Frankenstein's Cat

And Other Assorted Lectures on Skepticism and Secular Humanism

William B. Jensen

Revised Edition

The Epicurean Press
Cincinnati OH
2015

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Dedicated to Joe Levee

Who made it all possible

Preface

The following lectures were delivered over the past twelve years to two local organizations – the Cincinnati Association for Rational Thought (ART), and the Cincinnati Free Inquiry Group (FIG). The first of these organizations is devoted to combating the growth and spread of pseudoscience and supernaturalism in our society and the second to promoting the values of secular humanism. Both are outgrowths of parent organizations located in Amherst New York.

In the winter of 1999 I began a sabbatical leave from the University of Cincinnati. Since I had never received a formal education in the classics and part of my duties at the University entailed teaching a course on the history of chemistry, I decided to use this opportunity to educate myself on the history of ancient atomism. This led me, in turn, to a study of the life and philosophy of the fourth century BC Greek philosopher, Epicurus, and to a reading and study of the epic poem, *De rerum natura,* by the first-century BC Roman poet and Epicurean, Titus Lucretius Carus.

I soon found that I was attracted to more than just Epicurus' views on atomism. His views on virtually everything – be it his emphasis on the importance of friendship to a fulfilling life; the central roles of moderation and prudence in personal interactions; his admonishment to avoid the self-delusions and stresses that result from a life wasted in the single-minded pursuit of fame, power and money; or his stoic attitude toward death – all struck a strong emotional cord with me. Indeed, many of his conclusions coincided with those which I had, almost unconsciously, arrived at on my own during the course of my 51 years of existence. This forced me, in turn, to finally sit down and consciously confront just what my own life philosophy really was.

Not surprisingly, given my training in science and history, I found that it roughly coincided with what is now called secular humanism and this led me, in turn, by a path I can no longer remember, to seek out and attend a local meeting of FIG. It was there that I first met Joe Levee, a retired accountant who was very active at both the national and local levels in both the secular humanist movement and the skeptics movement, and Gary Weiss, a Professor of Mathematics at the University. Their interest in my background soon produced an invitation to speak to both FIG and ART on my research, which happened at that time to focus on pseudoscience in 19th-century chemistry, and resulted in the first lecture reprinted in this volume. Soon after this, again by a process I can no longer remember in detail, we decided to form a weekly luncheon group at the University faculty club to discuss issues of common interest. In this we were soon joined by others, including a Professor of Geography, a retired computer programmer, a Professor of Philosophy, and eventually a retired high school teacher and a retired newspaper reporter and art historian, to name but a few.

One of the great disappointments of my university career was the almost total absence of any form of stimulating intellectual interaction with my fellow faculty members. Certainly none was to be found within the chemistry department itself, and the other departments on campus were so insular that I had virtually no contact with faculty in other disciplines. But what I failed to find within the formal structure of the university, I did find within our little band of skeptical humanists.

As our luncheon conversations ranged over the spectrum of western science, literature and art – often sparked by a recent article in the *New York Times* or by some recent documentary on PBS, I would disagree or elaborate if it happened to touch on some subject I was currently reading about or doing research on. Joe would often pick up on these enthusiasms if he thought they might be of interest to either ART or FIG and soon after I would receive an invitation to give a lecture from the organization's program chair. And so, over the years, this eclectic collection of lectures came into being though, being by nature a nonjoiner, I would never become a formal member of either organization.

The collection and printing of lectures, whether popular or scholarly, *as lectures* was quite common in the 19th century and, as an historian of science, I have had occasion to read a great many of them and have always found it a highly accessible and attractive literary form. The use of the first person singular by the lecturer, the explicit direction of questions and comments to the reader in the guise of the audience, the explicit references to the date, time, and reason for the lecture, and the frequent use of a less formal phraseology all combine to make the printed lecture a far more readable genre than either the formal essay or the printed textbook.

Yet, for reasons, I do not fully understand, the printed lecture has all but disappeared from the scientific and popular literature. Though I have tried several times to have a lecture of mine, given at a chemical symposium, printed as delivered in the resulting proceedings, the reviewers have always objected that it is too informal and have insisted that I remove

all of the devices and allusions that made it accessible to the audience in the first place. Quite obviously, in this collection, I have done it my way, as the popular song goes, and have attempted to give the reader a sense of being a part of my original audience.

Just as I have always found illustrated books far more attractive than unillustrated books, so I have always preferred illustrated lectures and have always attempted to use as many photos and woodcuts as the subject would permit. Since part of the illusion of transferring the spoken lecture to the printed page is to have the illustrations or photos appear on cue, I have taken the unusual step of using the double-column format, usually reserved for journals and magazines, rather than the single-column format employed in most books, since this allows for a more intimate integration of text and illustration than would the grouping of all of the illustrations together in a separate section of plates.

William B. Jensen
Cincinnati, OH
April 2011

Revised Edition

The only change made in this revision, aside from the correction of several typos, is the addition of a recent lecture on Auguste Comte and a corresponding update of the index and table of contents.

March 2015

I

The Reichenbach Affair: Pseudoscience and 19th-Century Chemistry

1. Introduction

Before beginning this morning's lecture, I should perhaps warn you that it is based on preliminary research and is therefore by no means as complete and thorough as I would like (1). In addition, it deals with a 19th-century example of pseudoscience rather than with one of the regrettably all too numerous current examples that are the main focus of your organization. Such are the risks of asking an historian to speak about his research! Nevertheless, as an historian I cannot resist the hope that you will find much of what I will tell you today about 19th-century pseudoscience relevant (albeit depressingly so) to its 20th-century descendants as well.

2. The Nature of Pseudoscience

20th-century chemistry has experienced its share of pseudoscience nonsense – two of the most recent and best known examples being, of course, the polywater scandal of the late 1960s and early 1970s and the more recent cold-fusion scandal of the 1990s. The first of these has been documented in the delightful book by Frank (2) and there have been several published accounts of the second, the most thorough and readable being the book by Taube (3). Alas, historians of science are almost as interested in documenting and analyzing these apparent breakdowns of the scientific method as they are in documenting its greatest triumphs, as these temporary aberrations have much to tell us, not only about the inherent limitations of the scientific method, but also about its ability to eventually undergo self-correction.

When analyzing examples of pseudoscience, it is helpful, whenever possible, to distinguish between the scientific aspects of the case and the sociological aspects. The scientific aspects may, in turn, be further broken down into the experimental versus the theoretical. The former refers to the reproducibility of any claims to have detected hitherto unknown phenomena and the reliability of the detection methods used, whereas the latter refers to the compatibility of any postulated theoretical rationales of the phenomena in question with already established theoretical models.

The sociological aspects include such factors as the personal, disciplinary, and national status of the person advocating the discovery in question. Thus in the case of the recent cold-fusion fiasco, the original phenomenon was reported by two electrochemists, both of whom had relatively high status within the chemical community – a fact which no doubt played a role in their being able to successfully publish their controversial claims in an established chemical journal. However, these claims overlapped heavily with the field of nuclear physics, which has a higher disciplinary status than chemistry and their primary critics were drawn largely from the physics community, which viewed mere chemists as having little or no competence for work in the field in question. Likewise, when attempts to replicate the work around the world were evaluated, it was quickly noted that the negative reports came primarily from countries viewed as having a high perceived status in the field of physics, whereas so-called confirmations were reported primarily by workers in countries having a low perceived status.

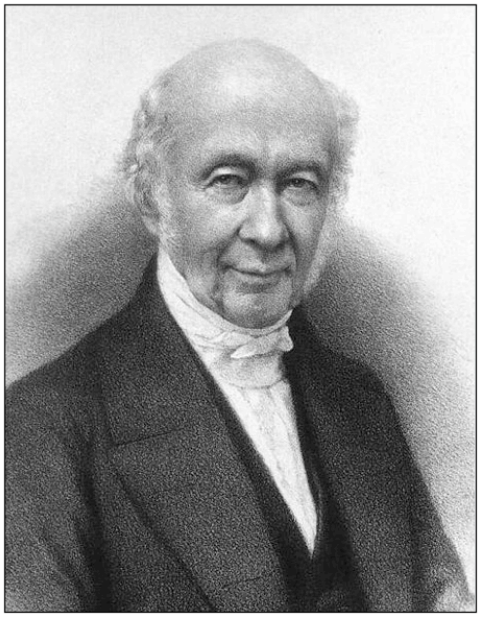

Figure 1. Baron Karl von Reichenbach (1788-1869).

This morning I would like to apply some of these criteria to an assessment of what may aptly be viewed as 19th-century chemistry's version of the cold-fusion fiasco – namely the so-called discovery of the "Od" force by the German chemist Karl von Reichenbach.

3. The Discoverer of Od

Karl Reichenbach (figure 1) was born on 12 February 1788 in Stuttgart, the son of the Court Librarian. He was educated at the University of Tübingen, from which he received a doctorate in 1811 for a thesis dealing with a new design for a hydrostatic bellows (4-6, 10). Following a year of travel in France and Germany, where he visited various iron works and chemical plants, Reichenbach set up his own iron foundry and charcoal furnaces in Baden. He soon also entered into a business partnership with an Austrian Count and opened a series of similar iron and metallurgical works in Moravia and lower Austria, as well as a factory for the manufacture of sugar from sugar beets.

By the 1830s these various manufacturing ventures had made him independently wealthy and had allowed him to acquire four landed estates in Austria, including one near Vienna known as Castle Reisenberg. In recognition of these achievements, he was – as a native son of Stuttgart – granted the title of Baron von Reichenbach by the King of Württemberg in 1839.

Considered something of an expert on the manufacture of sugar and the nature of meteorites, of which he owned an extensive collection, Reichenbach also earned a minor chemical reputation for his work on the isolation and characterization of the products obtained from the destructive distillation of wood and other organic materials. These he gave fanciful Greek names such as *paraffin*, *creosote*, *eupion*, *picamar*, *pittical*, *kapnomor*, *assamar*, *cedriret*, *mesit*, etc., of which paraffin and creosote are perhaps the best known (7).

However, Reichenbach's true claim to fame, or rather infamy, came in 1845 when he announced his discovery of a new cosmic force called "Od" (also called Odyle, Odische, Odic or Odylic). Between this announcement and his death 24 years later in Leipzig on 22 January 1869 at age 80, he would write at least 10 books and polemical pamphlets describing, defending, and extending his initial discovery (8-17).

4. The Properties of Od

Before tracing the history of the debates surrounding Reichenbach's imagined discovery and analyzing it as a prototypical example of pseudoscience, we should first be clear as to the exact nature of his claims. These amounted to nothing less than the belief that he had discovered a previously unknown universal force of nature, which permeated the entire universe and was actively implicated in all physical, physiological and psychological phenomena. This claim was coupled to the further claim that the effects of this force could only be detected by certain human "sensitives" – that is by persons suffering from certain nervous and mental disorders often associated with hysteria, sleep walking and hypersensitivity to sound, light, and hypnotic trance. The new force did not affect photographic plates or other physical apparatus normally used to detect electrical, mechanical, magnetic, or electromagnetic forces, nor could it be detected by normal humans (including Reichenbach). Only by asking his sensitives what they saw or felt, usually by means of leading questions, was Reichenbach able to study its properties.

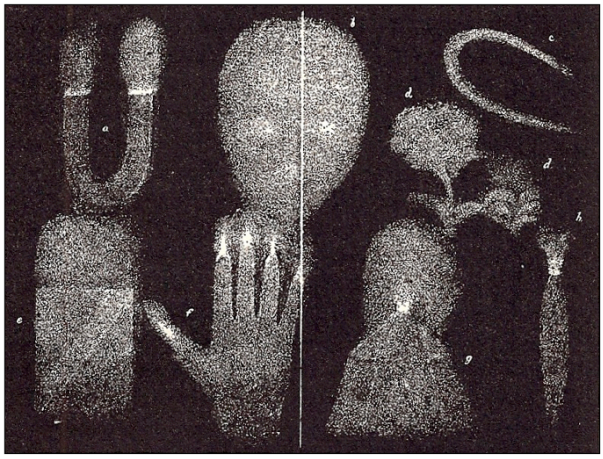

Figure 2. Various images of the "Odic glow" as perceived by sensitives and associated with such objects as magnets, the human face and hands, crystals, and various flowers and plants.

In his initial account Reichenbach hinted that his discovery of the Od force was a by-product of his interest in proving that the northern lights or *aurora borealis* were due to the earth's magnetic field. Hearing of a young woman who had become hypersensitive to light, he thought of having her view normal magnets in a darkened room in the hope that, with her superior ability to detect light, she would be able to see a miniature version of the *aurora borealis* emanating from the much weaker poles of artificial magnets (figure 2). She soon verified this hunch, leading him to declare, in a curiously convoluted fashion, that (9):

I believe this much to be certain ... that an astonishing analogy exists between the two: so great, that the identity of the magnetic flame and the aurora rises unmistakeably to a high degree of probability.

In recognition of this connection, Reichenbach took the name of his force from the pagan god, Odin, of Norse mythology, which he believed to be a personification of an earlier Sanskrit word meaning "all transcending," though at least one wag would later suggest that, given its undetectability using normal scientific

Figure 3. Jöns Jakob Berzelius (1779-1848).

instruments, he would have been better advised if he had named it the "Odd force" instead.

Based on further experiments conducted with his sensitives, Reichenbach quickly discovered that, like electricity and magnetism, his Odic force possessed polarity and that the positive and negative forms of Od differed in their color, feel, and taste. Likewise, just as some materials were good conductors of electricity and others were insulators, so various materials differed widely in their ability to conduct and store Od.

Additional experiments quickly revealed that changes in the Odic content of materials accompanied all magnetic electrical, and thermal phenomena and, more importantly, from the standpoint of Reichenbach's training as a chemist, that they also accompanied all chemical phenomena, including crystal polarity, effervescence, dissolution, fermentation, putrefaction, the feel and taste of the various elements, etc. Thus, just as the great Swedish chemist, Jöns Jakob Berzelius (figure 3), had divided the known chemical elements into the two great classes of electropositive and electronegative, so, by touching samples of the elements, Reichenbach's sensitives were able to sort them into the classes of Odic positive and Odic negative.

Changes in Od also accompanied all mechanical phenomena, such as friction, sound generation, etc. as shown by the glows reported by sensitives when viewing vibrating bells in a vacuum, or the shaking of liquids, and this in turn, allowed one to explain such phenomena as water dowsing, pendulum swinging, and table turning.

Od also manifested itself in both physiological and psychological phenomena. Its inherent polarity was reflected in a difference in the Odic emanations given off by the left and right hands and accounted for the ability to heal using the laying on of hands. Its generation during the chemical reactions responsible for body metabolism accounted for the presence of a human aura, as well as for similar auras in lower animals and plants, and the ability of certain individuals to control its flow accounted for the phenomena of mesmerism. Likewise, the excessive amounts of Od given off during the chemical reactions accompanying the decay of the human body accounted for the mysterious glows often seen above graves in cemeteries and thus for the phenomenon of apparitions and ghosts.

It is important to emphasize that Reichenbach was not postulating that his sensitives possessed the power of ESP but rather that they possessed an acute sensitivity of existing senses, nor was he actively supporting supernaturalism and spiritualism. Rather he was actually offering what he viewed as a naturalistic rationale of apparitions, mesmerism, water dowsing, table turning, neurotic behavior, etc. Hence his claim in 1852 that, by means of his new force, he had "made an attack on supernaturalism, hunting it down to its hiding place" (10).

It should be obvious that many of the properties of the Od force were modeled on those attributed to the more conventional forces of electricity and magnetism,

Figure 4. Franz Anton Mesmer (1734-1815).

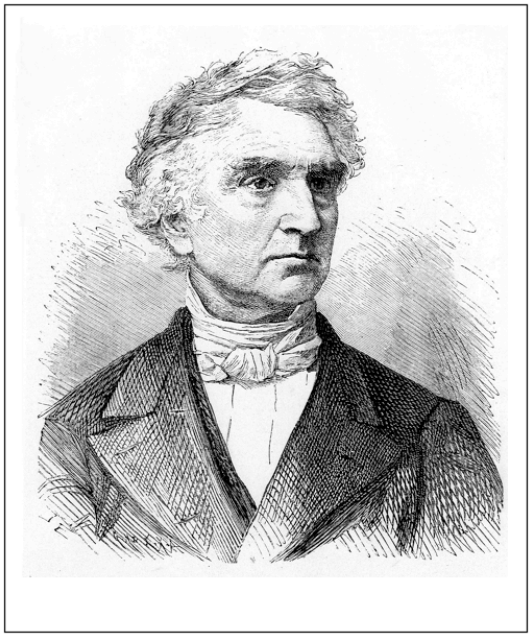

Figure 5. Justus von Liebig (1803-1873).

both of which, like heat itself, were explained by 18th- and early 19th-century physicists as being due to the accumulation and flow of various imponderable (i.e. weightless) fluids, such as caloric. Even more so, it is apparent that the Od force was in many ways little more than a relabeled and elaborated version of the magnetic fluid postulated by the 18th-century Austrian physician, Franz Anton Mesmer (figure 4), to rationalize his discovery of animal magnetism. Like Od, Mesmer's fluid was universally diffused, exhibited polarity and could be stored and conducted to differing degrees by various materials (18). This virtual identity was quickly recognized by Reichenbach's contemporaries, as vividly expressed by at least one admirer in his proclamation that :

Reichenbach has boldly reduced mesmerism and its mysteries to an exercise in applied physics.

5. The Rise of Od

Reichenbach had a sufficient reputation within the chemical community, based on his previous chemical publications, and sufficient political and economic influence, based on his personal wealth and baronage, to ensure initial publication of his work on the Od force in a special supplementary issue of the *Annalen der Chemie und Pharmacie* in the winter of 1844-1845 (8). Under the editorship of the well-known German organic chemist, Justus von Liebig (figure 5), the *Annalen* was one of the most prestigious chemical journals of the day.

The acceptance or rejection of papers in 19th-century science journals seldom involved the elaborate peer review process used today and was instead largely the prerogative of the editor. Apparently Liebig had acted unilaterally in his decision to publish Reichenbach's claims, since his coeditor, the equally famous German chemist, Frederick Wöhler (figure 6), was appalled when he saw an early copy of the supplement to the January issue, as indicated in a letter to Liebig written on 30 December 1844 (19):

The Reichenbach business that was printed in the Annalen has created a very unfavorable impression. Professor Rüte has tested a number of Reichenbach's claims on the sick here [i.e., at Göttingen] and explains all of them as psychological illusions. Our names are somewhat compromised by this affair.

In a response to Wöhler, written in March of 1845, Liebig, though expressing shame for his actions, also attempted to evade responsibility (19):

I consider Reichenbach's discovery of Od to be either a self-delusion or the start of a frantic effort to make himself famous, [and] he will easily succeed with many medical practitioners. You can imagine why I have written nothing of this to you. I am ashamed that I made the Annalen a showplace for this rubbish, but I

Figure 6. Friedrich Wöhler (1800-1882).

was finally induced to do so as a result of unbearable harassment.

According to Liebig biographer, William Brock, the most probable source of Liebig's "unbearable harassment" was the Scottish chemist, William Gregory (figure 7) (20). Gregory, who had studied under Liebig at Giessen, was the most important proponent of Liebig's views on agricultural and physiological chemistry among English-speaking chemists and had also translated several of Liebig's books into English. In short, he was an indispensable conduit for the propagation of Liebig's scientific reputation and influence outside of Germany.

Gregory also had a fairly decent reputation of his own as a chemist and teacher of chemistry, though this was increasingly tarnished in his later years by his almost pathological addiction to pseudoscientific claims of all sorts, including spiritualism, phrenology, clairvoyance, and animal magnetism. The results of this addiction were aptly described by one of Gregory's fellow faculty members at the University of Edinburgh, who has left us with an account of one of Gregory's attempts to defend his views in public (21):

... he dosed his audience with all the common trash of mesmerism, clairvoyance, table-turning and spirit-rapping, and declared his belief in all of them and in every alleged fact connected with them. He had the egregious simplicity to declare that he had seen a table, of its own accord, making "gracious movements," and walking from one part of the room to another; and that he believed, on the authority of a witness whose testimony was indisputable, that a pet table had in a similar fashion followed its mistress upstairs like a dog. I was not present, thinking it a shame to encourage in any shape the Professor of Chemistry in making a donkey of himself and a laughing-stock of the University.

Gregory immediately translated the initial installment of Reichenbach's work in the *Annalen* into English (8), as well as the expanded two-volume edition which Reichenbach brought out in 1849 under the expansive title [in translation] of *Physico-Physiological Researches in the Dynamics of Magnetism, Electricity, Heat, Light, Crystallization, and Chemism in their Relations to Vital Force,* and which contained much of the material that Liebig had refused to publish as a second installment of the supplement (9).

In his 1850 English translation of this work, Gregory managed to drag yet another famous chemist into the controversy by claiming that the great Berzelius (recall figure 3) had fully endorsed Reichenbach's work in a letter written shortly before his death in 1848 (9):

Figure 7. William Gregory (1803-1858).

... the lamented Berzelius took a very deep interest in the investigation and expressed in a letter to the editor that it could not possibly be in better hands than those of Baron von Reichenbach.

– an endorsement considered important enough to be repeated over a century later by René Sudre in his well-known monograph on parapsychology (22):

Reichenbach's experiments were treated with contempt by the scientific world in spite of the patronage of Berzelius ...

These claims are consistent with what little is said of Reichenbach in Berzelius' correspondence with other chemists. Though falling short of out and out endorsement, Berzelius' comments do display an interest in Reichenbach's results, a lack of overt criticism, and support of Reichenbach's right to publish his experiments, however controversial.

Thus in January of 1845, shortly after the publication of Reichenbach's initial papers in the *Annalen,* Berzelius wrote to Wöhler expressing his confusion over Liebig's apparently contradictory behavior in this matter (23):

I have just had a long and mystical letter from Reichenbach in Vienna concerning a natural force which he believes he has discovered, whose effects, however, are detectable only by persons with a morbid sensitivity of the nervous system, similar to that encountered in

somnambulists or which is the cause of somnambulism. Reichenbach himself says that people will think him deranged, but he is completely persuaded of the correctness of what he, by means of the unanimous and identical testimony of his observers [i.e., sensitives], has found after a year of continuous research. Liebig has been with him and has frequently rebuked him for conducting such investigations. This will be followed by their appearance in print as a supplement to the January issue of your Annalen, which I normally first receive in April. It is impossible for me to make sense of all of this.

That July Berzelius also wrote to Liebig and congratulated him for having printed Reichenbach's work (24):

Reichenbach has visited me here and we have spoken daily of the singular series of investigations which he has made known by means of your journal, and which, on the whole, seem at first glance to be so improbable and yet, according to everything I have heard and learned from him here and from others who were present, it might be possible that they are not without some basis. You were right to allow him use of your journal for this. What will come of it in time only God knows.

By May of the following year, in a letter to Wöhler, we find him commenting instead on the behavior of Reichenbach (23):

In his last letter Reichenbach has shared a very interesting experiment with me which has the great advantage that one can use it to control [i.e. screen] sensitives. You well remember that he has maintained that, if one runs a metal wire from a dark cellar to a room where one can expose a portion of the other end to sunshine, then the sensitives in the cellar will see light streaming from the wire. Now he has held the other end in the differently colored rays of a well defined spectrum and the sensitives in the basement are able to correctly give the colors as well as the time of the exposure. This is a beautiful experiment similar to another, long known, involving sound, in which a metal wire was connected to the foot of a piano and strung far enough so that the sound of the instrument could not be heard, but was audible to a person holding the wire firmly between the teeth. Both were chiefly the result of the conduction of undulations through the metal.

It is a sad thing concerning Reichenbach. He is not a calm investigator. He is troubled by what people say of his researches, he is distressed by those who ridicule him, angered by those who doubt him, etc. so that, when he believes he has found a new result, he is beset with thousands of annoyances that he could have avoided if he were calmer. Liebig's refusal to allow him to complete the printing of the supplement has deeply hurt him. I told him that the situation could be easily remedied if he would print the continuation himself – one of his [economic] means need not be concerned with costs. I do not know what he will do.

At least one later commentator, unimpressed by Berzelius' waffling ("impossible for me to make sense of all of this," "only God knows," etc.) and apparent inability to critically evaluate the evidence, rather bluntly declared that, in light of his advanced age:

Berzelius must have been senile.

More importantly, however, the above correspondence calls into question Liebig's behavior in this affair. Reichenbach had apparently sent him a series of papers describing his experiments as far back as July of 1844 on the assumption that they would be printed in successive issues of the *Annalen*. However, Liebig, realizing that they were pseudoscientific nonsense, kept postponing publication and, finally, in desperation, had visited Reichenbach and attempted to talk him out of publication altogether. Failing, and apparently under possible pressure from Gregory, he then relented because he did not want to alienate his strongest patron in Great Britain, and so finally printed the accumulated manuscripts as a special supplement to the January 1845 issue (25) – in other words, he put his personal interests ahead of good science. Yet, after suffering a storm of criticism from his fellow scientists for having published the initial installment, he once again pursued his personal interests by refusing to publish the second installment of Reichenbach's work. Nevertheless, this belated attempt at damage control did not prevent at least one of his contemporaries from later complaining that (26):

Liebig has brought a misery upon the physical sciences for which there is no excuse by first introducing Od through the medium of his chemical journal into the scientific world from which it can now be banished only at the expense of much time and trouble.

Only in 1852 did Liebig finally articulate his true position on Reichenbach's results in a public lecture entitled "On the Study of Natural Science," given as the opening lecture for his annual course on Experimental Chemistry at the University of Munich (27):

Since the senses and nerves are the instruments for the

mental operations of the observer, through which he receives and communicates the impressions on which he bases his conclusions and deductions, it is in the nature of things that persons whose nervous systems are not in a perfectly healthy state are not particularly trustworthy observers, and, as a result, you will understand why the new science of Od has not found entry into the domain of true scientific research. The discoverer of Od has neither seen nor experienced any of its phenomena for himself, nor have unbiased persons with healthy senses ever experienced them. His sensitives are not in a condition which allows them to describe by themselves what they see and experience around them, rather they must be guided to their peculiar conclusions by the questioner himself, though he cannot and never has seen the phenomena for himself. No sensible person can believe that the existence of a new natural force can be established on the basis of so false a method, through the visual and tactile sensations of enervated and sick persons.

As for Gregory, after completing his translations of Reichenbach, he would go on to write his own book on the subject, published in 1851 under the title of *Letters to a Candid Enquirer on Animal Magnetism*, of which one book reviewer wrote (21, 28):

Dr. Gregory regards all objections raised against his favorite science as illogical and absurd in the extreme; that he admits, almost without question, all the lower as well as the higher phenomena: that clairvoyance, prevision, retro-vision, intro-vision, and transference of senses, present to him no insurmountable difficulties. He is an enthusiastic advocate of, and a firm believer in animal magnetism, under whatever name it is presented to him. Being more of a chemist than a physician, he is less qualified than many other members of his profession to form sound opinions and a correct judgement ...

Gregory's premature death, seven-years later at age 55, finally ended his involvement in the affair.

6. Attacks by the Medical Community

Roughly 60 years had passed since the French Academy of Sciences had appointed a commission to investigate the claims of Mesmer concerning animal magnetism and his so-called universal fluid. Composed of nine prominent physicians and scientists, including the American, Benjamin Franklin, and the great French chemist, Antoine Lavoisier, the commission had rapidly concluded that there was no compelling evidence for Mesmer's fluid and that the so-called manifestations of animal magnetism were instead largely the result of imagination and suggestion (18). In a similar fashion, the results of Reichenbach's

Figure 8. James Braid (1795-1860).

experiments soon came under attack, not so much from other chemists, as from members of the medical profession specializing in physiology and psychology, who soon called into question the reliability of Reichenbach's so-called sensitives and the role played by suggestion in obtaining the results he had reported. In Germany this criticism came from several of the leading medical "materialists" of the day, including Karl Vogt (1817-1895), Jacob Moleshott (1822-1893), and Emil DuBois-Reymond (1818-1896), with the latter declaring that Reichenbach's work was nothing less than "an absurd romance."

