes of the province, the very same Medici family that would become the very supportive patrons of Galileo and his research. Naturally, the Medicis supported the Habsburgs in Mantua, which strained their relationship with Pope Urban VIII. The conflict in Mantua dragged on until 1630 when the city, already devastated by a plague (one of the great hazards of living along a popular byway), was sacked and looted by Imperial troops. They didn’t have time to stay, however, because the situation in the northern Empire had taken a turn for the worse. This resulted in a stalemate that benefited the French, but the Habsburgs kept a small force to the south and everyone’s attention turned elsewhere.

Right then, with Urban struggling with the Mantua conflict and under pressure from both the Spanish and the Medicis, Galileo traveled to Rome to submit his *Dialogue* to the Church censors and begin the process of having it printed. Remarkably, despite the strain of the times, he had an encouraging visit. He met with Urban’s nephew, Francesco, and received assurances from both the chief censor and the consultant reviewer that his book would be approved, pending the usual minor revisions and the Pope’s approval. After Galileo returned home, however, an outbreak of the plague prevented commerce with Rome, so he sought approval to have the book published in Florence. Rome was reluctant, but the Medicis lobbied on Galileo’s behalf and he was given licenses to print in both cities. Once again, Galileo expected and received the support

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42 Chambers and Rice, *The Western Experience*, 481.
of powerful patrons who were willing and able to exert their influence to accommodate him and his beliefs.\textsuperscript{44} It was to be the last time.

As the censors began reviewing Galileo’s book in 1630, Gustavus Adolphus, the Lutheran king of Sweden, began invading Germany. Importantly, he immediately allied with Catholic France, a cross-faith agreement made possible because of France’s primary concern with defeating the Habsburgs and the Habsburg ally, the Holy Roman Empire. German Protestants, despite their same-faith affiliation with Adolphus, were initially concerned about his possible territorial ambitions, but ensuing events changed their minds. From November 1630 to May 1631, imperial troops laid siege to the German city of Magdeburg in order to secure its store of goods. As the city was falling, fires broke out and the soldiers lost control. They massacred the inhabitants; of the 30,000 original citizens, only 5,000 survived. Incinerated corpses were loaded onto wagons and dumped into the Elbe River for weeks, but for almost an entire year the remaining survivors continued to find bodies, five to ten at a time, in ruined cellars where the victims had suffocated and died.\textsuperscript{45} Such horrific scenes became the norm in the Thirty Years War, the perfect storm of religious zeal and political ambition. Part of the devastation derived from the nature of the 17\textsuperscript{th} century military whose armies were expected to be largely self-funded. This caused massive looting, pillaging, and famine as entire regions were stripped bare by foraging troops. Adding to the wreckage were severe episodes of plague as the influx of foreign troops brought in diseases that spread quickly among mobile armies. By the time the Peace of Westphalia ended the major fighting in 1648, Germany was destroyed; as much as half of its male population had perished. Some regions lost as much as two-thirds of their entire population, either from direct fighting or from the plague, pestilence, and epidemics that

\textsuperscript{44} Ibid.

\textsuperscript{45} Tryntje Helfferich, \textit{The Thirty Years War: A Documentary History} (Indianapolis: Hackett Pub. Co., 2009), 111.
accompanied it. Such wide-spread death and destruction would not be seen again for four hundred years.

Horrified by the carnage at Magdeburg, the Protestant states rushed to Adolphus and the Swedish/French flag. Here, trained by superior Swedish troops and funded by France, they would begin to turn the tide against the Catholic Church. A quick series of victories ensued:

1. September 17, 1631: Adolphus and the Protestant army destroy two-thirds of the Catholic forces at Breitenfeld, near Leipzig, causing the remaining troops to scatter and the Habsburgs to lose control of the Rhine Valley.

2. Spring, 1632: Adolphus invades and conquers the Catholic stronghold of Bavaria reducing the imperial lands, which had stretched from the Alps to the Baltic two years earlier, to the practically defenseless Habsburg ancestral lands of Austria and Bohemia.

3. May, 1632: Adolphus captures Constance at the southern border of Germany and is allowed safe passage through the eastern Swiss Alps. A Protestant invasion of Italy was imminent.

By the time the Swedes finished with Germany (the fighting would continue in Germany until 1648), they had destroyed as many as 2,000 castles, 18,000 villages, and roughly one-third of all German towns. This was the lowest point of the Catholic Counter-Reformation, and everyone was blaming Urban VIII.

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47 Miller, "The Thirty Years War and the Galileo Affair," 60.  
48 Trueman, "Population and the Thirty Years War."
Urban was not entirely without blame. He had many resources in his papal toolbox that he could have used to aid the imperial cause. Representatives of Spain and the Emperor demanded that he do more. They wanted more troops to support the Emperor and they wanted Urban to use his spiritual authority to force the Catholic princes to unite behind Ferdinand. They also wanted him to declare a Holy War and to threaten the heretics and their allies with excommunication. Aware that the heretics were allied with his Catholic France, Urban refused.\textsuperscript{49} In the end, he would barely raise money to help pay for the war. Understandably, Spain was indignant. In a consistory meeting in March of 1632, Cardinal Gasparo Borgia, the Spanish ambassador to Rome, began to read a bold statement blaming Urban for “any injury suffered by the Catholic religion.”\textsuperscript{50} He was interrupted by the Pope himself, however, and the rest of the meeting turned into a shouting match. Borgia had the full text of his complaint published and the scandal grew. Some started to question whether, in fact, the Pope was still Catholic and some of the Habsburg representatives threatened to have him deposed. For his part, Urban was still hoping that France would faithfully return to the side of the Catholic Empire. He also knew that the French Cardinal Richelieu had privately threatened to break with the Roman Church if the Pope proceeded to move against France, and the last thing Urban wanted was to lose France the same way his predecessors had lost England. That said, France \textit{was} allied with the Lutheran Swedes who had just devastated the Holy Roman Empire and were about to cross the Italian Alps. Urban’s hesitation and inaction put him, the Church, and the entire Empire in real danger.

At exactly this time, as Adolphus was sweeping his way south toward Italy, Galileo’s \textit{Dialogue} went on sale in Florence.\textsuperscript{51} Technically, Galileo followed the letter of the law; he did

\textsuperscript{49} Miller, "The Thirty Years War and the Galileo Affair," 60.
\textsuperscript{50} Ibid.
\textsuperscript{51} Ibid., 61.
not explicitly endorse a sun-centered system. However, one of the characters in the book argued strongly for the Copernican theory, and Galileo gave the bad arguments for the Aristotelian/Ptolemaic system to another character insultingly named Simplicio. Even worse, Galileo tactlessly gave Urban’s argument against Copernicus to Simplicio, too. Urban had a rather unique take on the whole Copernican question. On the one hand, due to its remote subject, Urban didn’t think heliocentrism was a theory that could be proven one way or the other, and he openly permitted discussion about the hypothetical possibility of a moving earth. Mostly, however, Urban believed any attempt by man to define the necessity of a particular heavenly motion was an inappropriate attempt to tell God what He could and could not do. Urban reasoned that an omnipotent God should be able to create a universe however he wanted, and if we couldn’t figure out the mathematics of how it worked, we should just be content in the knowledge that God was smarter than us. This was a reasonable argument by theological standards, but in the mouth of Simplicio it came across as a mockery of the Pope, the very same Pope whose favor and support had allowed Galileo to publish the book in the first place. Now, however, due to the events of the past two years, Urban was not the same Pope that Galileo had known.

By 1632, not only was the authority and power of the Church greatly threatened by Adolphus and his successful Protestant campaign, the authority of Urban himself was threatened by internal dissention and Spanish malcontent. He faced daily, personal objections to his leadership and the constant threat of deposition by the Spanish faction. At this point there wasn’t much Urban could do to mitigate the political and military crisis facing the Empire, but

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54 Miller, "The Thirty Years War and the Galileo Affair," 60.
he could do something about the other complaints questioning his faith and dedication to the Catholic cause. Urban needed to “look busy.” He needed a fall guy and Galileo was the perfect fit. By reining in Galileo and his semi-heretical book (which had actually been cleared by the Vatican censors before publication), Urban could establish that he was a hard-nose defender of the faith, in control, and not afraid to take on famous and well-connected men. Galileo’s connections, of course, were with the Habsburg-sympathizing Medicis, so by punishing Galileo, Urban could also take a stab at his Spanish antagonists. It was the perfect plan.

This hypothesis about Urban’s motivations during the Galileo Affair assumes that Urban was acting very practically and in his own interest, rather than as a Pope truly concerned about a heretical threat. It’s a subtle but important deviation from the standard “Galileo got in trouble with the Church because his theories contradicted the Bible” aphorism, but it is supported by historical context and four unusual facts of Galileo’s case. First, Urban went semi-public with Galileo’s case. This went against standard Inquisition procedure that usually investigated, denounced, tried, and convicted heretics in secret before they were even summoned, but Urban needed a public case so the entire realm could see that he was taking action against heretics. Second, instead of giving Galileo the standard full Inquisition trial, Urban arranged what was essentially an out of court settlement. In exchange for a confession of guilt, Galileo would receive a lenient sentence of house arrest. This seems to counter Urban’s need to keep things hard-nose and public except for a third fact: after securing Galileo’s acceptance of the settlement, Urban went back to Inquisition procedure, formally threatening Galileo with torture, forcing him to recite a public abjuration, and prohibiting the publication of the Dialogue. Galileo would be

55 Ibid., 62.
56 Ibid., 63.
57 Ibid.
58 Ibid., 64.
“formally imprisoned” and also forced to do penance. In proceeding this way, Urban eliminated the possibility of Galileo “fighting back,” something the proud Galileo had always done whenever his ideas were attacked. Urban already had Galileo’s confession, so the conviction was assured without the Church being challenged by any of Galileo’s typically brilliant defensive arguments. The agreement also allowed Urban to privately secure a lenient sentence for Galileo who Urban still respected despite the insult of Simplicio and the *Dialogue*. Fourth and finally, Urban had Galileo’s abjuration and sentence published and distributed to every Papal nuncio and inquisitor with the order that both documents be read publicly to all university professors throughout Catholic Europe. Galileo was treated leniently, but the public presentation of his trial indicated a harsh and severe conviction, a sure sign that Urban wanted to show everyone he was fighting heresy, but was much less concerned about fighting Galileo.

The oddities of Urban’s procedure allow us to finally explain away the last of the Galileo myths. As stated at the very beginning, Galileo was apparently tortured and imprisoned by the Inquisition. We now know that this was not the case and that Urban was relatively lenient with Galileo, but there is an interesting footnote here that justifies, perhaps, a little of the myth surrounding Galileo’s story. (At least it gets Voltaire off the hook.) For many years, the main evidence about Galileo’s trial came from the two documents that Urban circulated through Europe, the abjuration and the sentence. Read together and with an understanding of the legal terms of the period, they strongly implied that Galileo was indeed tortured and imprisoned. Strict and harsh treatment was, after all, exactly the tough impression that Urban needed to convey. Almost 150 years later, however, in 1774-1775, additional documents came to light that proved Galileo was not actually imprisoned, but was rather held in comfortable “house arrest”

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59 Ibid., 65.
60 Ibid.
with either friends or his patron family, the Medicis.\textsuperscript{61} Three days are unaccounted for during his many months in Rome during the Inquisition proceedings, but those were likely spent in the residence of the prosecutor rather than in a cell. Finally, in 1867, 234 years after the Affair, the actual trial proceedings were published and showed that Galileo had never been tortured, but only threatened with torture.\textsuperscript{62} Urban was, after all, quite lenient in his treatment with Galileo. Galileo was forced to endure the humiliation of public abjuration and confined to his home in Arcetri for the rest of his days. He was also prohibited from discussing or publishing anything related to Copernican theory—a form of torture for any scientist, to be sure—but he was \textit{not} physically abused, harmed, or imprisoned.

