The Galileo Myth and the Facts of History

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Abstract

A review of Galileo and the heliocentric theory controversy reveals that a major reason for his difficulties was opposition from scientific colleagues. The church became involved primarily as a result of pressure from the academic community. This paper also concludes that the claim that scientists are more receptive to empirical evidence and research than people of faith is questionable. Reactions of today's scientists to innovative ideas and unorthodox views in the area of origins indicate that not much has changed in this area in the past three centuries.

Introduction

In discussions of origins and Christianity in general, the Roman Catholic Church's historical opposition to the heliocentric solar system (i.e., the belief that the Earth and planets revolve around the Sun) is often used to prove the harmful influence of religion on scientific progress. Typical is an editorial in Omni that claimed

> once a religion becomes politically powerful, it suppresses all "heretical" teachings. Galileo was silenced by the Roman Catholic Church. ... Robert A. Heinlein predicted three decades ago that the United States would be ruled by a religious dictatorship in the twenty-first century (Bova, 1981, p. 6).

A more recent example was an editorial that claimed "Western civilization has progressed since Galileo was branded a heretic for observing that the sun has spots and for daring to adopt a radical new theory that Earth is not at the center of the universe." (Marrison, 2002, p. 10). The Galileo affair may be not only the most quoted example of "persecution" of science by religion, but one of the most misunderstood events in history. An example is the claim by Charles Darwin's great great grandson Matthew Chapman in his book about the Scopes trial:

> For supporting Copernican theory in the mid-1600s, Galileo was tried by the Roman Catholic church and put under house arrest for the last eight years of his life. He was not 'pardoned' until 1988 when Pope John Paul II finally conceded that the church had made a 'mistake'. *1988!* Over three centuries to concede a scientific point that every man of reason had accepted two hundred years before (2000, pp. 136–137).

Chapman added that Galileo "had been prosecuted by theologians" and then quotes a trial attorney stating "Haven't we learned anything?... Are we to have our children know nothing about science except what the church says they shall know?" (2000, pp. 194–195). The common myths repeated by Marrison and Chapman are in major areas contrary to the historical record. For example, University of New Mexico History of Science professor Timothy Moy concluded that

> Unfortunately, Galileo's trouble with the Church later became a popular archetype for the historical relationship between science and religion. Nothing could be further from the truth. For most of the medieval and Renaissance periods, and even stretching into the eighteenth century Enlightenment, the primary supporter of research and teaching in the sciences was the Roman Catholic Church. In fact, one historian of science, John Helbron, has recently published a book entitled *The Sun in the Church* that documents how the Church, in the aftermath of the Galileo affair, continued to promote research into evidence for heliocentrism, even to the point of turning entire cathedrals into giant pin-hole cameras to measure the apparent diameter of the solar disk at various times of the year (2001, p. 45).

The Galileo affair has continued to be a subject of much public interest (Sobel, 1999). Another example is that in 1992 Pope John Paul II officially declared that Galileo was "wronged" by the church and the Inquisition. A review of the historical record shows that Galileo's trial "was not the simple conflict between science and religion so commonly pictured" (Hummel, 1986, p. 116) and that the popular conception of the situation is a myth (Lessl, 1999).

It is widely believed that the eventual acceptance of the heliocentric position was one of the many triumphs of sci-

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ence over religion. This view, immortalized by Andrew White (1955), has been naively repeated ever since (Harris, 1973). White's warfare thesis and work has been thoroughly refuted by many researchers (Brooke, 1991). It is more historically accurate to conclude that, although many Jesuits and other clerics opposed Galileo, the main opponents of the new Copernican position were academicians teaching science in the universities, and that much, if not most, of Galileo's support came from church officials. The distinction between the scientific/academic community and the church was far less pronounced in Galileo's time than it is today. In Galileo's day most European educational institutions were associated with a monastery or other church institution, and professors in Catholic schools often were required to follow the rules set for priests, even having to take vows of celibacy. Nonetheless, academic and clerical roles were often clearly distinguishable, although not totally separate as they usually are today (Livingstone, 1987; Moore, 1981).

From our twenty-first century secular scientific and materialistic perspective, and in view of the atheism generally intertwined with science today, it is easy to dismiss the seventeenth-century controversy as a primary proof of the Catholic Church's antipathy to the results of scientific research that conflicted with religious dogma. Seeger concludes that the Galileo conflict is usually cited as an example of the "supposed warfare between science and theology." In fact, he concludes it is "merely an instance of the perpetual clash between an individual's freedom of thought and society's establishment of authority. ...Conflicts between the individual and society are always taking place" (1981, p. 168).