In England, the primary critic of Reichenbach, and the counterweight to the enthusiasms of Gregory, was the Scottish-born physician James Braid (figure 8). Braid is best remembered today for his 1843 book *Neurypnology* in which he first introduced the term hypnotism and extensive evidence for the hypothesis that the phenomena of mesmerism were due to suggestion rather than to a magnetic fluid of some sort (29). Not surprisingly, Braid viewed Reichenbach's work as a thinly disguised attempt to revive Mesmer's ideas and in 1846 he published a rebuttal in the form of a booklet with the lengthy title of *The Power of the Mind Over the Body: An Experimental Enquiry into the Nature and Cause of the Phenomena Attributed by Baron Reichenbach and Others to a New Imponderable* in which he presented compelling evidence that, like mesmerism itself, the results reported by Reichenbach's sensitives were due largely to the use of leading

Figure 9. Johann Christian Poggendorff (1795-1877).

questions and the power of suggestion (30). This he did by sitting in a darkened room with subjects whom he knew, from previous work, to be particularly susceptible to hypnosis and by presenting them with various falsely labelled objects and phenomena, such as wooden sticks rather than real magnets. By suggesting to them what they should be seeing, he was able to replicate all of Reichenbach's results.

Reichenbach's response to these criticisms was to publish the names and addresses of his sensitives, emphasizing that many came from the professional and upper classes, including several of minor nobility. Just as Gregory had appealed to the authority of Berzelius, so Reichenbach now appealed to the authority of social status, claiming that this alone assured the reliability of their observations, though any traveling mesmerist of experience could have told him that there was absolutely no correlation between social and economic status and susceptibility to suggestion and mental delusion.

In 1841 the German newspaper, the *Augsberger Allgemeine Zeitung*, began the practice of publishing popular accounts of various sciences in the form of so-called letters from well-known scientists, many of which were subsequently collected together and reissued in book form. Among the more famous of these was a series of letters on chemistry by Liebig which was published in book form in the period 1843-1844 under the title of *Chemische Briefe* or *Familiar Letters on Chemistry*, as they became known in English translation (30). Not to be outdone, Reichenbach published a similar series on his new Odic force, which he issued in book form in 1852 under the title of *Odische-magnetische Briefe,* variously translated as *Odic-Magnetic Letters* or as *Letters on Od and Magnetism* (10). This was followed by yet further books on the Odic force in 1854, 1855, 1856, and 1858 (11-14).

7. Attacks by the Physics Community

In 1861, however, an event happened which added the German physics community to the list of Reichenbach's active opponents. In an incident curiously reminiscent of that which had occurred 15 years earlier with respect to Liebig and his journal, Reichenbach sent a series of four papers on his Odic force to the *Annalen der Physik und Chemie*. Sometimes known as *Poggendorff's Annalen* in honor of its long-time editor, the German physicist, Johann Christian Poggendorff (figure 9), it was to the German physics community what Liebig's journal was to the German chemical community.

Poggendorff dutifully published the first of Reichenbach's memoirs in the March issue. However, when the other three failed to appear in due course, Reichenbach travelled to Berlin to find out why. He soon discovered that the first paper had caused an upset within the German physics community and that Poggendorff now refused to print the remaining three until Reichenbach convincingly demonstrated the truth of his claims before a committee composed of five physicists (Dove, Magnus, Poggendorff, Riess, and Schellbach), one chemist (Mitscherlich), one botanist (Karsten), one mineralogist (Rose), and one physiologist (Ehrenberg).

Three such demonstrations were given during late 1861 and early 1862. The first involved Reichenbach's most recent claim to have successfully photographed the Odic glow and was an absolute failure. The second involved the use of sensitives to determine the polarity of magnets and which objects had or had not been charged with positive or negative Od. However, Professor Dove insisted that the trials with the magnets be done using an electromagnet rather than Reichenbach's permanent magnets, since this allowed Dove to both turn the magnetic field on and off and to reverse the magnetic poles at will. Under these controls, Reichenbach's sensitives failed miserably, though Reichenbach rationalized these failures by claiming that the changes in the magnetic field were much faster than the accompanying changes in Od polarity and had thus confused his sensitives. Though Reichenbach scheduled yet a third demonstration, all of the committee members refused his invitation and only a few local amateur scientists and retired teachers made an appearance. Even then the reported results were only moderately

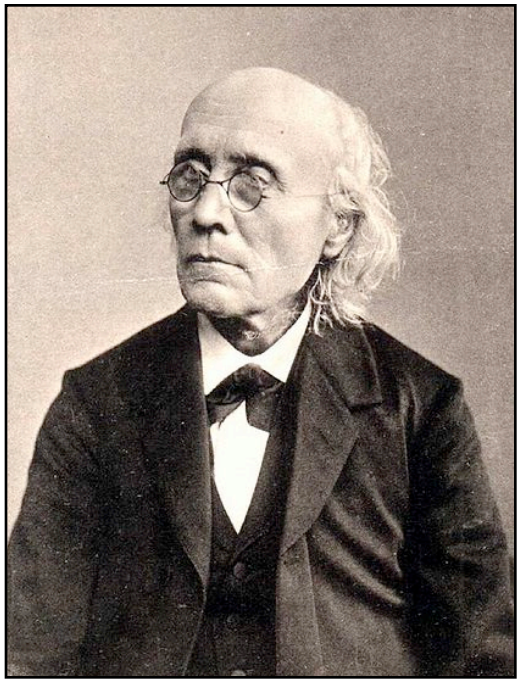

Figure 10. Gustav Theodor Fechner (1801-1887).

successful since, as Reichenbach later rationalized, all of his superior sensitives, who were of lower class origin, had deserted him because they were intimidated by the high social status of the professors!

In late 1862 Reichenbach published his version of the Berlin tests in a booklet entitled *Odische Begebenheiten zu Berlin in den Jahren 1861 und 1862* (*Odic Adventures in Berlin in the Years 1861 and 1862*) (15). This was followed, before his death in 1869, by two additional books on Od published in 1866 and 1867 (16-17) and by a visit made in 1867 to Leipzig in a last ditch attempt to convert the renowned German physicist and psychologist, Gustav Fechner (figure 10), to his views. Widely regarded as the founder of the field of psychophysics or the study of the physics of sensation, Fechner described this visit in a curious booklet published in 1876 under the title of *Erinnerungen der Letzen Tage der Odlehre und ihres Urhebers* (*Memoirs of the Last Days of the Odic Doctrine and its Originator*) (32) in which he painted a sad portrait of an 80-year old man suffering from "unmistakable signs of senility," with failing eyesight and poor hearing, who was grieving "at the thought of having to die without obtaining recognition for his system."

8. Od as Pseudoscience

Though the Reichenbach affair was a major scandal for mid-19th-century physical science, all memory of it seems to have disappeared from the history and philosophy of science literature. Examination of more than a dozen 20th-century exposés of pseudoscience, both past and present, shows that only one of them accorded any significant space to a discussion of the affair – the 1935 volume, *Wish and Wisdom: Episodes in the Vagaries of Belief*, by the American psychologist Joseph Jastrow (33). This may be because of the unique fashion in which it crossed traditional disciplinary boundaries. Initiated and propagated by chemists, it relied on detection methods which fell instead within the province of abnormal psychology rather than chemistry proper and, save for its brief encounter with the Berlin physics community during the years 1861-1862, its most strident critics came from members of the medical community specializing in either physiology or psychology.

As recognized by both its contemporary critics and by Jastrow, the single most important scientific factor which clearly places the Od force among the denizens of pseudoscience was the total unreliability of the methods used to detect and measure its properties. No matter how meticulously Reichenbach recorded his findings, no matter how many times he repeated his observations, his inability to accept the fact that his measuring technique (the testimony of so-called sensitives) was inherently flawed, virtually guaranteed that his results would be rejected by the scientific community. Yet a second indicator of its pseudoscientific nature was Reichenbach's tendency to resort to *ad hoc* after-the-fact rationales and appeals to authority whenever his claims failed to be confirmed by others under controlled conditions, whether by the medical community (e.g. Braid) or the physics community (e.g. Dove).

Even more intriguing is the role played by various social factors and the manner in which they parallel the more recent case of cold fusion discussed in Section 2. Relative to the issue of personal status, both the Od force and cold fusion were initiated by chemists of sufficient standing to get their claims published in established chemical journals. Relative to the role of disciplinary status, both claims relied on detection methods (sensitives and neutron counters) which fell under the province of other scientific disciplines (psychology and nuclear physics), and, as a result, both came under immediate attack by the practitioners of those disciplines who claimed that the chemists in question had no idea what they were doing.

Finally, with respect to the issue of national status, it was mentioned in Section 2 that most failures to confirm controversial scientific claims tend to come from countries that are perceived as having a high scientific status, whereas most confirmations tend to come from countries with a low perceived status. In the case

of the Od force, this pattern centered almost exclusively on the countries of Germany versus Austria and rapidly became an issue of Prussian "Wissenschaft" versus Austrian "Gemütlichkeit." Thus while the members of the Berlin Academy of Sciences demanded that Reichenbach experimentally demonstrate the truth of his claims, those of the Vienna Academy of Science were willing to allow him to give a series of lectures on his discoveries which he published in 1867 under the title of *Die odische Lohe und einige Bewegungserscheinnugen als neuentdeckte Formen des odischen Princips in der Natur* (*The Odic Glow and Some Kinetic Phenomena as Newly Discovered Manifestations of the Odic Principle in Nature*) (17). Likewise, when demonstrating his discoveries in Berlin, Reichenbach was puzzled at his inability to locate a significant number of sensitives among the professional and scientific classes of the city, since he had no problem finding them within the Austrian scientific community – a failure which he attributed, not to a difference in scientific standards, but to the cold and wet climate of Northern Germany, which he felt was not conducive to the requisite heightening of the senses.

Figure 11. Photographs of a group of Luys' neurotics responding to the various poles of a bar magnet.

9. The Legacy of Od

If Reichenbach and the Od force have largely been forgotten by the literature dealing with the history and philosophy of science, the same is definitely not true of the literature dealing with occultism and mysticism. Just as the Od force was in many ways a relabeled version of Mesmer's magnetic fluid, so aspects of Reichenbach's work have been repeatedly revived since his death under a bewildering array of new labels. In the interests of brevity, I will simply list a few of the most significant of these subsequent developments:

1) 1891: de Rochas publishes a defense of the fluid theory of magnetism based on the experiments of Luys with hypnotized neurotics at the Charité hospital in Paris (figure 11) in which virtually all of Reichenbach's earlier results are replicated (34).

2) 1896: Using both fake magnets and electromagnets Ernest Hart shows that Luy's results are the product of suggestion and the use of leading questions, thus replicating the earlier refutations by Braid and Dove (35).

4) 1904-1910: Reprints of Reichenbach's main books appear.

5) 1911: Walter J. Kilner claims positive detection of the human aura using dicyanine dye screens (36).

6) 1914: One Professor Haschek of the University of Vienna has some success in detecting Reichenbach's Odic glow but attributes it to oxidation of oils and organic matter on magnets and hands (37):

7) 1919: Similar investigations of the Odic glow by A. Hoffmann find that the Odic glow of crystals is due to suggestion and that Kilner's results on the human aura are due to retinal fatigue (38).

8) 1960: Sudre concludes that "Careful research subsequent to all this work seems to have finally discredited any belief in the Od and its successors" (22).

9) 1968-1978: Reprints of English translations of Reichenbach's books appear, many of which now sell on the internet for several hundred dollars apiece.

As a glance at the internet will quickly reveal, most of this is still very much with us in one form or another, be it claims for the existence of such phenomena as biomagnetism, bioradiation, therapeutic touch, auras, psychic fluids, crystal power, or Wilhelm Reich's orgone energy (22) – all are direct descendants, in one way or another, of Reichenbach's Od force and Mesmer's original magnetic fluid.

10. Conclusion

Since we have spent most of this lecture exploring the foibles of 19th-century science, it is only fitting that we allow one of its representatives to also provide our concluding remarks. These I have taken from the *Recollections* of the prominent Victorian physician, Sir Henry Holland (1788-1866), who also served as President of the Royal Institution for many years and whose evaluation of the problem of pseudoscience within the medical profession is as pertinent today as it was when he first uttered it over 140 years ago (37):

... those many Charlataneries I have witnessed in my professional career; coming rapidly in succession to one another; and each drawing largely for a time on public credulity. The name of physical science wrongly usurped, and the claim of curing every disease – a claim which carries its own refutation with it – are brought in to sanction what is purely imposture. Here, unfortunately, the tests of truth are of a kind easily overridden by extravagant pretensions, commonplace fallacies, or the strong seduction of novelty; and the particular folly or fraud is often corrected only by the intervention of some other deserving a like fate ...

It is curious to note how periodical these epidemic visitations of miracle have become. Mesmeric visions and prophecies, clairvoyance, spirit-rappings, table-turnings and liftings, etc., succeed one another in popular fashion; with certain intervals between to allow prior detections to be forgotten, and to catch the credulous of a new generation. The reason disappears when the imagination is thus called into play. It was a shrewd observer of the foibles of the world who said that "Folly is like matter and cannot be annihilated."

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II
Epicurus and the Origins of Western Humanism

1. Introduction

As part of its perennial plea for money, I was surprised to recently discover that the Center for Free Inquiry was offering donors of a certain level a free thank-you gift in the form of a small plaster bust of either Socrates or Plato – surprised because it is hard to imagine two ancient Greek philosophers more at odds with the underlying assumptions of modern skepticism and free thought. Socrates believed that the study of natural science and astronomy was arrogant nonsense and received omens and portents of future events from a personal "demon" or spirit who whispered them into his ear. Likewise, Plato's philosophical idealism has for centuries been one of the cornerstones of both western religious thought and much of western mysticism.

As pointed out by H. J. Blackham and others, a far more suitable candidate for an ancient predecessor of modern materialism and humanism is to be found, not in Socrates and Plato, but in the writings of the Greek philosopher Epicurus (figure 1), for reasons which I hope to make apparent in this evening's lecture (1, 2).

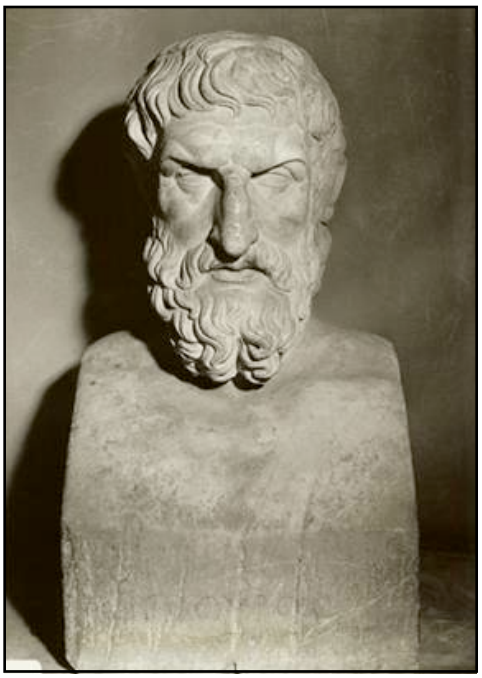

Figure 1. One of about 40 surviving images of Epicurus (341-270 BC). This example (actually a double herm) is located in the Capitoline Museum in Rome.

2. Epicurus the Man

Epicurus was born in February of 341 BC in the deme of Gargettus, the youngest of four sons of Neocles and Chaerestrate. While still a child, his family immigrated as cleruchs or colonists to the island of Samos just off the western coast of Ionia or modern-day Turkey. After having challenged his schoolmaster concerning the interpretation of a line from the poet Hesoid, it was decided that Epicurus should study philosophy. Consequently in 327 BC, at age 14, he began the study of mathematics, rhetoric and dialectics under the Platonist philosopher, Pamphilus of Samos.

In 323 BC, at age 18, Epicurus moved to Athens in order to fulfill his two years of required military service. Here he also continued his philosophical education by attending the lectures of Xenocrates at Plato's Academy. However, his cadetship was soon interrupted by the death of Alexander the Great and the news that the Athenian colonists, including his family, had been forcibly expelled from Samos.

In the wake of similar political upheavals in Athens following the news of Alexander's death, Epicurus left the city in order to join his family, now in exile in the city of Colophon on the coast of Ionia. Loss of the property on Samos had reduced the family to near poverty and his father, in order to survive, began teaching elementary school, while his mother attempted to generate additional income by selling charms and spells. Epicurus assisted both while continuing to study philosophy on his own. His discovery during this period of the writings of Democritus marked the beginning of his growing anti-Platonism. However, his efforts to further pursue this change of interest by studying with a follower of Democritus by the name of Nausiphanes of Teos ended in disaster, due to a clash of personalities.

In 309 BC, at age 32, Epicurus began to publicly teach his new materialistic anti-Platonist philosophy in the city of Mytilene on the island of Lesbos, but met with such violent opposition that he was forced to flee to the city of Lampsacus on the northern coast of Ionia near the Hellespont. Here he successfully developed a school of followers, including Metrodorus (figure 2), Idomeneus, Leonteus, Thermista, Colotes, Polyaneus, and Pythocles, and, in light of his experience on Lesbos, also took the precaution of obtaining political protection from the local authorities.

In 306 BC, at age 35, Epicurus purchased, with financial help from his followers, a small house and

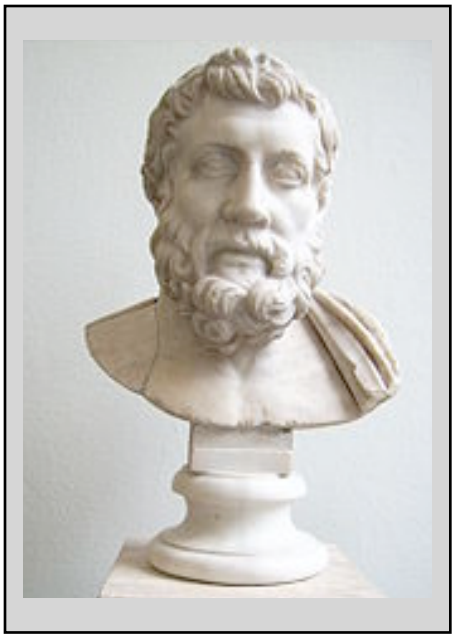

Figure 2. Metrodorus of Lampsacus (c. 331-278 BC), an early follower of Epicurus.

garden in Athens (figure 3). In order to avoid a repeat of the incident at Mytilene, he taught philosophy privately at his house and garden for the next 36 years

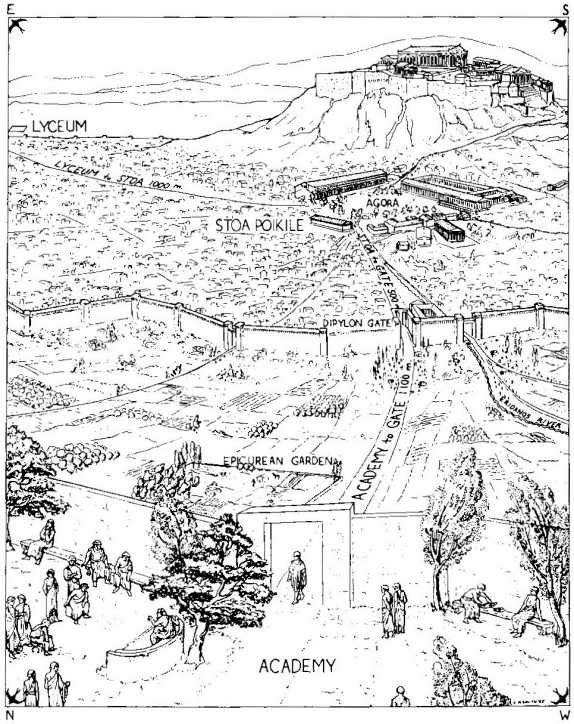

Figure 3. A modern reconstruction of the locations of the Academy of Plato, the Lyceum of Aristotle, the Stoa of the Stoics, and the Garden of Epicurus.

rather than in the public stoa and gymnasia, a routine broken only by occasional trips to visit conclaves of friends in Ionia and Rhodes.

Epicurus died in Athens in 270 BC at age 71, after an illness of two week's duration, while lying in a warm bath to alleviate the pain from kidney stones. In his will he appointed Hermarchus (figure 4), an early convert from the disastrous period at Mytilene, as his successor. Though it is generally assumed that the Garden continued to function until around 529 AD, when the Christian Emperor Justinian officially banned the teaching of pagan philosophy in the schools of Athens, there is little surviving evidence of an active Epicurean presence in classical literature after about 225 AD.

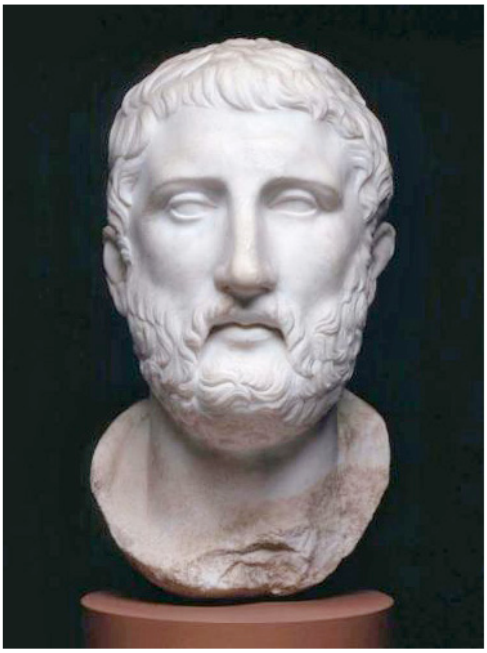

Figure 4. Hermarchus of Mytilene (c. 325-250 BC), an early follower of Epicurus and his successor as head of the Garden in Athens.

3. The Surviving Sources

In dealing with the work of an ancient philosopher, it is always important to be aware of the nature and limitations of the surviving source material. In the case of Epicurus and Epicureanism in general, these surviving ancient sources may be divided into three groups:

Original Writings (306 - 270 BC)

Epicurus is reputed to have been a prolific writer and to have authored more than 300 volumes or scrolls during his lifetime on various subjects. Of these, only three

Figure 5. The imprint of a Roman finger ring thought to represent the image of the Roman poet, Titus Lucretius Carus, the author of *On the Nature of Things*.

short synoptic letters addressed to Herodotus (On Method and Physics), to Pythocles (On Meteorology and Astronomy), and to Menoeceus (On Ethics) have survived. In addition, there are two collections of brief statements of key concepts and principles known, respectively, as the *Principle Doctrines* (40 in number) and the *Vatican Sayings* (61 in number), as well as a few fragments from the Herculaneum papyri. However, the latter, which also contain some fragments from the writings of Epicurus's friend and follower, Metrodorus of Lampsacus, have never, to the best of my knowledge, been translated into English.

Early Roman Period (60 - 50 BC)

Nearly 200 years separate the original writings of Epicurus and his contemporaries from our next collection of significant Epicurean documents, all of which are Roman rather than Greek in origin. These are three in number:

1. Fragments from the writings of Philodemus of Gadara (c. 60 BC) which form the majority of the surviving Herculaneum papyri and which are only gradually becoming available in English translation.

2. The epic poem, *On the Nature of Things* (c. 56 BC), by the Roman author, Titus Lucretius Carus (figure 5). This is by far the longest, most complete, and most significant surviving example of Epicurean literature.

3. Numerous critical discussions of various aspects of Epicurean philosophy found in the essays and dialogs (c. 50 BC) of the Roman politician and lawyer, Marcus Tullius Cicero, including *On the Nature of the Gods*, *On the Chief Good and Evil*, and the *Tusculan Disputations*.

Later Roman Period (60 - 225 AD)

We now jump yet another 100-300 years to discover five additional sources:

1. The *Essays* and *Moral Epistles* (c. 60 AD) of the Roman Stoic, Lucius Annaeus Seneca, which contain numerous quotes and paraphrases from Epicurus.

2. Several essays (c. 90 AD) of the famous biographer and Platonist, Ploutarchos of Chaeronea, better known as Plutarch, such as *Against Colotes*, *A Pleasant Life*, *On Living the Inconspicuous Life*, etc., which explicitly attack various aspects of Epicurean philosophy.

3. Some passing references to contemporary Epicureans in the writings (c. 160 AD) of the satirist, Lucian of Samosata, and most notably in his tale of *Alexander the False Prophet*.

4. Portions of various Epicurean documents inscribed on a large stone wall by one Diogenes of the city of Oenoanda in southern Turkey (c. 180 AD).

5. The biography of Epicurus written by Diogenes Laertius (c. 225 AD) as part of his larger *Lives and Opinions of Eminent Philosophers*. Next to the poem of Lucretius, this is the single most significant Epicurean resource. Not only is it our primary source for the life and writings of Epicurus (including his final will), it is also our source for the three surviving letters written by Epicurus and the *Principle Doctrines*, all of which were reproduced by Diogenes as part of his synopsis of Epicurean philosophy.

In addition to these primary sources, there are also scattered references to Epicurus in the writings of the later doxographical commentators, many of which have been collected and translated for easy reference (3). However, unless indicated otherwise, all quotes used in this evening's lecture will be taken either from the surviving writings of Epicurus or from the epic poem of Lucretius (4).

4. Epicurean Philosophy

Like much of ancient philosophy, Epicurean philosophy was divided into the three major branches of epistemology, physics, and ethics. Epistemology, other-

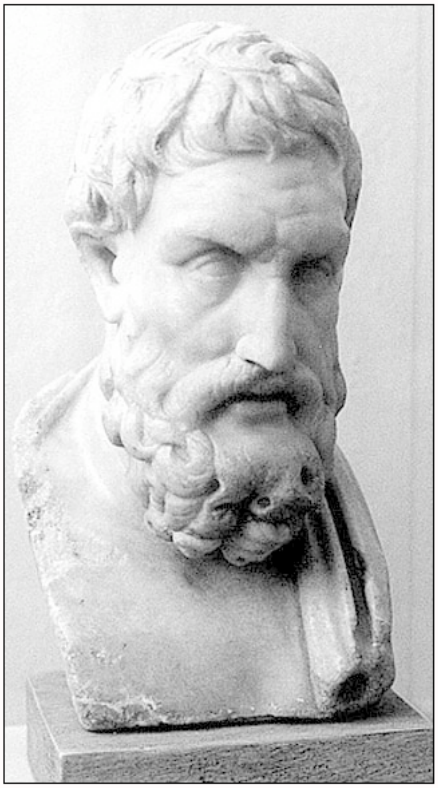

Figure 6. A marble head of Epicurus which seems to have served as the model for the bronze bust shown in figure 9.

wise known as logic or methodology, dealt with the question of how we know. Physics, otherwise known as science or cosmology, dealt with the question of what we know, and ethics or morals dealt with the question of how we should act in light of that knowledge. This evening we will honor this traditional classification by summarizing each of these three aspects of Epicurean philosophy in turn.

5. Epicurean Epistemology (Canon)

Epicurean epistemology, which Epicurus referred to as the canon or standard, rests on at least four assumptions:

1. *Qualitative rationalism* based on an explicit rejection of mysticism and supernaturalism.

2. *Observational empiricism* based on an explicit use of the observable to deduce the existence and behavior of the unobservable (i.e., atomic level) and allowance for multiple naturalistic rationales if the observational data is theory neutral.

3. *Naive realism* based on the belief that the universe exists independently of man and that sensations provide a true picture of the external world, though subject to potential misinterpretation on the part of the observer, which may be compensated for through a knowledge of physics.

4. *Operational linguistics* based on an insistence that words have an actual empirical content, leading to an explicit rejection of dialectic, rhetoric and poetry as detrimental to clear objective description.

Not unexpectedly for this period in history, there is no explicit use of the experimental method. In addition, in keeping with Epicurus's anti-Platonism, there is also an explicit rejection of mathematical modeling and deduction.

6. Epicurean Physics

Epicurean physics may be likewise summarized in terms of at least eight assumptions or principles:

1. The universe, including man, is made of atom and void:

All Nature, as it is in itself, is made up of two things. For there are bodies of matter [atoms], and there is the void in which these bodies exist and through which they move in their various courses.

2. The universe was neither created by the gods nor created for the benefit of man:

... certain men, ignorant of the structure of matter, hold, that without the aid of the gods, Nature could neither change the seasons of the year in a way so fitted to the needs of men, nor produce crops for their use ... But when they suppose that the gods have established all things in the interest of mankind, they clearly have fallen far from the truth in every respect; for even if I did not know the nature of the atoms, yet I would still venture to assert from the very ways of the heavens – and to prove from many other examples – that by no means was the world created for us by the gods, given the imperfections with which it is filled.

3. Rather the universe is self-generated and nonteleological, i.e. it lacks a predetermined purpose or goal:

Surely the atoms do not individually put themselves in their proper places as a result of deliberation with conscious intent, nor have they agreed, we may be sure, what motions they shall produce, but it is because many atoms undergo many changing conditions throughout all space during limitless time, and are

moved and stirred by blows, that, after having tried every kind of motion and combination, at length they chance to fall into such groupings as those from which this world of ours is formed and continues to exist.

