

Punishing Scientists For Seeking Truth

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Belief is a guess which is formed in the absence of adequate substantiation. Of those beliefs which can be subjected to scientific evaluation, some are proven to be true whereas others are falsified. For example, until 350 years ago many people believed that maggots arose from rotting meat. In 1668 a scientist named Francisco Redi performed a series of experiments which proved that flies arose not from rotting meat, but from eggs which were deposited upon the meat by female flies. Redi used the scientific method to test a widely held belief, and in this case he proved the belief to be factually wrong.



Sometimes scientific analysis of a belief shows it to be true. When that happens the belief is thereafter properly referred to as a fact. For example, many religious traditions believe that blood is the life force of the body; modern biological science has proven that belief to be quite accurate.

Dogma is a belief which is uncritically accepted by adherents. Fundamentalist dogma are those guesses which are zealously defended by true believers, individuals who are unwilling to question the validity of their guesses. True believers do not seek enlightenment; in fact, their inquiring faculties are intentionally suppressed both by the individual, and the group. Fundamentalist zealotry is not limited to religion; indeed, many political and cultural groups are quite dogmatic.

In the 700 years since modern science emerged, an accumulating body of scientific fact has regularly challenged fundamentalist dogma. As an example, consider the belief which held that the earth is flat. Observation by scientists, including photographs from space ships have proven that dogma to be invalid.

Unlike dogma, the data and conclusions of science are without agenda. The very nature of science is to perpetually explore the new, even if doing so leads to evidence that popular theories are no longer valid. In order to guard against contamination from politics or personal viewpoint the method of science demands transparency, replicability and mathematical validity. Only those findings which can be recreated to a level of statistical significance are granted influence and relied upon thereafter. Science celebrates when earlier theories are replaced by more advanced findings.



As one might suspect, scientific data which does not agree with fundamentalist dogma can provoke a hostile response. One example of fundamentalist retaliation against a scientist is the execution of Giordano Bruno on February 17, 1600. Bruno publicized the

findings of Nicolas Copernicus. Copernicus was a scientist who carefully recorded the movement of heavenly bodies in the night sky. The observations and mathematical equations of Copernicus proved that that heavenly bodies do not rotate about the earth, as was commonly believed. Further, Copernicus proved that the earth rotates on its axis once per day, and that the earth travels a path around the sun once per year. As punishment for traveling throughout Europe lecturing upon Copernican astronomy, religious fundamentalists arrested Bruno and burned him alive.

What happened to Bruno is not isolated; history records hundreds of events wherein scientists were punished for their findings, when the findings challenged prevailing dogma. This leads us to the central thesis of this discussion:

When the results of scientific inquiry invalidates dogma, fundamentalist zealots attack science and scientists.

Two intertwined cycles exist; together, they demonstrate the mechanics of the phenomenon just mentioned. Within the cycle of science, experiment and observation produce evidence which under girds an explanation. As experiment and observation are repeated, the body of evidence increases and the explanation gains solid footing. In some cases the explanation (theory) becomes a fact or a law.

The second cycle is responsive to the first, when accumulating evidence under girds a theory which contradicts a prevailing dogma. In response, fundamentalist zealots do not chose to re-evaluate their belief in light of the accumulating evidence; instead, they attack both the scientists, and science itself.

The actions of fundamentalist zealots demonstrate a second thesis:

Inquiry is the enemy of dogmatic fundamentalism.

What is the nature of such attacks? One can assume, rightly, that they are devoid of scientific merit. Below are four categories into which one can classify the various responses by zealots to contrarian scientific findings.

METHOD 1: Arrest, torture, intimidate, or kill scientists. This method was the most popular response to unwanted science during the first 400 years of the modern scientific era, though it certainly has continued since then. A few examples serve to illustrate.