A Short History of the Heliocentric Revolution

The reactions of seventeenth-century Europeans to the heliocentric theory can be understood only by evaluating the entire situation in its historical context. Throughout history, most civilizations understood the Earth to be a world that existed primarily for their benefit and was the physical center of the Universe. The stars guided them at night and revealed information about their lives, the Sun warmed them and lighted their way, and the rain clouds were created to water their crops.

Until the sixteenth century most of humanity accepted the geocentric worldview, viz. that the Sun, planets, and stars all circled the Earth. The common people took it for granted for generations because it fit a simplistic, straightforward view of the Earth-Sun relationship. Geocentrism was both part of their total worldview and intertwined with their religious beliefs. Few scientists since Aristotle challenged it, and since Augustine few churchmen had questioned the theory until Copernicus.

It seemed obvious to anyone who had the blessing of vision that the Sun rises and sets, and that the Earth is stationary (Bentley, 1966). Seventeenth-century scientists and non-scientists alike argued that if the Earth moved around the Sun, wind would blow constantly at a uniform speed and intensity (Draper, 1957). If it moves, why do we not feel its movement as we do when we ride a horse? They were not aware that the Earth is blanketed by an atmosphere that moves with the Earth, but compared their experience with traveling on horses to the Earth traveling in space. Also, if the Earth were traveling around the Sun, what prevented everything from flying off, and what prevented the Earth itself from falling into the Sun? Since they had no understanding of centrifugal force or gravity, the new idea was to them blatantly foolish (Walsh, 1911).

Since it was axiomatic that the Sun moves around the Earth, they argued that anyone who denied this obvious fact was wrong. Even today we say "the Sun rises in the East and sets in the West." The Earth's place in the center of the physical and psychological Universe was a belief taken for granted for centuries (Gingerich, 1993). Scientists saw no significant reason to view the Universe in any other way until Copernicus published his *On the Revolution of the Celestial Spheres* in 1530. For years, new astronomical discoveries were altered or interpreted to fit into the established system by elaborate intellectual schemes (Leith, 1973). It was for this reason that it took several generations after Galileo to prove the heliocentric position true (Wallace, 1986).

Although an early sixteenth-century physician probably originated the modern heliocentrism theory, the one first credited with its scientific development was Nicholas Copernicus (Leith, 1973). Copernicus (1473–1543) was a priest, a student of canon law, and, later, a professor of astronomy. His research on the Sun, Moon, and planets eventually culminated in his 1530 work noted above (Nash, 1929). Importantly Copernicus received much support from the church and its popes, especially Clement VII (Hagen, 1908). Cardinal Schonberg and a protestant clergyman, Andreas Osiander, both helped Copernicus to publish his great work (Koestler, 1959). They even arranged for its printing, and the work was dedicated with permission to Pope Paul III (Hoyle, 1973).

At this early date, the opposition was mostly from the academic community. Gingerich (1981) notes Copernicus' book was highly regarded in Lutheran circles and extensively studied throughout their university system. Fear of exposing himself to the ridicule of common people was a major reason why Copernicus' work was not published until shortly before he died. A major reason they opposed the theory was because it proposed a radically new view of the

universe that contradicted the common view of most people.

The Campaign Against Galileo

When Galileo began his crusade for the Copernican position, to his surprise it provoked the ire of many establishment professors. Galileo no doubt reasoned that Copernicus was a respected orthodox scientist who published his work without major problems from the Church (Hoyle, 1973; Kesten, 1945). The problem developed when Galileo's ideas were looked upon favorably by certain influential churchmen and scientists, causing jealousy in many of his rival scientists (Drake, 1957). A major reason for the academic opposition to Galileo was all the various "natural" philosophies, including physics and chemistry, were firmly based on Aristotelianism (Drake, 1980). Many scholars of the time did not value observation, experimentation, or research, a major means of support for Galileo's conclusions (Wallace, 1977; Ronan, 1974). For centuries, many scholars concluded that the basic truths of nature were to be found in Aristotle's writings and those of his learned commentators (Wallace, 1981). Scientific arguments were settled by quoting Aristotle, a geocentrist whose theories of both the universe and philosophy stemmed from geocentricity (Ludwig, 1978). Logical arguments and reason, they believed, were often more to be trusted than were the evidence of one's senses (Santillana, 1955).