4. Living organisms, societies, cultural and technological developments, etc. are not created fully perfected by either the gods nor by the fortuitous concourse of atoms but are rather the result of a gradual evolutionary process in which unfit variations are eliminated and fit variations survive:

Thus then the passage of time alters the nature of the whole world and the earth enters upon one state after another, so that it is not able to produce what it once did, and can produce what once it could not. In the past, the earth tried many experiments in creation, producing creatures with strange forms and strange members ... but to no purpose since Nature refused them increase, nor could they attain to the desired prime of life, find food, or be united in the task of Venus. For we see that many points must meet favorably for creatures, if they are to continue their race by propagating it ... For whatever animals you see feeding upon the life-giving air, either craft or courage or, it may be, speed, has saved and protected that breed since its first beginning; and there are also many which, commended to us by their utility, survive because committed to our protection ... But as for those to whom Nature has granted none of these things ... these in truth fall as prey and a booty to others, all of them entangled by their own fated bonds, until Nature brings the breed to destruction.

Navigation, fields under cultivation, walls, laws, arms, highways, dress and other things of this sort; prizes, every pleasure of life from its very foundation, songs, pictures, and the creation of wondrous works of sculpture – all these things, practice and, along with it, the experience of an active mind, were taught slowly to men, who were making progress step by step.

5. The universe is infinite in duration and extension:

Moreover the universe as a whole is infinite, for whatever is limited has an outermost edge to limit it, and such an edge is defined by something beyond. Since the universe does not have an edge, it has no limit; and since it lacks a limit, it is infinite and unbounded.

6. The universe contains countless other worlds which, like the earth itself, were created by a fortuitous concourse of atoms, and which will, like all complex material objects, eventually decay again into their component atoms:

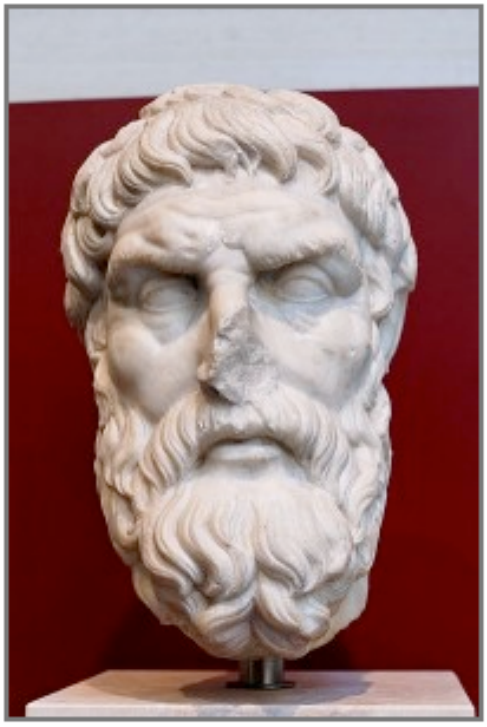

Figure 7. A heavily damaged head of Epicurus, probably broken off of a full-body statue.

Finally, the number of worlds – some like ours, and others unlike – is also infinite ... One must not suppose that, because of necessity, worlds in a single pattern were created, or in every possible pattern ... Moreover, we may believe that in all the worlds there are animals, plants, and other things we see, for no one can show that the seeds from which these grow might not have been included in one particular world and that in another kind of world this was impossible ... In addition, it is necessary to believe that the worlds, and every limited complex ... have been formed from the infinite, each of them – greater or smaller – separating out from its own whirling mass. We must suppose also that these will all be dissolved again – some more quickly and some more slowly, some affected by one calamity and others by another.

7. Consistent with man's free agency, the universe displays a statistical rather than an absolute determinism:

[The prudent man] thinks that the chief power of decision lies within us, although some things come about by necessity, some by chance, and some by our own wills, for he sees that necessity is irresponsible and chance uncertain, but that our actions are subject to no

power. It is for this reason that our actions merit praise or blame. It would be better to accept the myth about the gods than to be a slave to the determinism of the physicists; for the myth hints at the hope for grace through honors paid to the gods, but the necessity of determinism is inescapable ... Remember that the future is neither ours nor wholly not ours, so that we may neither count on it as sure to come nor abandon all hope of it as certain not to be.

8. The soul of man is material and, like his body, ceases to exist after death. It functions as the medium by which sensations are transmitted from the body to the mind and by which the mind commands the body. In short, it serves much the same function as the central nervous system in modern physiology:

Those who say that the soul is incorporeal are talking nonsense, for in that case it would be unable to act or be acted upon ... the soul is a finely divided, material thing, scattered throughout the whole aggregation of atoms that make up the body ... if the whole body is destroyed, the soul is scattered ... and no longer possesses sensation.

Accustom yourself to the belief that death is of no concern to us, since all good and evil lie in sensation and sensation ends with death ... he is foolish who says that he fears death, not because it will be painful when it comes, but because the anticipation of it is painful; for that which is no burden when it is present gives pain to no purpose when it is anticipated. Death, the most dreaded of evils, is therefore of no concern to us; for while we exist death is not present, and when death is present we no longer exist. It is therefore nothing either to the living or to the dead, since it is not present to the living and the dead no longer are.

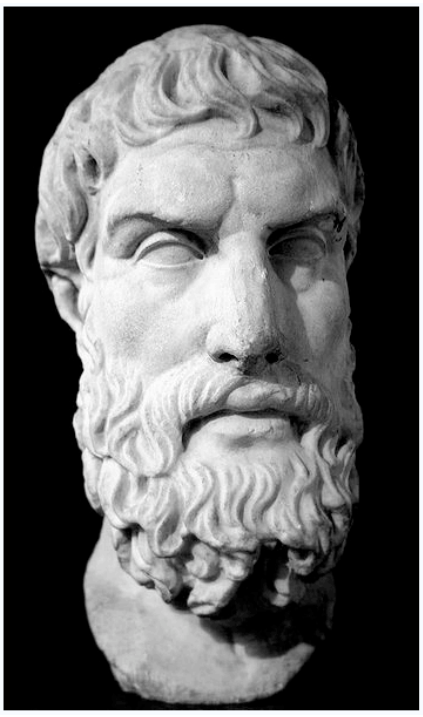

Figure 8. Yet another head of Epicurus corresponding to a fragment of a larger statue.

7. Psychology and the Nature of the Gods

Epicurean insistence on external sensations as the source of all knowledge resulted in a psychology which grossly underestimated the role of imagination in the formation of human beliefs about the supernatural.

In Epicurean physics vision was the result of the movement of an "idol" of the perceived object from the object in question to the eye or brain of the viewer. This idol was a film or cast of the outer surface of the object formed from superfine particles present in the surrounding air and was projected from the object to the eye at unimaginable speeds. As quickly as one idol was projected, another was formed to take its place:

We see or think of the outer form of a thing when something comes to us from its surface ... It is not impossible that emanations of this sort are formed in the air that surrounds a body, that there are opportunities for the creation of these thin, hollow films, and that the particles composing them retain, as they flow from the solid object, the same position and relative order they had while on its surface. Such images we call "idols"... Moreover, there is nothing to prevent our believing that the creation of idols is as swift as thought. They flow from the surface of a body in a constant stream, but this is not made evident by any decrease in the size of the body since other atoms are flooding in [from the surrounding air].

This theory was used, in turn, to account for ghosts and monsters. Thus ghosts are neither the souls of the dead (which do not exist) nor the products of our imagination, rather they are due to real, albeit highly attenuated, visual sensations produced by the still not fully dissipated "idols" of the dead that were generated while they were still living and which are still flying about in the air:

And these same idols, coming upon us awake or asleep terrify our minds when we behold their monstrous shapes and the likeness of those who have departed from the light; and when we are sleeping they have often aroused us in terror from our slumber ... when

sleep has relaxed our limbs, the rational parts of our minds remain awake, but with this difference: the idols that stir our minds when we are awake now stir them to the point that we believe we truly see the man whom death and the earth already hold bereft of life. Nature brings this about because all the senses of the body, checked by sleep, are dormant throughout the limbs and cannot refute the false by the true. Moreover, memory lies languid in sleep and does not argue that he whom the mind believes it sees alive has long since passed into the power of death and destruction.

Similarly, mythical animals and monsters are due, not to the imagination, but to real sensations resulting from the mixing of stray idols:

Certainly an idol of a centaur is not made from a living centaur, since no such animal ever existed; but when by chance the idols of a horse and of a man have come together, one clings readily to the other because of their subtle nature and tenuous texture ... other idols of this kind are formed in the same way.

The importance of the theory of idols is that it also forms the basis of the Epicurean theory of the nature of the gods. As with ghosts and imaginary monsters, the gods are not a product of the human imagination but rather the result of sensations produced by external stimuli or idols which originate from a race of perfected beings who dwell between the worlds (*intermundia*):

1. These beings have human form and are not supernatural, having been created from the concourse of atoms and evolution like all natural objects.

2. They are not responsible for the creation of the universe, are not involved in its maintenance, and have no special powers of any sort.

3. They have no interest in human beings or their welfare. They do not respond to prayers or sacrifices nor do they bless or punish.

4. However, they have succeeded in perfecting their lives and now enjoy that perfect tranquility corresponding to the Epicurean vision of true happiness.

5. It is this vision of happiness and tranquility which their highly attenuated idols awaken in the sleeping brains of mankind and which account for the almost universal belief in the existence of the gods as some form of perfected human being.

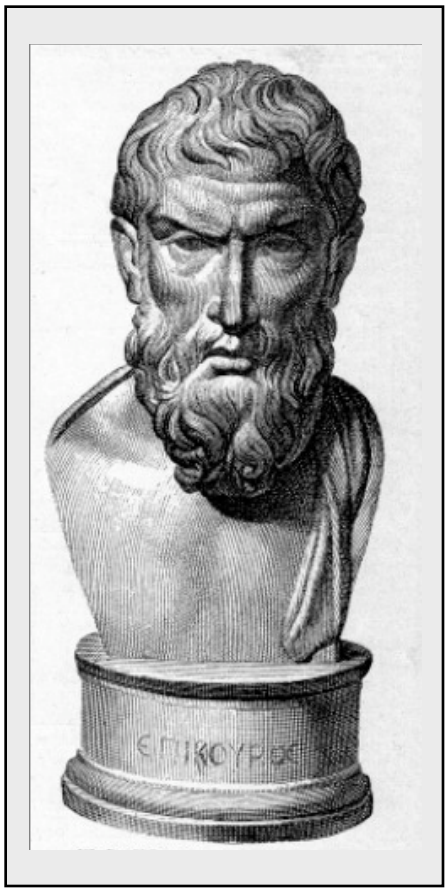

Figure 9. A 19th-century etching of a bronze bust of Epicurus uncovered at Herculaneum.

6. Unfortunately, most humans have failed to correctly interpret the true meaning of this vision and, in their ignorance, have endowed the gods with all sorts of false attributes and supernatural powers.

In short, the Epicurean gods serve only one purpose: to function as cosmic role models. Thus, as with the term "soul," the term "god" has been given a very special interpretation by Epicurus.

Opinions on this interpretation have varied among scholars. Some feel that it was taken very seriously by the Epicureans as a concept totally in keeping with both their physics and their ethics, whereas others feel that it was an elaborate ruse on the part of Epicurus to protect his followers from the charge of atheism. It allowed them to claim a belief in the gods, while in actual fact not believing in them in any normal sense of the word. If the latter interpretation is correct, then the ruse hardly failed to fool anyone:

1. Cicero, in his essay on *The Nature of the Gods*, called the Epicurean concept of the gods "absurd." Any

Figure 10. An 18th-century etching of a Roman finger-ring bearing the profile of Epicurus.

gods that could not account for the origin of the universe and the workings of Nature and whose worship failed to provide one with some cosmic advantage in the crap game of life, were, in his opinion, hardly worthy of the name and certainly not worth worshiping.

2. The Jews and early Christians were even more direct in their evaluation. The traditional Rabbinical term for a disbeliever or apostate eventually became "Apikoras" or "Epicurean."

8. Epicurean Ethics

The Epicurean gods do not mandate ethical behavior, though they do set an example. They neither reward good nor punish evil. Consequently ethical guidelines, like all other things in the universe, must be rationalized on naturalistic grounds and originate, according to Epicurus, in the interplay between between the natural forces of pain and pleasure as mediated by the self-conscious, rational exercise of human free-agency or "prudence."

Man is mortal and has but one life to live. The goal of that life should be the attainment of happiness through *ataraxia* or tranquility of both body and mind. These are obtained, in turn, through a calculus of hedonism, a rational selection, as far as humanly possible, of pains and pleasures mediated by the exercise of prudence:

pain & pleasure + prudence = tranquility = happiness

When we say pleasure is the end, we do not mean the pleasure of the profligate or that which depends on physical enjoyment – as some think who do not understand our teachings ... but by pleasure we mean the state wherein the body is free from pain and the mind from anxiety.

Neither continual drinking and dancing, nor sexual love, nor the enjoyment of fish, and whatever else the luxurious table offers, brings about the pleasant life; rather it is produced by reason which is sober, which examines the motive for every choice and rejection ... For this reason prudence is more precious than philosophy itself. All other virtues spring from it. It teaches that it is not possible to live pleasantly without at the same time living prudently, nobly, and justly, nor to live prudently, nobly and justly without living pleasantly.

The central role played by prudence was well summarized by the 18th-century French writer of epigrams and maxims, Nicolas Chamfort, though perhaps not without a slight touch of added sarcasm (5):

Philosophers recognize these four principle virtues, from which they derive all others: justice, temperance, courage, and prudence. The last may be said to comprehend the first two – justice and temperance – and to do duty, to some degree, for the third by sparing the man who has the misfortune to be deficient in courage many of the occasions on which this quality is needed.

9. The Epicurean Duty Toward Self

The true Epicurean sought attainment of physical tranquility through the prudent selection of physical pleasures (whether food & drink, material possessions, or sexual fulfillment) which neither engendered unhealthy obsessions nor damaged the body. Prudence was the guiding rule, as aptly summarized many centuries later by George Santayana (6):

Allowed to look but once upon the wonderful spectacle that is life ... we should look and admire, for tomorrow we die; we should eat, drink and be merry, but moderately and with much art, lest we die miserably, and die today.

Even more importantly, the true Epicurean also sought the attainment of mental tranquility or *ataraxia* (freedom from disturbance) through:

1. The study of natural science in order to eliminate unfounded superstitions and fears and to learn which pains must be accepted as an inevitable consequence of

the operation of the impersonal laws of nature and which are partly open to human control and hence capable of being mitigated through the exercise of prudence.

It is not possible for one to rid himself of his fears about the most important things if he does not understand the nature of the universe but dreads some of the things he has learned in the myths. Therefore, it is not possible to gain unmixed happiness without natural science.

2. The prudent selection of fulfilling interpersonal relationships

3. A prudent response to social pressures and turmoil.

These latter two points require further elaboration.

10. The Epicurean Duty Toward Others

The Epicurean is admonished to do no harm to others and to accept no harm from others, whether that harm be physical or mental. He should not unnecessarily disturb the tranquility of others through impoliteness, harsh criticism, or spitefulness. In short, he should be a gentleman:

He who is calm disturbs neither himself nor another.

Recalling Schopenhauer's famous metaphor of the freezing porcupines on a winter's day seeking warmth by huddling together and yet driven apart by the poking of their quills, we would say that Epicurus came to the conclusion that friendship represented the ideal equilibrium position – the most prudent and fulfilling of all human interactions.

1. He felt that a closer approach often resulted in relationships based on unbridled and irrational passions, sexual or otherwise, which could potentially disturb the mind through jealousy and envy and the body through the creation of insatiable desires.

2. He felt that a more distant approach, based on mere acquaintance, social conventions, and the formalities of law and justice, was ultimately a poor substitute for the affection and trust engendered by true friendship.

Instead, the tranquil man fills his life with the company of friends of like mind, selected through the exercise of prudence and maintained through the exercise of trust and mutual sympathy. Epicurean communities were essentially conclaves of friends, linked through a common study of natural science and celebration of the memory of deceased members:

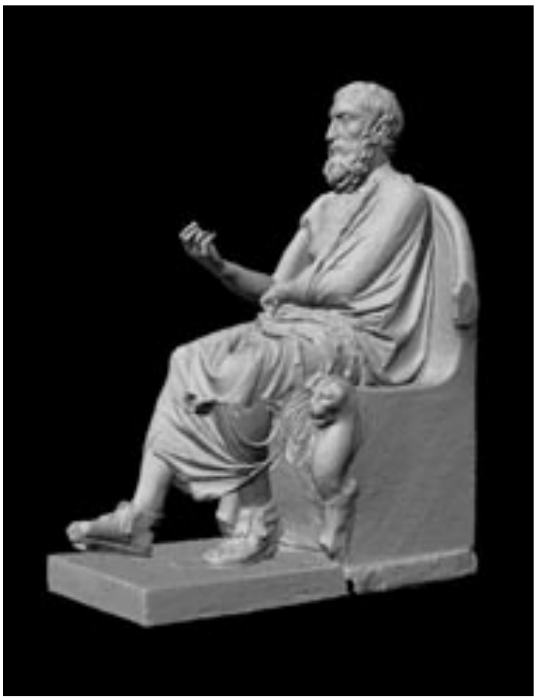

Figure 11. A computer image of a restored full body statue of Epicurus. Many of the heads found in various museums are probably fragments of these larger statues.

Of the things that wisdom prepares for insuring lifelong happiness, by far the greatest is the possession of friends ... The noble man is chiefly concerned with wisdom and friendship; of these the former is a mortal good, the latter an immortal one ... Friendship dances through the world bidding us all to awaken to the recognition of happiness.

11. The Epicurean Duty Toward Society

The tranquil man does not unnecessarily incur the wrath of society through public disrespect of the law or the state religion, in so far as this can be done in a manner consistent with his private beliefs. Indeed, in order to maintain tranquility of mind, Epicureans were expressly advised not to participate in politics or public life in any way:

If a man were to undertake a systematic inquiry into what is most destructive of friendship and most productive of enmity, he would find it in the system of political life. Witness the envy roused by those who compete for its prizes, the rivalry that springs up between the contestants, the animosities that accompany the

introduction of new laws, and the deliberate organization of faction fights which set, not only individuals, but whole peoples on their ears.

Epicureanism is basically a philosophy of social "quietism." The tranquil man is known to his friends but is unknown to society as a whole. Its central premise is summarized by the phrase:

λαθε βιωσαζ

which roughly translates as "live unknown."

12. Summary

I can provide no better summary to this evening's lecture then to quote the words of the Epicurean scholar, Peter Preuss (7):

An Epicurean good life is a life of pleasure taken in mere existence for its own sake, a pleasure which is the very opposite of boredom and despair, the very opposite of a fearful, troubled life of toil and duress. It is a simple life lived by a self-complete individual in friendship with other such individuals. And it is a mortal life lived in the face of death which removes it from the everyday temptations to pettiness and greed. It is a life lived in a kind of garden oasis in a world which is a brute fact, a spiritual desert without a trace of divine intent.

The basic themes of Epicurus' philosophy speak to us today as much they did to his contemporaries over two millenia ago because they address themselves to timeless human issues which retain their urgency within the flow of historical change. They speak of human beings engaged in lives filled with misery and joy, success or failure, meaning or bleak pointlessness, of human beings at a loss about what really matters in life, or declaiming about it with a confidence got from finding their wisdom in fashionable platitudes. They speak of human beings driven by ambition, chasing luxury and the goods dictated by convention, all those things which are indispensable if you are going to amount to anything in this world. They speak of people trained to wear out their lives in service, whether of worldly or otherworldly expectation, and they speak with a philosophical simplicity which rejects mere complexity and subtilty in favor of a kind of candid directness with which one feels that which is true and important can be stated.

I submit that one could not ask for a better definition of humanism.

13. References and Notes

1. A lecture given to the Cincinnati Free Inquiry Group (FIG), Cincinnati, OH, on 27 March 2001.

2. H. J. Blackham, *Humanism*, Penguin Books: Baltimore, MD, 1968.

3. A. A. Long, D. N. Sedley, *The Hellenistic Philosophers: Volume 1, Translations of the Principle Sources with Philosophical Commentary*, Cambridge University Press: Cambridge, 1987.

4. There have been many English translations and printings of the writings of both Epicurus and Lucretius, including the inexpensive paperback editions currently published by Prometheus Books as part of their "Great Books in Philosophy" series. I, however, recommend the following translations by Russel Geer for their unusual clarity: Epicurus, *Letters, Principle Doctrines, and Vatican Sayings*, Bobbs-Merrill: Indianapolis, IN, 1964, and Lucretius, *On Nature*, Bobbs-Merrill, Indianapolis, IN, 1965.

5. E. Powys Mathers, *Maxims and Considerations of Chamfort*, Vol. 2, The Golden Cockeral Press: London, 1926, p. 3.

6. G. Santayana, *Three Philosophic Poets: Lucretius, Dante, and Goethe*, Harvard: Cambridge, MA, 1927.

7. P. Preuss, *Epicurean Ethics*, Mellon: Lewiston, NY, 1994.

III
Oliver Wendell Holmes as Skeptic

1. Introduction

Like many in the audience, I have long been a subscriber to *The Skeptical Inquirer Magazine*, and yet I must confess that, as time goes on, I find less and less in the magazine to interest me (1). Instead, on opening each new issue, I find myself overwhelmed with a strong sense of *déja vu*. Apparently the nonsense of the world, though limitless with respect to quantity, is rather less so when it comes to variety. The same old fads and foolishness seem to repeat themselves over and over no matter how many times they are exposed or debunked, so in the end one is forced to agree with Ecclesiastes that:

The thing that hath been, it is that which shall be; and that which is done is that which shall be done; and there is no new thing under the sun. Is there anything whereof it may be said, See, this is new? It hath been already of old time, which was before us. There is no remembrance of former things, neither shall there be any remembrance of things that are to come with those that shall come after.

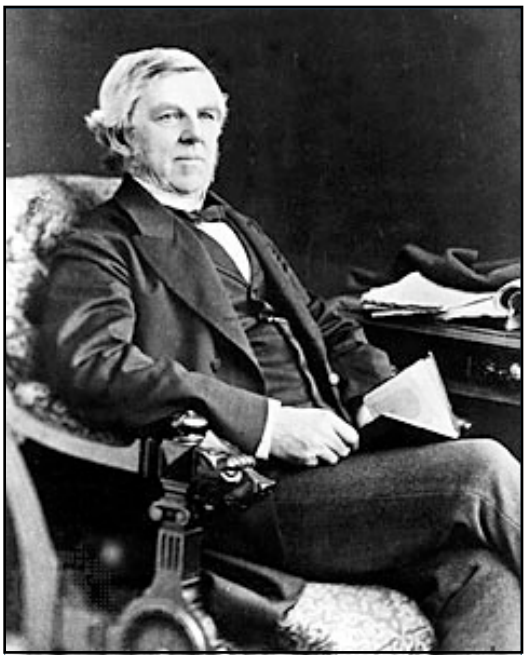

Figure 1. Oliver Wendell Holmes (1809-1894).

And yet, as an historian of science, I cannot resist occasionally taunting my contemporaries with some "remembrance of former things," and I will, I'm afraid, be indulging that whim this morning by reviewing for you a little-known aspect of the life and career of the 19th-century American physician, poet and writer, Dr. Oliver Wendell Holmes – namely his pioneering efforts in combating the pseudoscience and medical quackery of his time.

2. Holmes the Man

In my youth some exposure to Holmes and his humorous poetry was a standard feature of the high-school American literature course. Having no children of my own, I have long since lost track of how that curriculum has or has not changed in the intervening years but strongly suspect that it would be a mistake to assume that the younger members of our audience must necessarily know who Holmes was and what he was famous for. Hence, before entering into his activities as a skeptic, I would like to give you a brief overview of his life and career (2).

Born on 29 August 1809 in Boston, MA, the son of a congregational minister, Holmes entered Harvard College in 1825 at age 16. It was during his undergraduate years at Harvard that he first began publishing humorous verse in various student publications and local newspapers. Graduating in 1829, he began the study of law the next year at the Harvard Law School, and also gained local fame with the publication of his poem "Old Ironsides," lamenting the impending passing of this famous ship from the American Revolution. The poem was widely credited with saving the ship from destruction and, of course, it can be seen to this day on visiting Boston Harbor. Finding the study of law uncongenial, Holmes transfered to the Harvard Medical School in 1831. From 1833 to 1835 he studied medicine in Paris and also travelled in Holland, Italy and England, returning to Harvard in 1836 to complete his M.D. degree.

Over the next decade Holmes was in private medical practice. During this period he also joined the Boston Society for Medical Improvement, won three Boyleston Prizes for his medical essays, published his first book of poems (1836), served as physician to the Boston Dispensary, became a cofounder of the Tremont Medical School and Professor of Anatomy at Darmouth College, and married in 1840 Amelia Jackson, the niece of his medical mentor, Dr. James Jackson.

Their first, and equally famous child, Oliver Wendell Holmes Jr., was born the next year.

In 1843 Holmes published his famous essay on childbed or puerperal fever, which anticipated the work of Semmelweis, and which forms the basis of his claim to fame in the annals of American medicine. Four years later he was appointed, at age 38, as Professor of Anatomy and Physiology, as well as Dean, at the Harvard Medical School. Soon giving up his private medical practice, Holmes continued as Dean of the Medical School until 1853, though he retained his professorship until his final retirement in 1882 at age 73.

In 1857 Holmes began writing humorous pieces for the newly founded magazine, *The Atlantic Monthly*. These were collected together in book form the next year to produce the first of his four famous breakfast collections, *The Autocrat of the Breakfast Table*, and in 1861 he also published the first of three pioneering psychological novels, *Elsie Venner*. To these were later added in 1886 a book of travels entitled *Our Hundred Days in Europe*, based on a final tour of Europe undertaken at age 77, four years after his retirement from the Medical School, and during which he had the pleasure of meeting Louis Pasteur. Eight years later, on 7 October 1894, Holmes (figure 2) passed away in his home at age 85.

3. Collected Works

A feel for the nature and extent of Holmes' lifework can be had by a brief glance at his collected works, which were published in 13 volumes by Houghton Mifflin in 1892, two years before his death. These consisted of (3):

1. Two volumes of poems.
2. Four volumes of the "Breakfast Series":

The Autocrat of the Breakfast Table (1858).
The Professor at the Breakfast Table (1860).
The Poet at the Breakfast Table (1872).
Over the Teacups (1891).

3. Three volumes of psychological novels:

Elsie Venner (1861), which dealt with schizophrenia.
The Guardian Angel (1867), which dealt with hysteria.
A Mortal Antipathy (1885), which dealt with gynophobia.

4. Two volumes of literary and miscellaneous essays.
5. One volume of medical essays.
6. One volume of travel.

In what follows, two of these – *The Professor at the Breakfast Table* and the volume of medical essays – will be of most interest to us.

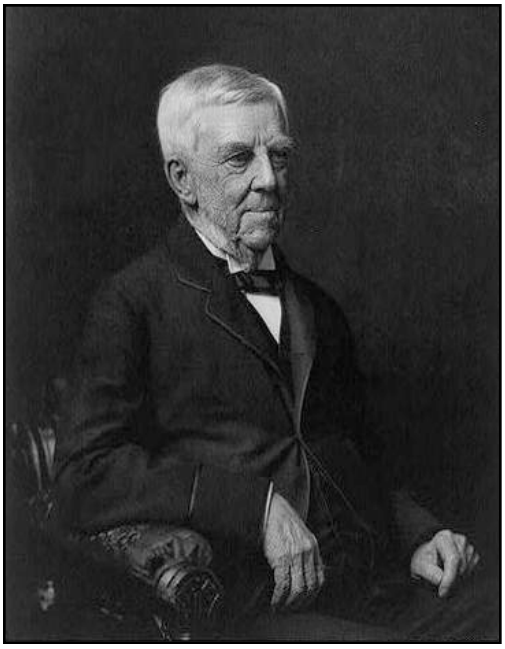

Figure 2. Holmes near the end of his life.

4. Holmes as a Debunker of Medical Quackery

Holmes' work as a debunker of medical quackery is connected with his activities as a lyceum speaker. These started in 1837, when he began giving occasional popular lectures in the Boston area and continued at an ever increasing pace through the 1850s, when he began lecturing in various cities and towns up and down the Atlantic coast and as far west as Cincinnati, where he spoke in 1855.