Galileo Galilei built his own telescope, and then he carefully studied the sky above. Galileo wrote down his observations about the movement of stars and planets across the night sky. Using his telescope, Galileo also studied the surface of the sun. As a scientist, Galileo spent considerable time evaluating the data which he had collected. His conclusions were



astounding, and they changed the way we view the heavens forever. Consider some of his findings:

1. Galileo observed mountains and craters on the moon, disproving the popular belief that the moon is flat.
2. Galileo observed that the Milky Way is comprised of millions of stars, disproving the belief that it is merely a smear of light.
3. Galileo observed that Venus travels a path around the sun, disproving the belief that Venus rotates around the earth.
4. Galileo observed sunspots, disproving the religious dogma of heavenly incorruptibility. Galileo's observations of sunspots also proved that the sun rotates on its axis.

For these transgressions, Galileo was arrested, tried and sentenced to life imprisonment by religious zealots. In exchange for a recantation, Galileo was permitted to live the rest of his days at home under house arrest.

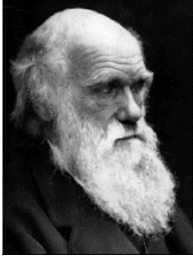


During the Soviet cultural revolution, Trofim Lysenko, a Russian biologist, wielded great political power. Lysenko did not hesitate to label as "enemies of the Soviet people" anyone who did not agree with the Lamarckian view of biology. Lamarckism holds that it is not an organism's genetics which determine the phylogeny of the next generation; but rather, the organism's will to change. As one might imagine, such a dogma does not hold up to scientific scrutiny, thereby putting at peril those scientists whose experimentation and analysis falsify it. Because of Lysenko's unwillingness to embrace the scientific method of experimentation and statistical analysis, Soviet biological sciences fell far behind the rest of the world.

Josef Stalin killed thousands in his quest to purge free thought and individualism in Russia. No one represented independent thought and a spirit of inquiry more than academics and scientists. As a result, these inquirers were especially targeted for arrest, torture, and execution. Stalin's dogma was simple: What is best for the people is socialism. Dissent, even that which was based upon scientific analysis and statistical significance was treasonous, and was punished severely. Stalin is not alone; non-benevolent dictators always move to stifle the forces of inquiry and thought, because they cultivate the human desire for freedom and self-actualization. This is true not only for dictators of countries, but also for dictators who rule religious and cultural groups as well.



METHOD 2: *Ad homonym* personal attacks designed to embarrass or discredit an individual scientist.



Charles Darwin conducted three years of detailed scientific observation in the Galapagos Islands and other places. Recognizing the mathematics and mechanics of natural selection, he never the less feared backlash from religious zealots were he to publish a record of his observations and the conclusions which they suggested. Because of these fears, which later proved to be accurate, Darwin withheld publication of "Origin of the Species" for 20 years.

Many religious fundamentalists hate Charles Darwin not only because his observations and theories helped introduce the science of evolutionary study, but also because he was a seminary student whom they feel betrayed his Christian faith. Darwin is sometimes called "The father of monkey science" by his detractors. Fundamentalists sometimes report that Darwin recanted his theories while laying upon his deathbed, as a way of discrediting Darwin's seminal work. The claim that Darwin recanted is, in fact, not true. Darwin's daughter, Henrietta, attended Darwin at his death and she reports that Charles Darwin died fully convinced that his theory was proper.

A current example of *ad homonym* attacks by zealots upon a scientist whose work reveals truths they wish to keep concealed can be found in the story of Tyrone Hayes, the youngest full professor ever hired by UC Berkeley. Dr. Hayes, a developmental endocrinologist, is an expert on the effects of atrazine, and has published a number of papers on the subject. Atrazine is the most commonly utilized weed killer in the world, and the second most common contaminant found in drinking water in the U.S. Atrazine is an endocrine disrupter which has deformed and sterilized animals in Dr. Hayes' laboratory.