The real threat of Galileo to his contemporary scientists was less his position on heliocentricity than his insistence on observation, research, and experimentation to determine reality (Bergman, 1981). It was for this reason that G. A. Magnini, an eminent astronomy professor at Bologna, openly declared that Galileo's observations, which indicated that Jupiter had satellites, must be incorrect (Ronan, 1974). Although the scientific revolution emerged gradually, and many of Galileo's ideas can be traced to before the thirteenth century, Galileo openly challenged the *whole system of determining truth* that existed then, and therein lay most of his problems (Wallace, 1981; Burnam, 1975).

The famous church-Galileo conflict began around 1611, or about 68 years after Copernicus' book was published. The opposition was generated primarily by "... a body of dissident professors at Pisa who ... had allied themselves with a set of courtiers at Florence" (Ronan, 1974, pp. 131–132). Most of the early organized opposition came from the academicians: they were qualified to argue against it, whereas the common people, few of whom were literate, usually could not articulate valid reasons for their opposition (Barbour, 1971). Conversely, Galileo had many powerful supporters both in and outside the church, a fact that openly infuriated his opponents. Moy notes that Galileo by 1616 had the "support of some powerful liberal theologians, particularly Cardinals Roberto Bellarmine and Maffeo Barberini"—later Pope Urban VIII (2001, p. 44). Some clergy also were very opposed to heliocentrism, and often because of the arguments of the astronomers—and they occasionally tried to use their positions to influence others. Likewise, today many clergy oppose creationism, and their opposition is often based primarily on the authority and power of Darwinists.

To ensure success, Galileo's opposition worked hard to build their case. Although it eventually became apparent that the scientific community's arguments against Galileo's position were not as convincing as they first assumed, Galileo's writings themselves were far less than convincing. Moy concludes that Galileo's 1632 book, which he believed finally proved his case for heliocentrism, did not, but rather:

> Galileo's new proof made no sense; it was a cockamamie argument about how the motion of the tides proves that Earth orbits the Sun, and it just doesn't work. When push came to shove (and it did), Galileo simply did not know how to prove that Earth truly moved. Galileo had therefore crossed the line set out sixteen years earlier—he had promoted an idea contrary to Scripture without providing convincing proof of its truthfulness (2001, p. 45).

It is no wonder many of Galileo's critics remained unconvinced. On the other hand, many in the church were anxious for new ideas, and the honors it bestowed upon Galileo made his enemies furious:

> They were all jealous of the special treatment Galileo was given [by the church and] of his large salary and of the continual favours bestowed upon him personally by the Grand Duke. In addition, the academics were furious that this braggart of an anti-Aristotelian should be in a position to promote his iconoclastic views (Ronan, 1974, pp. 131–132).

Santillana concluded that during the first half of the seventeenth century

> a major part of the Church's intellectuals were on the side of Galileo, while the clearest opposition to him came from secular ideas. It can be proved further ... that the tragedy was the result of a plot of which the hierarchies themselves turned out to be the victims no less than Galileo—an intrigue engineered by a group of obscure and disparate characters in a strange collusion who planted false documents in the file, who later misinformed the Pope, and then presented to him a misleading account of the trial for decision (1955, pp. xii–xiii).

Frustrated at trying to stop Galileo with scientific arguments, his detractors decided that it was much easier to quiet him on grounds of heresy. The church was used by

the academic community to squelch what some academicians felt was a threat to both their method of knowing and their authority. Ronan notes that Ludovico delle Colombe's anti-Galileo faction were

> disappointed with the way the argument on floating bodies had gone, [and] decided that it was time to carry the attack on Galileo into court circles, and to shift the emphasis from problems in physics to the far more dangerous ground of religious fidelity. Formal court banquets provided suitable occasions, and one day, when Galileo was not present, the opening salvo was fired by the pious Dowager Grand Duchess Christina who raised the question of the religious orthodoxy of the Copernican view. Unwittingly primed by Boscaglia, the university's strongly pro-Aristotelian professor of philosophy, the Grand Duchess questioned the Benedictine monk, Benedetto Castelli, who was a well-known pupil of Galileo's, asking him whether a moving Earth was not contrary to the Scriptures (1974, pp. 144-145).