The story of Galileo is usually framed as one of “Good Galileo vs. Bad Church,” but, as we’ve seen, the real story is far more complex than this trite portrayal conveys. As Galileo scholars have noted throughout generations of research, the factors affecting the Affair ranged from strong intellectual conflicts, both philosophical and theological, to practical conflicts, like Galileo’s stubbornness and the clash of personalities within the Church,\textsuperscript{63} but the popular presentation of the story remains tied to the “Science v. Religion” myth. Of course the Church was heavily involved and imposed restrictions on Galileo and his work, but in those times in Catholic lands, the Church was inseparable from any aspect of life, whether it was science, politics, trade, economics, education, philosophy, law, or art. To expect that Galileo should have been able to freely study and publish his ideas outside of Church influence is to practice a sort of retroactive moralizing, an imposition of our current values on the past, and it completely sidetracks our understanding of the actual events. As the record shows, Galileo was tried by the

\textsuperscript{61} Finocchiaro, "That Galileo Was Imprisoned and Tortured for Advocating Copernicanism," 73-74.
\textsuperscript{62} Ibid., 74-78.
\textsuperscript{63} Miller, "The Thirty Years War and the Galileo Affair," 49-50.
Inquisition, forced to recant his support of the Copernican system, and prohibited from even discussing heliocentric and geokinetic theories for the rest of his life. Prior to 1632, however, despite the fact that his work was in direct conflict with the dominating worldview of his time, Galileo’s research was admired and encouraged by many important and influential people, all of whom were Catholic and even some who were Protestant (e.g., Johannes Kepler). He was treated with great respect, liberality, and tolerance. He had his detractors in both the scientific and the sacred schools, but he also had many supporters, including the two highest-ranking leaders of the Church, Cardinal Bellarmine and then Pope Urban VIII. The important lesson of the Galileo affair is not the salvo “The Church suppressed Galileo and Science,” but rather the question, “What made the Church change its mind?” What changed between 1616, when Galileo was favored and protected, and 1633, when the same Galileo was arrested and threatened with torture? A closer look at the broader historical context surrounding Galileo’s trial reveals a Church and its Pope in severe crisis, threatened not just theologically by the Protestants (even internally by the disputes between Dominicans and Jesuits), but politically by France and Sweden, and physically by the war raging through its Empire and beating down its northern door. No entity, whether a church, a nation, a business, or even an individual, has ever been able to maintain liberality and tolerance when faced with such crises. Galileo and his works were casualties of war, but it wasn’t the war between science and religion that we normally ascribe to him. Rather his discoveries were the victims of a much more immediate, pressing, and real conflict, the Thirty Years War.

64 Ibid.
**THE TROUBLE WITH DARWIN**

The context of Charles Darwin’s scientific endeavors in 19th century England was so different from the situation in Galileo’s 17th century Italy, it hardly seems possible to include it in the “good scientist vs. bad Church” cannon. Most obviously, the power and authority of the Catholic Church was null and void in Protestant England, so Darwin didn’t worry about an Inquisition or even his books being banned. More significantly, however, science as a discipline and endeavor had gained a great deal of credibility and respect by this time. The Aristotelian hierarchy had been demolished in favor of an all-out inquiry into God’s “Good Book of Nature.” Darwin’s age was a time of budding amateur naturalists when everyone was picking up rocks, comparing butterflies, and building private collections of natural curiosities. This wide-spread curiosity about nature helped pave the way for Darwin and the acceptance of his theories about evolution.

**A Naturalist’s World**

As the Catholic Church dominated Galileo’s age, the Industrial Revolution dominated Darwin’s time. We typically think of industry primarily as a driver of economic and social change, but the growth of industry and invention also had a profound effect on the scientific discoveries of the day. The first big advantages came, perhaps surprisingly, not from advanced instruments or experimental labs, but from the steam engine and the huge machines that used steam power to cut canals, carve roadways, and dig deep wells. In a very short time, complete layers of rock strata were exposed, and curious people couldn’t help but notice all the interesting things inside, not just the variety of new fossils (which had been collected and prized from natural outcrops for years), but the *layers* themselves. William “Strata” Smith, a surveyor for the
Somersetshire Canal Company, was the first to notice that the same rock layers spread across vast swaths of England. He further observed that each layer was associated with a particular kind of fossil type and he was able to determine a connection between the relative ages of strata and the fossils contained within them.¹ Budding geologists Adam Sedgwick and William Buckland followed Smith’s insights and collected more and more specimens until a full layout of the geologic column could be created showing the “order and appearance of life on earth.”

It should be said that the “order and appearance of life on earth” in no way meant “evolution” at this time. Smart people disagreed about what exactly the fossil record demonstrated. Highly influential in the discussion was George Cuvier, the eventual director of the French Museum of Natural History and therefore the keeper of one of the most complete collections of life on earth, both past and present. A skilled anatomist and observer, Cuvier was the first to establish that some species had gone extinct, a radical idea in 1800.² His interpretation of the fossil record held that catastrophic floods and natural disasters of the past wiped out whole sets of species. Cuvier thought these past events were responsible for the succession of species revealed in the strata, but he strongly believed that each species was distinct, i.e., there was no physical link between one species that came before and another very-similar species that came after. He also didn’t see any progression to the succession. He never would admit that organisms became more complex over time. Cuvier was a conservative Christian and believed that a gracious God had specifically created each new species to match its new environment each time a flood altered the previous landscape and destroyed a previous species. Buckland and Sedgwick disagreed. They believed their discoveries revealed a clear

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² Ibid., 22.
progression from one species to another, not simply a succession. Being conservative Christians as well, however, they attributed the progression they saw to the directed design of a gracious God who was building up Creation until it was time to create man.\(^3\)

Cuvier had another influential opponent in Charles Lyell, but for completely different reasons. While Cuvier limited his fieldwork to local regions throughout France, Lyell traveled extensively around Europe and especially in Italy where active volcanoes convinced him that landscape-altering events happened in the present day, too, not just in Cuvier’s past catastrophic episodes. This “uniformitarian” theory, the idea that geological processes weren’t just things of the past, but were actors in the present, was important for Darwin’s later success for three reasons:

1. It implied the earth was very old. In addition to witnessing immediate processes like erupting volcanoes, Lyell’s fieldwork confirmed that other geologic processes took a long time, including mountain-building, erosion, sediment formation, and glacial advances and retreats. Darwin’s process of evolution by natural selection would require vast expanses of time and Lyell’s geologic evidence provided it.

2. It implied that geologic change was still happening. People like Cuvier who held ideas of the “fixity” of species relied on a relative “fixity” of geology. If God’s purpose was to create a landscape for his ultimate creation, i.e., man, that landscape had to stop changing now that man was here. Darwin’s ever-changing species needed an ever-changing landscape and Lyell’s geologic evidence provided it.

3. Lyell’s formal Uniformitarian theory was published as *Principles of Geology* in 1830 and Darwin took a copy with him on his five-year voyage on the Beagle. Darwin was

\(^3\) Ibid., 34.
initially a Catastrophist, but Lyell’s book changed his view of everything and caused
him to see the world through Lyell’s eyes, especially after personally experiencing a
strong earthquake in Chile in 1835. Darwin considered himself primarily a geologist
during this journey and took twice as many geology field notes as biology notes. In
this way Lyell’s geology work was highly influential on what would become
Darwin’s biology work.

Interestingly, however, even though he was a good friend of Darwin and instrumental in
the publication of *On the Origin of Species*, Lyell could not bring himself to accept Darwinian
evolution. He was no conservative Christian and would often complain that Cuvier’s
Catastrophism invoked larger-than-life forces that reeked of religion. Dedicated to the principles
of methodological naturalism, Lyell thought such miracle-making had no place in science.\(^4\)
Rather than a religious objection, Lyell had more of an “Enlightenment” objection; he believed
man’s moral character and ability to reason placed him far above animals. With this view, Lyell
believed the idea of evolution was simply damaging to human dignity.

Lyell’s objection to the idea of evolution is a perfect example of what Darwin was up
against with his ground-breaking *Origin of Species* and especially his later work, *Descent of
Man*. Good men with good scientific minds just couldn’t get beyond the implications of
Darwin’s good ideas. In some respects, it was similar to Galileo’s problem. Many people within
the Catholic Church and some of Galileo’s scientific colleagues understood and supported his
work, but only to a point. Once his conclusions touched a strongly-held belief, the belief always
won. (Galileo himself had a similar problem when considering Johannes Kepler’s ideas of
ellipses for planetary orbits. Despite the obvious advantages (and genius) of Kepler’s solution,

\(^4\) Ibid., 48.
Galileo favored the ideal of the perfect circle too much to give it up.) The modern myth of “Science v. Religion” as framed in Darwin’s case emphasizes a reluctance to accept evolution as a consequence of religious belief, but there were also non-religious scientists who had philosophical reasons to resist Darwin’s theory.

This is not to say that there weren’t real scientific challenges to Darwin’s theory of evolution. Even among those who could accept the idea of change over time—even change without the guidance of God—there were still very valid questions about inheritance and the mechanism of change. Three years after the publication of *Origin*, William Thompson (Lord Kelvin) revised the estimated age of the earth after conducting experiments about the cooling times of molten spheres. He concluded that the earth could be no less than 20 million and no more than 100 million years old, likely not old enough for all the present-day species to evolve via Darwin’s slow process of natural selection. In 1867, Fleeming Jenkin pointed out a major problem with the idea of offspring inheriting characteristics, especially variations or changes, from both parents. Dubbed the “blending” problem, it stemmed from a mindset, widespread in Darwin’s time, that the passing of traits in organisms happened much like the dilution of dye in water. For example, if “Parent 1” is a vial of normal-clear water and “Parent 2” is a vial of variant-red water, their offspring will be a shade of pink. With each successive pairing, the offspring will become a more and more diluted pink until eventually, several generations down the road, it’s back to clear water again. This was the exact opposite of Darwin’s theory, which held that new traits could be passed down and preserved in successive generations until eventually bringing about a new species.

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Darwin’s theories persuaded some, almost persuaded many more, and sent most people back to the ideas of a previous evolutionist from the turn of the century who represented a happy medium between everyone’s philosophical, scientific, and religious objections. Jean-Baptiste Lamarck saw a definite progression in the fossil record, but he attributed it neither to God’s plan or random selection. Lamarck was a child of Enlightenment optimism and saw individual effort and agency in the direction of life. In his 1809 book *Philosophy Zoologique*, Lamarck proposed that changes in habits and behavior (stimulated by either the environment or by effort) could lead to the production of new organs and/or the modification of old organs and that these adapted changes could be passed to offspring. When this idea was first proposed, the powerful and influential Cuvier had no trouble dismissing Lamarck entirely. Ever the premier anatomist, Cuvier showed that the parts of an organism fit together too perfectly to have arisen piecemeal as individually acquired traits7 (not unlike the parts of William Paley’s watch, for example.) Decades later, however, the ever-accumulating fossil record was showing overwhelming evidence of progression and Cuvier’s stubborn objections were overruled. Lamarck offered a solution that was palatable to almost everyone. First, according to his theory, traits were acquired rather than naturally selected, so they didn’t require nearly as much time to accumulate. Second, the blending concern wasn’t as worrisome because traits, if acted upon or encouraged by environmental conditions, would continue to build and pass from generation to generation. Third, there was nothing about Lamarck’s theory that necessarily did away with God, so believers could keep their faith and their fossils. Fourth, and most importantly to the Enlightened Lamarck, since traits were acquired during the lifetime of the organism, organisms (at least smart and industrious ones) could essentially control their own evolution. In a Victorian era marked by progress and potential, this was exactly the message people wanted to hear.