Holmes certainly had plenty of material to work with since the 1830s and 1840s saw a veritable flowering of pseudoscientific and supernatural nonsense in American culture. Thus, in the field of medicine, this period sees the rise of mesmerism, homeopathy, hydropathy, phrenology, psychometrics, and Reichenbach's odic force, whereas in religion it saw the rise of spiritualism, Mormonism, the Millerites, and the Campbellites. Utopian movements included Owenism, Fourierism, Brook Farm, the Oneida community, transcendentalism, and the United Order, whereas social reform movements included Bloomerism, free love, temperance, abolitionism, feminism, vegetarianism, and abstinence. Much of the resulting social ferment and upheaval has been documented by past historians and period novelists, and I refer those of you who are interested in the details to the titles listed in my references (4-7).

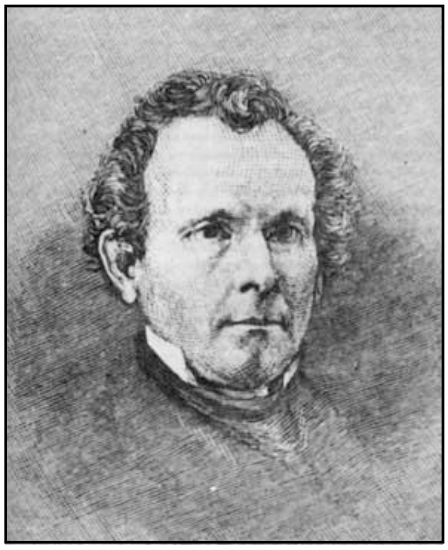

Figure 3. Sylvester Graham (1794-1851).

We are aware of five lectures and/or essays by Holmes touching on medical quackery and pseudoscience:

1840 The Natural Diet of Man
1842 Astrology and Alchemy
1842 Medical Delusions of the Past
1842 Homeopathy
1860 Phrenology

The lyceum lecture on "The Natural Diet of Man" criticized the fad of vegetarianism popularized by the likes of William Alcott and Sylvester Graham (of Graham flour and Graham cracker fame). While praising the virtue of bran bread, Graham (figure 3) also deplored the evils, not only of meat, but of tea, coffee, alcohol, spices, sexual intercourse and masturbation. Unfortunately, only a brief newspaper summary of Holmes' lecture survives.

The lyceum lecture on "Astrology and Alchemy" survives only in manuscript form, which I have not seen.

The lectures on "Medical Delusions of the Past" and "Homeopathy" were later combined by Holmes into a single written essay entitled "Homeopathy and Its Kindred Delusions" and printed in 1883 in his volume of medical essays, whereas his comments on phrenology appeared in the *Atlantic Monthly* as part of his "Professor at the Breakfast Table" series and in book form in 1860.

5. Medical Delusions of the Past (1842)

"Medical Delusions of the Past" covers four topics:

1. The royal cure of the King's Evil or scrofula.
2. The weapon ointment and the sympathetic powder.
3. The tar-water mania of Bishop Berkeley.
4. The history of metallic tractors or Perkinism.

Holmes' treatment of the first three topics is largely historical and only occasionally includes a personal observation on the nature of pseudoscience and self-delusion:

Berkeley [figure 4] himself afforded a remarkable illustration of the truth which has long been known to members of one of the learned professions, namely, that no amount of talent, or of acquirements in other departments, can rescue from lamentable folly those who, without something of the requisite preparation, undertake to experiment with nostrums upon themselves and their neighbors ... But the good bishop got excited; he pleased himself with the thought that he had discovered a great panacea; and once having tasted the bewitching cup of self-quackery, like many before and since his time, he was so infatuated with the draught that he insisted on pouring it down the throats of his neighbors and of all mankind.

Figure 4. Bishop Berkeley (1685-1753).

Holmes' treatment of Perkins' metal tractors is much more detailed, in part because they had been used on him as a child. Invented by Dr. Elisha Perkins (1741-1799) of Norwich, Connecticut, around 1796 and inspired by Galvani's discovery of animal electricity in 1771, they consisted (figure 5) of two pointed, 3-inch, rods of metal (one iron and the other brass), which were rubbed across the afflicted parts of the body to cure aches and pains, tumors, pimples and other skin blemishes (figures 6). In 1804 Perkins' son Benjamin, opened a "Perkinean Institute" in London. The fad rapidly collapsed after Benjamin's death in 1810, though not before he had succeeded in amassing a fortune of more than ten thousand pounds.

Holmes first analyzes what parts of society were most prone to endorse the tractors:

Con: Most of the medical profession.

Pro: Wealthy aristocracy, politicians, ministers, and women of all classes: especially those who had already been foolish enough to purchase the expensive tractors and had a vested interest in convincing both themselves and others that they had not been duped:

These little bits of brass and iron, the intrinsic value of which might perhaps amount to ninepence, were sold at five guineas a pair! A man who has paid twenty-five dollars for his whistle is apt to blow it louder and longer than other people ... I believe it would have been found that most of these persons were of ardent temperament and of considerable imagination, and that their history would show that Perkinism was not the first nor the last hobby-horse they rode furiously.

He also analyzes the arguments used both to support the tractors and to explain away the opposition of the medical profession, commenting that they ...

... have been so long bruised and battered around in the cause of every doctrine or pretension, new, monstrous, or deliriously impossible, that each of them is as odiously familiar to the scientific scholar as are the faces of so many old acquaintances, among the less reputable classes, to the officers of the police.

Figure 5. A surviving set of Perkins' metallic tractors.

Figure 6. "Metallic Tractors," a satirical caricature of Benjamin Perkins and the metal tractor craze by John Gillray, 1801.

Finally, he summarizes the efforts of one Dr. Haygarth (1740-1827) of Bath to discredit the tractors by showing that the results were due solely to the imagination, since Haygarth was able to obtain similar cures using wands made of wood and lead, or with nails, pieces of bone, slate pencils and tobacco pipes:

These experiments did not result in the immediate extinction of Perkinism. Doubtless they were a great comfort to many obstinate unbelievers, and helped to settle some skeptical minds; but for the real Perkinistic enthusiasts, it may be questioned whether they would at that time of changed their opinions even if one had risen from the dead to assure them that it was an error. Rather it perished without violence, by an easy and natural process. Like the famous toy of Mongolfier, it rose by means of heated air – the fevered breath of enthusiastic ignorance – and when this grew cool, as it always does in a little while, it collapsed and fell.

6. Homeopathy (1842)

First proposed by the German physician Samuel Hahnemann (figure 7) in 1796 and further elaborated in a series of books published between 1805 and 1828, the homopathic movement was based on three principles:

1. Like cures like.
2. Drugs are most effective when administered at almost infinite dilution.

3. Most chronic disease is due to "psoria" or the itch.

Holmes first notes that there appears to be no logical connection between these three assertions:

And when one man claims to have established these three independent truths, which are about as remote from one another as the discovery of the law of gravitation, the invention of printing, and that of the mariner's compass, unless the facts in their favor are overwhelming and unanimous, the question naturally arises: "Is this man deceiving himself or is he trying to deceive others?"

Indeed, Hahnemann's followers appear to have universally rejected the third principle, so Holmes confines himself to evaluating the "facts" favoring only the first two, using three criteria:

1. That the symptoms produced by diluted drugs in the healthy should be reproducibly and accurately described.

2. That diluted drugs should be shown to be always capable of curing those diseases most like their own symptoms.

3. That remedies should be shown not to cure diseases when they do not produce symptoms resembling those present in these diseases.

With respect to criterion 1, Holmes finds that different homeopathic writers attribute widely different symptoms to the diluted drugs, that many allopathic writers have been unable to reproduce these symptoms, and that most of the so-called symptoms are probably unrelated to the drug in the first place, but are due rather to accidental associations:

I have not cited these specimens with any view to exciting a sense of the ridiculous, which many others of those mentioned would not fail to do, but to show that the common accidents of sensation, the little bodily inconveniences to which all of us are subject, are seriously and systematically ascribed to whatever medicine may have been exhibited, even in the minute doses I have mentioned, whole days or weeks previously.

With respect to criterion 2, Holmes finds that most of the examples cited by Hahnemann involve outdated and unreliable sources (many Greek and Roman), that others are unable to locate many of these quotes, and that in many cases Hahnemann has misquoted the source in question:

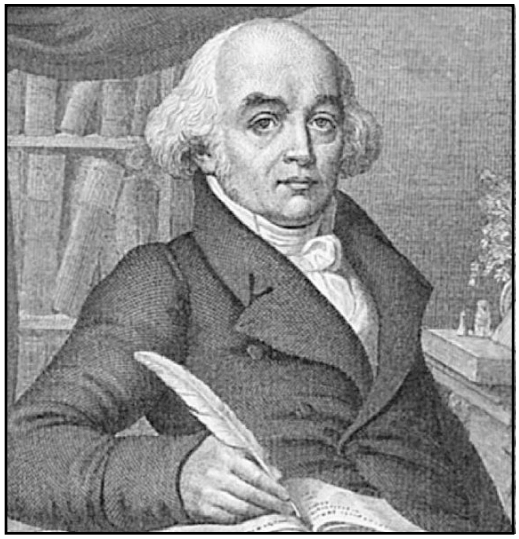

Figure 7. Samuel Hahnemann (1755-1843).

It has hitherto been customary, when examining the writings of authors of preceding ages, upon subjects as to which they were less enlightened than ourselves, and which they were very liable to misrepresent, to exercise some little discretion; to discriminate, in some measure, between writers deserving confidence and those not entitled to it. But there is not the least such delicacy on the part of Hahnemann. A large majority of the names of old authors he cites are wholly unknown to science. With some of them I have long been acquainted, and I know that their accounts of diseases are no more to be trusted than their contemporary Ambrose Paré's stories of meremen and similar absurdities.

With regard to this criterion, Holmes further cites clinical trials of homeopathic treatments by several notable European hospitals using control groups, all of which produced negative results. He concludes that most cures reported in the homeopathic literature involve trivial, nonlethal, complaints which naturally correct themselves over the course of time:

Suppose then, a physician who has a hundred patients prescribes to each of them pills made of some entirely inert substance, as starch, for instance. Ninety of them get well, or if he chooses to use such language, he cures ninety of them. It is evident, according to the doctrine of chances, that there must be a considerable number of coincidences between the relief of the patient and the administration of the remedy. It is altogether probable that there will happen two or three very striking coincidences out of the whole ninety

cases, in which it would seem evident that the medicine produces the relief, though it has, as we assume, nothing to do with it. If the principle "like cures like," is true, then every poison should be its own antidote. Homeopathy tries to wiggle out of this dilemma by claiming "same cures same" is not the same thing as "like cures like." Nevertheless they cite the practice of vaccination as support for their principle, even though it is clearly an example of "same cures same."

Finally, with regard, to criterion 3, the homeopaths, as already noted, are silent.

Holmes closes the lecture by summarizing the degree to which the homeopaths have misrepresented both the extent and prestige of their literature and their followers in the medical community. His final conclusions are not optimistic. Of homeopathy in particular:

It is impossible not to realize the entire futility of attempting to silence this asserted science by the flattest and most peremptory results of experiment. Were all the hospital physicians of Europe and American to devote themselves, for the requisite period, to this sole pursuit, and were their results to be unanimous as to the total worthlessness of the whole system in practice, this slippery delusion would slide through their fingers without the slightest discomposure, when, as they supposed, they had crushed every joint in its tortuous and trailing body.

And of medical quackery in general:

As long as the body is affected through the mind, no audacious device, even of the most manifestly dishonest character, can fail of producing occasional good to those who yield to it an implicit or even a partial faith. The argument founded on this occasional good would be as applicable in justifying the counterfeiter and giving circulation to his base coin, on the ground that a spurious dollar had often relieved a poor man's necessities.

7. Phrenology (1860)

First proposed by the Austrian anatomist Franz Gall (figure 9) and propagated by his disciple Johann Spurzheim (1776-1832), phrenology was based on three premises:

1. Personality traits are localized in different regions of the brain.

2. The strength of the personality trait is proportional to the size of the region in question.

Figure 9. Franz Joseph Gall (1758-1728).

3. The bumps of the skull reflect the size of the underlying regions of the brain.

Holmes' criticism of phrenology is very different from his earlier efforts from the 1840s. As time passed, he seems to have come to the conclusion that rationalism and facts had only a small role to play in combating pseudoscience and that both its generation and defeat depended more on psychological and sociological factors. Thus his attack on phrenology came not in the form of a semi-popular scientific lecture but rather in the form of a satirical lecture embedded in his popular book, *The Professor at the Breakfast-Table*, first published in 1860, and which I quote in full:

A Short Lecture on Phrenology
(Read to the Boarders at our Breakfast-Table)

I shall begin, my friends, with the definition of a Pseudo-science. A Pseudo-science consists of a nomenclature, with a self-adjusting arrangement, by which all positive evidence, or such as favors its doctrines, is admitted, and all negative evidence, or such as tells against it, is excluded. It is invariably connected with some lucrative practical application. Its professors and practitioners are usually shrewd people; they are very serious with the public, but wink and

laugh a good deal among themselves. The believing multitude consists of women of both sexes, feeble-minded inquirers, poetical optimists, people who always get cheated in buying horses, philanthropists who insist on hurrying up the millennium, and others of this class, with here and there a clergyman, less frequently a lawyer, very rarely a physician, and almost never a horse-jockey or a member of the detective police. – I do not say that Phrenology was one of the Pseudo-sciences.

A Pseudo-science does not necessarily consist wholly of lies. It may contain many truths, and even valuable ones. The rottenest bank starts with a little specie. It puts out a thousand promises to pay on the strength of a single dollar, but the dollar is very commonly a good one. The practitioners of the Pseudo-sciences know that common minds, after they have been baited with a real fact or two, will jump at the merest rag of a lie, or even at the bare hook. When we have one fact found us, we are very apt to supply the next out of our own imagination. The Pseudo-sciences take advantage of this. – I did not say that it was so with Phrenology.

I have rarely met a sensible man who would not allow that there was something in Phrenology. A broad, high forehead, it is commonly agreed, promises intellect; one that is "villainous low" and has a huge hind-head back of it, is wont to mark an animal nature. I have as rarely met an unbiased and sensible man who really believed in the bumps. It is observed, however, that persons with what the Phrenologists call "good heads" are more prone than others toward plenary belief in the doctrine.

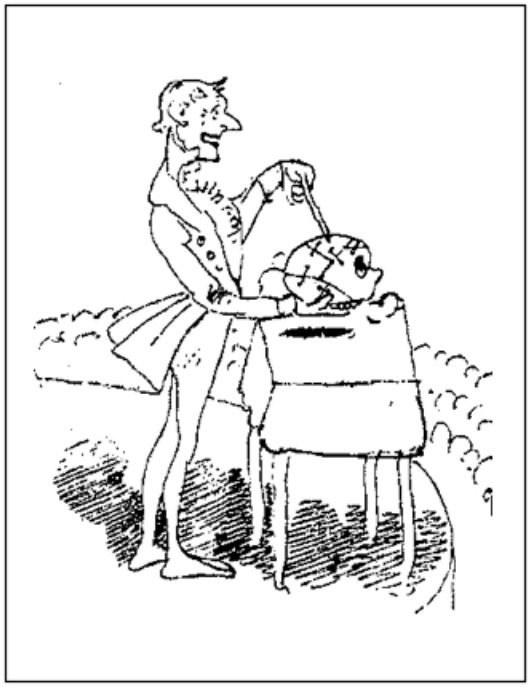

Figure 10. A panel from a cartoon strip by the Swiss humorist Rodolphe Töpffer satirizing phrenology using the character of an itinerant phrenologist named Professor Craniose, circa 1837.

It is so hard to prove a negative, that, if a man should assert that the moon was in truth a green cheese, formed by the coagulable substance of the Milky Way, and challenge me to prove the contrary, I might be puzzled. But if he offers to sell me a ton of this lunar cheese, I call on him to prove the truth of the caseous nature of our satellite, before I purchase.

It is not necessary to prove the falsity of the phrenological statement. It is only necessary to show that its truth is not proved, and cannot be, by the common course of argument. The walls of the head are double, with a great air-chamber between them, over the smallest and most closely crowded "organs." Can you tell how much money there is in a safe, which also has thick double walls, by kneading its knobs with your fingers? So when a man fumbles about my forehead, and talks about the organs of Individuality, Size, etc., I trust him as much as I should if he felt of the outside of my strong-box and told me that there was a five-dollar or a ten-dollar-bill under this or that particular rivet. Perhaps there is; only he doesn't know anything about it. But this is a point that I, the Professor, understand, my friends, or ought to, certainly, better than you do. The next argument you will all appreciate.

I proceed, therefore, to explain the self-adjusting mechanism of Phrenology, which is very similar to that of the Pseudo-sciences. An example will show it most conveniently.

A is a notorious thief. Messrs. Bumpus and Crane examine him and find a good-sized organ of Acquisitiveness. Positive fact for Phrenology. Casts and drawings of A are multiplied, and the bump does not lose in the act of copying. – I did not say it gained.

Presently B turns up, a bigger thief than A. But B has no bump at all over Acquisitiveness. Negative fact; goes against Phrenology. – Not a bit of it. Don't you see how small Conscientiousness is? That's the reason B stole.

And then comes C, ten times as much a thief as either A or B, – used to steal before he was weaned, and would pick one of his own pockets and put its contents in another, if he could find no other way of committing petty larceny. Unfortunately, C has a hollow, instead of a bump, over Acquisitiveness. Ah, but just look and see what a bump of Alimentiveness! Did not C buy nuts and gingerbread, when a boy, with the money he stole? Of course you see why he is a thief, and how his example confirms our noble science.

At last comes along a case which is apparently a settler, for there is a little brain with vast and varied powers, – a case like that of Byron, for instance. Then comes out the grand reserve-reason which covers everything and renders it simply impossible ever to corner a Phrenologist. "It is not the size alone, but the quality of an organ, which determines its degree of power."

Oh! oh! I see. – The argument may be briefly stated thus by the Phrenologist: "Heads I win, tails you lose." Well, that's convenient.

It must be confessed that Phrenology has a certain resemblance to the Pseudo-sciences. I did not say it was a Pseudo-science.

I have often met persons who have been altogether struck up and amazed at the accuracy with which some wandering Professor of Phrenology had read their characters written upon their skulls. Of course the Professor acquires his information solely through his cranial inspections and manipulations. – What are you laughing at? (to the boarders.) – But let us just suppose, for a moment, that a tolerably cunning fellow, who did not know or care anything about Phrenology, should open a shop and undertake to read off people's characters at fifty cents or a dollar apiece. Let us see how well he could get along without the "organs."

I will suppose myself to set up such a shop. I would invest one hundred dollars, more or less, in casts of brains, skulls, charts, and other matters that would make the most show for the money. That would do to begin with. I would then advertise myself as the celebrated Professor Brainey, or whatever name I might choose, and wait for my first customer. My first customer is a middle-aged man. I look at him, – ask him a question or two, so as to hear him talk. When I have got the hang of him, I ask him to sit down, and proceed to fumble his skull, dictating as follows:

SCALE FROM 1 TO 10

LIST OF FACULTIES FOR CUSTOMER	*PRIVATE NOTES FOR MY PUPIL (Each to be accompanied with a wink)*
Amativeness, 7	*Most men love the conflicting sex, and all men love to be told they do.*
Alimentiveness, 8	*Don't you see that he has burst off his lowest waist coat-button with feeding, – hey ?*
Acquisitiveness, 8	*Of course. A middle-aged Yankee.*
Approbativeness, 7+	*Hat well brushed. Hair ditto. Mark the effect of that plus sign.*
Self-esteem, 6	*His face shows that.*
Benevolence, 9	*That'll please him.*
Conscientiousness, 8 1/2	*That fraction looks first-rate.*
Mirthfulness, 7	*Has laughed twice since he came in.*
Ideality, 9	*That sounds well.*
Form, Size, Weight, Color, Locality, Eventuality, etc., 4 to 6	*Average everything that can't be guessed.*

And so of the other faculties

Of course, you know, that isn't the way the Phrenologists do. They go only by the bumps. What do you keep laughing so for? (to the boarders.) I only said that is the way I should practice "Phrenology" for a living.

(End of my Lecture)

8. Homeopathy Revisited (1860)

In this same volume, when once again discussing homeopathy, Holmes also voices what might be called his "retribution" theory of pseudoscience:

Now when a civilization or a civilized custom falls into senile dementia, there is commonly a judgment ripe for it, and it comes as plagues come, from a breath – as fires come, from a spark.

Thus he now views the rise of homeopathy as a just retribution for the quackeries perpetrated by doctors and druggists in the 17th and 18th centuries in the form of their excessive use of elaborate, obnoxious, ineffectual, and often dangerous prescriptions:

Here, look at medicine. Big wigs, gold-headed canes, Latin prescriptions, shops full of abominations, recipes a yard long, "curing" patients by drugging as sailors bring a wind by whistling, selling lies at a guinea apiece – a routine, in short, of giving unfortunate sick people a mess of things either too odious to swallow or

too acrid to hold, or, if that were possible, both at once ... Now mark how the general plague came on the generation of drugging doctors, and in what form it fell.

A scheming drug-vender (inventive genus), an utterly untrustworthy and incompetent observer (profound searcher of Nature), a shallow dabbler in erudition (sagacious scholar), started the monstrous fiction (founded the immortal system) of Homeopathy. I am very fair, you see – you can help yourself to either of these sets of phrases.

All the reasons in the world would not have had so rapid and general an effect on the public mind to disabuse it of the idea that a drug is a good thing in itself, instead of being, as it is, a bad thing, as was produced by the trick (system) of this German charlatan (theorist). Not that the wise part of the profession needed him to teach them; but the routinists and their employers, the "general practitioners," who lived by selling pills and mixtures, and their drug-consuming customers, had to recognize that people could get well, unpoisoned. These dumb cattle would not learn it of themselves and so the murrain of Homeopathy fell upon them.

The same scenario also applied to the fad of spiritualism, which Holmes now represents as a retribution for the senility of conventional theology:

You don't know what plague has fallen on the practitioners of theology? I will tell you then. It is Spiritualism. While some are crying out against it as a delusion of the Devil, and some are laughing at it as an hysteric folly, and some are getting angry with it as a mere trick of interested or mischievous persons, Spiritualism is quietly undermining the traditional ideas of the future state which have been and are still accepted – not merely in those who believe in it, but in the general sentiment of the community, to a larger extent than most good people seem to be aware of. It need not be true to do this, anymore than Homeopathy need, to do its work. The Spiritualist have some pretty strong instincts to pry over, which no doubt have been roughly handled by theologians at different times. And the Nemesis of the pulpit comes in a shape it little thought of – beginning with the snap of a toe joint, and ending with such a crack of the old beliefs that the roar of it is heard in all the minister's studies of Christendom!

In other words, to use a medical metaphor, pseudoscience is like a puss which forms whenever something is rotten in the normal body and which warns us of an underlying pathology:

It is the folly of the world, constantly, which confounds its wisdom. Not only out of the mouths of babes and sucklings, but out of the mouths of fools and cheats, we may often get our truest lessons. For the fool's judgment is a dog-vane that turns with a breath, and the cheat watches the clouds and sets his weathercock by them – so that one shall often see by their pointing which way the winds of heaven are blowing, when the slow-wheeling arrows and feathers of what we call the Temples of Wisdom are turning to all points of the compass.

9. References and Notes

1. A lecture given to the Cincinnati Association for Rational Thought (ART), Cincinnati, OH, on 10 November 2001.

2. For biographical background see E. M. Tilton, *Amiable Autocrat: A Biography of Dr. Oliver Wendell Holmes*, Schuman: New York, 1947.

3. *The Complete Writings of Oliver Wendell Holmes*, 13 Vols., Houghton, Mifflin: Boston, MA, 1892.

4. G. Adams, *The Mad Forties*, Harper: New York, NY, 1942.

5. E. D. Branch, *The Sentimental Years*, 1836-1860, Appleton-Century: New York, NY, 1934.

6. O. A. Brownson, *The Spirit-Rapper*, Little, Brown: Boston, MA, 1854. This is a period novel which satirized many of the social and religious fads of the time.

7. R. G. Walters, *American Reformers*, 1815-1860, McGraw-Hill: New York, NY, 1976.

8. For a modern overview of many of the same examples of medical quackery discussed by Holmes, see R. Porter, *Quacks, Fakers and Charlatans in English Medicine*, Tempus: Stroud, 2000.

IV
Ludwig Feuerbach
The Religious Atheist

1. Introduction

Any proper history of atheism is sure to mention the 19th-century German philosopher, Ludwig Feuerbach (figure 1), and his famous critique of Christianity, *The Essence of Christianity*, which he first published in 1841 (1). Consequently, I was delighted some years ago to discover that the most recent catalog from Prometheus Books was offering an inexpensive paperback reprint of his classic as part of its "Great Books of Philosophy Series" (2). However, my enthusiasm was soon tempered when, on purchasing a copy and attempting to read it, I was almost immediately met with an impenetrable wall of complex sentences and philosophical-theological jargon. Alas, I thought, yet another example (and there are so many) of a famous book often mentioned but seldom read, and promptly placed it on the shelf to collect dust.

I did not really think about Feuerbach again until last fall, when, on passing through Madison, Wisconsin, and visiting one of my favorite used book stores, I chanced upon a volume by him entitled *Lectures on the Essence of Religion* (3). These proved to be a series of popular public lectures which Feuerbach gave in 1848 and, unlike his more famous book, they proved to be highly readable, and, indeed, I spent most of my vacation in Wisconsin doing just that.

This evening I would like to share with you the results of that reading, as not only does Feuerbach provide a series of unique insights into the nature of religion and atheism – many of which are repeated without acknowledgement by more recent authors – he also provides some important suggestions for an affirmative approach to atheism which can serve as a much needed supplement to its more traditional role as a philosophy of negation.

2. Feuerbach the Man

Ludwig Andreas Feuerbach was born on 28 July 1804 in Landshut, Bavaria, the fourth of five sons of a famous German jurist, Paul Johann Anselm von Feuerbach. Graduating from the local gymnasium in Ansbach in 1822, Feuerbach entered the University of Heidelberg the next year with the intention of studying theology, but was soon repelled by the scholastic rationalizations of his professors. Consequently he transferred to the University of Berlin in 1824 in order to study under the renowned philosopher, Georg Wilhelm Hegel (figure 2).

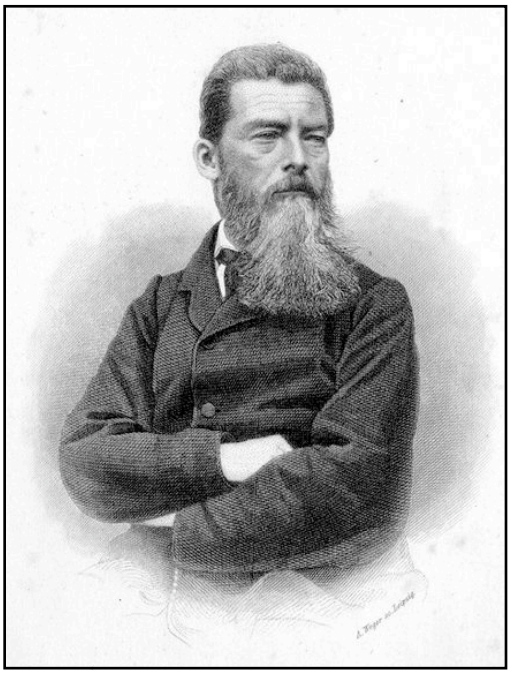

Figure 1. Ludwig Andreas Feuerbach (1804-1872).

For financial reasons, Feuerbach was forced to transfer to the University of Erlangen in 1826, where he added the study of natural science and medicine to his curriculum, finally receiving his doctorate in philosophy in 1828, at age 24, for a thesis entitled *Reason: Its Utility, Universality, and Infinity*. Though he began teaching philosophy at Erlangen the next year as a *Privatdocent,* he essentially destroyed any chance of ever obtaining a professorship when he published his first book, *Thoughts on Death and Immortality,* in 1830. This attack on the Christian belief in life-after-death, coupled with his clumsy and halting lecture style, essentially spelled the end of his academic career, though he would not confront this fact until 1835.

In the meantime Feuerbach continued to write books, including *The History of Modern Philosophy from Bacon to Spinoza (*1833), *Abilard and Heloise* (1834), and *The Exposition, Development, and Critique of Leibnizian Philosophy* (1836), taking time out only in 1837 to marry Berta Löw and to move to the

Figure 2. Georg Wilhelm Friedrich Hegel (1770-1831).

village of Bruckberg, where he and his growing family were able to survive by living off the income from a small porcelain factory inherited by his wife.