In this case the science professors and establishment scholars actually were greater enemies of science than religion. Certain secular astronomers even refused to look through Galileo's telescope to verify his observations, whereas the Jesuit astronomers in contrast were willing to look through his telescope and "saw the phenomena for themselves, were convinced, and turned to honouring and feasting Galileo: after all, was he not Jesuit trained, a true son of the Church, whose fame brought distinction to the Order?" (Ronan, 1974, p. 127). Not only were these Jesuits delighted with Galileo, but also during a visit to Rome he had an audience with Pope Paul III that evidently made such a favorable impression on the Pope that

> afterwards church dignitaries vied with one another to do him honour. In brief, the trip was an unqualified success, a triumph for Galileo and his telescope. ... As far as Galileo was concerned, he was overjoyed with the reception he had received; his telescopic observations had been confirmed by the highest astronomical authority in the land; he had the support and friendship of Prince Cesi and, it seemed, the sympathy ... [of] Cardinal Barberini. Church and society were on his side; what more could he ask? (Ronan, 1974, p. 131)

Galileo's main problem, what Santilana called his "fatal mistake," was his

> rash indiscretion, his insistence on throwing open to the common people, by writing in the vernacular, a question which was far from being settled ... the proper approach would have been to write elaborate tomes in Latin and then patiently wait for the appraisal of the scholars ... (Santilana, 1955. p. 18).

When Galileo was brought to trial the second time, he was a man of nearly 70, in poor health, and, partly for this reason, the churches' interference in his life work was actually minor. He had many research interests, most of which he could pursue without problems, and the trial only forced him to regard any findings that directly supported the Copernican system as theory and not fact (Brodrick, 1964; Drake, 1957; 1967; 1974; 1981; 1983). It is also commonly claimed that Galileo was tried and found guilty of heresy. In fact, "Galileo was never charged with nor tried for heresy, as is commonly believed. Heresy was a far more serious offense and carried a much stiffer penalty" (Moy, 2001, p. 45). Galileo was in fact tried and found guilty only of not keeping the agreement he made in 1616 to discuss heliocentrism as hypothetical only until definitive proof was forthcoming. In Galileo's day "no one had yet come up with a convincing proof that Earth really flew around the Sun at great speed, as Copernicus's proposal required" (Moy, 2001, p. 44).

Although the outcome of the second trial hindered him from directly researching heliocentrism, Galileo nevertheless continued to make major discoveries in his many other areas of interest. His last major astronomical discovery made in 1637 proved that the Moon swayed or vibrated as it circled around the Earth. Galileo's defeat was primarily psychological, although it is true that some branches of the Catholic Church later attempted to suppress his heliocentricity work. And, as is quite clear from the literature, the reasons for suppression included the opposition of major portions of academia against Galileo and his ideas.

Ironically, the Catholic Church's response probably encouraged many people who otherwise would not examine the heliocentric view, and as a result many eventually accepted it. Although the heliocentric revolution had begun with Copernicus, most universities still taught geocentricity years after Galileo died (Spielberg and Anderson, 1987). When Harvard was founded in 1636, the faculty remained "firmly committed to the Ptolemaic theory." The facts reviewed here are widely known among science historians. An article published in a journal that is openly hostile to the religious worldview concluded that:

> While scholars have (naturally) been unable to come to a consensus on why Galileo was tried by the Inquisition, almost all historians agree that it was *not* primarily because Galileo believed in the Copernican heliocentrism (Moy, 2001, p. 43 emphasis in original)

The Major Sin of the Catholic Church

The Catholic Church's major sin was probably capitulating to the pressure from the scientific community, certain Jesuits and other enemies of Galileo. Only as a result of pressure from the secular establishment and the Aristotelian

philosophers did the Catholic Church firmly side against Galileo (Himmel, 1986). An important factor in the controversy over heliocentrism was the matter of how to interpret the Scripture's descriptions of nature in harmony with the authority of factual observations about nature. The struggle was "a complex power struggle of personal and professional pride, envy and ambition, affected by pressures of bureaucratic politics" (Himmel, 1986, p. 116).[1] Galileo rightly understood that natural theology and divine revelation could not be in conflict. He reasoned that God could not say one thing in His Word and something else in "His natural revelation," the natural world. If there is a discrepancy, it must lie with our understanding or interpretation of either the natural world or God's revelation, and this means more research, study, understanding, and patience (McMullin, 1988). It also means we should not reject scripture for human interpretations of our currently limited scientific data. Science books that are only a few years old are commonly found to be wrong or misleading in the light of new research.

The Catholic Church was by no means innocent, but in fact was guilty of much repression and persecution of dissidents, including various Protestants, Jews, and others who dared to disagree with it. The scientific community, though, also has been historically guilty of much persecution of its dissidents, heretics, and even its most promising sons (Brewster, 1841; Nash, 1929). And science may be even more guilty than some religionists (Walsh, 1911).