7 Ibid., 41.
A Revolutionary World

The Victorian era, Darwin’s era, is part of what’s called the Long 19th Century because historians usually start the clock in 1789 and end it in 1914. “It was the best of times, it was the worst of times.” While the American Revolution of 1776 brought much light to the world, the French Revolution of 1789 set everything on fire; the Reign of Terror shocked the world, especially neighboring monarchs. So, as Wellington was defeating Napoleon at Waterloo (and as “Strata” Smith was drawing his geologic map of England), the leaders of the European powers met at the Congress of Vienna in 1815 to redraw the map of the world and try to restore order and stability. The Congress was dominated by conservative leaders whose goal was to contain the liberal and nationalist forces that had been unleashed by the French Revolution. To them, the solution was to create a new balance of power by restoring the old ruling families. To others, however, such a traditional solution was untenable. The world was moving faster in Darwin’s century, literally faster. The first railroads crossed England by the 1850s, and by the end of Victoria’s reign in 1901 all of Europe was accessible as well.\(^8\) Faster travel meant faster change and faster exposure to new people and new ideas. The structures of the past would not suffice. This was a time of rapid industrial growth, trade expansion, and the \textit{laissez-faire} capitalism that would keep them going. It was a time of growing colonialism, imperialism, and the bitter national rivalries that would keep them going. The Congress of Vienna resulted in stronger Russian and Austro-Hungarian empires, the weakening of the Ottoman Empire, and the peak of the British Empire, which soon expanded to claim the loyalty of one in every five people on the planet. (In fact it was this widespread network of British colonies that made Darwin’s Beagle voyage not only possible, but relatively pleasant.) Changing economies meant changing

societies, however, and contrary to the desired order of the Congress of Vienna, a host of disruptive radical movements began to spring up all over Europe. The first was called “Chartism,” possibly the first working class labor movement in the world. It began in Britain in 1838 as a push for both political and social reform, mostly by demanding the right to vote for all men 18 and over. The Chartists were unsuccessful in the short term, but their aims were finally met in the passing of the Reform Act of 1867.9 In one day, three million working-class voters were added to the electorate, practically doubling the total overnight. In Europe, even more radical movements were forming. In 1848, Karl Marx and Friedrich Engels published the *Communist Manifesto* and called for a European revolution. Within months, Paris, Vienna, Berlin, and all of Italy erupted in revolt, all fueled by Marx’s words and a continent-wide economic depression.

To the conservative leaders trying to maintain order since the Congress of Vienna, the revolts and the people leading them were the direct result of Enlightenment thinking from the previous century and the philosophy of rational materialism that came with it. They believed that the men of the Enlightenment, by questioning traditional royal authority, had not only brought about the terror of the French Revolution, but encouraged the dismantling of all other forms of authority—political, economic, religious, moral, and otherwise—and the riots and chaos across Europe were the natural result. Of course to the radicals trying to throw off the traditional tyrannies of royalty, aristocracy, religion, and even just the upper class, all change was good even if a little violent. Change was the point. It was absolutely necessary, and that is where Darwin started to run into trouble: even though Darwin was no radical himself, all of these radical reformers quickly claimed Darwin’s theory of biological evolution as scientific.

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proof that their revolutionary philosophies were right. They began to use evolution as a justification for revolution. This discipline hop, from biology to philosophy, reflected two major shifts in the relationship between science and the world, shifts that formalized during Darwin’s time, but continue to cause problems today:

1. Science was no longer trapped in the epistemological ghetto of the Aristotelian/Thomistic hierarchy, nor was it just the realm of eccentrics with their pith helmets and bug nets. Now it was a highly respected professional discipline and not only a reliable way to learn truths about the world, but a required and sought-after voice in any discussion about truth. The scientific method and the evidence it produced added gravitas to any statement, so people began to look for scientific arguments to support their non-science-related theories about everything from government to economics to society.

2. Not only was science being asked to support non-scientific theories, it was being used to create whole new theories from scratch. This was the age of Auguste Comte after all. Comte had famously asked, “How does one reorganize human life, irrespectively of God and king?”10 He proceeded to answer his own question with a new theory of “Science and the World” called Positivism, a blending of the old natural and moral philosophies long sundered by the Greeks and Christians. With Comte, it became not only acceptable but preferable for science to jump out of its original domain of planets and inclined planes and move into less objective fields like politics, economics, and society. Comte was a major influence on the thoughts of John Stuart Mill, perhaps the most influential English philosopher of the 19th century, who would

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go on to champion empiricism and what he thought was an empirically-supported liberal political view of society and culture.\textsuperscript{11}

The shifts in the prestige and reach of science threatened any institution that had been prestigious and powerful \textit{before} science and its methods came along, not just the royal and political powers, but the church powers as well. Though the church (Catholic or Protestant) would never again have the authority in Europe that it had during Galileo’s day, it was still a force to be reckoned with in the realm of morals and ethics, and it was from this ground that the Anglican Church of England fought Darwin’s theory of evolution. As mentioned earlier, even conservative Christians like Buckland and Sedgwick had been able to accept some level of evolution by seeing God’s hand guiding the process. Some were even able to accept the principle of \textit{human} evolution, again, as long as it was presented as part of God’s plan. The problem for Darwin was not evolution \textit{per se}. The problem was his proposed \textit{mechanism} of evolution—natural selection—a mechanism that made God not only unnecessary, but problematic.\textsuperscript{12} Randomly generated variations were essential to Darwin’s view of evolution by natural selection and it meant there could be no direction, no intention, and no pre-conceived progression in the succession of life. In Darwin’s system, the success of an organism, whether hummingbird or human, was determined by a combination of luck, timing, and location, not by God’s divine plan. Such a world was simply more than devout Christians could accept. In a way that scientists still don’t always grasp, the Christian complaint was three-fold because the question of human origins was not just about the past, it was about the present and especially about the future. If humans were not part of a plan from the beginning, they weren’t part of a


plan now. How then were they to live? When everything, including nature, was part of God’s plan, “is” and “ought” were the same thing. Now that science had taken over “is,” where was “ought” supposed to come from? More importantly, God’s plan had always promised a heavenly reward. What did Darwin offer after death? Of course Darwinian evolution didn’t just offend the sensibilities and hopes of the devout, it flatly contradicted the Bible. Under normal circumstances, this would be a big problem, but in another amazing instance of bad timing, a breakthrough in scientific understanding came at a time when religious belief and Biblical authority were experiencing a crisis. Once again, the church would react poorly.

In March of 1860, just four months after the publication of Darwin’s *Origin*, a book of seven articles called *Essays and Reviews* appeared in London. Each essay was written by a leader within the Church of England. Several men were also tutors or professors at Cambridge and Oxford, and one would even become the Archbishop of Canterbury. On the surface, *Essays and Reviews* was simply a look at the Genesis creation story, the different evidence for Christianity, the biblical research of German critics, and other topics. In effect, however, it was seven Anglican churchmen attacking the divine inspiration of scripture. Beginning in the late 1700s and continuing into Darwin’s time, German scholars had been applying a new technique to the study of the Bible. Called “Higher Criticism,” it started from the assumption that the Bible was a text created by normal human beings at a particular point in time in order to accomplish particular motives, and therefore should not be seen as the inerrant word of God. In addition to closely analyzing the text itself, researchers analyzed historical records from the Middle East and tried to find independent confirmation of biblical events. This was scientific rationalism and empiricism (specifically geology, archeology, and biology) applied to biblical studies and it was

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13 John W. Parker, ed. *Essays and Reviews* (London: John W. Parker and Son, 1860).
considered heresy by the church, both Catholic and Anglican. Nevertheless, without an
Inquisition to rein it in, the book sold over 20,000 copies in two years. (It would take Darwin
twenty years to sell so many copies of Origin.\textsuperscript{14}

The publication of \textit{Essays and Reviews} launched a five-year debate between conservative
teologians and more moderate Christians and scientists about the historicity of biblical events
and the question of whether or not biblical passages should be reinterpreted in light of scientific
findings. The book and the crisis it caused focused attention on a conflict that had been building
since Galileo’s day, specifically, how much should science and religion engage each other and
how far should we be willing to take this new empirical, materialistic, scientific worldview? It
was one thing to throw all of nature into a materialist box, but should religion and the Bible be
thrown in, too? Rationalists, materialists, and atheists had long been attacking the traditional
authority of the church, but their arguments had been largely philosophical, not empirical. (Karl
Marx is a perfect example.) Against the materialist arguments, church leaders and other
believers (including, importantly, many believing scientists) had long offered the magnificent
“Book of Nature” as evidence of God’s existence and goodness. Protestants especially looked to
the order and grandeur of the natural world to support their claims against Catholic Church
authority since the 16\textsuperscript{th} century. Now, however, scientific advances in general and Darwin’s
theory of natural selection specifically seemed to add empirical weight to the materialist
argument, painting nature as ambivalent at best and downright hostile at worst. With nature no
longer proclaiming the existence of God, the Church had only one remaining claim to
authority—the Bible—and the Higher Criticism movement aimed right at it. The publication of
\textit{Essays and Reviews} brought the “Science v. Religion” issue to the forefront of the public mind

and caused a huge rift both within the church and between the church and the rationalist minds of the day. It was a lightning rod: over four hundred books and pamphlets were published in response to *Essays and Reviews*. Some were supportive, but most were highly critical of the authors’ views. *Essays* had very little to do with Darwin specifically, but because *Origins* and *Essays* were published so close together and *Essays* dealt directly with the contradictions between scientific discoveries and religious truths, Darwin’s work was strongly associated with the theological crisis that followed in its wake.

The shifts in the prestige and reach of science that so alarmed the church also created some fascinating interplay between the different evolutionary theories, thinkers, and reformers of Darwin’s day. We’ve already seen how pre-existing philosophies affected whether or not scientists favored a static, a Lamarckian, or a Darwinian form of evolution (Shift 1 from above), but the bias went the other way, too (as in Shift 2). For example, one’s scientific views about the mechanism of heredity could determine one’s opinions about how best to achieve progress of the human condition. The issue became the first “nature vs. nurture” divide. People who favored Lamarck’s theory believed that beneficial traits were acquired during life (i.e., nurture) and tended to think the human condition could be improved by making changes to one’s environment (presumably to make it more nurturing). On the other hand, people who favored Darwin’s theory believed that traits were generated randomly and selected out by nature and therefore tended to think more like the breeders of the day. They favored societal solutions based on arranged marriages and sterilization. (It should be said that Darwin himself and some of his supporters did not take this view, but other Darwinian thinkers did.) As another example, one’s scientific views about the action of natural selection could determine one’s political philosophy

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15 Ibid.
about the role of government in society. People who, like Darwin, thought the theory of competition and survival applied only to individuals favored a small government that would leave room for each citizen to duke it out with each other, thereby allowing the best to rise to the top. On the other hand, people who believed that Darwin’s theory applied to groups favored big government and believed nations should duke it out until the best race won. These examples seem both simplistic and extreme, but they are modeled on the men who distorted and manipulated Darwin’s scientific theory into political, economic, and social theories. Darwin didn’t have to contend with the unquestionable authority of the Catholic Church that so troubled Galileo. Instead he had to contend with a plethora of amateur authorities, a million philosophers who thought for themselves and would support or deny his theory—or just bend it to fit their preferred worldview.  

**Revolutionary Naturalists**

Darwin’s cousin, Francis Galton (1822-1911), was a child prodigy with an affinity for counting and measuring things. Born into a family of highly successful gun manufacturers and bankers, Galton started his career in medicine until he was pulled away by Darwin’s *Origin*. “Your book drove away the constraint of my old superstition as if it had been a nightmare and was the first to give me freedom of thought.”  

Thus inspired by his cousin’s life and work, Galton became an explorer, a geographer, a travel writer, a meteorologist (the first to discover anticyclones), and one generally obsessed with the idea and mechanism of human heredity. His research focused on two novel methods: (1) an analysis of “pedigree,” the characteristics of a subject’s ancestors, and (2) twin studies, the comparison of characteristics as they represented in

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17 Ibid., 154.
identical offspring. He also pioneered new techniques using questionnaires and surveys to collect data about individuals, families, and communities. Returning to his natural affinity for numbers and counting, Galton invented the statistical tools of regression, correlation, standard deviation, and regression to the mean to help analyze his results.\(^\text{18}\) (One is reminded of Newton inventing calculus in order to progress with his other research.) Before long, Galton’s data convinced him that talent and character were inherited traits and that humans could be bred to enhance, preserve, and pass on these desirable qualities. Thus Galton, among all his other accolades, became the father of eugenics. It’s important to note, however, that Galton was what we today call a “positive eugenicist.” He focused on the idea that people with desirable traits should be encouraged to have more children.\(^\text{19}\) After he died, however, others would turn his ideas into “negative eugenics,” the belief that undesirable people should be sterilized and otherwise prevented from “breeding.” Because Galton’s work was based on a Darwinian understanding of inheritance and evolution, Darwin’s name has forever since been associated with this sinister practice.