By the 1830s Feuerbach had arrived at a major insight into what he felt was the fundamental underlying fallacy, not only of Christianity and other religions, but of philosophical idealism in general, including that of Hegel – an insight which he would expound in greater and greater detail over the course of the remaining three decades of his life in a series of more than ten additional books. These include: *Pierre Bayle: A Contribution to the History of Philosophy and Humanity* (1838), *Toward the Critique of Hegelian Philosophy* (1839), *Philosophy and Christianity* (1839), his most famous work – *The Essence of Christianity* (1841), *Preliminary Theses for the Reform of Philosophy* (1842), *Foundations of the Philosophy of the Future* (1843), *The Essence of Faith According to Luther* (1844), *The Essence of Religion* (1845), *The Question of Immortality from the Standpoint of Anthropology* (1846), *Theogony* (1857), and *God, Freedom, and Immortality* (1866).

The only significant break from this endless regimen of writing came with the brief flowering of political and cultural liberalism in Germany following the Revolution of March 1848 (figure 3), during which Feuerbach was invited by the revolutionaries to give a series of public lectures in the City Hall of Heidelberg on the *Essence of Religion*. When the revolution collapsed the following year, he briefly contemplated immigrating, like many other German liberals and intellectuals, to the United States, but in the end decided to remain in Germany, where, in 1851, he published his series of public lectures under the title *Lectures on the Essence of Religion*.

In 1860 the porcelain factory at Bruckburg failed and Feuerbach was forced to move his family to Rechenberg near Nuremberg, where they lived off the charity of friends until Feuerbach's death in 1872 at age 68, after having suffered a series of paralytic strokes.

Though Feuerbach eventually succeeded in liberating himself from the delusions of Hegalian idealism, he never quite succeeded in freeing himself from the influence of Hegel's opaque prose style. Consequently those few of his books, including *The Essence of Christianit*y, which are available in English translation are rather heavy going for the modern reader. Luckily, as already noted, the same is not true of the popular lectures which he gave in 1848. Since these contain – to use his favorite expression – the "essence" of his previous books and are also available in English translation, they will serve as the primary source for this evening's lecture and all quotes, unless indicated otherwise, are taken from them.

3. Feuerbach's Central Premise

Feuerbach is best known for his thesis that God is created in the image of man rather than the other way around:

This doctrine of mine is briefly as follows: theology is anthropology. In other words, the object of religion, which in Greek we call theos, and in our language, God, expresses nothing other than the essence of man. Man's God is nothing other than the deified essence of

Figure 3. The triumph of the revolution of March 1848 in Berlin.

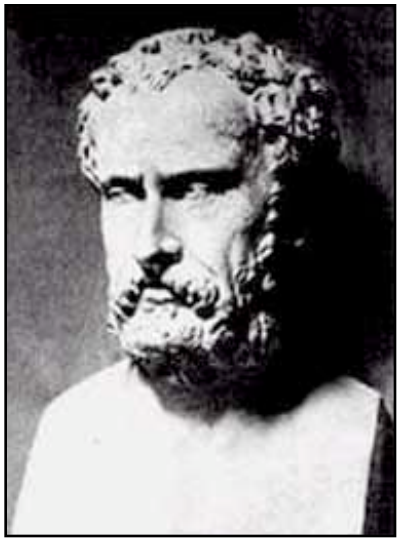

Figure 4. Xenophanes (c. 570-470 BC).

man, so that the history of religion or, what amounts to the same thing, of God – for the gods are as varied as mankind – is nothing other than the history of man.

Feuerbach was not the first to propose this. Aspects of it are to be found, for example, in the writings of the Greek philosopher Xenophanes (figure 4), who, in the 6th century BC, rather sarcastically observed that (4):

Men believe that the gods are born, are clothed and shaped and speak like themselves. If oxen and horses and lions could draw and paint, they would delineate their gods in their own image.

Nor would he be the last. Thus in an 1864 essay entitled "The Uses of Anthropomorphism," the British philosopher, Herbert Spencer (figure 5), noted that (5):

It is now generally admitted that a more or less idealized humanity is the form which every conception of a personal God must take. Anthropomorphism is an inevitable result of the laws of thought.

However, no one – before or since – has ever developed and applied this thesis to the same extent as Feuerbach.

4. The Errors of Reification and Inverted Causality

Feuerbach's rejection of religion is not based on its conflicts with the historical and archaeological record nor on its conflicts with the naturalism of modern science, but almost solely on psychological and philosophical arguments. His primary argument is that idealistic philosophy and religion alike are the product of the psychological error known as "reification" or "hypostatization." These are Latin and Greek terms for one and the same thing and are defined, according to Webster, as follows:

Reification (from the Latin res meaning "thing"), the act of regarding something abstract as a material thing (see also hypostatization).

In other words, philosophical idealism and religion alike have mistaken abstract class concepts, such as truth, beauty, space, time, cause, and God for real things rather than as convenient linguistic generalizations for the description of the properties and emotions common to large numbers of individual material objects and individual human beings. This idealistic interpretation of abstract ideas is often, and not without irony, referred to as "realism," whereas their interpretation as useful linguistic conventions is referred to as "nominalism."

According to Feuerbach, this error of reification has, in turn, led to a second major error involving the inversion of cause and effect. In other words, instead of interpreting the properties of individual objects and the emotions of man as the origin of abstract ideas, idealistic philosophy and religion have taken the abstractions to be the causes or origin not only of the individual objects but of man himself:

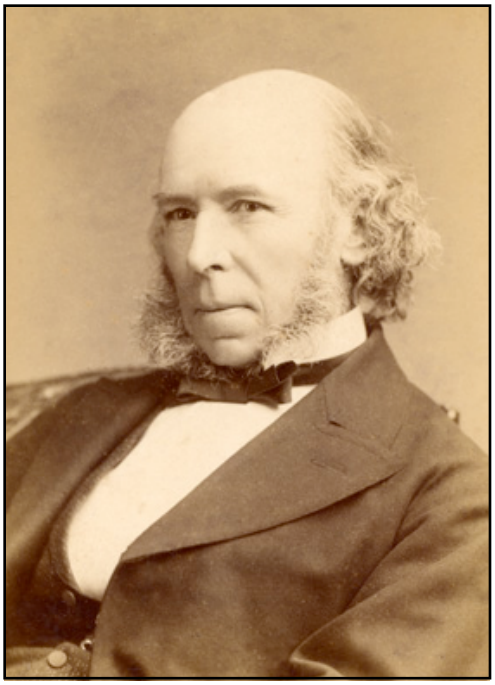

Figure 5. Herbert Spencer (1820-1903).

In theology things are not thought and willed because they exist, they exist because they are thought and willed. The world exists because God thought and willed it, because He still thinks and wills it. The idea, the thought, is not abstracted from the object, thought is the author, the cause of the thought object. But this doctrine – the core of Christian theology and philosophy – is an inversion in which the order of nature is stood on its head.

... man, quite rightly so from a subjective point of view – or quite rightly at least so long as he has not understood his own nature – sets the class or class concepts before the species and individuals, the abstract before the concrete ... the abstract has thus become the foundation of the real [and] man comes to regard the being who is nothing but a bundle of universal concepts, the thinking spiritual being, as the first being, as the being who precedes all other beings not only in rank but also in time. Who is indeed the ground and cause of all being and the Creator of all beings.

5. The Multifaceted Nature of the God Concept

Feuerbach came to these conclusions in stages, first through his rejection of the philosophical idealism of Hegel, then through his rejection of the God of Christianity, and finally through his analysis of paganism and primitive nature worship. He thus came to recognize that philosophical idealism, from Plato to Hegel, was in fact nothing more than crypto-theology and that there were at least three distinct, and often mutually contradictory, facets to the concept of God:

1. God as moral and spiritual guide and benefactor, i.e. as father and redeemer.

2. God as the external cause or creator of nature.

3. God as nature itself (pantheism).

The first of these Feuerbach viewed as a reification of idealized human attributes and thus as an extension of the study of mankind or anthropology, whereas he viewed the second and third as a reification of the attributes of raw nature and thus as an extension of physics or – to use the outdated 17th century term – of physiology:

... as I showed in "The Essence of Christianity," God, considered in his moral or spiritual attributes, God as a moral being, is nothing other than the deified and objectified mind or spirit of man, and in the last analysis theology is therefore nothing other than anthropology. Accordingly, in "The Essence of Religion," I showed that the physical God, or God regarded solely as the cause of nature, of the stars, trees, stones, animals, and of man, insofar as they too are natural, physical beings, expresses nothing other than the deified, personified essence of nature, that the secret of physico-theology is therefore nothing other than physics or physiology – physiology not in its present restricted sense, but in its old universal sense of natural science in general. A moment ago I summed up my doctrine by saying that theology is anthropology. I should now like to complete that statement by saying: anthropology and physiology.

6. God as Moral and Spiritual Guide

Feuerbach has little to say in his lectures about the first of these interpretations, having dealt with it in great detail in his earlier books, and contents himself instead with pointing out that the reduction of God to an abstract personification of idealized human values in no way detracts from their role as standards for ethical and moral behavior:

One of the most frequent laments heard from the religious and learned bewailers of atheism is that it destroys or ignores an essential need of man – the need to revere something higher than himself, and therefore turns man into a presumptuous egoist. But in annulling what is above man theologically, atheism does not annul what is ethically and naturally higher. The ethically higher is the ideal that every man must pursue if he is to make anything worthwhile of himself; but this ideal is and must be a human ideal and aim.

7. God as Creator

In the second of these interpretations, Feuerbach argues that God is abstracted from nature and set above it, though still functioning as its cause or origin:

It is a universal doctrine in our upside-down world that nature sprang from God, whereas we should say the opposite, namely that God was abstracted from nature and is merely a concept derived from it.

... all those divine predicates that are not borrowed from man are derived from nature, so that they objectify, represent, illustrate nothing other than the essence of nature, or nature pure and simple. The difference only is that God is an abstraction, that is, a mere notion, while nature is concrete, that is, real. But the essence, the substance, the content are the same. God is nature in the abstract, that is, removed from physical

perception, transformed into an object or concept of the intellect. Nature itself is sensuous, real nature as directly revealed and communicated to us by the senses.

This concept of God as creator – as recently rediscovered by Michael Shermer – continues to form the basis of the most commonly cited arguments for his existence:

Proof of the existence of God based on this view of nature is known as the physio-theological or teleological proof, that is, proof drawn from purpose; for it is based chiefly on the so-called purposes of nature. Purposes presuppose intelligence, intention, and consciousness; but, so the proof goes, since nature, the world, or matter is blind, devoid of intelligence and consciousness, it presupposes a spiritual being who created it, or who at least guides it in accordance with aims and purposes. This proof was already adduced by the ancient religious philosophers, the Platonist and Stoics. It has been repeated ad nauseum in Christian times. It is the most popular, and from a certain standpoint, the most plausible proof, the proof of the naive human mind – that is, the uneducated mind, knowing nothing of nature. Consequently it is the only, or at least the only theoretical, foundation of popular theism.

In Feuerbach's opinion, this type of argument is ultimately flawed because it is based on the fallacy that Nature, when left to itself, is necessarily random and thus incapable of generating either order or purpose:

Though the world does not owe its existence to any accident, we need not suppose it to have had a man or some one similar to a man for its author. Sensuous things are not letters which stand in no necessary relation to each other and therefore have to be put in place by a printer. Things in nature attract each other, they need and desire each other, for one cannot be without the rest. They enter into relationships of their own accord, they combine by their own power.

In addition, such arguments are based on the usual inversion of cause and effect:

Organic life did not come to earth and move in with inorganic nature by accident; organic and inorganic nature goes hand in hand. What am I, a product of organic life, without the outside world? Just as my lungs are part of me, so is the air; just as my eyes are part of me, so is the light; for what are lungs without air or eyes without light? The light does not exist in order to be seen by the eye, the eye exist because there is light; similarly, the air does not exist in order to be breathed; rather, because there is air and because without it there would be no life, the air is breathed.

And, of course, they ultimately lead to an infinite regression:

If I cannot refrain from spinning out fantasies, from looking further and further afield, if I am unable to stop with nature and content my intellectual need for causes with the universal action and interaction of nature, what is to prevent me from going beyond God? What is to prevent me from looking for a ground and cause of God as well? Do we not find in God the same situation as in the concatenation of natural causes and effects, the very situation that I wished to remedy by positing the existence of God? ... Thus the difficulties arising from the question of the beginning of the world are only postponed or thrust aside or glossed over by the notion of a God, a being outside the world. They are not solved. Is it then not more reasonable to assume that world always was and will always be, and consequently that it has the ground of its existence within itself?

8. God as Nature (Pantheism)

It is the third and most primitive of these three interpretations – the identification of God with nature itself, rather than as a being outside of or above nature – that most strongly appeals to Feuerbach, and it is this incipient pantheism which justifies my choice of the subtitle for this evening's lecture – "The Religious Atheist:"

Originally religion expressed nothing other than man's feeling that he is an inseparable part of nature.

Though I myself am an atheist, I openly profess religion in the sense just mentioned, that is, nature religion. I hate the idealism that wrenches man out of nature. I am not ashamed of my dependency on nature. I openly confess that the workings of nature affect not only my surface, my skin, my body, but also my core, my innermost being, that the air I breathe in bright weather has a salutary effect not only on my lungs but also on my mind, that the light of the sun illuminates not only my eyes but also my spirit and my heart. And I do not, like a Christian, believe that such dependency is contrary to my true being or hope to be delivered from it. I know further that I am a finite mortal being, that I shall one day cease to be. But I find this very natural and am therefore perfectly reconciled to the thought.

Just as I can honor and love a human individual without deifying him, without even overlooking his faults and failings, I can also recognize that without nature I am nothing, and yet not for that reason forget its lack of heart, reason, and consciousness, which it first acquires in man. I can recognize nature for what it is without falling into the error of nature religion and philosophical pantheism, namely, of making nature into a god.

9. The Positive Nature of Atheism

As mentioned in my introductory comments, Feuerbach strongly believed that atheism was not simply a negation of religion but also a positive force which promised to provide mankind with a healthier psychological approach to both life and death:

True atheism, the atheism that does not shun the light, is also an affirmation; it negates the being abstracted from man, who is and bears the name of God, but only in order to replace him by man's true being.

... God is nothing other than the abstracted, phantasmagoric essence of man and nature, hypostatized by the imagination. Hence theism sacrifices the real life and nature of things and of men to a being who is the mere product of thought and imagination. Thus atheism is positive and affirmative; it gives back to nature and mankind the dignity of which theism has despoiled them; it restores life to nature and mankind which theism had drained of their best powers. God, as we have seen, is jealous of nature and man. He wants man to honor, love and serve Him alone. He wants everything else to be nothing and Himself alone to be something. In other words, theism is jealous of man and the world and begrudges them any good. Envy, ill will, and jealousy are destructive, negative passions. Atheism, on the other hand, is liberal, openhanded, open-minded. An atheist acknowledges every being's will and talent. His heart delights in the beauty of nature and the virtue of man – joy and love do not destroy, they are life-giving, affirmative.

The same applies to the elimination of the hereafter, which is inseparable from atheism. If denying the existence of a hereafter were an empty negation, without consequence, it would be better, or at least no worse, to retain the afterlife. But the negation of the next world has as its consequence the affirmation of this world; the denial of a better life in heaven implies the demand for a better life on earth. It transforms the hope of a better future from a concern of idle, inactive faith into a duty, a matter of independent human activity. If we no longer believe in a better life but decide to achieve one, not each man by himself but with our united powers, we will create a better life, we will at least do away with the most glaring, outrageous, heartbreaking injustices and evils from which man has hitherto suffered. But in order to make such a decision and carry it through, we must replace the love of God by the love of man as the only true religion, the belief in God by the belief in man and his powers – by the belief that the fate of mankind depends not on a being outside it and above it, but on mankind itself, that man's only Devil is man – the barbarous, superstitious, self-seeking, evil man – but that man's only God is also man himself.

I am sure you will agree with me that these sentiments accurately and elegantly describe most of the basic tenets of modern-day humanism.

10. Feuerbach Summarizes

[In] this series of lectures I have tried to prove that the god of nature religion is nature and that the God of spiritual religion, of Christianity, is the spirit or essence of man. I have been guided by the conviction that henceforth man should seek and find the determining ground of his action, the goal of his thinking, the cure for his ills and sufferings in himself, rather than outside himself like the pagan or above himself like the Christian.

11. A Parting Thank-You

Near the end of his first lecture, Feuerbach confessed to what he felt were his primary failings as both a speaker and teacher:

A subject interests me and holds my attention only so long as its presents me with difficulties, only so long as I am at odds with it and have, as it were, to struggle with it. But once I have mastered it, I hurry on to something else, to a new subject ... This does not mean that I am an intellectual miser or egoist, who amasses knowledge for himself alone ... What I do and think for myself, I must also think and do for others. But I feel the need of instructing others in a subject only so long as, while instructing them, I am also instructing myself.

On reading this, I was astonished at how closely these thoughts corresponded to my own psychology as both a scholar and teacher, though perhaps the Roman philosopher, Seneca, said it even better 1800 years earlier (6):

... part of my joy in learning is that it puts me in a posi-

tion to teach; nothing, however outstanding and however helpful, will ever give me pleasure if the knowledge is for my benefit alone. If wisdom were offered me on the one condition that I should keep it shut away and not divulge it to anyone, I should reject it. There is no enjoying the possession of anything valuable unless one has someone to share it with.

So, in closing, I would like to thank you not only for providing me with this opportunity for self instruction but also for allowing me the opportunity to share the results with you this evening.

12. References and Notes

1. A lecture given to The Cincinnati Free Inquiry Group (FIG), Cincinnati, OH, on 25 June 2002.

2. L. Feuerbach, *The Essence of Christianity*, Prometheus Books: Amherst, New York, 1989.

3. L. Feuerbach, *Lectures on the Essence of Religion*, Harper & Row: New York, NY, 1967.

4. Quoted in A. B. Drachmann, *Atheism in Pagan Antiquity*, Ares: Chicago, IL, 1977, p. 18.

5. H. Spencer, *Illustrations of Universal Progress: A Series of Discussions*, Appleton: New York, NY, 1864, pp. 444-450.

6. Seneca, *Letters from a Stoic*, Penguin: Harmondsworth, 1969, pp. 39-40.

V
Winds of Delusion
Heat Engines and Psychokinesis

1. Introduction

This morning I would like to talk to you about two examples of pseudoscience from the field of parapsychology that have repeatedly come to my attention over the years (1). The first of these, involving experiments purporting to detect human radiations capable of causing telekinesis, has never, to the best of my knowledge, been discussed in published books dealing with pseudoscience, whereas the second, dealing with experiments purporting to detect and weigh the human soul, has been commented on frequently.

I have coupled them together this morning because they both illustrate characteristics common to most pseudoscience:

1. In both cases the experiments reveal a lack of knowledge of the elementary principles of physics and chemistry and often of the proper use of basic laboratory equipment.

2. In at least one case, the experiments reveal a lack of knowledge of previous experimental work done by earlier investigators of psychic phenomena.

3. In both cases a highly improbable, albeit exciting, rationale is given of a phenomenon which, in reality, has a very mundane everyday explanation.

In both cases we will begin with an elementary physics lesson followed by examples from the literature of parapsychology in which these lessons are either ignored or subverted.

2. Heat Transfer

Our first physics lesson involves the subject of heat transfer. As even a late 19th-century high-school physics textbook will inform you, heat can be transferred in at least three ways:

1. conduction
2. convection
3. radiation

Heat transfer via conduction is the primary mechanism in solids where the component molecules or atoms lack freedom of translation and occurs primarily by means of molecular vibrations.

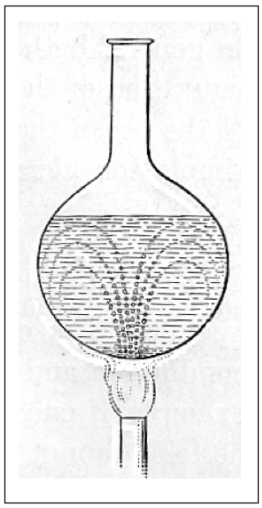

Figure 1. A depiction of convection currents in a flask of heated liquid taken from a typical late 19th-century high-school physics textbook.

On the other hand, heat transfer via convection is the primary mechanism in fluids (liquids and gases) in which the component molecules have freedom of translation and is based on the actual movement or diffusion of the molecules from place to place. Any temperature differences in the fluid will give rise to convection currents between the different temperature regions (figure 1). These are circular and involve the simultaneous movement of the hotter molecules from the high temperature region to the low temperature region coupled with the movement of the colder molecules in the opposite direction. Generally, the greater the temperature difference, the stronger the resulting currents. In the case of the atmosphere the result is an air current, also called, depending on its magnitude, a breeze or wind. In the case of the ocean, the result is called an ocean current.

Heat transfer via radiation actually involves electromagnetic radiation or light as the medium of transmission. When the light strikes an opaque surface, it is, depending on its wavelength, partly reflected and partly absorbed. The absorbed light is usually degraded into heat energy and the surface becomes warmer. White surfaces reflect most of the wavelengths found in visible light and experience little heating due to absorption, whereas black surfaces absorb most visible light and experience greater heating due to absorption. One practical application of this difference is the ad-

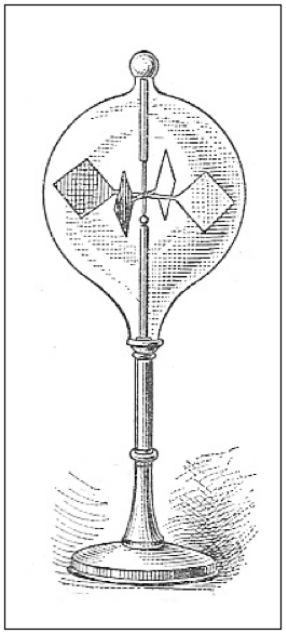

Figure 3. A depiction of a Crookes radiometer taken from a typical late 19th-century high-school physics textbook.

vice to wear white clothing in summer and dark clothing in winter. Light in the red and infrared regions is particularly prone to absorption and heat generation.

3. Heat Engines

A "heat engine" is a device for the conversion of heat energy into mechanical energy. It may range in size and practicality from the well-known steam engine and internal combustion engine to small novelty toys, and may be based on any of the above methods of heat transfer. Thus it is possible, though not very practical, to construct a heat engine based on conduction and the alternate expansion and contraction of solid metal rods or bands. In contrast, radiant heat drives a device invented by William Crookes in 1873 and known as the "radiometer." It consists of a light horizontal pinwheel which pivots on a sharp needle, the whole being sealed inside a partially evacuated bulb (figure 3). Attached to the pinwheel are four vanes. One side of each vane is colored white and the other black. When light is shown on the vanes, the black side, due to preferential absorption, is heated more than the white side and likewise for the air molecules which come into contact with them. As a result the air molecules in the immediate vicinity of the black side are moving faster than those in the immediate vicinity of the white side and the difference in the speeds with which they collide with the two surfaces imparts a net movement to the vanes which causes the pinwheel to rapidly rotate.

Far simpler are convection heat engines in which the resulting air currents from a heat source, such as a candle, steam radiator, or filament lightbulb, are used to drive a light pinwheel. A classic example is the spinning serpent, shown in the woodcut in figure 4, which is taken from a 19th-century book of scientific amusements entitled *Science in Sport Made Philosophy in Earnest* (2). Toys and displays of this type are often used in Scandinavian countries as traditional Xmas decorations.

As already indicated, all of the above facts may be found in any late 19th-century high-school physics textbook or book of popular scientific amusements, but now let us see what happens when they fall into the hands of a typical psychic investigator.

4. Colin Wilson and Robert Leftwich

For our first example we will look at the work of the British writer Colin Wilson (figure 5). Wilson began his career in the 1950s as the darling of the intellectually alienated with such books as *The Outsider* and *Religion and the Rebel*, but by the 1970s he had degenerated into writing and editing countless books speculating on the psychology of violent crimes and the occult. I confess that as a teenager and university undergraduate I greatly enjoyed Wilson's early books and novels, which I found very stimulating, and for some time I tried to ignored his increasingly frequent forays into the occult.

The parting of the ways, however, came in 1973 with the publication of his book, *Strange Powers*, in which Wilson profiled three people claiming to have psychic abilities of various sorts. Among them was one Robert Leftwich, who supposedly had the power of telekinesis or psychokinesis, including the ability to disperse clouds at will (3):

So I wrote to him about this power to disperse clouds ... An answer came back fairly promptly ... He said that

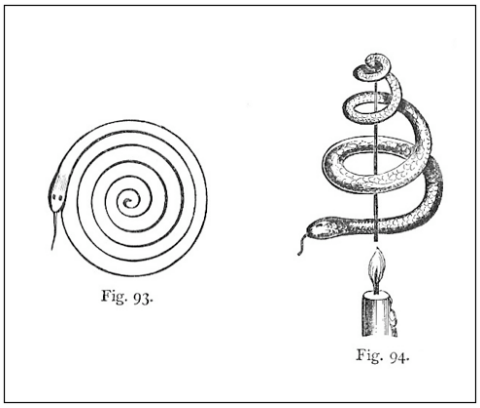

Figure 3. The "spinning serpent" - actually a cardboard spiral pinwheel balanced on a pin or knitting needle.

Figure 5. A young Colin Wilson at the height of his "Outsider" fame in the 1950s.

the dispersal of clouds was extremely difficult but that it was quite easy to demonstrate psychokinesis, the mind's power to directly influence matter. In the envelope he included a small square of paper, which had been folded from corner to corner, and also across the middle – giving an effect like a union jack ... He told me to fold this in the form of a paper dart with four fins, balance it on a needle stuck in a cork, and try willing it to go round [figure 6]... I tied a handkerchief around my face, cupped my hands around the dart and concentrated ... As amazing as it seemed, it actually worked. I left it on my table and practiced periodically later in the day, sometimes not even cupping my hands around it. When I told Leftwich about it in a letter, he replied that the element of imagining it moving was crucial.

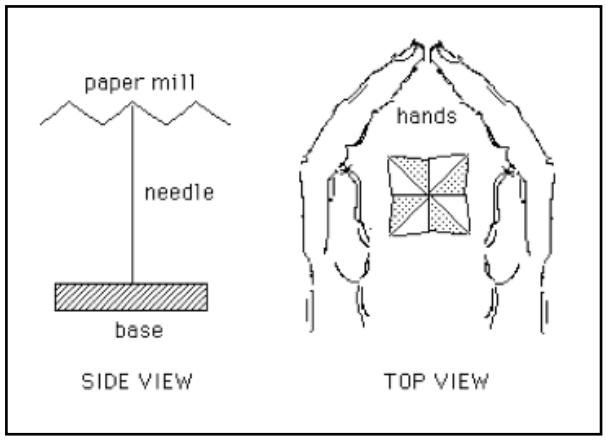

Figure 6. The Leftwich telekinesis detector.

I was aghast when I read this – not only because of the incredible level of gullibility which it demonstrated – but even more so because I had a distinct memory of having seen the device described by Wilson in a 19th-century collection of scientific parlor tricks (figure 7), where it was rationalized as nothing more than a simple convection current heat engine – albeit a highly delicate and temperamental one – based on the temperature difference between the hands (98.6° F) and that of the surrounding room (70°F or less) (4). How well it worked depended on the temperature of the room, the exact position of the hands, and the size and weight of the paper pinwheel. The folds described by Wilson were merely a well-known method for locating the center of gravity of the piece of paper in order to facilitate balancing it on the tip of the pin. Though it is true that the heat of a human hand is hardly comparable to that of a candle or incandescent light bulb, it is equally true that the weight of a small square of tissue

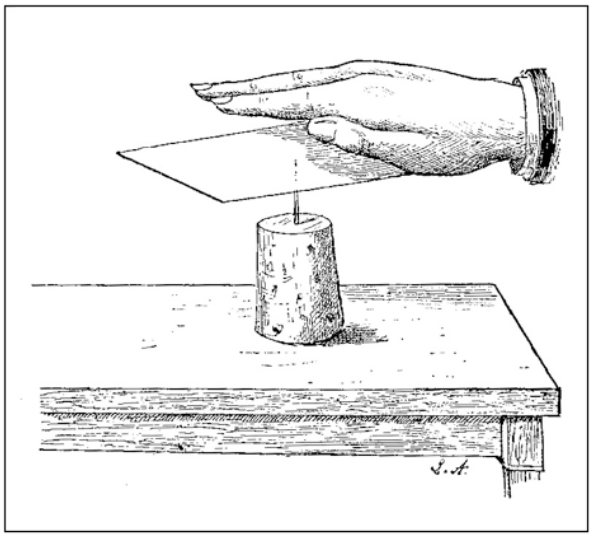

Figure 7. A variation of Leftwich's device as depicted in a 1901 translation of an earlier French book of scientific parlor tricks by Georges Brunel.

paper is hardly comparable to that of the typical wood and metal pinwheels used in most convection toys.