Examples of the Same Problem Today

The same problem still exists today, and many mainline Church leaders are again making the same mistake that they made in Galileo's time by siding with the secular establishment and supporting evolutionary naturalism (Johnson, 1995; Moore, 1979). They have again rejected Galileo's "Book of Nature" concept and elevated nature not only to a god status, but to the creator as well.

The orthodox science position is that the creation created itself and that natural law only is responsible for, and can fully explain, the existence of everything in the Universe. Many prominent opponents of creationism and even intelligent design today are theologians (Numbers, 1992). Editorials such as in the secular humanist magazine, *The Free Inquirer*, commonly claim that the evolutionists' strongest allies are the clergy. Many modern denominations may again be proved wrong for defending a belief system that is both without empirical foundation and intellectually bankrupt. History may also again condemn religion for once more siding with the scientists:

> Today many churches and theologians have great respect for natural scientific conclusions. Sometimes they suppress ideas they would espouse in the absence of those conclusions.... But holding unwarranted respect for all things scientific is dangerous. It was ever so: when Greek science became widely available in the West in the thirteenth century, it eventually helped to provide theologically dogmatic answers to the great cosmological questions. Will modern theologians and churches adopt uncritically modern natural scientific ideas concerning origins and order and convert those ideas to theological dogma today? (Maatman, 1994, p. 181).

The history of the university reveals that the academic community not uncommonly has been, and still is, intolerant of dissonant views (Bergman, 1993). Once convinced of the righteousness of a cause, educated persons sometimes are more vehement in suppressing opposition than their less-educated brethren. It is no accident that Hitler arose, and the Holocaust occurred, in a country that had a higher educational level and a greater percentage of Ph.D's than any other nation in the world. With very few exceptions, academia supported Hitler's tyranny and policies (Morse, 1968).

Kindness, compassion, and love for one's fellow humans are not a prerequisite to earn a Ph.D., and the highly intelligent often are stereotyped as sadly lacking in these qualities. Few universities encourage the development of these traits, and many probably suppress them. Higher education often exposes one to other cultures and peoples, and may increase tolerance in these areas, but it does not always increase tolerance for a diversity of ideas. All too often education indoctrinates those in its care in a certain worldview, and for this reason college graduates have re-

[1]One reviewer of this paper stressed that I should add that Galileo tried to defend heliocentrism to Catholic theologians by arguing that Biblical scholars should take into consideration well-established facts about the world from science as they interpret Scripture: "The Catholic Church at the time did not generally appreciate the now well-understood concept of phenomenological language in Scripture. Scripture describes events as they appear to an observer on Earth. To take scripture to be a literal precise description of the actual processes involved (like scientific theories) fails to interpret Scripture as it would have been understood by the original readers. In general, this was not appreciated in Galileo's day by the church, and is still a concept rejected even today by today's geocentrists. The Catholic Church's sins included they gave too much credence and authority to Aristotelian philosophy and did not have an adequate approach for interpreting Scripture. This made them unable to accept important new discoveries. Although they also capitulated to pressure from the scientific community, I would view that as more of a symptom of the problem and not the root problem."

markably similar views on a wide variety of social questions, from abortion to zoophilia, from gun control to religion (Robertson, 1981). In our age of almost worship of the science enterprise, it is quite possible that a more accurate view of reality will be dismissed simply because it does not conform to some body of scientific opinion. And the view often most at issue is religion:

> In research universities, "the religious people keep their mouths shut ... And the irreligious people discriminate. There's a reward system to being irreligious in the upper echelons." Stark suggest that perhaps more NAS members are religious than think it politic to admit (Larson and Witham, 1999, p. 91).

Censorship of professors and ideas has been with us for a long time, and is still very much with us today. Gruber's extensive study concludes that the problem of suppressing minority views in science—or those that were considered threatening to the existing social order—was historically common in

> virtually every branch of knowledge, repressive methods were used: lectures were proscribed, publication was hampered, professorships were denied, fierce invective and ridicule appeared in the press. Scholars and scientists learned the lesson and responded to the pressures on them. The ones with unpopular ideas sometimes recanted, published anonymously, presented their ideas in weakened forms, or delayed publication for many years (1981, pp. 203).