Herbert Spencer (1820-1903)\(^\text{20}\) was not a Darwinian evolutionist; he was a Lamarckian “use-inheritance” man all the way. He chose to focus his attention on the influence that outside agencies had on an organism’s development, i.e., how environmental forces affected the acquiring of characteristics, and he concluded that organisms developed and flourished best with the least number of restrictions placed on them as possible. In other words, an organism had to be free to acquire (or not acquire) the traits that it needed. He still believed there was a struggle for existence (Lamarck shared this view with Darwin), but as long as its hand was not tied

behind its back, Spencer thought an organism would be able to acquire the skills it needed to fight for itself. This is what led Spencer, not Darwin, to coin the phrase “survival of the fittest.” Importantly, Spencer also believed that societies functioned like an individual, so in his mind the same evolutionary principles that worked for individuals worked for groups as well. This subtle view allowed Spencer to transpose the laws of biology (actually any natural law) onto social institutions such as governments and economies, and it’s how Spencer became known as the father of Social Darwinism (even though he was a Lamarckian). Ironically, the principle at the root of Spencer’s Social Darwinism was a purely Lamarckian idea: the possibility and importance of individual self-improvement. When extrapolated to the possibility of societal self-improvement, this led to the extreme small-government/uber-capitalistic/anti-welfare position that so enthralled Spencer’s American readers and would eventually give Social Darwinism a bad name. During his lifetime, however, the appeal of Spencer’s philosophy of empowering self-improvement made him a rock star. He began to have mental health problems and secluded himself from the general public in 1855, but his books traversed the globe, inspired leaders from America to Poland to China, and sold so many copies he was able to live off of the profits. By the 1870s, he was one of the most famous and influential philosophers of the age.\textsuperscript{21} Unfortunately for Darwin, history would come to judge Spencer’s ideas and influence in a negative light. Once again, one man’s bad ideas based on a bad understanding of evolution made Darwin guilty by association.

Like Francis Galton, Ernst Haeckel (1834-1919)\textsuperscript{22} began his career as a physician, but changed his route after reading Darwin’s \textit{Origin}. Rather than focusing on heredity, however,

\textsuperscript{21} Ibid.
\textsuperscript{22} UCMP, "Ernst Haeckel (1834-1919)," University of California Museum of Paleontology, Regents of the University of California, http://www.ucmp.berkeley.edu/history/haeckel.html.
Haeckel focused on zoology and comparative anatomy. Like Darwin, he was able to explore widely, reaching Norway, Dalmatia (modern Croatia), Egypt, Turkey, and Greece, and he discovered and named hundreds of new species. Fortunately for posterity, he was also a gifted artist and his beautiful illustrations are still highly prized today. (Unfortunately, he was also flamboyant and sometimes embellished his drawings to better illustrate his theories when the object and theory didn’t quite match.\textsuperscript{23} This is how Haeckel’s drawings of embryonic development became a tool of today’s anti-evolution camp.) Haeckel spent almost his entire career at the University of Jena and he quickly became Darwin’s biggest promoter in Germany. Importantly, however, while Darwin’s Britain was the picture of materialist and utilitarian thinking, Germany was moving in the opposite direction toward idealism and romanticism. Haeckel’s Jena had once been the center of the action. Hegel, one of the founders of German Idealism, had been part of the University of Jena faculty before Haeckel’s arrival. Haeckel’s science was strongly influenced by the idealistic and romantic culture of Jena, and once again, one of Darwin’s biggest promoters would become decidedly un-Darwinian.

Like Spencer, Haeckel was more of a Lamarckian than a Darwinian. He believed that traits could be acquired, and he also believed there was a linear progression to life; as opposed to Darwin’s branching shrub, Haeckel saw something more like a Lodgepole pine.\textsuperscript{24} Also like Spencer, Haeckel applied evolution to groups as well as individuals, but rather than looking at societal groups, Haeckel focused on racial groups. Popular theories of the day supported a polygenic understanding of human origins that assumed different races came from different lineages. Darwin disagreed with this position and favored instead the monogenesis view that all humans came from a common origin regardless of race. Haeckel not only stuck with the

\textsuperscript{24} Ibid., 120.
polygenesis theory, he tried to find Lamarckian evolutionary proof for it in the way languages arose separately from speechless pre-human ancestors and then were acquired differently by different races. This convoluted idea was the direct product of the mixing of Haeckel’s scientific views of evolution with the German Idealism of his day and location. The 1815 Congress of Vienna attempted to bring order to Europe by establishing “spheres of influence” over which each of the four great powers dominated (England, France, Russia, and Austria.) Napoleon dissolved the Holy Roman Empire in 1806, but the many German states still had not been unified by 1815, and they would spend the next fifty-five years trying to figure out how to become a unified German nation on par with the other European powers. Central to this unification process was the idea of the unifying power of a common language and a common culture (Kulturkampf). Haeckel used his distorted view of evolution to support the claim that advanced languages indicated advanced races and that the German race was therefore the most advanced of all. Like Spencer, Haeckel believed that evolutionary theory applied to all human endeavors. To him, politics was applied biology. In short, Haeckel became the worst combination of all evolutionary options. Belief in Lamarckian acquired traits, group application, survival of the fittest, and German Idealism made Haeckel a scientific racist who would go on to champion a strong centralized state as the driving force for human progress through racial competition, group sacrifice, and international war. Darwin would have been appalled, but there was nothing he could do about the association between evolution and the evil that would result from Haeckel’s twisted interpretation of it.

By Darwin’s time, almost everyone agreed that species were changing over time, even the human species. Three years before Origin, workers in the Germany’s Neander Valley

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25 Ibid., 144.
26 Ibid., 115.
uncovered a skull cap, two femora, five arm bones, and fragments of a scapula and ribs that came to be known as Neanderthal Man. The exact nature of the specimens was hotly debated, but additional finds made it clear that not-quite-humans had once called Europe home. The question was not did evolution happen; it was by what mechanism did it happen? God, Lamarckian adaptation, or Darwinian natural selection? Importantly, though there were scientific objections to consider, most answers to the question of mechanism had more to do with personal philosophy and worldview than scientific evidence. Where gaps existed in the science of evolution, people supplied their own philosophic or religious solutions.

For most of Darwin’s life, public opinion about his version of evolution was still mixed. He had strong supporters and strong detractors and many people who were simply stuck in between, honestly confused about the scientific mechanisms and philosophical implications of his theory of natural selection. Darwin’s century was a confusing time on many levels. The rapid changes brought on by industrialization, expansion, political and economic reforms, revolutions, reactionaries, and the general questioning of all traditional authorities created an environment full of potential and promise, but also instability and fear. Ideas of cultural, social, and political instability have been associated with biological instability ever since. “How does one reorganize human life, irrespectively of God and king?” asked Comte and a million philosophers and scientists rose to answer the call in their own way. Given the power of Darwin’s dangerous idea and the new respect accorded to scientific discoveries, it was only natural that people would claim his theory supported their own theories. Given the bias and blinders of men, however, it was also only natural that they would distort and manipulate Darwin’s theory to support their own agendas, thus forever associating Darwinian evolution with

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worldviews not supported by Darwinian evolution or by Darwin himself. In an ironic way, this puts Darwin in sympathy with the church rather than against it, for nothing has been more distorted and manipulated to suit the agendas of men than the word of God.

Such an awkward parallel can only be seen as a testament to the increasing influence and authority of science and scientists in Darwin’s day. By then, “Science” was no longer the meek Galileo challenging the authority of “The Church”; it had become an authority in its own right. In an age so taken with the new rational and empirical methods, the war between science and religion must have seemed over. Now however, science faced a new challenge. Two hundred and fifty years of experiment and observation had dethroned religion and made science the authority on all things related to the natural world. That was fine, but religion had not just been an authority on the natural world; it had been the moral and cultural authority, too. The questions most troubling Darwin’s contemporaries were less and less about the truth of evolution and more about its consequences. Was evolution true? Yes. Now what are we supposed to do? What would science do with its newfound moral and cultural authority?
THE SCOPES TRIALS

“...a nation [United States] formed by emigrants from several of the most energetic and intellectual nations of the old world...the very circumstances which drove them to emigrate led to a natural selection of the most energetic, the most independent, in many respects the best of their several nations...Such a people...would almost necessarily develop both the virtues, the prejudices, and even the vices of the parent stock in an exceptionally high degree.”

Alfred Russell Wallace, the co-discoverer of evolution by natural selection, spent ten months in the United States in 1886. Though he expressed great praise for much of what he saw, his general impression was that evolution had run amok in America. He was appalled by soot-filled cities with trees blacker than in London and rows upon rows of ugly identical housing that had too-quickly sprung up to house the factory working class. He longed for the gentle curving lanes and greenways that indicated time and a human hand had been involved and he regretted the abundance of resources that allowed progress to get so out of hand so quickly. America had run away with the cult of progress, Wallace thought, and along the way obliterated any idea of moderation or constraint, either ethical or economic. This observation provides a useful perspective from which to better understand the story of the Scopes Monkey Trial of 1925.

American Evolution

Though embroiled in the Civil War in the years immediately following Darwin’s publication of *Origin*, Americans soon got up to speed with the details and drama surrounding Darwin’s “dangerous idea.” Like Britain and the other European powers, Americans experienced a rapid Industrial Revolution and economic expansion and they, too, had questions and concerns about the new economic, political, and social structures that accompanied such

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great change. In many ways, the American reaction to evolution by natural selection was the same as the British reaction: fascination coupled with scientific questions, philosophical hesitation, and then a general attempt to bend the theory to support personal worldviews. True to their nature, however, and as predicted by Wallace’s observation, Americans infused their interpretation of evolution with a sense of energy, individualism, and exceptionalism that took the new theories to a whole new level.

The late 1800s was a time of unprecedented economic, population, and production growth in America. By the turn of the century, American manufacturing outstripped the production of Great Britain, Germany, and France combined.\(^3\) Railroad routes tripled between 1860 and 1880 and then tripled again by 1920.\(^4\) It was the beginning of industry consolidation and the rise of corporations and “trusts,” which dominated industries like steel, coal, and oil. It was also a time of innovation with new marvels like light bulbs and phonographs, plus the industrial research labs to improve them, and the power plants to turn them on. In such an environment, the ideas of Herbert Spencer found affinity with the financiers and businessmen of this bright and shiny Gilded Age. Spencer’s thought was an amalgamation of Lamarckian “use inheritance” and the population theory of Thomas Malthus,\(^5\) the British scholar and economist whose writing had inspired both Wallace and Darwin to see natural selection as the driver of evolutionary change. Malthus noted that populations reproduced exponentially until they outgrew their food supply, at which time starvation would cull out the weakest members. From this premise, Malthus concluded that efforts to support the poor and weak members of society

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would exacerbate population pressures and cause more problems in the long term than they solved in the short term. He therefore lobbied for an end to poverty assistance and poor laws claiming they would make the overall population weaker. (Interestingly, though these ideas led Darwin and Wallace to the theory of non-God-driven evolution by natural selection, Malthus was an Anglican clergyman and therefore viewed population pressure and its consequences as part of God’s plan. Malthus believed God designed starvation as well as bounty, and he considered any form of public assistance to be a misguided attempt to circumvent God’s plan. He presented his arguments as scientific—and certainly his opening proposition was based in fact—but he invoked God’s plan as support for his expanded theory and he claimed “Christian morals” as justification to stop helping the poor.)