The problem is this: The research conducted by Dr. Hayes places Syngenta, the company which manufactures atrazine, at risk for loss of profits. As one might expect, the response from within the chemical industry was swift. Dr. Hayes has been labeled a "junk scientists", and his research has been called "more akin to a Brothers Grimm fairy tale than science".¹ Even a pre-eminent scientist is not insulated from the fury of the enemies of free inquiry.

It is illuminating to read a quote by David Stockman, who was Ronald Reagan's budget director. Mr. Stockman explained the pervasive view of science found among corporate and religious zealots: "We know what we want to do, and they'll only give us contrary advice."¹

METHOD 3: Misrepresentation of the facts at hand.

Examples of the misrepresentation of facts are plethora among the current Bush administration. In order to advance the dogma of unfettered capitalism, and the social mores of religious fundamentalism, it is necessary to subvert decades of environmental, social, and biological research upon which environmental and social law has been predicated.

For example, a growing body of scientific evidence substantiates the claim of lesbians and gays that their sexual identity is biologically assigned. The evidence and conclusions of these studies directly contradict religious dogma which holds that gays and lesbians chose to be who they are, and the accompanying belief that lesbians and gays can therefore chose to become heterosexual if they want to.

The "choice" dogma is relied upon to justify hostility towards homosexual people under the theory that if you make them miserable enough, they will give up being gay or lesbian and chose to go back to being straight. Because there is not a single academically sound study to substantiate the choice dogma, and because dozens of biological, sociological and psychological studies substantiate the assertion of early sexual preference assignment, the biological and social scientists whose work has been published are under attack by zealous religious activists. To zealots facts don't matter unless they agree with pre-determined dogma.

A non-religious example are the many reliable studies which have established a link between burning coal and the deposition of mercury in bodies of water downwind. Scientific technology has developed methods by which a substantial amount of mercury can be removed from the gasses released by coal burning power plants. The Bush administration has attacked those scientific studies as "junk science", and therefore rolled back the EPA rules and deadlines for power plants to clean up their emissions. Scientists who study this type of pollution are finding their funding cut off, and a recent law passed by the Republican controlled Congress does not permit the US government to rely upon contrarian scientific papers when establishing environmental regulations. Further, the current administration, full of self-admitted religious fundamentalists and proponents of unfettered capitalism, characterize emission studies which disprove their dogma as "inconclusive." Naturally, industry-funded studies are received more favorably.

Though there are millions of items of evidence which substantiate the law of evolution, and in spite of tens of thousands of peer reviewed studies which analyze the chemistry and mechanics of evolution, and the absence of a single peer-reviewed, academically solid study validating any alternative views, there has sprung up a sizeable following for the so-called "Intelligent Design" (ID) theory. Briefly, ID holds that God created everything, and that nothing evolved, and there is no such thing as natural selection. Intelligent Design is a religious belief disguised in the trappings of science.

What is stupefying is the misrepresentation of facts by proponents of ID. As an example, consider one of the arguments which ID proponents offer as support for their theory: Entropy.

The second law of thermodynamics, also known as entropy, can be expressed in terms of the flow of heat, or it can be described in terms of order within a closed system. Within such a system, order diminishes over time. This process is irreversible unless more energy is added into the system. Because closed systems are in a state of perpetual decay, and because natural selection represents the progression of organisms from a less ordered to a more ordered state, ID proponents claim that the second law of thermodynamics disproves the possibility of natural selection.

There is a slight problem. The proponents of intelligent design are either intentionally mis-representing the second law, or perhaps they have forgotten an important lesson from their freshman year physics course in college. The second law of thermodynamics only applies at the atomic and subatomic levels, and not the molecular or organismal level. Using entropy in an anti-evolutionary argument is like attempting to judge the flavor of an apricot by considering the energy required to remove a proton from the nucleus of a uranium atom.

METHOD 4: Dismantle, de-fund, and silence scientists.