These practices are still true today. Max Planck, after discussing his revolutionary work that concluded energy, like matter, exists in units or quanta, stressed: "It isn't a matter of the strength of the arguments. It's a matter of the old scientists dying off" (quoted in Durden-Smith, 1981, p. 91). Before an article is published in a scientific journal, it must be approved by a board of reviewers or *referees*. The valid requirement to select work of high quality not uncommonly results in excluding unorthodox or new theories, blurring the distinction between refereeing and censoring. Rejection of a scientific paper because it disagrees with one's personal opinions is common, and sometimes a new journal is founded because of such incidents. Professor Bateson, when serving as a referee, once rejected a paper submitted by Karl Pearson and his colleagues who responded by founding a new journal called *Biometria* as an outlet for their articles.

Unfortunately, many ideas in science are at first seen as "fringe" or pseudo-science. One very efficient strategy for insuring that certain ideas are not seriously discussed in scientific circles (much less gain acceptance) is for critics to label them "pseudo-science" before they are examined carefully. This often insures that they will not get a fair hearing. Pomeranz found that acupuncture, administered by his co-worker to anesthetized animals, caused neuron cells to no longer fire for about twenty minutes. Pomeranz became extremely interested in acupuncture and pain. Unfortunately, though, Pomeranz found it was difficult to interest others in his research to the extent that he

> has had grant applications turned down for work on "acupuncture," only to have them accepted the following year for "peripheral electrical stimulation"—in effect, the same thing, as almost all acupuncture involves the use of electrical charges. He has had to combat the skepticism of his peers by using 10 control groups in an experiment where one would be more usual. Though his more conventional work has appeared in *Science*, the most prestigious of the American scientific journals, he has yet to publish a single paper there on acupuncture and its effects. "In fact, they've never taken one paper, however highly reviewed," he says, "that didn't knock acupuncture." (Durden-Smith, 1981, p. 91).

Even highly qualified scientists have difficulty publishing if their ideas are too controversial. One of the most eminent modern astronomers, the late Fred Hoyle, lived for many years "almost in exile from the scientific world community" (Overbye, 1981, p. 69). A founder of a major research institute at Cambridge University in 1967, he was widely considered one of this century's most creative, published (and controversial) astronomers.

After study and pondering the origin of life problem for some time, Hoyle concluded that conditions on Earth were never such that life could have originated naturally here. His problems stemmed not so much from his new theories, which he admitted had problems, but from questioning some of the older scientific theories that have become sacred such as the spontaneous generation of the first form of life. Hoyle concluded that "Heavy government funding of science is the mainspring of a degeneration of science into conformity. The system has a natural evolution towards killing minds" (quoted in Overbye, 1981, p. 72).

His research led him to postulate that if life arose naturally, it must have "originated in space and migrated to Earth abroad comets" or similar means (Overbye, p. 69). Hoyle also got into trouble for questioning the Big Bang hypothesis, the theory that matter, energy, space, time, and the laws of physics flung themselves into being "like a party girl popping out of a cake." Hoyle concluded: "It seemed absurd to have all the matter created as if by magic" (Overbye, p. 70).

Although he was recognized as a highly influential thinker in astronomy and was knighted by Britain's Queen Elizabeth II in 1972 for his contributions, conflicts with colleagues over his conclusions became so great that he was forced to leave Cambridge in 1971 (Maddox, 2001, p.270). Yet, one well-known astronomer admitted he did not believe "there have ever been any victories against

Hoyle" (Overbye, 1981 p. 72). The long term editor of *Nature* John Maddox stated that

> only last year came the book *A Different Approach to Cosmology*, by Hoyle, Geoffrey Burbidge and Narlikar, published by Cambridge University Press. This is a scholarly rather than a polemical work, in that it is a well-documented guide to extragalactic evidence against the Big Bang (a term, incidentally, intended to be derisive, that was coined by Hoyle himself in a broadcast lecture of 1952). My own conviction is that Hoyle's scepticism was well-founded. But it is too soon to tell how the Big Bang will be replaced by some other cosmology. That is heterodoxy. Soon after *A Different Approach to Cosmology* appeared, I asked one of Hoyle's former colleagues if he'd read it. "Wouldn't waste the time," was the reply. The hope must be that civility will break out among Hoyle's enemies now that he is dead (2001, p. 270).

Maddox adds that Hoyle and three colleagues published in 1957 in *Reviews of Modern Physics* a "classic paper now known affectionately as B^2FH. Fowler won a Nobel prize for his work. Hoyle, shamefully, did not" (2001, p. 270).