Spencer was not a religious man, but he latched on to Malthus’ broader idea and used it to justify his preference for individual self-improvement over state-directed assistance, what he would call state *interference*. In America, this idea translated into a call for small government, minimal regulation, and a justification of *laissez-faire* capitalism that conveniently allowed the captains of industry to rationalize any business practice as long as it aided the company’s ability to compete and profit. This theory was further supported by the corruption of the Grant administration during the post-war Reconstruction period. Scandals involving political payoffs and government contracts convinced many that any government role in the economy could only lead to fraud, favoritism, kickbacks, and waste. The effect was to strengthen Spencer’s case. Additionally, Spencer’s “survival of the fittest” frame was expanded to justify the stratification of wealthy and poor that was quickly developing between the rich titans of industry and the impoverished working class. Yale sociologist William Graham Sumner used Malthus’ ideas (via

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Spencer) to argue that helping the poor actually lessened their ability to survive and prosper in society. These ideas found great support from the political, economic, and cultural leaders of the day not only because the ideas upheld their current beliefs about the structures of society (structures that kept them rich and in power), but because they melded so well with the particularly American ideal of independence and self-sufficiency.

Francis Galton’s ideas about heredity and eugenics also found a ready audience in America, partly for ideological reasons, but also due to scientific reasons. Galton held to Darwin’s theory of evolution by natural selection, which put him squarely in the “nature” camp of the nature vs. nurture debate. His research led him to conclude that all traits, not just height and hair color but also intelligence, talent, and character traits, were inherited via natural mechanisms that were essentially unalterable by “nurture” or environmental conditions. This understanding became the basis of his eugenics theory and it led him to think of ways to increase the transmission of “favorable” traits across the population by encouraging “favorable” people to mate and reproduce. In the late 1800s, Galton’s ideas were interesting and shared by some, but they were held back by the still-lively debate and uncertainty over the exact mechanism of evolution. Smart people were still conflicted over the choice between the acquired and therefore linear mechanism of Lamarck and the random, non-linear mechanism of Darwin. That all changed, however, with the research of Gregor Mendel which overwhelmingly supported Darwin’s theory. Mendel spent most of his adult life as a priest in the Abbey of St. Thomas in Brno, Austria, where he taught physics and practiced botany. He began studying the variation of plants in 1856, and by 1863 had tested almost 30,000 pea plants to learn how traits such as color,

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shape, and height were passed from one generation to the next. Other naturalists and scientists tried to understand heredity by conducting cross-breeding experiments, but Mendel was the first to carry out such a broad, thorough, and systematic program. He was also the first to apply mathematical tools to such large amounts of biological data. In the process, he discovered something remarkable: almost without fail, traits were passed on to successive generations in a 3:1 ratio. In other words, a dominant trait would appear in three out of four of the offspring and a recessive trait would appear in one out of four.

The main implication of Mendel’s research as it applied to Darwin’s theory was that it immediately filled in its biggest gap, the “blending” objection based on the dilution of traits that had been assumed up until Mendel’s discovery. The problem for Darwin now was that no one knew about Mendel’s research. He had presented his findings in two meetings of the Natural History Society of Brünn in 1865 and published a paper in its journal in 1866, but no one took notice until 1900 when his work was rediscovered and replicated by Hugo de Vries and Carl Correns. Once their work was published, Darwin’s theory of evolution was justified and, by extension, so was Galton’s theory of eugenics. Importantly, the growing strength of Darwin’s theory not only gave credence to the “nature” argument and hence Galton’s “positive eugenics” (the use of incentives to encourage desirable people to mate), it also increasingly indicated a natural world without a plan, without a linear direction, a world where progress and improvement were not guaranteed. Without nature or God or something moving life toward a better state, many started to believe that it was up to people to direct the process. This view opened the door to “negative eugenics,” the use of mandatory sterilization to prevent unfavorable people from reproducing, and the idea spread through American policy in the first decades of the

20th century. During this time, “nearly every American state maintained institutions for forcibly segregating those suffering from hereditary disabilities and, during the period from 1900 to 1935, thirty-two states enacted compulsory-sterilization laws.”\textsuperscript{10} Just as some started to view politics and economics as applied biology, eugenics was now simply applied evolution.

**American Revelation**

Other controversial ideas were steaming across the Atlantic and settling into the American psyche. After making a few exploratory trips in the mid-1800s, the Higher Criticism movement, which so disrupted the Anglican Church of England, finally came to stay in the States in 1891. In that year, Charles Briggs, a Presbyterian scholar and the new professor of Biblical Theology at Union Theological Seminary in New York, delivered an address called “The Authority of Holy Scripture” in which he proceeded to inform the American people that:

- Moses did not write the Pentateuch;
- Ezra did not write the books of Ezra, Chronicles, or Nehemiah;
- Jeremiah did not write the book of Kings or the Lamentations;
- David only wrote a few of the Psalms;
- Solomon did not write the Song of Solomon or Ecclesiastes;
- Isaiah did not write half his book;
- The Bible is loaded with errors and inconsistencies;

The theory of Biblical inerrancy “is a ghost of modern evangelicalism to frighten children.”\textsuperscript{11}

Briggs was tried for heresy by the presbytery of New York but was acquitted. American Protestantism would never be the same, however. After Briggs’ speech and almost two decades of debate within the Presbyterian Church, the General Assembly drafted and passed “The Doctrinal Deliverance of 1910” establishing the five main beliefs that were “necessary and essential” to the Christian faith:

1. The Bible is inspired by the Holy Spirit and is therefore inerrant.
2. The virgin birth of Christ was real.
3. Christ’s death was atonement for sin.
4. Christ really rose from the dead.
5. Christ really performed miracles.\textsuperscript{12}

These tenets became known as the “Five Fundamentals” and within a few years the people who believed them became known as “Fundamentalists.” Not everyone in the Presbyterian Church was such a traditionalist, however, and the next decade saw more back and forth between liberal modernists and conservative fundamentalists. In 1922, Harry Emerson Fosdick (a Baptist preaching to a congregation of Presbyterians in New York) asked “Shall the Fundamentalists Win?” and defended religious liberals as sincere Christians who were working to reconcile their Christian faith with the new scientific and historical discoveries of the day. His sermon was

\textsuperscript{11} Charles Augustus Briggs, \textit{The Authority of Holy Scripture: An Inaugural Address}, 2nd ed. (New York: Charles Scribner’s Sons, 1891).
quickly published and sent to every Protestant clergyman in America. Pastor Clarence E. MacArtney promptly fired back from his church in Philadelphia with “Shall Unbelief Win?” arguing that liberalism had been slowly replacing the sacred church with secular ideas. He encouraged conservative believers to fight the spread of liberalism lest the church become “a Christianity of opinions and principles and good purposes, but a Christianity without worship, without God, and without Jesus Christ.” The Modernist/Fundamentalist divide was not isolated within the Presbyterian Church; it was affecting all of American Protestantism. As had happened in England decades earlier, the challenges of Higher Criticism, new scientific discoveries—especially evolution—and a general trend toward Comte’s Positivism were causing a rift within the world of belief. Surveys showed a widening gap between a God-fearing, fundamentalist, traditionalist majority, and a liberal-leaning, scientifically educated, disbelieving minority. Eventually the Presbyterian Church, along with every other major Protestant denomination, would find a way to accommodate liberalism with their traditional doctrines—every denomination, that is, except the Southern Baptists.

In a very Darwinian way, the Industrial Revolution, Higher Criticism, and the onslaught of new scientific and philosophic theories challenged Americans to adapt and thrive in a rapidly changing environment, but another European export was to be the greatest challenge of the young 20th century: World War I. The Congress of Vienna of 1815 had done a reasonable job of trying to preserve order and peace in Europe throughout the 1800s, but tensions were very high by the end of the century as the organized “spheres of influence” began to break down. The

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13 Harry Emerson Fosdick, "Shall the Fundamentalists Win?," Christian Work 102 (1922).
Crimean war of 1854-1855 and the Italian War of 1859 both served to weaken the relationship between the major powers, but the biggest driver of the collapse was Germany’s continual quest to become unified. In 1815 the many states of Germany had originally been “assigned” to the Austrian sphere of influence, but by mid century it was clear that the Kingdom of Prussia was becoming powerful and would also make a good guardian. Northern Germans were more closely tied to Prussia, but southern Germans were tied to Austria, and the problem of unification remained. Otto von Bismarck, the new Minister-President of Prussia, realized the importance of a unified German state (especially since other European nations were becoming more powerful), but he also knew that the treaties binding the various German states prevented him from taking any unilateral action. Instead, in a masterful display of anti-diplomacy and cunning, he manipulated events to make his opponents declare war on Germany. Prussia would come to her aid, all would be united in the fight, and the end result would be a fully united German nation, courtesy of and including the Kingdom of Prussia. Everything went according to plan. The Danish engaged in 1864, the Austrians attacked in 1866, and the Franco-Prussian War wrapped it up in 1871. By the time the unification papers were signed at Versailles, Bismarck had proven that Austria was no longer the dominant power in Central Europe and the new German Empire was finally in the game. The following years saw the development of many alliances, public and secret, between Germany and other nations as it sought to “cover its back” against the possibility of invasion from all sides. Then, in 1914, when a Serbian nationalist assassinated Archduke Ferdinand of Austria, the alliances were activated and within weeks all the major European powers were at war.

Thus came the end of the Long 19th Century, but WWI marked the end of something else, too: the hopes of the Enlightenment, the dream of infinite progress, and the general feeling that
the world was on the right track. WWI was the first industrial war with armored tanks, giant warships, enormous guns and cannon, chemical weapons, air reconnaissance, submarines, automatic weapons, and even flamethrowers. Whole regions of Europe were scorched and destroyed. The results were devastating for all sides, with an estimated 37 million total casualties: 16 million dead and 21 million wounded. Much of the world mourned for years. Among the millions of victims lay many of the philosophies and idealistic notions of human progress and improvement. No one had ever imagined that man could bring about such destruction upon himself. Everyone was simply stunned. Among the most stunned, angered, and motivated was an American politician named William Jennings Bryan, a person who was intimately tied to each of the other challenges facing 1920s America and the man who would almost single-handedly bring about the Scopes Monkey Trial of 1925.

American Crusade

Much of the public perception of the Scopes Trial chapter in the “Science v. Religion” cannon has been formed by the iconic-but-fictional recreation of the trial in a 1960 movie called Inherit the Wind. The movie famously portrays Bryan as an old religious buffoon, reduced to spewing Bible verses against the logical, modern, and ever-superior defense attorney, Clarence Darrow. (The names are changed in the film, but the representations are obvious.) By the end of the movie, the audience is convinced that Bryan and the anti-evolution Fundamentalists he represented were backwards, ignorant hicks who were so blinded by their faith they couldn’t see the obvious truth of science. In the movie, they were so divorced from reality they preferred to condemn their children to ignorance then have them risk atheism by being taught evolution in

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school. In real life, Bryan was a very devout man, but he was not an idiot. He had very good
reasons for fighting Darwin and Darrow in the Dayton courthouse that summer of ‘25.

In contrast to the Social Darwinists, eugenicists, and uber-capitalists, of his day, William
Jennings Bryan was a progressive, populist Democrat. Born in southern Illinois in 1860, he
studied classics at Illinois College and then moved to Chicago to study law. He soon became
involved in politics and was elected to Congress in 1890 where he served two terms. He would
eventually represent the Democratic ticket in three political elections, but he never won. The
very early days of the 20th century were relatively peaceful and prosperous and Republican
incumbents were hard to defeat. If not a successful politician, Bryan was a highly successful
orator and for many years he was the most popular speaker on the Chautauqua circuit (second
only to Helen Keller and Annie Sullivan). He spoke often on religious topics and his most
famous lecture was “The Prince of Peace,” in which he stressed the primacy of religion as a
strong moral foundation and also emphasized personal and group morality as the only foundation
for peace and equality in society.