Newt Gingrich and the Republicans eliminated the Congressional Office of Technological Assessment (OTA). The OTA provided an independent, scientific means by which congress people could fact-check claims by industry and special interest groups. The problem was this: The Republicans could not control the results of independent academic inquiry, so they had to eliminate it. Too often the OTA concluded that the reports of scientists were valid, and that is contrary to the interests of industry contributors, and therefore the party.

Though scientific observation and analysis had established that acid rain existed, early in his presidency Ronald Reagan did not want to admit that was true. For one reason, admitting the existence of acid rain would require government regulation of polluting industries in order to safeguard the health of the American people, and Reagan hated government regulation, and he loved unfettered capitalism. When the White House Office of Science and Technology Policy (OTSP) validated the scientific studies regarding acid rain, Ronald Reagan watered down their report and delayed its release. Members of his staff called for dismantling the OTSP as reprisal for not bending the reports to fit the administration's dogma. Many years later, late in his presidency, and only in the face of overwhelming evidence Ronald Reagan finally admitted that acid rain exists.

Currently the Bush administration disputes the existence of global warming, in spite of a significant body of scientific evidence which substantiates the phenomenon. Because there is a scientific basis for the assertion that the temperature of the planet is increasing, and because the increase is linked to the combustion of hydrocarbons, and because the largest consumer of hydrocarbons on the planet is the United States, and because there are huge profits for those industrial giants who acquire and sell petroleum products, or those who provide ancillary services such as war-making for the purpose of seizing the oil of other countries, one can predict the response of the industry-friendly administration to contrarian and unwanted science.

Having arrived at an understanding that blind adherence to dogma leads to zealous reprisal against science and scientists who falsify cherished dogma, one can make a case for a science-informed moral code. Dogma can be neatly divided into two categories: That which can be tested by science, and that which cannot. The existence of God exemplifies the former, and the dogma of demons as the cause of disease exemplifies the latter.

Morality can be defined as rules which prescribe or prohibit an action. For example, as Unitarian Universalists we have a moral code which prescribes love of all people, and which prohibits hatred and violence.

When science examines those dogma which can be tested, and there are many of them, a new set of truths emerge. We become informed about biological, sociological, psychological, and even political truths. Such enlightenment then raises the issue of guilty knowledge, that is, the act of becoming enlightened about an issue is accompanied by an obligation to act according to the direction indicated by the newly acquired truth.

For example, in the past there was a dogma which was widely held in Europe, the middle east, Asia, and most of Africa; this view, a dogma, was nearly universal throughout all cultures for all recorded time. It is codified in nearly all the books which guide the major and minor religions of the world. What might this dogma be? The inferiority of women to men.

This dogma can be tested by science, and it has been thousands of times over the last 100 years. What science tells us is that there are many differences between women and men which can be isolated and subjected to experimentation and mathematical analysis. The results of such experimentation prove a number of facts. For example:

- For most phenomena there is a wide variance of subtypes among men and among women, and there is considerable cross-over between the sexes. For example: height. Some men are five feet tall, whereas others are seven feet tall. There is a sizeable subset of women who are taller than a

significant portion of the male population. In general, however, the average man is taller than the average woman.

- When discrimination and economic barriers are removed, a higher percentage of women are found to graduate from college compared to men, at least in western countries.
- On average, women outlive men.
- On average, women are the victims of domestic violence at a substantially higher rate than men.

Some sex-based dogma have been falsified. For example:

- Women don't have a head for business matters.
- Women are hysterical and illogical.
- Women cannot drive automobiles.
- Women need a husband and cannot live without one.

The fact that many dogmas can be scientifically tested has created a growing and irreversible problem for fundamentalists. The genie is out of the bottle. Modern science is here to stay and it is unstoppable. Mathematics and sociological cycles predict two outcomes:

- Zealots will become increasingly isolated from science-informed, and science-devoted society.
- Moderates will adjust their belief systems as they become further enlightened by scientific discovery.