Francis Crick, likewise a Nobel Prize winner and one of the most eminent living scientists, also has voiced heresy. Like Hoyle, Crick feels that the conditions never were appropriate on the Earth for the self-formation of life, and thus also has hypothesized a panspermia theory (Crick, 1981). Niles Eldredge, who himself has been under fire because he has questioned the slow, gradual Darwinian evolution and advocates in its place a form of the punctuated equilibrium theory, stated that

> Crick's book strikes me nothing short of a disaster. To be sure, poorly written books by eminent scientists abound, and ... Crick has every right to hold—and publish—any idea he wants, however odd it may seem. But in science, ideas for which there are few ways to test, for which there is virtually no accumulated corroboration, and which address phenomena for which there are simpler hypothesis, usually do not command book-length treatment (1981, p. 94).

Did Crick also encounter difficulties in obtaining grant money and publishing his views as a result of this book? Some people feel this book, at the least, tarnished his reputation. One may experience difficulties publishing in a refereed journal, but sometimes can publish in the open market, although even best-selling authors such as Velikovsky have experienced problems (Bloch, 1975). Velikovsky's main thesis is the major events in the history of Earth and other planets have been dominated by catastrophism rather than uniformitarianism (Goldsmith, 1997). He correlated these proposed catastrophes with world events, including those mentioned in the Bible. Gardner notes that the first response of many scientists to Velikovsky's work, led by Harlow Shapley of Harvard University, "was one of rage," and a

> flood of indignant letters to the publisher from scientists who threatened to boycott the firm's textbooks, led to the dismissal of the associate editor who brought the manuscript to the company's attention. Publication rights were turned over to Doubleday. ...which has no textbook department ... (Gardner, 1957, pp. 28–29).

Block noted after *Worlds in Collision* was published in 1950, "a modern classic case of academic demagoguery" followed:

> Scientists and scholars who supported Velikovsky's thesis—and even those who simply defended his right to be heard—were shouted down. Some, like astronomer Gordon Atwater and Macmillan editor James Putnam, were summarily dismissed from their positions. Favorable reviews of the book were killed before their publication, to be replaced by fervent attacks on 'irresponsibility' in the publishing industry. All too frequently, these attacks were written by scientists who admitted that they had not read *Worlds in Collision*, while those who had read the book grossly misrepresented the author's position and ignored or distorted his evidence. The book's publisher, Macmillan, came under such pressure in the academic community that it was forced to transfer the publication rights to Doubleday, even though at that time the book had been 20 weeks on *The New York Times* best seller list (1982, p. 929).

The 1950 meeting of the American Association for the Advancement of Science set up a "theory-censoring board" to prevent publication of what in their judgment was "the wrong kinds of science books" such as those that openly support creationism or Biblical ideology. One difference is that Galileo has largely been vindicated by science, while the jury is still out on many of Velikovsky's ideas. This is precisely the point: it is easy to condemn or censor ideas that seem wrong, but few condemn those whose ideas seem correct. Therefore, those whose ideas seem wrong are the scholars in need of protection.

Although Velikovsky's work is still very controversial, some claim that certain of his predictions have proved correct, and his ideas are no less fantastic than some of those proposed today by other, more mainline catastrophists such as the theory of dinosaur extinction proposed by Luis and Walter Alvarez (see Alvarez, 1997). Velikovsky engaged in a written debate with Albert Einstein right up to the latter's death in 1955, and although Einstein "accepted Velikovsky's evidence of recent catastrophes," he was adamant that certain other of his ideas were wrong until

> just a few days before he died, Einstein learned that radio noises had been detected from Jupiter, he offered to use his influence to arrange other experi-

ments on Velikovsky's behalf. Albert Einstein died with *Worlds in Collision* open on his desk (Bloch, 1982, p. 931).

The major reason for university terminations today is not incompetence, but rather conflicts between the fired professor and his or her colleagues based on differing beliefs and opinions about academic or political/cultural matters (Bergman 1980; 1993).

Hoyle is not the only modern eminent astronomer who has suffered a fate that in many ways is worse than that of Galileo. Linus Pauling, who has the rare distinction of earning two Nobel Prizes, likewise dared to oppose the scientific community. Finding it difficult to obtain grant money for his research, he was forced to set up his own foundation so he could support his research from public contributions (Gardner, 1991). Horgan concluded that "science today is locked into paradigms. . . and if you try to get anything published by a journal today" that contradicts the orthodox paradigm chances are "the editors will turn it down" (1995, p. 47).