There is, by the way, no doubt that the device described by Wilson works – at least occasionally. In preparing for this lecture I constructed one using tissue paper and was able to get it to move roughly 50% of the time, but both my own experiences with this device and yet a second description of it, which I encountered long after reading the Wilson account, have raised serious doubts in my mind about the original rationale based on the presence of micro convection currents.

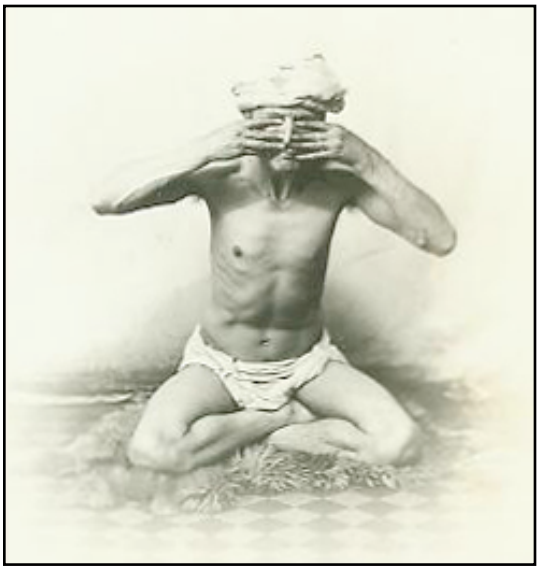

Figure 8. Hereward Carrington (1880-1959) demonstrating a yoga position.

5. Hereward Carrington

This second account appears in a book by Hereward Carrington (figure 8), a British-born psychic investigator and health guru who spent most of his adult career in the United States. One of the original founders of the American Society for Psychical Research (1907), he started his own organization, The American Psychical Institute, in 1922, along with a laboratory for the investigation of various paranormal claims.

In 1939 he published *Laboratory Investigations in Psychic Phenomena* in which he summarized his examination of various "instruments" proposed in the parapsychology literature for the detection of psychic phenomena, including (5):

The Dynamoscope
The Suggestometer
The Bioscope
The Dowsing machine
The Magnetometer
The Psychic telephone
The Psychic galvanometer
Malta's cylinders
The Biometer
The Eye Machine of Dr. Russ
The Sthenometer
The Lastrometer
Thore's Cylinders
The Howler
The Fluidic Motor
The Telekinetoscope
The Volometer or Will Board
The Pugh Table

Though this list presents the debunker with a veritable buffet of choices, we will have to limit ourselves to what Carrington had to say about the so-called human magnetometer.

A real magnetometer is a magnetized needle used to measure the intensity and direction of the earth's magnetic field. The psychic's magnetometer has nothing to do with normal magnetism. It is a light paper arrow or dart either mounted on a needle or suspended from a silk thread (figure 9) and is intended "to show, instrumentally, that a certain 'vital radiation' emanates from the living human body – especially from the hands." In short, it is a variation of the Leftwich device later described by Wilson. These so-called magnetometers may or may not be enclosed to protect them from air drafts.

As a result of his experiments, Carrington found that exposed human magnetometers were, not surprisingly, highly sensitive to air currents, temperature changes, and static electrical charges from the human hand, whereas enclosed magnetometers were sensitive to both heavy charges of static electricity and to infrared radiation from the human hand. As a result, he concluded that (5):

There is no evidence to support the theory that these instruments are normally operated by other than natural causes, based on definite physical laws, or that there is anything "psychic" associated with the deflection of their needles.

though, with his typical evasiveness, he could not help but add a qualifier to this conclusion designed to keep both himself and his laboratory in business (5):

Their deflection is due to normal physical causes – aside from possible cases of genuine telekinetic action.

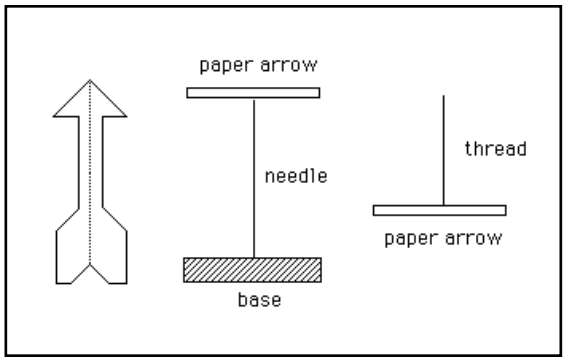

Figure 9. The so-called human magnetometer.

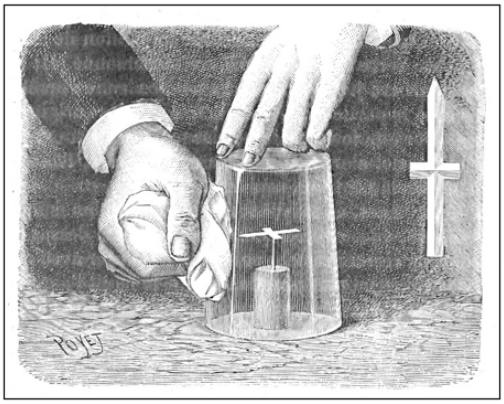

Figure 10. Tom Tit's enclosed "magnetometer."

Thus we discover that Wilson, despite his supposed mastery of the paranormal literature, was apparently unaware that Leftwich's device had been discredited by a fellow psychic investigator nearly 35 years previously, whereas Carrington, in turn, was apparently unaware that the so-called enclosed "magnetometer" was a standard feature of the 19th-century literature dealing with scientific parlor tricks, as shown in the woodcut in figure 10, taken from the 1892 edition of *La science amusante* by Tom Tit (6).

6. My Own Conclusions

Carrington's account also raises the possibility that our earlier explanation of the Leftwich device, based on micro convection currents, may be wrong – a possibility supported by my own brief experiences with the device using a tissue paper arrow instead of the folded square employed by Wilson:

1. By cupping my hands, I was able to get the "magnetometer" needle to rotate like the paper square.

2. It also responded to the approach of a single finger. Indeed, the distancing of the hands, rather than their positioning seemed to be the crucial factor (recall figure 7).

3. It did not respond to the approach of a heated knife blade.

4. Eventually it stopped working.

5. The lighter and more pointed the arrow the better it worked.

My tentative conclusion is that both the rotating square and the rotating arrow are responding to electrostatic charges on the hands and fingers and not to convection currents. In short, they are a crude form of an "electroscope" and stop working once the initial electrostatic charges are dissipated.

Were I to summarize the lessons to be extracted from the above scenario for the would-be pseudoscientist, they are as follows:

1. First build a device specifically designed to be supersensitive to air currents and electrostatic charges and then proceed to deny that it is responding to any of these and instead postulate supernatural causes unknown to science.

2. Then give the resulting instrument a totally misleading name, but one designed to cash in on established scientific terminology.

7. Conservation of Mass

Our second elementary physics lesson involves the law of the conservation of mass and is best approached as a brief historical overview:

c. 2500 BC. The Egyptian and various Mesopotamian civilizations develop the double-pan suspension balance. Its use to measure goods in commerce is predicated on the assumption that the quantity of a given commodity is proportional to its mass.

c. 330 BC. Aristotelian physics assumes conservation of matter in substantial (i.e. chemical) changes, but does not necessarily assume that mass is an inherent property of matter. Epicurean philosophers, on the other hand, explicitly equate mass with the amount of matter present and assume conservation of both mass and atoms in all changes.

17th century. Revival of ancient atomism. Newton explicitly equates mass with a measure of the amount of matter present.

18th century. Black, Lavoisier and others apply conservation of mass to chemical reactions. In doing so, they explicitly recognize the role of gases and the necessity of using closed systems.

1905. Einstein subsumes conservation of mass under the more general law of mass-energy conservation. However, his equivalency equation:

$$\Delta m = \Delta E/c^2$$

shows that the energy changes in typical chemical

SOUL HAS WEIGHT, PHYSICIAN THINKS

Dr. Macdougall of Haverhill Tells of Experiments at Death.

LOSS TO BODY RECORDED

Scales Showed an Ounce Gone in One Case, He Says—Four Other Doctors Present.

Special to The New York Times.

BOSTON, March 10.—That the human soul has a definite weight, which can be determined when it passes from the body, is the belief of Dr. Duncan Macdougall, a reputable physician of Haverhill. He is at the head of a Research Society which for six years has been experimenting in this field. With him, he says, have been associated four other physicians.

Figure 11. A newspaper clipping from the *New York Times* reporting on MacDougall's soul weighing experiments.

reactions lead to mass changes that are below the limits of detectability using normal laboratory balances.

1908. Landolt experimentally confirms the conservation of mass in chemical reactions to the nearest 10^{-9} gram.

17th-19th century. Refinements in balances show the necessity in accurate weighing of protecting the balance from air currents, static electrical charges, and temperature variations, and of correcting for buoyancy effects.

In summary, conservation of mass can only be applied with certainty to closed systems and, despite Einstein's equation, is essentially valid for all systems not involving high-energy nuclear reactions (7). Once again all of these results are to be found in a typical elementary physics text, but are seldom applied with rigor in the hands of the psychic investigator.

8. Duncan MacDougall

In the May 1907 issue of the *Journal of the American Society for Psychical Research*, Duncan MacDougall, a doctor at the Massachusetts General Hospital in Boston, published a paper describing his attempts to weigh the human soul (figure 11). As the time of their deaths approached, each of six volunteer patients and their beds were placed on a large platform balance sensitive to ± 0.2 ounces (± 5.7 grams). All of the patients showed a progressive loss of mass as death approached and four of the six showed a sudden decrease of 0.5 - 1.5 ounces (14.2 - 42.5 grams) at the presumed point of death. Without further investigation, MacDougall concluded that this sudden weight loss corresponded to the departure of the soul and consequently that the soul was material or ponderable in nature (8).

He later repeated his experiment on 15 different dogs of varying size who were progressively killed using drugs in order to keep them immobilized on the balance. No sudden mass losses were reported at death from which MacDougall concluded that, unlike humans, dogs have no souls.

There are, of course, any number of serious design flaws with MacDougall's experiments:

1. They were based on a tiny sample and employed a balance of low sensitivity (thus, by comparison, a typical 19th-century chemical balance was sensitive to 0.0001 grams or was nearly 10,000 times more sensitive than the balance used by MacDougall).

2. No attempt was made to capture and analyze any gases or vapors lost on dying, thus violating the first, and primary, condition for the application of the principle of conservation of mass.

3. Since no independent method of determining the exact point of death was employed, it was impossible to determine whether it was truly coincident with the sudden drop in mass.

4. No attempt was made to experimentally eliminate alternative rationales, such as progressive water loss and lung collapse.

9. H. L. Twining

In 1915 H. L. Twining, a Los Angeles high-school physics teacher, self-published a small booklet entitled *The Physical Theory of the Soul* in which he outlined his attempts to weigh the souls of white mice killed using either cyanide or suffocation (9). His results, which were based on experiments on at least 30

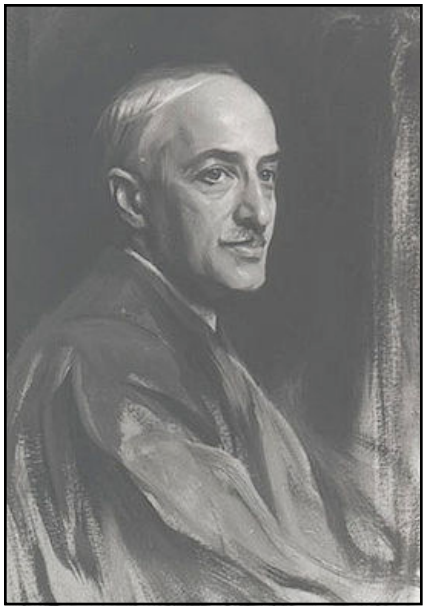

Figure 12. André Maurois (1885-1967).

different animals, were unambiguous:

1. All mice killed in open containers with cyanide showed a mass loss on death.

2. All mice suffocated in hermetically sealed tubes showed no mass loss on death.

3. All mice killed in open containers containing a desiccating agent (calcium dichloride) to absorb evaporated water showed no mass loss on death.

Not surprisingly, Twining concluded that the mass losses observed on death in the open systems – which corresponded to the weighing conditions used in MacDougall's human experiments – were all due to uncompensated water loss resulting from evaporation.

Of course the true believer might well object that all Twining had demonstrated was that, in addition to possessing mass, the material soul also lacked the ability to penetrate glass. However, if one believes this, then one is also obligated to believe the curious fact that the soul (or at least the souls of mice) can be absorbed by common laboratory desiccating agents.

10. André Maurois

In 1931 MacDougall's experiments were made the basis of a short novelette by the French novelist and biographer, André Maurois (figure 12), entitled *The Weigher of Souls* (10). Instead of Boston, the novel is set in London in the years immediately following the First World War, where MacDougall's analog, one Dr. H. B. James, works as a resident at Saint Barnaby's Hospital in the industrial slums south of the Thames. Unlike MacDougall, James does not experiment upon his indigent patients until after they have been pronounced dead and have been transfered to the morgue for dissection, as he has discovered that about 90 minutes elapse between the time of clinical death and the final departure of the soul.

His experiments are performed in the small hours of the morning in the morgue's lecture amphitheater. Since a bed is no longer required, James is able to place the naked bodies of the patients directly on the platform balance. To increase the sensitivity of the balance, he also attaches a small mirror to the pointer. A beam of light is directed at the mirror, which, in turn, reflects it onto a distant, spring-wound, rotating drum with a phosphorescent scale which keeps an automatic time record of the changes in weight in the darkened lecture hall as revealed by the moving light spot. Like MacDougall, James observes a progressive drop in weight after death, followed by a sharp drop after 90 or so minutes of roughly 1.7 $x10^{-5}$ grams – far less than the average of 28.35 grams reported by MacDougall.

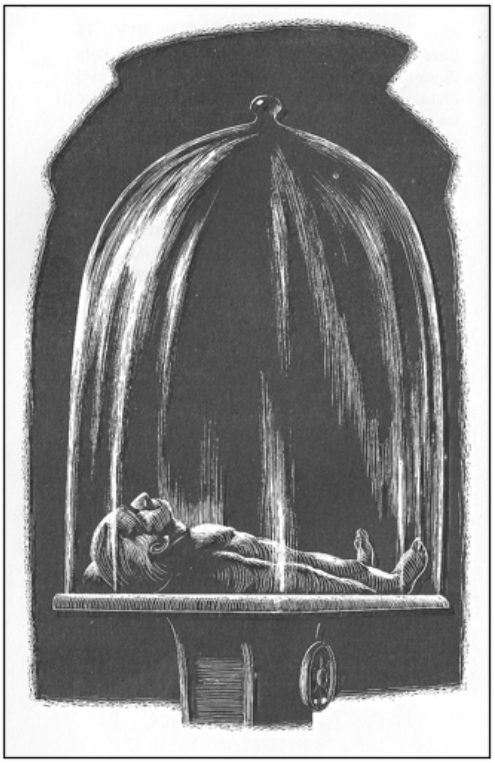

Figure 13. Maurois' fictitious modification of MacDougall's original experiment.

However, unlike MacDougall, James goes even further in his experiments and attempts to capture the departing soul by dispensing with the balance altogether and instead placing the corpse under an enormous glass bell jar especially built for this purpose (figure 13). In addition, he is able to render the soul visible through his discovery that it fluoresces under UV radiation. This allows him to modify the bell jar by attaching a small glass bulb to the top separated by means of a narrow glass tube. Once the UV radiation has revealed that the soul has moved to the top of the bell and through the tube into the glass bulb, he is able to permanently capture it by hermetically sealing off the connecting tube with a glassblowing torch.

In short, Maurois' fictional experiments are in many ways far more convincing then MacDougall's original experiments, their only failing being that they are, alas, totally a product of his imagination and are intended solely for our amusement.

11. References and Notes

1. A lecture given to the Cincinnati Association for Rational Thought (ART), Cincinnati, OH on 09 November 2002.

2. R. Routledge, *Science in Sport Made Philosophy in Earnest*, Routledge: London, 1877, p. 312. Even more elaborate convection toys are described in M. Nugent, *New Games and Amusements*, Doubleday: New York, NY, 1905.

3. C. Wilson, *Strange Powers,* Random House: New York, NY, 1973.

4. G. Brunel, *Fun with Magic: Amusing Experiments in Physics, Chemistry, and Geometry*, Caldwell: New York, NY, 1901, p. 86. The illustrations are obviously taken from earlier 19th-century books, though regrettably not the explanations, since Brunel attributes the movement of the paper to the "magnetic influence of the hand," in keeping with the devices later investigated by Carrington.

5. H. Carrington, *Laboratory Investigations into Psychic Phenomena*, McKay: Philadelphia, PA, 1939.

6. T. Tit, *La science amusante*, 2e série, Librairie Larousse: Paris, 1892, pp. 113-114.

7. Thermodynamically a closed system is defined as one which prevents the passage of matter through its boundaries. As long as the energy changes are of a magnitude similar to that of typical chemical reactions, such a system will suffice for the application of the principle of the conservation of mass. If, however, the energy changes are comparable to those found in nuclear reactions, then one must employ an isolated system, which is thermodynamically defined as one which prevents the passage of both matter and energy through its boundaries.

8. A detailed account of MacDougall and his experiments may be found in M. Christopher, *Search for the Soul*, Cromwell: New York, NY, 1979, Chapter 4.

9. H. L. Twining, *The Physical Theory of the Soul*, Los Angles, CA, 1915.

10. A. Maurois, *The Weigher of Souls and The Earth Dwellers*, Macmillan: New York, NY 1963. A newer edition of the original novelette of 1931.

2010 Update

A recent internet search for convection toys uncovered a device called a "monitor spinner." Made from a paper clip and a paper pinwheel, it sits on the top of your computer monitor and operates using the convection currents produced by the heat given off by your screen. Likewise, a similar search on the topic of weighing the souls of humans and animals reveals that this subject is – if you will excuse the pun – far from dead in the land of virtual reality.

VI
Was Einstein a Humanist?

1. Introduction

I am here this evening because of Joe Levee. As many of you know, Joe and I are members of a luncheon group which meets weekly to discuss issues related to free thought, evolution, and pseudoscience. Our topics of discussion are random and are usually stimulated by an event in the media or an article in the *New York Times* from the previous week. Indeed, not only are the topics random, they often repeat, and among these recurring themes has been the question of the exact nature of Albert Einstein's religious views. The last time this happened Joe challenged me to summarize what I knew of this subject in the form of a lecture for the members of FIG, whence my appearance this evening (1)

Luckily much of my work has been done for me in a book published in 1999 by Max Jammer entitled *Einstein and Religion* (2). Jammer, who is a Professor of Physics at Bar-Ilan University in Israel, is uniquely qualified to write on this subject. Not only is he a well-known historian and physicist, whose previous writings include such books as *Concepts of Space: The History of Theories of Space in Physics (1954), Concepts of Force: A Study of the Foundations of Dynamics (1957), Concepts of Mass in Classical and Modern Physics (1961),* and *The Conceptual Development of Quantum Mechanics (1966),* he also shares the same German-Jewish cultural background as Einstein.

Einstein and Religion is written in a straightforward, unpretentious manner and attempts to summarize Einstein's religious views based on information extracted from his popular essays and autobiographical notes, his letters and various newspaper interviews, and from the memoirs of his contemporaries. Though 279 pages in length, the book contains just three chapters:

1. *Einstein's Religiosity and the Role of Religion in his Private Life*.

2. *Einstein's Philosophy of Religion*.

3. *Einstein's Physics and Religion*.

This evening I am going to talk about two of these topics, plus two more of my own devising:

1. Einstein's religious background.

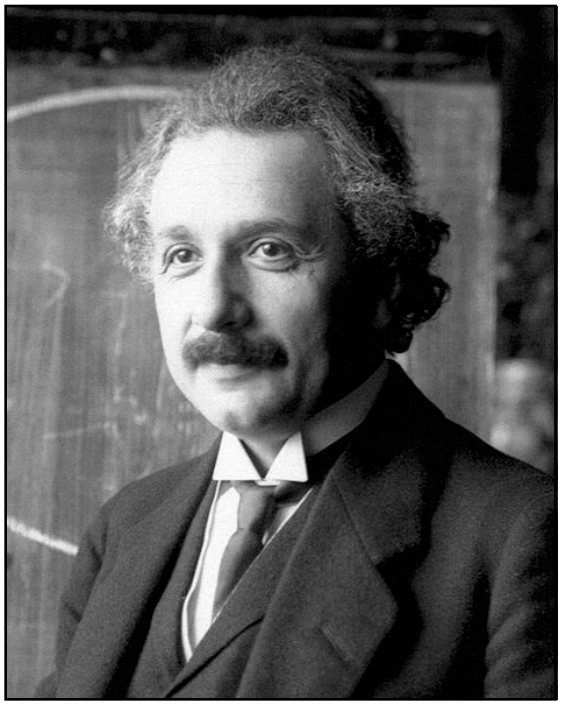

Figure 1. Albert Einstein (1879-1955).

2. What did Einstein believe?

3. Are Einstein's beliefs consistent with humanism?

4. The scientist as priest.

All quotations, unless indicated otherwise, are taken from Jammer's account.

2. Einstein's Religious Background

Einstein was born in Ulm Germany in 1879. His ancestors were Jewish on both sides of the family and had resided in Southern Germany since the middle of the 18th century. His father, Hermann Einstein, was a liberal who rejected Jewish religious observances and dietary practices as superstitious ritual.

In 1885, at age six, Einstein began his education in the public schools of Munich, where the family had moved in 1880. Since Bavaria was Catholic and religious instruction was compulsory, Hermann, in order to counteract the Catholic influence, hired a relative to tutor Albert at home in the principles of Judaism. Einstein's formal religious training in Catholicism contin-

Figure 2. Baruch Spinoza (1632-1677).

ued after he entered the Luitpold Gymnasium in 1888 at age nine, and seems to have provoked a reaction on Einstein's part, leading to a period of intense religious belief during which he insisted on rigorously observing Jewish religious and dietary rituals at home despite the contrary example set by his parents.

This was followed in 1891 by a sudden "deconversion," during which the twelve-year old now rejected all traditional religion, whether Christian or Jewish, and refused to submit to the *bar mitzvah* ceremony. It has been speculated that this sudden about face may have been due to the influence of Max Talmey, a Polish medical student lodging with Einstein's parents, who lent him numerous popular books during this period dealing with science, mathematics, materialism, and philosophy.

This deconversion not only proved to be permanent, it was also indicative of a growing tendency on the part of Einstein to reject all forms of authority – a rejection that would eventually extend to politics, academia, and even to his personal dress and life style. Throughout the rest of his life Einstein:

... never attended religious services and never prayed in a synagogue or at any other place of worship ... his last wish was not to be buried in the Jewish tradition, but to be cremated ... indicating that he disregarded religious rituals until his death on 18 April 1955.

It was in 1911, at age 22, that Einstein first encountered the writings of the 17th-century Jewish philosopher, Baruch Spinoza (figure 2). Spinoza's life and writings resonated strongly with Einstein – that of a Jew who has rejected his own religious heritage, is unable to fully identify with the surrounding Christian culture, and yet who still retains a highly personalized feeling of reverence and wonder for creation.

Spinoza's religious views were given in his posthumously published *Ethics,* where they are presented in pseudo-mathematical form as a series of so-called definitions and proofs – a format that undoubtedly appealed to Einstein. They were ultimately based on three major assumptions:

1. God and nature are identical. God is literally the "substance" from which the universe is made, and all manifestations of the universe, whether animate or inanimate, material or spiritual, good or evil, are manifestations of God.

2. God is totally impersonal and has no interest in petty human problems.

3. The universe and its laws are totally deterministic and leave no room for either chance or free-will.

Though Einstein would also read other philosophers, such as Kant, Hume, Schopenhauer, and Mach, Spinoza would remain central to his life and by 1920 he had begun to selectively weave these themes into his own personal brand of "cosmic religion."

3. What Did Einstein Believe?

At least three alternative interpretations of Einstein's religious beliefs are possible and I will summarize the evidence for each of them in order of increasing probability.

Interpretation 1: Einstein was an atheist who used religious metaphors to deflect public criticism of his atheistic views and to protect his personal privacy.

This is the least probable and the least popular of the three interpretations, though one which, perhaps not unexpectedly, was first advocated by Chapman Cohen, President of the National Secular Society of England, in his book *God and the Universe*. Commenting on Einstein's reply to a Rabbi's question of whether he believed in God: "I believe in Spinoza's God who reveals himself in the orderly harmony of what exists, not in a God who concerns himself with fates and actions of human beings," Cohen wrote:

Einstein's confession is but a confession of practical

atheism. One might as well pray to the Albert Memorial ... What significance have all the churches, synagogues, mosques, and other gathering places of the religiously afflicted if they are worshiping a God who takes no interest in their fates or their actions ... [These views show] that we have reached the stage where genuine religion finds it increasingly hard to live honestly, and altogether lacks the courage to die with dignity. Anything will do, so long as it is given the name of God. It is still a term which exerts a hypnotic power over the unthinking, and it is by support of the unthinking that established religion today hopes to carry on. ... One can imagine the twinkle in the eyes of Albert Einstein when he replied to the Rabbi's inquiry, "I believe in Spinoza's God." Perhaps he whispered to himself, "And that is no God at all."

Likewise, in a 1998 biography of Einstein we read:

Einstein was a lifelong atheist.

These claims are contradicted by numerous facts:

1. Rather than attempting to keep his religious views private and to deflect public attention, Einstein actively and willingly responded to requests by liberal theologians (both Jewish and Christian) to expound his religious views in public throughout his career.

2. On numerous occasions Einstein explicitly stated that he was neither an atheist nor a free thinker and even criticized those who were:

I am not an atheist ... We are in the position of a little child entering a huge library filled with books in many languages. The child knows someone must of written those books. It does not know how. It does not understand the languages in which they are written. The child dimly suspects a mysterious order in the arrangement of the books but doesn't know what it is. That, it seems to me, is the attitude of even the most intelligent human being toward God.

.... there are people who say there is no God. But what really makes me angry is that they quote me for support of such views.

Then there are the fanatical atheists whose intolerance is of the same kind as the intolerance of the religious fanatics and comes from the same source. They are like slaves who are still feeling the weight of their chains which they have thrown off after hard struggle. They are creatures who – in their grudge against the traditional "opium for the people" – cannot bear the music of the spheres.

... I am also not a "Freethinker" in the usual sense of the word because I find this is in the main an attitude nourished exclusively by an opposition against naive superstition. My feeling is insofar religious as I am imbued with the consciousness of the insufficiency of the human mind to understand deeply the harmony of the universe which we try to formulate as the "laws of nature." It is this consciousness and humility I miss in the Freethinker mentality.

Based on this evidence, Jammer confidently concludes that:

... Einstein was neither an atheist nor an agnostic.

Our second interpretation is by far the most common and is based on Einstein's repeated statements that his God was the God of Spinoza, and the fact that Spinoza was, without a doubt, a pantheist:

Interpretation 2: Einstein was a pantheist, who equated God with the laws of physics.

Further support for this view comes from Einstein's frequent use of the word God as a metaphor for the laws of physics:

It is hard to sneak a look at God's cards. But that he would choose to play dice with the world ... is something I cannot believe for a single moment. [i.e., the laws of physics are deterministic, and not probabilistic in nature].

The Lord God is subtle, but malicious he is not. [i.e., the laws of nature are difficult, but not impossible, to discover and understand.]

The problem with this interpretation is that it lacks philosophical consistency. If God and Nature are identical and science has explained nature mechanically, then why continue to use outdated religious terminology to describe the mechanism? – a point made by the German philosopher, Arthur Schopenhauer (figure 3), over 150 years ago (3):

The chief objection I have to Pantheism is that it says nothing. To call the world "God" is not to explain it; it is only to enrich our language with a superfluous synonym for the word "world" ... Pantheism presupposes Theism; only so far as you start from a god; that is, in so far as you possess him as something with which you are already familiar, can you end by identi-

fying him with the world; and your purpose in doing so is to put him out of the way in a decent fashion. In other words, you do not start clear from the world as something that requires explanation; you start from God as something that is given, and not knowing what to do with him, you make the world take over his role ... Taking an unprejudiced view of the world as it is, no one would dream of regarding it as a god. It must be a very ill-advised god who knows no better way of diverting himself than by turning into such a world as ours, such a mean shabby world ... We find accordingly that what is described as the great advance from Theism to Pantheism, if looked at seriously, and not simply as a masked negation of the sort indicated above, is a transition from what is unproved and hardly conceivable to what is absolutely absurd.