We now arrive at the topic of science-enlightened morality. To begin with, let us consider the fourth principal of Unitarian Universalism:

We, the member congregations of the Unitarian Universalist Association, covenant to affirm and promote a free and responsible search for truth and meaning.

As one can see, the scientific method is welcomed in our midst. The UUA celebrates the search for truth whether on an individual level, in a university laboratory, or perhaps a sociology or biology book. Unfortunately, the UUA is not the predominant religious organization in the United States today. In fact, some of the scientists under attack from zealots find refuge and fellowship in UUA houses of worship.

Science is not a convenience. It is not a tool which provides evidence that can be utilized to substantiate a pre-determined dogma. Science is a moral philosophy, in that it is a commitment to experimentally substantiated, statistically sound truth.

Traditionally, progressive minded thinkers are reluctant to claim that there are concrete standards of truth. I beg to differ. Certainly there are many areas of

ambiguity where no amount of science can establish a moral truth. For example, the use of marijuana. There are medicinal and even psychological benefits which are documented; there is also a substantial population of brain and lung damaged humans due to prolonged use of the drug.

Science can, however, provide a foundation for some moral truths. Returning to the topic of homosexuality, an example is provided. The sum of scientific findings substantiate early fixation of sexual preference, with some findings suggesting the fixation occurs as soon as a few weeks after creation of the zygote. If that is true, then a moral truth can be extrapolated: It is hideous and sinful to hate homosexual people, because they don't chose to be gay. It is evil and wrong to discriminate against homosexual people, and it is a lie for religious people to claim that gay and lesbian people have made a choice in their sexuality. In this case, science has given us a tool to use, and this tool has a moral compass.

Consider the morality which flows from environmental science. Scientific studies show that school children exposed to diesel fumes have a much higher rate of asthma. Scientific studies establish the melting of glaciers and the polar ice, and the resulting rise in sea level. Scientific studies suggest that increased exposure to mercury is correlated to elevated rates of Parkinson's disease in the population. Scientific studies show that the smog from combustion of petroleum products in vehicle engines pollutes the air, water, animals, and vegetation. We can extrapolate moral absolutes from these scientific results. For example, can we justify driving to the grocery store three times in a week, rather than once, knowing that three times the air pollution is generated, in light of the knowledge about what that air pollution does to the environment and living things?

There is a dogma of entitled consumption which accompanies those who support unrestrained capitalism and religious fundamentalism. Typically it is worded something like this: "God gave us the whole world for our pleasure." Accordingly, it is OK to drive an SUV which utilizes three or four times more gasoline compared to a Prius, because God gave us petroleum to consume for our pleasure.

There is another dangerous dogma which follows the anti-inquiry fundamentalists, namely, manifest destiny. For example, it is the manifest destiny of the U.S. to take away the native lands of indigenous North American people, because God has given us these lands. It is OK to subvert the governments of other countries because they are a threat to the U.S., and God has given us this land. It is OK to militarily take resources away from other people because those resources are necessary to keep the U.S. functioning, and God has given us the U.S.

At many levels science is a threat to fundamentalism. Science provides a basis for a morality of conservation, which threatens the dogma of consumption. Science provides a basis for a morality of tolerance, which threatens the dogma of male

dominance, sexual discrimination, and patriarchy. Science provides a basis for the morality of peaceful co-existence, which threatens the dogma of manifest destiny.

Fundamentally, an unbridgeable chasm separates dogmatic zealots and science informed people. When zealots become open to inquiry, they begin to shed mandatory belief and an imposed moral code in favor of enlightenment and a truth based, rational morality. At a certain point a paradigm shift occurs, and they jump from one side of the chasm to the other. Sadly, sometimes the opposite is true, wherein an enlightened person abandons inquiry in favor of dogma, typically as a way to assuage existential anxiety and the fear of death; but then, that is the material for another day's lecture.

¹ From: Mooney, C. (2005) *The Republican war on science*. Cambridge, MA: Perseus Books, p. 109-113.