In addition to religious messages, Bryan also spoke about other important issues of the
day. He strongly opposed imperialism and continually called on his fellow Democrats to
dissolve trusts, regulate railroads, and support the Progressive cause. He was instrumental in the
passing of the four Constitutional Amendments of his time: establishing a progressive income
tax and the direct election of senators (Amendments 16 and 17, both in 1913), prohibiting the
manufacturing and sales of alcoholic beverages (Amendment 18, 1919), and giving women the

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18 Larson, "The Biology Wars: The Religion, Science and Education Controversy".
right to vote (Amendment 19, 1920). Bryan was a true Progressive and believed that government was an appropriate vehicle for moral education, encouragement, and enforcement. He therefore championed government efforts to create laws protecting consumers and laborers (including female and child laborers), laws against corruption and trusts, prohibition laws, and even sanitation laws. In 1912, Bryan’s popularity and support helped Woodrow Wilson gain the Democratic presidential nomination. (Wilson would be the only Democrat to win the White House between 1892 and 1932.) After Wilson won the election in a landslide, he named Bryan his Secretary of State, but Bryan only served for two years. Wilson eventually came to believe that the U.S. should enter the war in Europe, but Bryan, ever one for negotiating and arbitration, couldn’t support Wilson’s push for war. At this stage, like many of his contemporaries, Bryan was an optimist and believed that moral progress was the best way to achieve prosperity at home and peace abroad, and he believed the world was clearly progressing in that general direction. After the War, however, horrified by the brutal atrocities and the slaughter of so many men, Bryan decided he had misjudged the condition of the world and the goodness of the human heart. To him, WWI represented moral progress grinding to a halt, and he began casting around for explanations. He found them in three books that would inspire and direct his actions for the rest of his life.

1. Headquarters Nights: A Record of Conversations and Experiences at the Headquarters of the German Army in Belgium and France by Vernon Kellogg (1917). Kellogg was a Stanford entomologist who served in the American Commission for Relief in Belgium in 1915 and 1916. While there, he had the opportunity to spend time with officers of the German Supreme Command and he

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became convinced that Darwinian evolution was the motivation for the German war machine, writing, “the creed of natural selection based on violent and fatal competitive struggle is the Gospel of the German intellectuals.”

2. *The Science of Power* by Benjamin Kidd (1918). Kidd was a British sociologist who decried the psychological effect of Darwin’s theory of evolution based in natural selection because it gave “an almost inconceivable influence…to the doctrine of force as the basis of legal authority.” He called it the “Great Pagan Retrogression” and he blamed Darwin (and Nietzsche) for the German materialism, nationalism, and militarism that led to WWI.

3. *The Belief in God and Immortality, a Psychological, Anthropological and Statistical Study* by James Henry Leuba (1916). Leuba’s research revealed a trend showing that college students tended to lose their faith during the four years they spent in college.21

Bryan was no stranger to the “Darwin equals immorality” hypothesis. In 1909, he was already clearly concerned about Darwin and the implications that the theory of evolution by natural selection could have on public morality, saying:

“The Darwinian theory represents man reaching his present perfection by the operation of the law of hate—the merciless law by which the strong crowd out and kill off the weak. If this is the law of our development then, if there is any logic that can bind the human mind, we shall turn backward to the beast in proportion as we substitute the law of love. I choose to believe that love rather than hatred is the law of development.”22

Darwinian evolution and the Social Darwinism economic theories that came with it deeply offended Bryan’s progressive and populist sensibilities. In his mind they represented a world that was categorically opposed to everything he had fought for during his entire political and

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public life. Bryan was also a Presbyterian and had been actively involved with the Fundamentalist/Modernist crises that hit the denomination in the teens and early 1920s. He was one of the conservatives who worried about the liberal takeover of the church and once lobbied to halt funding to any Presbyterian college that taught human evolution. Such a confluence of events could not help but move Bryan. Prior to the war, he had been a pacifist, a diplomat, an optimist, and even somewhat tolerant of other views. The “Prince of Peace” speech that focused so strongly on religious morals still concluded, “While I do not accept the Darwinian theory I shall not quarrel with you about it.” After the war, the three books, and his re-evaluation of the world scene, however, Bryan was a changed man. He now believed that Darwin’s ideas about human evolution had demoralized the entire world and caused the greatest tragedy humanity had ever seen. The only question now was what he could do about it.

At the same time that Bryan was coming to this realization, a new high school movement was crossing the nation. The new industrialization and economic structures of the early 20th century required workers with an education higher than 8th grade, so secondary school (high school) became mandatory in many counties across America. In 1910 less than 20% of 15-18 year olds were enrolled in high school, and less than 10% graduated. By 1940, however, 73% of young people were enrolled and the median American youth had a high school diploma. Evolution was accepted and taught in mainstream science education, but it was a more complicated subject not usually covered before high school. Prior to 1910, few students were reaching higher-level biology courses so the teaching of evolution wasn’t a primary concern. Now, however, millions of students would be learning evolution in mandatory high school

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23 Larson, Trial and Error: The American Controversy over Creation and Evolution, 47.
24 Ibid., 41.
classes and many people, especially William Jennings Bryan, considered this new development a moral crisis of enormous consequence. Determined to protect the morality of American children and prevent them from turning into immoral little Germans, Bryan threw his influence and considerable voice behind the anti-evolution cause. Inspired by a proposal in Kentucky to remove evolution from the schools (and naturally inclined to think it the government’s responsibility to inform and protect the morality of its citizens), Bryan launched a massive campaign to adopt similar anti-evolution statutes in all the states. The Kentucky proposal lost by one vote in the House, but Bryan was undeterred and his influence and enthusiasm was contagious. The rest of America was troubled, too, and his message struck a chord. As an editorialist for the Chicago Tribune wrote, “William Jennings Bryan has half of the country debating whether the universe was created in six days.” Many state legislatures began debating the teaching of human evolution in their districts and the subject became a major issue during the elections of 1924 with many candidates promising to side with “Bryan and the Bible.” The first state to actually outlaw the teaching of human evolution was Tennessee. Called the Butler Act, it set the stage for the show trial of the century.

One of the great ironies of the Scopes story is that a trial decrying the demoralizing effect of “the competitive ethos” was instigated by a group of local townspeople wanting to increase the competitive advantage of their local business community. When the Butler Act passed, the young American Civil Liberties Union (ACLU) issued a press release offering to defend any teacher willing to challenge the law, and the leaders of Dayton, Tennessee, stood up and said “Here!” What better way to bring business and attention to their small but promising burg? They enlisted John Scopes, a coach and physics teacher who happened to be substitute-teaching

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26 Larson, "The Biology Wars: The Religion, Science and Education Controversy".
a biology class. Bryan, a major influence in the passing of the Butler Act and always up for a bully pulpit, offered to speak for the prosecution. Once Bryan was in, Clarence Darrow, the country’s most famous defense attorney and an outspoken critic of religion, signed up for the defense. It didn’t take long for the Dayton leaders to realize what was about to descend on their city. Two of the greatest lawyers of the era were coming to town for a colossal fight between science and religion, modernity and tradition. The press immediately recognized the makings of a great story and sent over 200 reporters to Dayton, some from overseas.

“Thousands of miles of telegraph wires were hung to transmit every word spoken in court, and pioneering live radio broadcasts carried the oratory to the listening public. Newsreel cameras recorded the encounter, with the film flown directly to major American cities for projection in movie houses. Telegrams transmitted more words to Britain about the Scopes trial than had ever before been sent over transatlantic cables about any single American event. Trained chimps performed on the courthouse lawn as a carnival-like atmosphere descended on Dayton.”  

In the end, however, even though the trial was supposed to be a head-on collision between science and religion, the judge refused to allow Darrow to call any of his scientists to the witness stand and Darrow would only ask Bryan two questions about the supposed contradictions between science and the Bible. Neither question was about evolution, and Bryan attempted to reconcile both of them. Harkening back to Galileo’s trials, Bryan allowed that God might have lengthened the day for Joshua by halting the earth instead of the sun. Next he allowed that the six days of creation described in Genesis could refer to six geological ages or epochs rather than six twenty-four-hour days, a version of the Day-Age theory that had been a popular compromise since Cuvier’s time. The effect of these conciliations was an admission that Bryan was interpreting the Bible rather than taking it literally, and that was enough for Darrow.

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28 Ibid., 213.
29 Ibid., 215.
The arguments came to a close, and the jury returned a verdict of guilty for Scopes, but that was hardly surprising. The defense actually encouraged a guilty verdict in the hopes of appealing the case to a higher court. The verdict was later overturned on a technicality, however, so the great trial fizzled out and quickly became old news. Movies like *Inherit the Wind* portray the trial outcome as a clear victory for Darrow and science, and in so doing have greatly affected public opinion since the 1960s, but the real ending was far more ambiguous. The science-sympathizing media gave Darrow the day and rendered Bryan an idiot. The Bible-sympathizing media gave Bryan the win and made Darrow look like a mean and bitter old man. The neutral papers called it a draw. Even Dayton got mixed results. It got the attention it desired, but much of it was negative and portrayed the town as a backward backwoods bastion of Bible-thumpers. Bryan’s supporters were pleased, however, and money was raised to build a school in his honor. Bryan College (motto: “Christ Above All”) is still operating in Dayton today.

The building of Bryan College reflects perhaps the largest real effect of the Scopes Monkey Trial. Neither side was able to win the converts it anticipated, but each gained the attention and support of its already-believing base. Glad the whole thing was over, the scientists went back to their research further bolstered by the outpouring of public and media support. Meanwhile the anti-evolutionists regrouped and began withdrawing from the public that had so harshly criticized them. During the trial, Bryan said he wished a school could be established “to teach truth from a Biblical perspective.” Inspired by the idea and dismayed that further attempts to remove evolution from the public schools were barely successful, the Fundamentalists decided instead to build their own schools, hire their own teachers, and write

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30 ———, *Trial and Error: The American Controversy over Creation and Evolution*, 69.
31 ———, *Summer for the Gods: The Scopes Trial and America’s Continuing Debate over Science and Religion*, 201.
33 Ibid.
their own textbooks. Far from resolving the conflict between science and religion or at least swinging the conflict to the advantage of one side over the other, the effect of the Scopes Trial was to make things worse. It created and then magnified the stereotypes of each side and further polarized the American public on both the science and religion questions. What began as a crusade to save all the nation’s children turned into a Fundamentalist retreat to protect their own. The Fundamentalists entrenched, insulated, and disengaged from the world and instead created their own subculture based on “truth from the Biblical perspective.”

In this sense, of the three “Science v. Religion” myths investigated here, the Scopes Trial is the only one that truly fits the frame of a war between science and religion if for no other reason than that’s how the participants viewed it, that’s how the media portrayed it, and that’s how the public wanted it to be. That said, the trial was never about science, but rather the alleged effect that a certain scientific discovery (Darwin’s theory of evolution by natural selection) could have on individual and group morality. Bryan questioned Darwin’s science and often referred to evolution as “guesses strung together,”34 but his problem with evolution was not that it was unproven. Whether it was true or not, evolution was a dangerous idea that caused people to question God, become immoral atheists, and launch devastating wars of aggression against humankind. In his widely read pamphlet The Menace of Darwin (1921), Bryan wrote, “Religion is defined as the relation between God and man, and Tolstoy has described morality as the outward expression of this inward relationship.” Ironically, at a time when science was discovering more and more about man’s relationship with the world, Bryan (and many others) believed Darwin’s science destroyed man’s relationship with the world because it had wiped out man’s inward relationship with God. How else to explain the increasing inhumanity of the early

20th century? In America, religion *had* to be at war with science, but not because science threatened the authority of the Church (as in Galileo’s day) or because it threatened the order of society (as in Darwin’s day). In America, as Bryan knew, religion was about one’s personal relationship with God. The very reason people left the old country to found new colonies on Plymouth’s shores was to seek a place where they could worship according to their own individual beliefs. With such a history, evolution wasn’t a challenge to some distant authority or hierarchy. Americans took Darwin’s theory personally and that meant war.
EPILOGUE

The events of the next hundred years read like a military history of a much-disputed battlefield, complete with attacks, counter-attacks, casualties, and propaganda campaigns. The Great Depression of the early 1930s brought with it a world-wide reconsideration of economic philosophies that nearly wiped out Social Darwinism’s faith in free markets and *laissez-faire* governance. Like WWI, World War II caused shock at man’s inhumanity to man. Interestingly, however, science emerged from WWII in much better shape than it had from WWI. As terrible and deadly as WWII technology had been, American research and innovation allowed the Allies to prevail and win the war. Furthermore, America enjoyed a booming post-war economy driven by invention and the free market exploitation of new products. GI’s returned home and went to college to become scientists and engineers, and a thriving new middle class kicked into gear. The late 1950s saw a renewal of interest in Darwin as the 100th anniversary of *Origin* neared. Julian Huxley event went on a national campaign for “Evolutionary Humanism” calling on Americans to protect the environment, embrace cultural diversity, and “value quality over quantity.”¹ The 20th century saw significant advances in every scientific field including geology (plate tectonics), biology (genetics and the modern synthesis), cosmology (the age and expansion of the universe), and physics (subatomic particles and quantum theory). Importantly, the space race began with the Soviet launch of Sputnik in 1957, and, accordingly, America turned its attention to improving science, engineering, and math education. With funding from the National Science Foundation, the American Institute of Biological Sciences established the Biological Sciences Curriculum Study in 1963. Within two years the institute released new high school biology textbooks that taught both evolution and genetics. Partially because of the

¹ Ibid., 248-49.
hubbub over the Scopes trial, evolution had largely been omitted from high school curricula. Now, however, with the newfound prestige, prominence, and importance of science education, evolution was back in. This of course meant the Fundamentalists had to come back out.