Or elsewhere more succinctly (3):

Pantheism is atheism in a silk hat.

In addition, this interpretation is at odds with the known facts:

1. Though Einstein adopted Spinoza's idea of an impersonal God unconcerned with human goals, needs, or suffering, and of a strictly deterministic universe, he rejected Spinoza's identification of God with the literal substance from which the world is made:

.. and I don't think I can call myself a pantheist ...

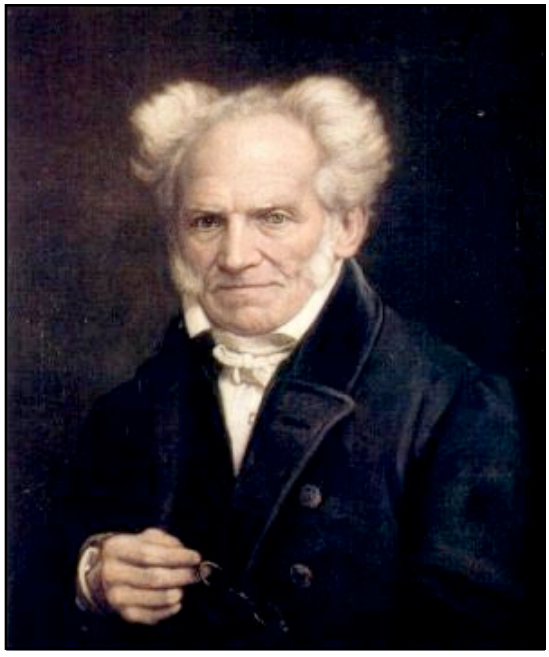

Figure 3. Arthur Schopenhauer (1788-1860).

2. In other places Einstein explicitly refers to God as a nonanthropomorphic spirit or intelligence that is separate from the universe and its laws, but which acts as the cause or creator of the universe and its laws:

... everyone who is seriously involved in the pursuit of science becomes convinced that a spirit is manifest in the laws of the Universe – a spirit vastly superior to that of man ...

I do not believe in the fear of life, in the fear of death, in blind faith ... I do not believe in the God of theology who rewards good and punishes evil. God created the laws that take care of that. His universe is not ruled by wishful thinking, but by immutable laws.

My religion consists of a humble admiration of the illimitable superior spirit who reveals himself in the slight details we are able to perceive with our frail and feeble minds. That deeply emotional conviction of the presence of a superior reasoning power, which is revealed in the incomprehensible universe, forms my idea of God.

This brings us to the third, and in my opinion, most probable of our three alternative interpretations:

Interpretation 3: Einstein was an attenuated deist.

This interpretation is strongly suggested by the above quotes in which Einstein's descriptions of God appear to be little more than rarified versions of the God of the 18th-century deists, as may be seen by comparing them with the following description of deism given by the authors of a recent popular dictionary of philosophy (4):

According to deists, God, having created the universe so that it functions thereafter as a machine governed by natural law, divorced himself from the world and merely contemplates it from beyond as a disinterested bystander, or absentee deity, who neither heeds prayer nor chooses to perform miracles. God did all that he planned, rendered the world capable of self perpetuation on the basis of natural law, gave man intelligence to understand and control nature and to detect in nature the creative activity of divine power.

This is not to say, however, that there aren't some important differences:

1. The God of the 18th-century deist was still anthropomorphic whereas Einstein's is not.

2. The God of the 18th-century deist revealed him-

self through purpose and harmony in the design of nature whereas Einstein's God reveals himself solely through lawfulness in the design of nature.

3. The God of the 18th-century deist is akin to a omnipotent watchmaker whereas Einstein's God is more akin to a disembodied mathematician.

Indeed – though I don't think this has ever been pointed out – Einstein's God actually has much in common with Aristotle's prime mover and his use of the word God shows many of the same ambiguities (5):

... Aristotle's picture of God is not clear: he has not worked out a systematic theology and he uses language loosely, sometimes speaking of God as pure intellect, sometimes as the universe, sometimes as the aether, sometimes as a kind of power behind the universe ...

As with Aristotle (figure 4), much of the difficulty in pinning down Einstein's beliefs lies in the ambiguity of the language he used:

1. His repeated claims that he believed in Spinoza's God are misleading. Though he accepted Spinoza's premise of an impersonal God and a strictly deterministic universe, he almost certainly rejected the most characteristic aspect of Spinoza's religious thought – his literal pantheism.

2. Though there is nothing wrong with describing one's emotional reaction to the laws of physics as one of "wonder, awe, or humility," describing them as "religious" seems to reveal an almost perverse desire to obfuscate.

3. Though there is ample historical and philosophical justification for using the word God to describe an impersonal prime mover, there is again a certain perversity in insisting on this highly restricted meaning when addressing an audience (whether Christian, Jewish, or Islamic) for which the most important attribute of God is his direct and personal involvement in the affairs of man.

Many of Einstein's contemporaries recognized these ambiguities and took him to task. Thus in a 1937 conversation with Einstein, Max Eastman told him (6):

For the sake of clear thinking the word religion ought to be used only to mean a faith that something in the external world is sympathetic to man's interest … it only confuses people's minds and makes them introduce supernatural ideas into science to call this attitude [i.e., scientific humility] religious.

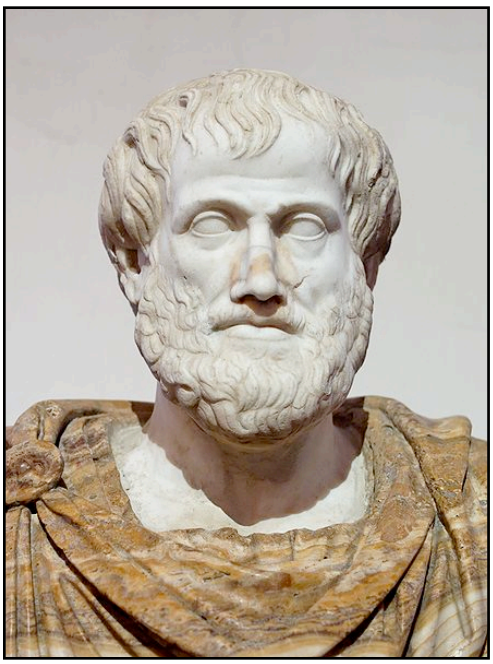

Figure 4. Aristotle (384-322 BC).

Likewise, conservative religious commentators were unanimous in condemning Einstein's use of the word God:

There is no other God than a personal God ... Einstein does not know what he is talking about. (Unnamed Catholic priest, North Hudson, NY).

In renouncing a personal deity, [Einstein] removes the Supreme Being so remotely from the sphere of human comprehension as to make his influence on the individual's conduct negligible ... Einstein is unquestionably a great scientist, but his religious views are diametrically opposed to Judaism. (Rabbi Hyman Cohen, West New York, NY).

Einstein's advice to give up the doctrine of a personal God shows that the good, Doctor, when it comes to the practicalities of life, is full of jellybeans ... (M. W. Bingay, Episcopalian, Detroit, MI).

Despite these criticisms, Einstein persisted in his own particular use of the words religious and God, insisting that the more traditional uses represented earlier, more primitive stages in mankind's religious development, whereas his represented the most recent sophisticated advanced stage – that of a so-called cosmic religion.

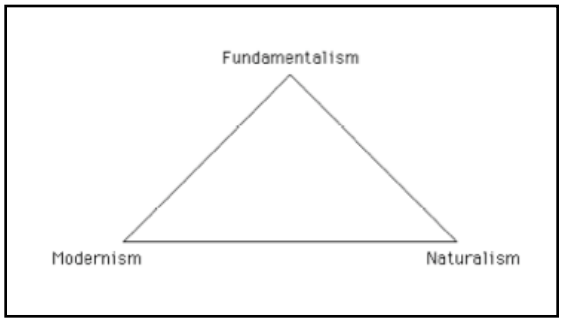

Figure 5. The three-cornered debate.

4. Einstein and Humanism

By the second decade of the 20th-century a three-cornered religious debate had evolved in the United States involving the extremes of atheistic naturalism, religious modernism, and religious fundamentalism (figure 5). Historically, at least, humanism may be viewed as an alliance of convenience between naturalism and modernism based on their common opposition to fundamentalism.

Einstein's concept of God is certainly consistent with humanism, though it lies closer to the modernism extreme than to the atheism extreme. This is reflected in the fact that his religious views were enthusiastically endorsed by liberal Christian and Jewish theologians but were universally condemned by fundamentalists. His claim that his cosmic religion represented a new phase in religious development is also part of the *Zeitgeist* of the time as reflected, for example, in Charles Potter's 1930 book, *Humanism: A New Religion*.

What is more debatable, however, is whether Einstein's belief in absolute determinism is consistent with humanism, since the latter is based on the premise that mankind has freedom of choice and is therefore fully responsible for both its current quality of life and its future survival. It is difficult to reconcile statements like the following with the fundamental tenants of the *Humanist Manifesto*:

I do not at all believe in human freedom in the philosophical sense. Everybody acts not only under external compulsion but also in accordance with inner necessity. Schopenhauer's saying, "A man can do what he wants, but not want what he wants," has been a real inspiration to me since my youth ...

... the man who is thoroughly convinced of the universal operation of the law of causation cannot for a moment entertain the idea of a being who interferes in the course of events ... A God who rewards and punishes is inconceivable to him for the single reason that a man's actions are determined by necessity, external and internal, so that in God's eyes he cannot be responsible, any more than an inanimate object is responsible for the motion it undergoes.

It is doubtful that Einstein was able to consistently apply this belief in his own life (for example, he refused to forgive the Germans for the holocaust, though in keeping with his belief in determinism he should have viewed their crimes as acts of necessity), and I doubt that he ever properly confronted its full ethical and scientific implications.

5. The Scientist as Priest

Given that Einstein's religious views are nothing more than his personal recasting of ideas that had been repeatedly voiced by various philosophers since the time of Aristotle, why has the public been so fascinated with them? The answer, of course, is based on the fallacy that Einstein's great scientific insights must have also provided him with a correspondingly unique religious insight into the universe – a fallacy fostered in part by Einstein's insistence on using quasi-religious terminology to voice his views.

This fascination is also one half of a schizophrenic view of scientists that has evolved in our society – a view which pits the "mad scientist" of technology gone amuck – that horror movie cliche who threatens our very existence with atomic bombs, genetic engineering, and ecological disaster – against the "scientist as priest" who reenchants the universe through the mystery and paradoxes of his incomprehensible mathematical equations. As Andrew Brown has observed (7):

God, when he died, left many situations vacant. Science has nowadays the prestige that theology once had as a source of authoritative answers to such questions as "Who are we?," "Why are we here?," and others whose answers are not strictly factual or even numerical. It has also inherited much of the capacity for hatred traditionally engendered by long study of God, truth or beauty.

The extraordinary thing about the pop science book market is that it is not driven by scientific curiosity at all. What people want is science which appears to answer religious questions. This means physics, cosmology, and biology. There are no works of popular chemistry.

Einstein was probably the first scientist to officially personify the scientist as priest. The public stood in awe of his work, not because it clarified reality for them, but because it mystified it by suggesting strange

paradoxes and violations of common-sense notions of time and space – a view repeatedly reinforced by science popularizers who persisted in mistaking mathematical expedience for physical reality. As Peter Coles has observed (8):

... the media consistently placed Einstein on the far side of a huge intellectual gulf that separated him from the common man, and people responded by treating him with the reverence usually reserved for the priesthood. People did not mind not understanding exactly what he did, but enjoyed believing that Einstein was an intellect greater than themselves.

If anyone plays this role today, it is, according to Coles, Stephen Hawking (8):

I believe that much the same process has occurred with Stephen Hawking [figure 6]. Hawking too works in an area far remote from everyday circumstance, and deals with concepts that run counter to many common-sense notions. The huge sales of "A Brief History of Time" do not necessarily imply that Hawking's ideas are widely understood. I would even doubt whether the majority of those who have bought the book have ever read it. ... The very remoteness of Hawking's ideas from our everyday world removes any sense of threat from his science ... Hawking's whole persona reinforces the "otherworldliness" of his science. Even the strange artificial voice with which he speaks casts him in the role of a kind of oracle, speaking the secrets of the universe ... When Hawking speaks, you listen but don't interrupt.

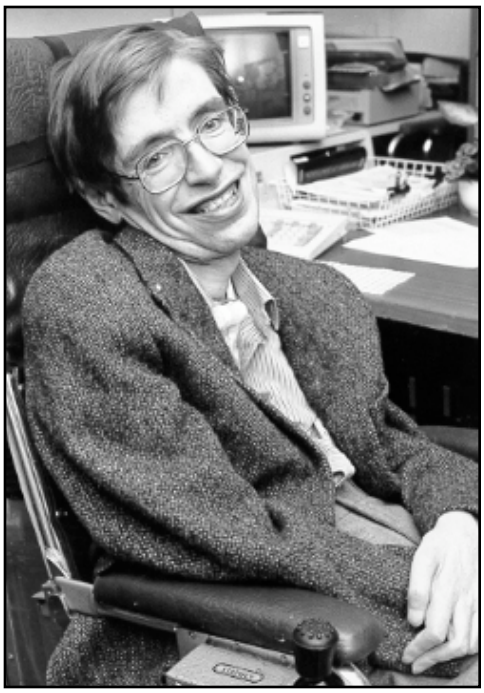

Figure 6. Stephen Hawking

And like Einstein, Hawking, though professing not to believe in the God of Christianity, has reinforced his image as a quasi-religious oracle by using ambiguous religious metaphors to voice his metaphysical views (8):

To look at the development of physics since Newton is to observe a struggle to define the limits of science. Part of this process has been the intrusion of scientific methods and ideas into domains that have traditionally been the province of metaphysics or religion. In this conflict, Hawking's phrase "To understand the universe is to know the Mind of God," is just one example of a border infringement. But by playing the God card, Hawking has cleverly fanned the flames of his own publicity, appealing directly to the popular allure of the scientist-as-priest.

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2010 Update

About a month after giving the above lecture, an article by the well-known atheist, Richard Dawkins, appeared in the magazine *Free Inquiry* in which Einstein was, as usual, presented as a pantheist and friend of free thought and atheism. In light of my remarks in the above lecture, Joe Levee urged me to write a letter to the editor pointing out both the existence of the Jammer book and the conclusion that Einstein is probably more accurately characterized as an attenuated deist, who on more than one occasion expressed a distain for

free thinkers and atheists. Alas, not only was the letter not published, it was never acknowledged, thus demonstrating that the cynical exploitation of the famous as propaganda for a particular set of beliefs is a game played with equal enthusiasm by both sides in the confrontation between religion and secularism.

VII
Frankenstein's Cat and Other Bioelectric Fantasies

1. Introduction

Joe Levee, having heard me pontificate several times at lunch on the many popular misconceptions surrounding Mary Shelley's famous novel, *Frankenstein*, has asked me to expand my comments into a lecture for the October meeting of FIG, with the obvious thought in mind that it would make a perfect topic for the Halloween season (1). Though such a subject would, at first glance, seem to be something of a stretch for an organization devoted to free thought and humanism, both the lives of those involved in the creation of the original novel and the true theme of the novel itself have, as I hope to demonstrate, a substantial overlap with the concerns of your organization.

2. Origins

Born Mary Godwin on 30 August 1797, Mary Shelley (figure 1) was the first and only child of William Godwin and Mary Wollstonecraft (2). Both parents began their careers as hack writers of eminently forgettable novels, and later found notoriety as the authors of radical political tracts – Godwin for his *Enquiry Concerning Political Justice* (1793) and Wollstonecraft for her *A Vindication of the Rights of Women* (1792).

Though both were middle aged and on record as opposing the social institution of marriage, they nevertheless tied the knot when it was discovered that Wollstonecraft was four months pregnant. Eleven days after the birth of their daughter, Wollstonecraft died of infection due to an imperfect removal of the birth placenta, leaving Godwin not only with a new-born daughter, but also with her half sister, Fanny – Wollstonecraft's illegitimate daughter by an earlier affair with a married man. In 1801 this rather eclectic household was further elaborated when Godwin married a widow named Clairmont and thereby acquired two more step-children.

At age 17 Mary first meets the young poet, Percy Bysshe Shelley, who has become a follower of her father's political views. Percy abandons his wife and two children and runs off to the continent with the young teenager, who is soon pregnant. In May of 1816, following a miscarriage and second pregnancy, Mary and Percy again escape to the continent in the company of Mary's step-sister Claire, who is infatuated with the

Figure 1. Mary Shelley (1797-1851).

poet Byron and is soon pregnant by him. Mary, Percy, Claire, Byron, and Byron's personal physician, John Polidori, share a villa in Geneva on the shores of Lake Léman. It is here, during the summer of 1816 that the 19-year old Mary outlines her first novel, *Frankenstein or the Modern Prometheus* (3).

Returning to England, Mary, pregnant once more, prepares her manuscript for publication and finally marries Shelley, following the suicide of his first wife. The novel is finally published in 1818 in three volumes without the author's name appearing on the title page. According to the preface to the first edition, which is widely thought to have been written by Percy, rather than by Mary, the novel was conceived as a result of a contest among the villa's inhabitants as to who could invent the best horror story. In a more extensive preface to the revised edition of 1831, Mary provided additional insights into the novel's origins (3):

... many and long were the conversations between Lord Byron and Shelley, to which I was a devout but nearly silent listener. During one of these, various philosophical doctrines were discussed, and among

others the nature of the principle of life, and whether there was any probability of its ever being discovered and communicated.

So here we have an important clue as to the novel's philosophy and vision. It is heavily influenced by the opinions of Byron and Shelley as perceived by an infatuated and impressionable young teenager basking in the presence of the two foremost romantic poets of her age. As we will see, however, it is a clue which has been almost totally ignored by modern commentators on the novel. Thus, for example, Mary's choice of the novel's subtitle – *The Modern Prometheus* – is surely not unrelated to the fact that both Byron and Shelley were fascinated by the myth of Prometheus. Byron wrote a poem entitled *Prometheus*, also during the summer of 1816, and Shelley would write an epic poem entitled *Prometheus Unbound* in 1818 – the same year in which *Frankenstein* was first published.

Mary would outlive all of the major protagonists present at the villa on Lake Léman during that fateful summer of 1816. Polidori would commit suicide in 1821 at age 25; Percy Shelley would die the next year at age 29 in a boating accident; and Byron would die in 1824 at age 36 of a fever contracted during the Greek War of Independence. In order to support herself and her children, Mary would go on to write numerous travel books, encyclopedia articles and novels, most of which remain – despite the attempts of certain feminists to present her as a major British authoress – as eminently forgettable as the novels written by her parents. In truth, her fame today rests almost completely on her first literary effort – *Frankenstein* – and even that fame is of a peculiar kind, since, as I hope to demonstrate, it is largely based on a series of 20th-century myths concerning the nature and contents of the novel which falsely attribute to Shelley a degree of insight, if not foresight, concerning the dilemmas of modern science and technology which are simply no where to be found in the original novel itself.

3. Nine Myths

For purposes of brevity, I will break the remainder of my comments into nine common myths concerning Mary Shelley and her famous novel – some trivial and others not so trivial when it comes to the creation of what is, in my opinion, a wildly inaccurate assessment of this author and her creation by most modern-day literary critics.

Myth 1: The monster is named Frankenstein.

No. Victor Frankenstein is the name of the monster's creator. The monster is never given a name. Confusion of the two had already begun in the 19th century when the name of Frankenstein began to be used by various political cartoonists (see figure 2) as a metaphor to represent any threatening event that appeared to be spinning out of control, be it the Irish problem, working class socialism or Russian militarism (4). In the case of the modern reader, however, this confusion is almost solely the product of Hollywood. It began in earnest in the 1940s with such movie spinoffs as *Frankenstein Meets Wolfman* (1943) or *Abbott and Costello Meet Frankenstein* (1948), and is now virtually universal as a result of its propagation by various TV comedies and Saturday morning cartoon shows.

Figure 2. An 1843 political cartoon in which the name of Frankenstein is incorrectly attached to the monster rather than to its creator – the monster in this case being the perennial Irish problem.

Myth 2: The novel is set in mid 19th-century Germany.

No. It is set largely in 18th-century Switzerland. The story is told via letters, dated merely as 17__, from an arctic explorer named Robert Walton to his married sister, Margaret Saville, back in England. Walton discovers an exhausted Frankenstein, who has been pursuing his monster across the arctic wastes. Before he dies in Walton's arms, Frankenstein tells his story to Walton, who embeds the account in his letters. The monster's personal tale, as told to Frankenstein, is embedded, in turn, within Frankenstein's account.

From internal references within the novel the date can be further narrowed to the 1790s, as Frankenstein

reports attending a course of science lectures as a young teenager in which "... the professor discoursed with the greatest fluency of potassium and boron, of sulphates and oxydes ..." The terms sulphate and oxide are part of the nomenclature reforms introduced into chemistry by the French chemist Lavoisier and his collaborators in 1787 and did not become common usage until the 1790s. On the other hand, potassium and boron were unknown until their electrochemical isolation by Sir Humphry Davy in the period 1807-1808, or nearly two decades after the event in question. This is but one of several examples of the faulty science used by Mary Shelley.

Myth 3: Frankenstein is a student of medicine.

No. Frankenstein never formally studies medicine nor becomes a doctor of medicine. He enters the University of Ingolstadt at age 17 to study natural philosophy or physics under Professor Krempe, and chemistry under Professor Waldman. Having accidentally discovered the secret of life his second year at the university, at age 19, Frankenstein drops out of school but remains in Ingolstadt, teaching himself physiology and anatomy, and working on his creature, which he finally succeeds in activating at age 20. It is truly a novel about teenagers written by a teenager.

Myth 4. Frankenstein is a Baron.

No. He is the son of a upper-middle class Swiss public servant and is born and raised in Geneva.

Myth 5: The monster is created in a castle using electricity.

No. There is no castle, no hunchback laboratory assistant, and no thunderstorm. The monster is created solo by Frankenstein in his student lodgings. No reference is made to electricity and galvanism in connection with its creation. Indeed no attempt is made to suggest just what Frankenstein's secret of reanimation is or to give an aura of scientific plausibility to his proceedings.

Electricity is mentioned only once in the novel. When he is about 15 years old Frankenstein witnesses a tree being struck by lightning. His father uses the occasion to teach him about static electricity by repeating Benjamin Franklin's famous kite experiment (3):

He constructed a small electrical machine and exhibited a few experiments; he also made a kite, with a wire and string, that drew down that fluid from the clouds.

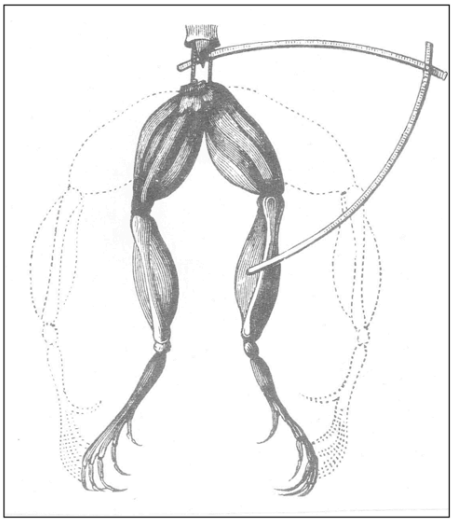

Figure 3. Galvani's famous experiment with severed frog's legs.

This occurs along with young Frankenstein learning about other physical phenomena, such as distillation and "experiments with an air-pump," and not in connection with anything related to physiology or the secret of life.

Here, as virtually every elaborator of Shelley's tale has since shown, Mary missed out on a great opportunity to give her science some semblance of plausibility. Though a crude electrostatic generator had been devised by the German natural philosopher, Otto von Guericke, in 1672, it was not until the 18th century that the study of static electricity became a science. In 1706 the British instrument maker, Francis Haukesbee, constructed the first practical electrostatic machine and in 1745 Musschenbroek and von Kleist discovered the Leyden jar – a sort of macro-capacitor which allowed one to store an electrostatic charge.

With these two innovations, popular lectures on electricity, complete with demonstrations, became the rage. One of the most popular of these demonstrations, introduced by the French "electrician," Jean Nollet, in 1746, consisted of forming a human chain by having a large number of persons hold hands and then discharging a Leyden jar at one end and watching all of the members of the chain jump as the charge passed from person to person – a feat which he performed on one occasion using a chain of 180 Royal Guardsmen and on another using a chain of 200 Carthusian monks. Nollet was also quick to suggest the use of electric shocks to treat paralysis and nerve disorders with the result that the usual predictable array of quack remedies soon made an appearance.

The next important step occurred in 1771 when the Italian physician, Luigi Alyisio Galvani, discovered animal electricity in the form of the spontaneous

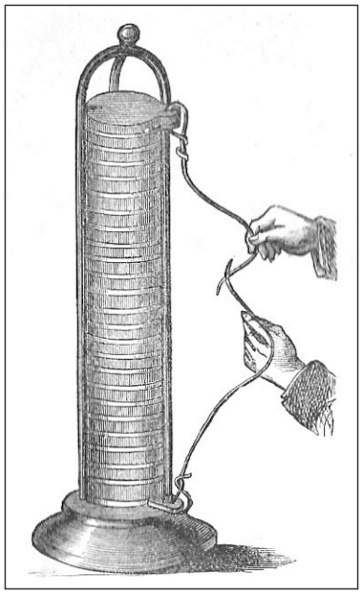

Figure 4. Volta's pile for the generation of current electricity.

twitching of severed frog legs into which metal rods had been inserted (figure 3). Galvani believed the nerves of the frog were the source of the electricity. This conclusion was disputed by the Italian physicist, Alessandro Volta, who believed that the muscles and nerves of the dead animal were not the source of the electric current but were rather responding to an exter-

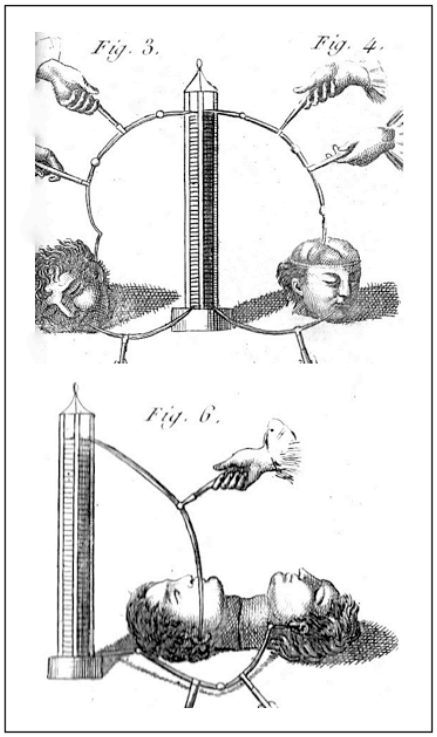

Figure 5. An excerpt from the plates in Aldini's treatise of 1804.

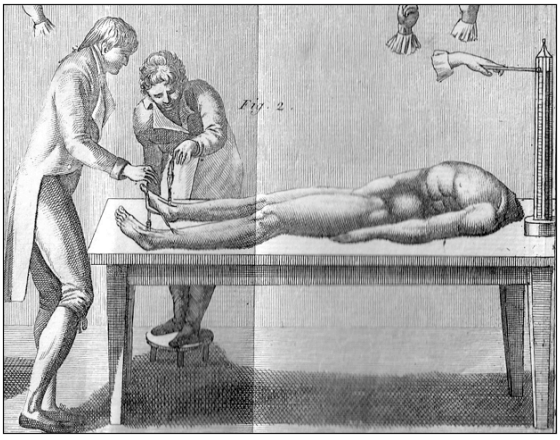

Figure 6. An excerpt from the plates in Aldini's treatise of 1804.

nal electrical current produced by the metallic rods in conjunction with the electrically conducting body fluids. In 1800 he showed that animal nerves and fluids were totally unnecessary by constructing an electrical source known as a Voltaic pile (essentially the first electric battery) which supplied a continuous source of current electricity but was made solely of metal plates and paper disks soaked in salt solution (figure 4).