Significance of the Galileo Case for Science

Religion has no monopoly on intolerance. Intolerance is a characteristic of imperfect humans and a trait that all of us must work assiduously to overcome. Testifying today against Darwinism can result in death threats, as has happened to Fred Hoyle's colleague, Chandra Wickramasinghe (threats that, according to the March 1982 issue of *Discover* magazine, the police took "very seriously.") Isaac Asimov concluded that if a

> heretic is himself a scientist and depends on some organized scientific pursuit for his living or for his renown, things can be made hard for him. He can be deprived of government grants, of prestige-filled appointments, [and] of access to the learned journals (Asimov, 1977, p. 7).

Today, more than ever before, we must realize that in experimental science ideas should be silenced *only* by empirical evidence that comes from experimentation and replication (Redondi, 1987; Langford, 1965). Since origins science is at its core, history, and not directly based on empirical, laboratory science, much speculation is involved. It is unfortunate for science that there is not more tolerance in this area in the twenty-first century.

Reports of terminations and other problems in academia based on religious beliefs now abound in the literature, forcing one to ask, "Have things changed much since Galileo?" The answer is, probably not very much. Harvard's Owen Gingerich concluded that "...scientific censorship, remains in our world today, and it may well be far more effective and insidious than in the seventeenth century" during the time of Galileo (1981, p. 60). Sir Fred Hoyle in an introduction to one of his books concluded:

> The popular belief is that the Copernican Revolution and the inquisition of Galileo are things of the past. Human societies, it is claimed, have progressed beyond the stage when such outrages could happen again. In this book we show that the Copernican Revolution is far from over, and that society has not improved since the sixteenth century in any important respect. If anything the situation may have got worse, with the successes of the Industrial Revolution conferring upon human beings a degree of arrogance not seen before (1993, p. 1).

The fact that many science heretics are proved wrong and fade into oblivion does not justify the persecution often meted out to science innovators. Asimov warned that in science the insiders or professionally trained scientists, what he calls endoheretics, are "sometimes right, and since startling scientific advances usually begin as heresies, some of the greatest names in science have been endoheretics" (Asimov, 1977, p. 12). This is proving true, even today. And as is true in the current creation-evolution controversy, Darwinists have worked hard to gain support from both the clergy and the common people. Although many clerics also opposed Galileo's position, they were critical of him and his work for reasons having nothing to do with religion (Schirrmacher, 2000; Gerard, 1908). They, too, were part of the zeitgeist of the time, and as is also true today in the Darwinism controversy, many clerics went along with the conclusions of the academic establishment.

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Book Reviews

Boltzmann's Atom by David Lindley
The Free Press, New York. 2001, 260 pages, $24

Just a century ago, many scientists rejected the concept of atoms. Ernst Mach (1838-1916), for example, rejected atoms because they could not be directly seen. Ludwig Boltzmann (1844-1906), in contrast, promoted atomic theory since atoms nicely fit his theoretical research on gases. Still today there is ongoing, good natured tension between experimental and theoretical physics, although the existence of atoms is now clear.

Boltzmann is of interest to creationists since he pioneered the understanding of the Second Law of Thermodynamics. His classic paper in 1877 gave the statistical definition of entropy, the universal tendency in nature toward disorder. Neither author Lindley nor Boltzmann apparently understood the conflict between the Second Law and evolutionary progress. In fact Boltzmann became a promoter of the new ideas of Darwin. Boltzmann's words: "The overall struggle for existence of living beings is…a struggle for [order], which becomes available in the flow of energy from the hot sun to the cold earth" (p. 225). As we know today, raw energy without intricate processing brings only further disorder, not order. Boltzmann was on good terms with the outstanding theoretician and creationist James Clerk Maxwell (1831-1879). The book gives intriguing details about several personalities. For example, Maxwell wrote poetry, often used humor, and he spoke with a strong Scot accent. Boltzmann was a pianist, father of five, and was a poor lecturer. Maxwell was a theist but Boltzmann apparently was not.

Boltzmann did not have a happy life. He was afflicted by *neurasthenia*, a term of his day for depression and anxiety. He finally took his own life by hanging. This sad practice of suicide was popular in Vienna around 1900. The author makes an important general statement concerning faith: "There comes a time when circumstances are so hard that muddling through doesn't work any more. Then one has to fall back on reserves of inner strength, on principles or beliefs. And if there are no such principles or beliefs, perhaps death begins to seem the only option" (p. 223). A eulogy for Boltzmann by Ernst Mach took another direction. Mach concluded that, in view of the intense rivalry over ideas between scientists, "the surprising thing was perhaps that cases such as the unfortunate death of Boltzmann did not occur more often" p. 218). In other words, he was surprised more scientists didn't kill themselves!