In 1961, Henry Morris, a civil and hydraulics engineer, and John Whitcomb, an Old Testament theologian, published *The Genesis Flood* arguing that the Noachian flood of the Bible was responsible for all the strata and fossils on earth. Many of Morris’ arguments echoed the earlier work of George McCready Price, a Canadian Creationist who published his own young-earth flood theories in *The New Geology* in 1923. (Bryan referenced some of McCready’s ideas during the Scopes trial.) More importantly, Morris made his arguments from the basis of scientific reasoning, in effect claiming that science could prove religious statements. This was an important shift in authority. After 350 years, religion was now looking to science to show that its beliefs were sound rather than using its authority to “prove” science wrong. Morris’ nod to science and its cultural authority created a new program called Creation Science, and the war was rekindled. Between 1968 and 1987, a series of court cases gradually concluded that Creation Science was not real science, but was in fact religion and therefore not permitted in public schools. In 1949 and 1963, previous courts ruled that religious instruction and school-sponsored prayer were also not permitted in public schools, so now the Fundamentalists were left without a leg to stand on. This was exactly the opposite of what Bryan wanted. Far from government providing moral guidance and enforcement, they had just removed all traces of moral education from the school system and abandoned it to the demoralizing and atheistic influence of science and evolutionism. As Bryan concluded, something had to be done, and so beginning in 1970, conservative Fundamentalists and other Christians began forming private
organizations with the intention of lobbying congressional leaders, storming public opinion, and packing school boards:

1. 1970 - Christian Heritage College (now San Diego Christian College), founded in San Diego by Tim LaHaye, Henry Morris, and Art Peters to develop studies within the framework of Biblical Creationism.²

2. 1970 - Institute for Creation Research, founded by Morris with scientists engaged in research and education, but driven by Christian ministry. It is the “research division” of LaHaye’s Christian Heritage College.³

3. 1977 - Focus on the Family, founded by James Dobson, to advocate for “traditional values,” school prayer, Creationism, and parental control of education.⁴

4. 1978 - Christian Voice, founded by Robert Grant and Gary Jarmin, one of the original Christian political advocacy groups.⁵

5. 1979 - Moral Majority, founded by Jerry Falwell to break the traditional Baptist principle of separating religion and politics, a principle that Falwell believed was causing a decay of the nation’s morality.⁶

6. 1979 - Concerned Women for America, founded by Beverly LaHaye, to advocate for school prayer, Creationism/intelligent design in schools, and parental rights.⁷

7. 1981 - Council for National Policy, founded by Tim LaHaye, a pro-theocracy Christian social conservative activist network.⁸

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8. 1981-83 - *Family Research Council*, formed by James Dobson, yet another group created to advocate for “traditional/family values,” school prayer, Creationism, and the rights of parents to control their kids’ education.⁸

9. 1983 - *Foundation for Thought and Ethics*, eventual publisher of the Creationist textbook *Of Pandas and People* (1989), a religious and educational corporation devoted to “proclaiming, publishing, preaching, teaching, promoting, broadcasting, disseminating, and otherwise making known the Christian gospel and understanding of the Bible and the light it sheds on the academic and social issues of our day.”⁹

10. 1990 - *Discovery Institute*, founded by Bruce Chapman. It is the leading promoter of Intelligent Design Creationism.

11. 1995 - *Center for the Renewal of Science and Culture*, founded in order to redefine science and bring about the “death of materialism and the renewal of culture.”¹⁰ It is now the leading agent promoting Creationism/Intelligent Design and is largely funded by conservative Christian donors like Howard Ahmanson Jr., whose stated goal is “the total integration of biblical law into our lives.”¹¹

Science, the scientific/naturalistic worldview, Darwin, and evolution cause great anxiety for these groups, and the fight against science is a central pillar of their existence. For example:

“Our commitment is to see the monopoly of naturalistic curriculum in the schools broken. Presently, school curriculum reflects a deep hostility to traditional Christian views and values and indoctrinates students to a mindset through subtle but persuasive"
arguments. This is not merely a war over ideas, but over young people and how their lives will be shaped. The current deplorable condition of our schools results in large part from denying the dignity of man created in God’s image. Even junior high students recognize that if there is no creator, as textbooks teach, then there is no law giver to whom they must answer, and therefore no need of a moral lifestyle, much less a respect for the life of their fellow man. The message of the foundation is that this is simply unacceptable.”

—Foundation for Thought and Ethics

“Our present moral state of affairs, morbid as it is, is the result of having accepted the entire materialist package, of which Darwinism was an essential part. This package supports all kinds of things which are morally repugnant to Christians, not only Social Darwinism and eugenics, but also sexual libertinism, abortion, infanticide, euthanasia, cloning, and so on. The cause for this moral reversal is secularization… the cause of secularization has been the rise of Epicurean materialism as culminating in moral Darwinism.”

—Benjamin Wiker, Moral Darwinism: How We Became Hedonists

[Mission statement] “to defeat scientific materialism and its destructive moral, cultural, and political legacies; to replace materialist explanations with the theistic understanding that nature and human beings are created by God.”

—Center for the Renewal of Science and Culture

All of these groups are the instigation and support behind every challenge to evolution and science curricula. They are the squadrons and companies in the war between science and religion. None of them are science groups, rather they are Christian-based organizations concerned about the moral implications of scientific findings and the prevalence of the scientific worldview. Recent tactics of the past ten years have seen a switch from the term Creation Science to the phrase Intelligent Design as a way of working around the court decision banning

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14 Benjamin Wiker, Moral Darwinism: How We Became Hedonists (Downers Grove, Ill.: InterVarsity Press, 2002), 297.
15 “The Wedge Document.”
Creation Science from the classroom. Intelligent Design pretends to be a scientific theory, but one of its leading proponents, George Gilder, has openly stated “there is no affirmative intellectual content to Intelligent Design.”\textsuperscript{16} In other words, the science stuff is just for show. “What gives life to the movement are the social implications of Darwinian thinking.”\textsuperscript{17}

\textsuperscript{16} Larson, "The Biology Wars: The Religion, Science and Education Controversy".
\textsuperscript{17} Ibid.
CONCLUSIONS

This review of the historical contexts surrounding the three archetypal stories of the Science v. Religion cannon was conducted to serve several purposes: (1) to learn the facts of each story in order to better understand its contribution to the cannon; (2) to get a better understanding of the environment in which the characters were acting in order to better understand their motivations and concerns; (3) to learn about the outside forces acting on each of the characters to better understand why events played out the way they did, often despite the characters’ wishes; and (4) to see if a more complete understanding of past confrontations can help us better understand, more effectively fight, and perhaps someday win the present-day war between science and religion.

Observation 1: The problem is not Science v. Religion, it’s Religion v. Modernity. Science is just a scapegoat.

In each of these “Science v. Religion” stories, religion, or rather religion’s actor, the church, was already experiencing a crisis when science came into the picture. The churches in all three stories were suffering from internal conflicts caused by broader changes in society and culture, changes that were forcing each church to reconsider its dogmatic and doctrinal positions, but changes that were not directly related to the science at hand. In Galileo’s case, the Catholic Church was dealing with the Protestant Reformation and the Thirty Years War. In Darwin’s case, the Anglican Church of England was under pressure from the new Higher Criticism movement, and during the Scopes Trial, Protestant denominations were struggling with the Fundamentalist/Modernist Crisis (the Higher Criticism movement as it played out in America). In general, times of crisis cause any entity to close in, “circle the wagons,” and react poorly to
new information or outside ideas. This was certainly the problem tying Pope Urban’s hands and affecting his actions toward Galileo. There is an important difference, however, between Galileo’s story and the two later stories in this regard. Urban used Galileo to make himself look stronger, but he did not blame Galileo (or science) for his initial problem. This was not the case with Darwin and the Scopes Trial. In these stories, the churches outright blamed Darwin and his theory of evolution for their problems, even though they were struggling with non-science challenges before Darwin and evolution came along. They transferred responsibility for their internal problems to Darwin, evolution, and science in general, rather than acknowledging the actual problem, namely, the inability of the church to remain credible in light of modern advances. From these stories, we see that science is a scapegoat, not an actual enemy, and this means we should reconsider the usefulness of the Science v. Religion frame. As long as everyone’s attention is focused on a “war” between science and religion, religion is freed from confronting its internal credibility problem. More thought is needed in this direction, but the question is worth considering: Would it be better for science advocates to drop the Science v. Religion “war” framing and instead redirect the focus back to the internal credibility problems of the church? For example, rather than casting Darwin and Scopes as battles between science and religion, should we frame the stories as internal conflicts between religion and modernity instead? Four advantages of this approach immediately come to mind: (1) it’s more accurate and swings the problem back to the real source; (2) it addresses one of the major flaws of the Science v. Religion model: the fact that many religious people have no quarrel with evolution specifically or science in general; (2) it takes pressure off of science because science is no longer named as part of the problem; (3) it puts pressure on religion because antonyms to “modern” are all negative.
Observation 2: For believers, the real concern isn’t science, it’s morality. Science is a red herring.

The speeches of William Jennings Bryan offer a valuable (and eloquent) window into the concerns and motivations of the anti-science, anti-evolution side. In his public addresses, Bryan clearly explains that the problem with Darwin is not the science itself; it is the moral crisis that arises if Darwin’s theory is real. Though this seems obvious and straightforward (and Bryan is far from the only person to express this – he is simply the most articulate), this concern has not been the focus of the pro-science, pro-evolution strategy. Instead, the science armies have taken three sidetracks:

1. “Just Teach the Science.” Most science education advocates have adopted Stephen J. Gould’s Non-Overlapping Magisteria (NOMA) model and believe that if they only teach the science of evolution and ignore the religious implications, each side will be able to “just get along.” This strategy has been minimally effective, but it is necessary because of the peculiar limitations imposed on public schools by the Establishment Clause of the First Amendment of the U.S. Constitution. Public school teachers are not permitted to defend or defeat religious views, so there is little they can do in class to address the religious objections that trouble some students after learning certain scientific facts. This is an unfortunate but understandable and practical position, and it is the basic policy of the nation’s leading science education advocacy groups, the National Center for Science Education, the National Academy of Sciences, and the American Association for the
Advancement of Science.¹ Outside of the classroom, there are no First Amendment restrictions and science advocates have formed two camps with opposite solutions.

2. “Just Explain the Science.” One side believes the Science v. Religion problem stems from a lack of appreciation and understanding of science (and evolution). They see no necessary conflict between science and religion, so their plan is to promote conciliation between the armies of science and religion. They are the Appeasers. They see that believers (and the general public) are removed from science and they think the best way to bridge the divide is to show everyone how wonderful, practical, and beneficial science is. Chris Mooney and his recent book, *Unscientific America*, is a perfect example of this position. Much of *Unscientific America* is devoted to a depressing review of the decades-long decline of respect for science in nearly every realm of society, especially in politics and entertainment. The solution, according to Mooney, is to improve science communication, to train scientists not just in lab techniques but speaking techniques, to make them more “savvy about politics, culture, and the media,” and to generally promote the “value of what science does.”² In other words, in this day and age, though the public lacks science literacy, the problem is the scientists who lack public literacy. Science has missed the marketing boat. It needs a better sales pitch and who better to do it than the scientists themselves?

3. “Just Get Rid of Religion.” Across the aisle from Mooney and the Appeasers are the Antagonists, the New Atheists like Richard Dawkins and Sam Harris. This side sees the entire problem as one of very-real and insurmountable conflict between science and religion. They argue that religious beliefs are antiquated and have no place in the modern

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² Ibid., 124.
world, so if they can just get people to stop believing in ancient books and Gods, everyone will become a reasonable fan of science and evolution. Yes, it is important to communicate the discoveries and advances of science, but the scientific endeavor is diametrically opposed to religious faith, so, according to the Antagonist view, until we get rid of religion, science will forever be under attack. From such a position, the Antagonists have stepped out of their science labs and have started speaking out against religion, faith, and the delusional people who still hold such archaic ideas.

A thorough understanding of Bryan’s complaint (and the similar complaints of Darwin’s era and our own) makes it clear that none of these current strategies address the Science v. Religion conflict as religious people see it and therefore none of these strategies will bring about an end to the war. Strategy 1 will not work because students who are struggling with a moral crisis caused by science (e.g., evolution) cannot be helped by the better teaching of science. If anything, the more solid the understanding of evolution—the more proven evolution becomes—the worse the problem becomes to the Bryan-like religious believer. (With this in mind, it’s easy to see why the growing strength and certainty of evolutionary science has correlated with an increase in religious-based homeschooling.) Strategy 2, the Appeaser position, fails for similar reasons. Mooney and others think that if we can only reach people and show them how science can “transform the future world they will in habit,”3 if we can just reestablish how relevant science is to American life, everyone will see the science light and create a unified, common, scientific culture. The problem, however, is that even though the Appeasers don’t see a conflict between science and religion, many religious believers do. Part of the conflict stems from literal contradictions between scientific facts and religious beliefs, but as Bryan and the anti-evolution

3 Ibid., 119.
groups tell us, the heart of the matter is much deeper and more personal. To them, even the possibility that evolution might be true causes a believer to doubt and therefore threatens the personal relationship between the individual and God. To believers, that relationship is the basis of moral behavior. If evolution is proven to be actually true (which of course it has been), the crisis is not solved, it’s magnified. To go even further, to not just advocate for science and science education but to promote an entire culture based on science, is akin to advertising an entirely immoral society—exactly what believers do not want to hear. In fact, it’s precisely what believers think is wrong with culture as it is now. The mission statements and tracts of anti-evolution and anti-science groups all decry what they perceive to be the rampant immorality of modern culture and they place the blame squarely on Darwin’s demoralizing idea. This very idea is the organizing force behind the entire movement. Mooney and other Appeasers must be familiar with this blame-game, but they seem to forget it when crafting their proposed solutions. Emphasizing science and pretending it poses no threat to religion does not address, let alone answer, the concern that fuels the other half of the Science v. Religion conflict. Strategy 3, “Just get rid of religion,” will not work because it’s aiming for the exact situation that so terrifies Bryan and his fellow believers, a population of non-believers with no personal relationship with God and therefore no sense of moral behavior and no ability to have a moral relationship with anyone else. (This view is encouraged by the direct, angry, and un-empathetic tone that so many of the Antagonists employ toward believers. Believers think this is rude, they take it personally, and they view it as confirmation of their belief that science equals mean and immoral.) Importantly, however, though their tone might be off, the Antagonists come closest to understanding the conflict as the religious believers see it. Unlike the Appeasers, they see that the issue is not about “the value of what science does,” but rather the values of science itself.
The values upon which science depends, e.g., openness, honesty, curiosity, critical thinking, skepticism, and independence, are in many ways antagonistic to religious values. At the very least, they are threatening to a belief in God. These aren’t just the values of science, however, they are the values of modernity, the very modernity that has been causing strife within religious communities since Galileo’s day. It’s the Fundamentalist/Modernity crisis writ large and it’s one of the reasons why believers equate modernity with science and science with immorality.

The nonbeliever’s standard response to this moral problem is to say “you don’t need a belief in God to know how to be moral.” Another variant delves into the psychology of morals and talks about religious morality being an immature morality because it is based on a primal fear of punishment rather than a true understanding of good and bad behavior. This misses Bryan’s point entirely. He is not talking about a morality based on fear; he’s talking about a morality based on love, a morality that makes you do the right thing because you love someone, not because you’re afraid of them. Bryan believes that love is the best guide and the noblest reason to do the right thing, and the example of how to love comes from a believer’s personal relationship with God. As Bryan sees it (and how millions of other believers see it, too), Darwin’s theory of evolution by natural selection eliminates God and therefore eliminates the moral knowledge that comes from having a loving relationship with Him. The Darwinian insult goes even further, though. Not only does it do away with morality based on love, it replaces it with a reward system based on competition, power, and force, i.e., the survival of the fittest. Bryan was convinced that this demoralization was the cause of WWI and all the other evils of his day, and it motivated him to undertake his crusade against Darwin’s theory of evolution. The same motivation drives the anti-evolution/anti-science movement today. If science advocates wish to stop the attacks on evolution and science, they must stop talking about the facts of
evolution, the power of science, and the stupidity of believers, and start addressing this very strong, very emotional, very personal moral anguish.

**Observation 3:** Some of the complaints and fears that believers express about science are completely reasonable and well-founded.

“I have read your book with more pain than pleasure. ‘Tis the crown & glory of organic science that it does thro’ final cause, link material to moral... You have ignored this link; & if I do not mistake your meaning, you have done your best in one of two pregnant cases to break it. Were it possible (which thank God it is not) to break it, humanity in my mind, would suffer a damage that might brutalize it.” —Adam Sedgwick in a letter to Darwin, 1859.

Within a week of reading Darwin’s *Origin of Species*, Adam Sedgwick, the conservative Christian geologist who earlier saw evidence of divine providence in the progression of fossilized organisms, identified one of the most problematic consequences of Darwin’s theory of natural selection. Relating back to an Aristotelian idea Christianized by Aquinas, Sedgwick chastised Darwin for challenging the principle of “final cause,” namely that all things had a purpose and were created by God for a reason. In this view, everything was part of God’s plan. To paraphrase Sedgwick, because everything was given a purpose by God (final cause), the more we learned about nature (the material, what “is”), the more we understood God’s plan for us (the moral, what “ought” to be). Under God’s plan, the “is” and the “ought” were the same thing and natural law became an expression of God’s moral law. Thus it had been for centuries, so Sedgwick was mortified that Darwin’s theory of evolution seemed to break the is/ought link by postulating the random, non-God-driven mechanism of natural selection.

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Sedgwick wasn’t the first to worry about the link between material and moral. Ever since David Hume first raised the issue in 1739, many philosophers and theologians had been dealing with the conundrum. Put simply, Hume noticed that people had a tendency to slip from a description of “what is” to a belief about “what ought to be” without realizing it, thereby moving from an objective statement to a subjective statement as though the latter flowed from the former, and both parts were equally true.

“This change is imperceptible; but is however, of the last consequence. For as this ought, or ought not, expresses some new relation or affirmation, ’tis necessary that it shou’d be observ’d and explain’d; and at the same time that a reason should be given; for what seems altogether inconceivable, how this new relation can be a deduction from others, which are entirely different from it.” —David Hume, A Treatise of Human Nature, 1739.

Hume generally felt that a link between “what is” and “what ought to be” could not be inferred, but people do it out of habit, and the characters from Darwin’s story are a prime example. Every time Galton, Spencer, and Haeckel leapt from Darwin’s biological theory of natural selection to a social, economic, or political theory based on evolution, they fell into the is/ought problem just like the theologians before them. “This” is how biology “is,” so therefore “this” is how society “ought” to be. As Hume pointed out, “is” to “ought” is not necessarily a logical step, and this error is why Galton’s, Spencer’s, and Haeckel’s theories went so wrong.

Before Darwin’s theory, when man and nature and God were all united under God’s plan, the “is” and the “ought” were the same thing. God made everything the way it is, and that’s how it ought to be, no changes, please. Countless kings and popes ruled from palaces for centuries benefiting from such logic, while serfs and peasants stayed in the fields for the same reason. Social and political reformers began to question the ordained order of things long before Darwin came along, but his evolution by natural selection eliminated God’s plan and severed the
divinely decreed “is/ought” link forever. Without God holding the link together, people had to do it and the optimists of Darwin’s age jumped at the opportunity to create new social, economic, and political structures—the opportunity to create a new “ought” from Darwin’s new “is.”

Unfortunately, as history has shown, they weren’t necessarily good at it. The upheavals and revolutions of the 18th and 19th centuries can be interpreted as the failed attempts of people to find an accurate link between a rapidly changing understanding of the “is” and their own opinions of what “ought” to be. Comte asked again, “How does one reorganize human life, irrespectively of God and king?” Bryan and his fellow believers responded, “Not very well. Please give the job back to God.” Science continuously claims to be objective and derives much of its authority from an assumed “neutral” position, but the subjective connection between the “is” of science and the “ought” of the world is unavoidable. History has shown it can also be disastrous, and it’s these disasters that give religious believers pause when they think about scientific discoveries and consider the implications of science for society. Rather than hastily dismissing these concerns (e.g., “Hitler was not an atheist, dammit!”), science advocates need to heed the caution that comes so naturally from non-science observers. It is born out of experience, many bad ones, and though the connections between Darwin and eugenics, racism, genocide, Social Darwinism, revolution, Communism, etc., are not directly causal, they are strongly correlational and need to be recognized and understood.

**Observation 4:** It is not appropriate to include the Galileo Affair in the Science v. Religion cannon.

Galileo’s confrontation with the Inquisition has long been cited as the first and most striking example of religion fighting science, but given the new understanding of the international and political events surrounding Galileo’s trial, it’s time to remove the story from
the cannon. First, far from the “persecuted scientist” stereotype normally ascribed to him, modern scholarship based on transcripts of the trial and documents from Galileo’s contemporaries shows that Galileo was a respected and protected man in his time and was well connected to both the sacred and secular authorities. Though he had enemies and was reported to the Inquisition twice before the main trial in 1633, he was not only cleared of charges but later received private, favorable audiences with the two most powerful men in Christendom, Cardinal Bellarmine and Pope Urban VIII. Galileo was reassured and encouraged with his research as long as he continued to work on “hypothetical” theories and did not claim his findings to be real. This was a restriction of Galileo by the Church, but it should not be considered an example of the “war between science and religion.” Second, we now know that Galileo was not harmed or tortured or forced to spend his post-Inquisition life in prison. He was kept in house arrest, but it was his house and he was permitted to have visitors, research and develop non-Copernican theories, and even occasionally stroll to town. Third, the “Science v. Religion” conflict frame breaks down because the scientist involved (Galileo) was also moderately religious, and many of the religious people (Urban, Bellarmine, and many of the Jesuits) were also moderately supportive of science. Fourth and most importantly, the outcome of Galileo’s story was largely driven by outside forces beyond the control of the two people most involved. In 1633, the Catholic Church (and therefore Pope Urban) was in a crisis that prevented it from continuing its public kindness toward Galileo, but this had less to do with Galileo’s science than his timing. When seen in the context of the Protestant Reformation and the Thirty Years War, the Church’s response and treatment of Galileo was not war-like, it was reasonable. It wasn’t right, but it was reasonable. The Church wasn’t at war with Galileo; it was at war with a different Church and Galileo was just collateral damage.
When I first began this research project, I had high hopes that a thorough study of past conflicts between science and religion could yield helpful insights about present-day conflicts. I had long been struggling with the fact that decades—generations—of science advocacy had passed without any progress, and I hoped to discover something that would improve the understanding of the situation and help point a way out. Clearly, the situation is very complex. Much has necessarily been left out here and I don’t believe there is a single silver bullet answer, but I hope these observations will open new discussions and bring new strategies to the science advocacy table.
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