Nevertheless, this debate was continued by Galvani's nephew, Giovanni Aldini, in a series of spectacular experiments (figures 5-7) conducted during the first decade of the 19th century in which he caused the eyes and lips of a decapitated ox to move by electrically stimulating its brain and was also able to produce facial grimaces, jaw movements, and eye openings by electrically stimulating the brains of guillotined crimi-

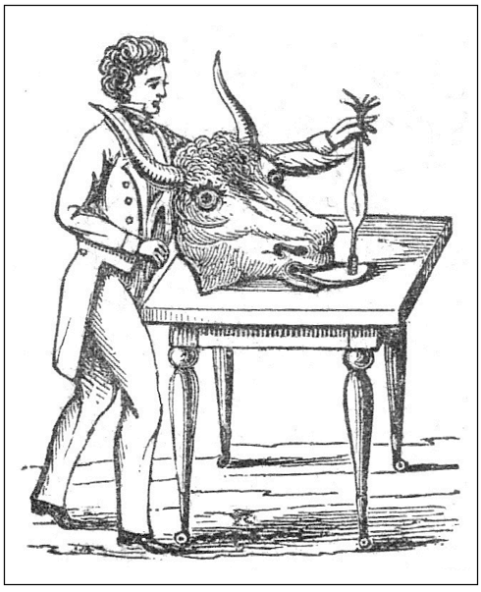

Figure 7 A illustration from a mid-19th century textbook based on Aldini's original experiments.

nals using, interestingly enough (as may be seen in figures 6 and 7), Volta's pile as the electrical source (5). Not to be topped by Aldini, in 1817, a year before Shelley published her novel, a German physiologist named Weinhold also reported having successfully reanimated a dead cat using electricity (see below).

Alas, no mention is made of any of this by Mary Shelley, who seems to have been only superficially acquainted with the science of her day. Indeed, by setting her novel in the 18th-century, rather than in the first decade of the 19th century, she precluded the possibility of mentioning the experiments reported by Aldini and Weinhold, both of which relied on the use of the Voltaic pile.

The only mention of any scientist by name occurs in Percy Shelley's preface, where he indirectly refers to Erasmus Darwin's description of the apparently spontaneous generation of worm-like animals in a paste made of flour and water – a phenomenon already disproved by Francesco Redi in the 17th century. And probably the only reason Shelley was aware of this defective piece of science is because of his interest in Darwin's scientific poetry (*The Botanic Garden* and *The Temple of Nature*) rather than in his science per se.

The actual role of science in the novel was aptly summarized by Leonard Wolfe in his preface to his 1977 edition of the novel, *The Annotated Frankenstein* (3):

But science, despite Percy Shelley's name dropping in the preface he wrote to Frankenstein, is barely visible in the novel. Mary Shelley, it is true, nods dutifully to the achievements of science in her day, but she makes almost no effort to give her tale that patina of verisimilitude that science fiction requires. Her protagonist, Victor, for example, is a semi-hemi-demi chemist and sometime anatomist who, after two years in college, is able, working in his private chambers, to discover the secret of life, a secret which had eluded the greatest human minds before he put his sophomore's attention to the problem. Mary Shelley handles the matter with the aplomb of a writer. A couple of strokes of the pen and genius behaved like genius!

Myth 5: The monster is a hideous creature stitched together from assorted body parts. It is covered with grotesque scars and has bolts projecting from his neck.

No. This image is actually that created by Boris Karloff in the 1931 movie adaptation (figure 8). In the original novel Frankenstein describes his creature, which is nearly eight feet tall, as having been designed so that "his limbs were in proportion" and "his features beautiful." However, due to some unforeseen side-effect of the chemicals used, the monster's skin is an unpleasant yellowish color and has tighten so as to clearly reveal the underlying muscles and arteries. Similarly, both the pupils and whites of his eyes are also yellowish, and the eyes unusually watery. However, he has "lustrous black flowing hair" and "teeth of a pearly whiteness."

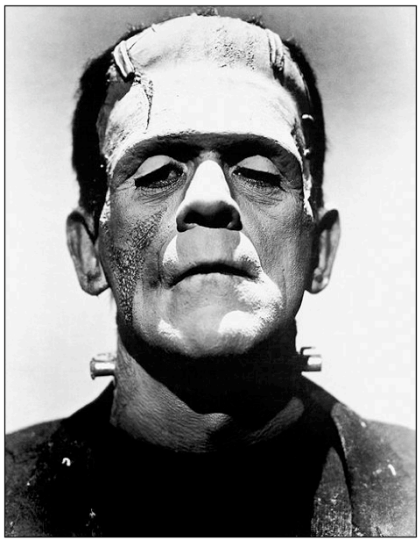

Figure 8. The 20th-century image of Frankenstein's monster as depicted by Boris Karloff in Universal's 1931 film adaptation.

As portrayed by the actor, Thomas Potter Cooke, who played the monster in the 1823 stage adaptation entitled *Presumption or the Fate of Frankenstein* (figure 9), and by the actor Richard John O. Smith in a

Figure 9. The British actor Thomas Potter Cooke as Frankenstein's monster in the 1823 stage adaptation entitled *Presumption or the Fate of Frankenstein*.

Figure 10. The British actor Richard John O. Smith as Frankenstein's monster in the 1826 stage adaptation entitled *Frankenstein, or the Man and the Monster.*

slightly later stage adaptation entitled *Frankenstein, or the Man and the Monster* (figure 10), as well as in the illustrations made for the second edition of the novel in 1831 (figure 11), the monster is represented as having long flowing black locks and as being dressed in a short Greek tunic and cape, the only concession to the horrible being the use of blacken lips and yellow skin covered with blue veins. In short, the monster was portrayed as an ancient Greek with a complexion problem. Apparently looking even vaguely near-Eastern or foreign was all that was required to frighten the typical early 19th-century British audience.

Most modern interpretations of the novel have assumed that its subtitle, *The Modern Prometheus,* refers to Frankenstein. Just as Prometheus was punished by the Gods for having stolen the secret of fire, so Frankenstein is punished for having stolen the secret of life. However, this early portrayal of the monster in Greek garb suggests instead that it is the monster, rather than Frankenstein, who is viewed as the analog of Prometheus and who, like the original, is guilty of defying his creator – an interpretation which, as we will see, is further supported by some of the novel's internal dialog.

Myth 6: The monster is an inarticulate brute with a defective brain.

No. Repelled by his creation, Frankenstein abandons his monster and flees back to Geneva. The deserted and bewildered monster takes refuge in a shed next to the cottage of a peasant family named De Lacey. By listening in on the family the monster learns to speak French, which in the novel translates into perfect Oxfordian English with Biblical overtones. In addition, the monster teaches himself to read, having found a case containing French translations of Goethe's *Sorrows of Young Werther*, Milton's *Paradise Lost*, and Plutarch's *The Lives of the Noble Grecians and Romans*.

Reading Goethe gives the monster a proper sense of adolescent *Angst* (3):

My person is hideous, and my stature gigantic. What did this mean? Who was I? What was I? Whence did I come? What was my destination?

whereas the reading of Plutarch gives him a proper sense of nobility and duty (3):

I was of course led to admire peaceable law givers, Numa, Solon, and Lycurgus, in preference to Romulus and Theseus.

But it is the reading of Milton that gives him the idea that his creator has in some way betrayed him and owes him recompense (3):

Did I request thee, Maker, from my clay to mold me man? Did I solicit thee from darkness to promote me?

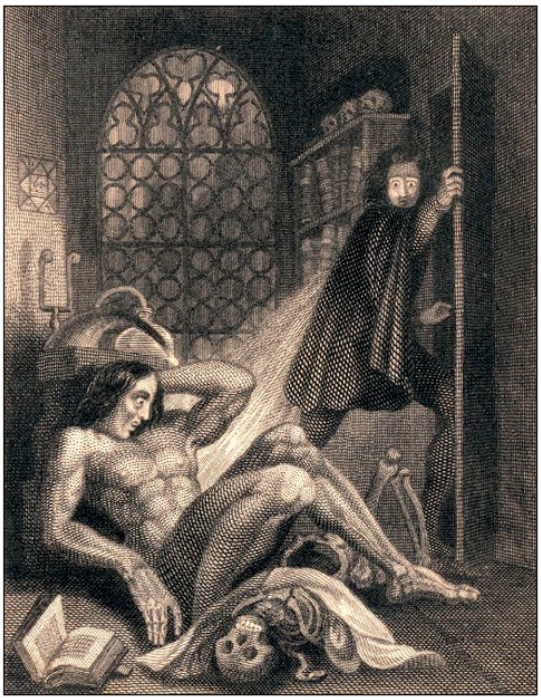

Figure 11. An illustration from the 1831 edition showing Frankenstein fleeing from his newly created monster.

On fleeing Frankenstein's rooms, the newly created monster demonstrates proper Victorian modesty by stealing some of Frankenstein's clothing. Based on papers found in the coat pocket, the monster is able, after learning to read, to further deduce that Frankenstein is his creator and so pursues him back to Geneva. Here at a Alpine mountain pass they confront one another and proceed to engage in a series of highly articulate philosophical conversations on such topics as the duty of God toward his creations, the meaning of life and happiness, and the nature of good and evil.

Myth 8: Frankenstein is possessed by the hubris of modern science.

No. Frankenstein is inspired to create his monster, not by the wonders of modern science, but by his adolescent addiction to the outdated literature of alchemy and occultism (3):

... my first care was to procure the whole of this author [Cornelius Agrippa], and afterwards of Paracelsus and Albert Magnus. I read and studied the wild fancies of these writers with delight ... and I entered with the greatest diligence into the search for the philosopher's stone and the elixir of life ... The raising of ghosts or devils was a promise liberally accorded by my favorite authors, the fulfillment of which I most eagerly sought.

Cornelius Agrippa (1486-1535), Paracelsus (1493-1541) and Albert Magnus (1193-1280) were all outdated writers on alchemy and occultism.

In contrast, Frankenstein finds the study of modern science dull and mundane (3):

I had a contempt for the uses of modern natural philosophy. It was very different when the masters of science sought immortality and power; such views, although futile, were grand, but now the scene was changed. The ambition of the inquirer seemed to limit itself to the annihilation of those visions on which my interest in science was chiefly founded. I was required to exchange chimeras of boundless grandeur for realities of little worth.

When Frankenstein reveals his occultist fantasies to Krempe, the professor of natural philosophy, he is publicly mocked. Waldman, the professor of chemistry, takes a more diplomatic approach and gradually inspires Frankenstein to study modern science. Frankenstein's epiphany comes when he realizes that he can use the power of modern science to achieve his occultist fantasies.

What these quotes further suggest is that Mary Shelley based much of her portrayal of young Frankenstein on what she knew of Percy Shelley's own youth and early interest in science and the occult. Thus in a 1930 study of Shelley's background in science and his use of scientific metaphors in his poem, *Prometheus Unbound*, Grabo writes (6):

At Eton Shelley is said to have "passed much of his time in the study of the occult sciences, natural philosophy, and chemistry; his pocket money was spent on books relative to these pursuits, on chemical apparatus and materials, and many of the books treated of magic and witchcraft." In his second letter to Godwin, Shelley writes: "Ancient books of chemistry and magic were perused with an enthusiasm of wonder, almost amounting to belief."

Myth 8: The novel is about science gone wrong.

No. At no point is there an explicit discussion of the abuse of science. The exchanges between Frankenstein and his creature are all semi-theological and are heavily dependent on the monster's reading of Milton's *Paradise Lost*. Just as God created Satan and then condemned him to a life of misery and sin by casting him out of heaven, so Frankenstein has abandoned his creation and condemned him to a life of unhappiness and evil (3):

Remember that I am thy creature. I ought to be thy Adam, but I am rather the fallen angel whom thou drivest from joy for no misdeed, Everywhere I see bliss from which I alone am irrevocably excluded. I was benevolent and good; misery made me a fiend. Make me happy and I shall again be virtuous.

Indeed, God is at least consistent because, after creating Adam and Eve, he also condemns them to a life of misery and sin by casting them out of the Garden of Eden. But unlike Adam, who has Eve to share his misery, and Satan, who has his minions, Frankenstein has provided no companion for his miserable creation (3):

... no Eve soothed my sorrows or shared my thoughts; I was alone. I remembered Adam's supplication to his Creator, but where was mine? He had abandoned me and, in the bitterness of my heart, I cursed him.

Using these arguments, the monster attempts to convince Frankenstein that he should create a mate for him (3):

You must create a female for me, with whom I can live in the interchange of those sympathies necessary for my being. This alone you can do and I demand it of you as a right which you must not refuse.

Frankenstein finally agrees, but half way through the process he reneges on his promise and destroys the partially created female.

Rather than submitting meekly like Adam to his fate, the outraged monster chooses to emulate Satan and to rebel against his creator by attempting to destroy all that is near and dear to him, including Frankenstein's family and bride (3):

Many times I considered Satan as the fitter emblem of my condition; for often, like him, when I viewed the bliss of others, the bitter gall of envy rose within me ..... Shall each man ... find a wife for his bosom, and each beast have his mate, and I be alone? I had feelings of affection, and they were requited by detestation and scorn. Man, you may hate, but beware! Your hours will pass in dread and misery and soon the bolt will fall which must ravish you from your happiness forever.

The resulting "war in heaven" between creator and creation ends in the arctic pursuit, where, after Frankenstein's death, the grieving monster destroys himself on his master's funeral pyre.

Both William Godwin and Percy Shelley were atheists. The Prometheus myth was so attractive to Shelley because it represented man's defiant rebellion against an unjust God – it was the defiance of Satan without the negative theological press. Thus, in his introduction to his poem, *Prometheus Unbound*, Shelley wrote (3):

The only imaginary being resembling Prometheus in any degree is Satan; and Prometheus is, in my opinion, a more poetical character than Satan, because, in addition to courage, and majesty, and firm and patient opposition to omnipotent force, he is susceptible of being described as exempt from the taints of ambition, envy, revenge, and desire for personal aggrandizement, which, in the hero of Paradise Lost, interfere with the interest.

Likewise, in his student essay, *A Refutation of Deism*, Shelley used many of the same arguments that would later be used by Frankenstein's monster. Thus in commenting on the fall of man, he writes (7):

God is here represented as creating man with certain passions and powers, surrounding him with certain circumstances, and then condemning him to everlasting torments because he acted as Omnipotence had made him. For to assert that the Creator is the author of all good and the creature the author of all evil, is to assert that one man makes a straight line and a crooked one, and that another makes an incongruity.

As already noted, most commentators on Mary Shelley's novel have assumed that the Prometheus reference in the subtitle refers to Frankenstein, but, as with the portrayals of the monster in the early stage plays, these quotes would suggest that it actually refers instead to the monster. Frankenstein is really not a science fiction novel. It is a morality play. It does not deal with the abuse of science but with the theological question of the relationship between God and his creations.

Myth 9: The novel became the Victorian symbol for technology and science gone bad.

No. Though the novel remained in print throughout the 19th century and was the subject of several popular plays, it is never referred to in 19th-century accounts of scientific ethics or technological abuse or in 19th-century accounts of electrophysiology.

Take, for example, the case of the German physiologist, Karl August Weinhold, who in 1817 published a monograph with the imposing title *Versuche über das Leben und seine Grundkrafte auf dem Wege der experimental-Physiologie* in which he described his experiments in reanimating dead cats by filling their scooped-out brain cavities with the chemical ingredients required to create a voltaic cell. As later summarized in a popular 1829 account by Isaac Ray, entitled *Conversations on The Animal Economy Designed for the Instruction of Youth and the Perusal of General Readers*, we read:

... behold the following among several marvelous experiments lately performed by Weinhold. He removed the brain and spinal marrow of a cat, and after all signs of life had disappeared, he filled up the cranium and vertebral canal with an amalgam of mercury, zinc, and silver. The effect was that the animal soon gave signs of life; it raised its head, opened its eyes, looked steadily, attempted to walk, and endeavored to rise after frequently falling down. In the mean time, the circulation was renewed, and the secretion of the gastric juice seemed more abundant than ordinary. The animal heat was also reestablished. This gentleman also remarked that the extremities of a divided nerve gave sparks when brought together.

Nothing could be closer to the popular 20th-century conception of Frankenstein and his experiments than this. Yet there is no evidence that Mary Shelley ever heard of Weinhold and his reanimated cats, nor is there any evidence that Weinhold's contemporaries and critics ever compared him with Shelley's literary creation. Likewise, Ray's account of Weinhold's experiments in a popular book intended for students and lay readers, though appearing over a decade after the publication of *Frankenstein*, makes no mention of or comparison with the events in Shelley's novel.

The same is equally true in the case of the British amateur electrician, Andrew Crosse, who, in 1836, observed the spontaneous generation of tiny, mite-like insects (figure 12) from white crystalline patches inside his electrochemical apparatus, which contained various solutions of inorganic compounds, including hydrochloric acid, potassium silicate, copper nitrate, copper sulfate, zinc sulfate, and hydrofluoric acid, through which he had been passing weak electrical currents for periods of weeks to months. The purpose of Crosse's experiments was not to artificially create life, but rather to electrochemically induce crystal growth and nowhere in his published papers does he suggest that the mites were created by him artificially. Nevertheless, his results were seized upon by the popular press in England, which loudly proclaimed that he had created life. As a result, he received death threats and was roundly condemned as an atheist, blasphemer, and "reviler of the holy religion."

Crosse's results were debated as late as the 1850s. Though the press falsely reported that they had been duplicated by the famous electrochemist, Michael Faraday, another amateur electrician named William Weekes did in fact claim to have successfully replicated them in 1842 under more rigorous conditions. This, despite the fact that samples of the mites supplied by Crosse had been identified as specimens of the common cheese mite by Richard Owen as early as 1837 and most mainstream scientists were of the opinion that the mites were due to contamination of the solutions and/or apparatus by ova of the insect in question. These ova are extremely resistant to harsh chemicals, including boiling water, and were probably stimulated to hatch by the weak electrical currents.

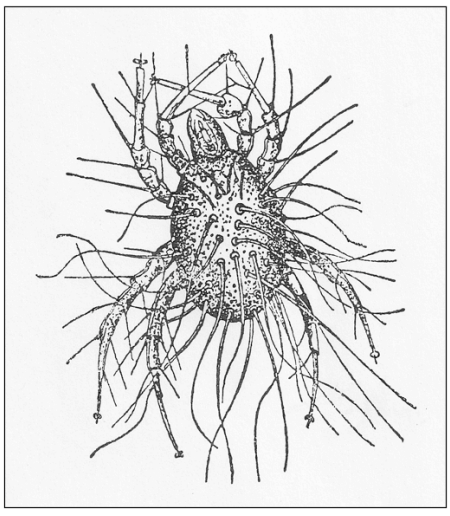

Figure 12. A drawing of one of Andrew Crosse's artificial mites.

Yet despite this prolonged publicity and public debate, there is no historical evidence indicating that Mary Shelley ever took an interest in the Crosse affair or that Crosses' numerous critics ever thought to compare him to her fictional creation (10).

4. Causes and Conclusions

The current view of Frankenstein as the quintessential metaphor for bad science gone astray is totally a creation of the modern 20th-century film industry and owes practically nothing to Shelley's original novel except the use of the name "Frankenstein." If use of this metaphor was correctly attributed to the films, rather than to the novel, then there would be no myth to correct, as indeed the movies do explicitly champion this view. The problem, however, is that virtually every modern commentator on Frankenstein incorrectly attributes these views to Mary Shelley and her novel as well, thus incorrectly making her into a prophetess of the modern technological dilemma.

There are at least three sources for this error:

1. Specialists on the history of science fiction and fantasy literature, who have a vested interest in making the genre seem more important and prophetic than it really is.

2. Feminist commentators, who have a vested interest in making Mary Shelley into a major female author, and who have resisted any attempt to assess the impact of Percy Shelley's ideas on the novel, which was in fact Mary Shelley's only literary success.

3. The canons of modern literary criticism in general which reject the use of historical evidence and logic and instead opt for the use of allegorical interpretation as a legitimate substitute for proper scholarship.

Allegory comes from the Greek *allos*, meaning "other," and *-agorein*, meaning "to speak publicly." In other words, it means to speak in a secret code known only to the initiated. It is the basis of much pseudoscience,

from Bible interpretation to Freudian dream analysis, and is based on the assumption that the interpreter has a privileged insight into the code that is denied to the rest of us poor mortals. Examples of its application to the Frankenstein novel have included the claims that:

1. It is an allegory for Mary Shelley's hatred of her father (Rosenberg 1972).

2. It is an allegory for the horrors of pregnancy and child birth (Moer 1974).

3. It is an allegory for the mistreatment of the handicapped (Gould 1990).

Though one would perhaps expect this kind of silliness from Hollywood and from literary critics, yet a fourth contributor to these myths has made an appearance in recent years of whom one might expect a higher standard. In a desperate attempt to make their work seem more socially relevant, several historians of science have begun to perpetuate the myth that Mary Shelley's novel shares a common *Zeitgeist* with 18th- and early 19th-century developments in electricity and electrophysiology, though this is in fact not true. Thus Secord, in his study of the experiments of Andrew Crosse, states that Crosse was called a Frankenstein by his contemporaries, though he cites no period references for this assertion (9). Likewise, Schiffer, in a study of 18th-century electrical technology, implies that the Shelleys were well versed in 18th- and early 19th-century electrical science, though both the absence any supporting documentary evidence and his wording ("perhaps he had read ...," "surely he could not have been unaware ...," "apparently he passed along...," "she may also have ...," etc.) quickly reveal that the entire discussion is based on mere speculation (11).

Even more egregious is the article by Finger and Law on the work of Weinhold, which carries the pretentious title "Karl August Weinhold and his 'Science' in the Era of Mary Shelley's Frankenstein: Experiments on Electricity and the Restoration of Life," thus implying that Shelley's novel was so important that it defined the era in which it was published (8). Since Weinhold's book was published prior to Shelley's novel, it cannot possibly have been influenced by the novel, and, as already stated, there is not a shred of evidence that either Percy or Mary Shelley ever heard of Weinhold and his reanimated cats. This, however, does not prevent the authors of the article from indulging in 19 pages of speculation and supposition concerning their mutual relations.

Indeed, both Schiffer and Finger boarder on the dishonest, or at least the disingenuous, in their attempts to forge links which simply do not exist. Thus both quote a comment made by Frankenstein upon commencing the animation of his creature (3):

With an anxiety that almost amounted to agony, I collected the instruments of life about me, that I might infuse a spark of being into the lifeless thing that lay at my feet.

Both writers would have us believe that this is a direct reference to the use of electricity, when, of course, the phrase "spark of being" – in which the term spark is used in the sense of an initiating influence, such as a spark from an ember or flint causing a conflagration – was a common English metaphor that had been around for centuries before Shelley employed it (12).

More recently the propagation of this myth has extended beyond the history of science literature to the museums as well. Thus the Baaken Museum for Electricity in Life of Minneapolis has a permanent display on Frankenstein and the National Library of Medicine sponsored a similar display in 2002 (4).

In short, poor scholarship, out and out misrepresentation, and exploitation of Shelley and her novel for a variety of modern-day objectives have all combined to create the "Myth of Frankenstein." Commenting on this ever-present exploitation of the past for present-day purposes, the American historian, Carl Becker, once observed that (13):

Every age is bound, in spite of itself, to make the dead perform whatever tricks it finds necessary for its own peace of mind.

And so poor Mary Shelly has been made to perform for the science fiction enthusiast, the feminist, and the historian of science alike.

As to the further question of whether *Frankenstein* is really a classic of literature or merely a hack thriller whose importance has been blown out of all proportion, ask yourself which of the following best describes history's judgment:

1. This is a perfect masterpiece, like the plays of Shakespeare, no line of which should ever be altered.

2. This is a very interesting idea but I think I can do much better.

I would humbly submit that the fate of Shelley's novel at the hands of countless playwrights, movie producers, and, more recently, other novelists (14), unambi-

guously demonstrates that the second, rather than the first, of these two choices best approximates the final verdict.

5. References and Notes

1. A lecture given to the Cincinnati Free Inquiry Group (FIG), Cincinnati, OH, on 23 October 2004.

2. M. Tropp, *Mary Shelley's Monster: The Story of Frankenstein*, Houghton Mifflin: Boston, 1976.

3. L. Wolf, Ed., *The Annotated Frankenstein*, Potter: New York, NY, 1977. An annotated facsimile of the first edition of 1818. All quotes from the novel are from this source.

4. S. E. Lederer, *Frankenstein: Penetrating the Secrets of Nature,* Rutgers University Press: New Brunswick, NJ, 2002, pp. 34-35, 71. This is a guidebook for an exhibition on Frankenstein held at the National Library of Medicine in 2002.

5. For background on Aldini and his experiments, see J. Aldini, *Essai théorique et expérimental sur le Galvanisme*, 2 Vols., Fournier fils: Paris, 1804; and S. Finger, *Minds Behind the Brain: A History of the Pioneers and Their Discoveries*, Oxford University Press: Oxford, 2000, Chapter 8.

6. C. Grabo, *A Newton Among Poets: Shelley's Use of Science in Prometheus Unbound*, University of North Carolina Press: Chapel Hill, NC, 1930, p. 5.

7. P. B. Shelley, *The Necessity of Atheism and Other Essays*, Prometheus Books: Buffalo, NY, 1993, pp. 61-62.

8. For background on Weinhold and his experiments, see K. A. Weinhold, *Versuche über das Leben und seine Grundkrafte auf dem Wege der experimental-Physiologie,* Creutz: Magdeburg, 1817; I. Ray, *Conversations on the Animal Economy Designed for the Instruction of Youth and the Perusal of General Readers*, Shirley and Hyde: Portland, ME, 1829, pp. 142-143; S. Finger, M. B. Law, "Karl August Weinhold and his 'Science' in the Era of Mary Shelley's Frankenstein: Experiments on Electricity and the Restoration of Life," *J. Hist. Medicine and Allied Sci.*, **1998**, *53*, 161-180; also Finger in reference 5.

9. For background on Crosse and his experiments, see R. T. Gould, *Oddities: A Book of Unexplained Facts*, University Books, New Hyde Park, NY, 1966, pp. 117-123; and J. A. Secord, "Extraordinary Experiment: Electricity and the Creation of Life in Victorian England," in D. Gooding et al, Eds, *The Uses of Experiment*, Cambridge University Press: Cambridge, 1989, pp. 337-383.

10. The only place that Mary Shelley makes an explicit reference to galvanism and life is in the preface to the revised edition of 1831, thirteen years after the novel's original publication, where she briefly states that "Perhaps a corpse could be reanimated; galvanism had given token of such things ..." but nowhere does she imply that this is the process used by Frankenstein in her novel.

11. M. B. Schiffer, *Draw the Lightning Down: Benjamin Franklin and Electrical Technology in the Age of Enlightenment*, University of California Press: Berkeley, CA, 2003, pp. 106-107, 130-131.

12. Interestingly, Shelley returned to this metaphor in her preface to the revised edition of 1831, where she writes that Frankenstein fled from his new creation in the hope that "left to itself, the slight spark of life which he had communicated would fade ...", thus verifying that the term spark is used in the traditional metaphorical sense and not as an electrical term.

13. C. Becker, *The Heavenly City of the Eighteenth-Century Philosopher*, Yale University Press: New Haven, CT, 1931.

14. A small, but typical, selection of recent Frankenstein rewrites and extensions include: B. W. Aldiss, *Frankenstein Unbound*, Random House: New York, NY, 1973; R. J. Meyers, *The Cross of Frankenstein*, Lippincott: Philadelphia, PA, 1975; H. Venables, *The Frankenstein Diaries*, Viking Press: New York, NY, 1980; J. Kay, *The Secret Laboratory Journals of Dr. Victor Frankenstein*, Overlook Press: Woodstock, NY, 1995; as well as the series of novels by Dean Koontz.

VIII
Some Recent Speculations on the Nature and Function of Religion

1. Introduction

This evening I would like to share with you the results of my recent reading on the subject of religion – a topic which I know is dear to your hearts and minds, if not the source of much of your indigestion. In particular, I would like to summarize for you the conclusions of three recent writers on the nature and function of religion – all three of whom have furnished me – and I hope the same will be true of you as well – with a number of fresh and stimulating ideas and insights (1).

2. David Stove

Let us begin with the writings of David Stove, an Australian philosopher most noted for his criticisms of the ways in which much of 20th-century philosophy has been subverted to the task of undermining science and reason. An acknowledged atheist and materialist, Stove gives his personal opinions or observations on the nature of religion, rather than attempting a formal theory based on empirical evidence. These opinions first appeared in an article entitled "Idealism: A Victorian Horror Story, Part I" which was, in turn, reprinted in a collection of his essays entitled *The Plato Cult and Other Philosophical Follies*, first published in 1991 (2).

Stove formulates the question "What is the origin of religion?" as follows:

Hegel held that animals have no religion, but against that, Darwin (and others before him) said that, to a dog, its master is a god. If this is true, it is to the credit of canine intelligence, since the evidence for this theism is obvious and overwhelming. But where is the evidence for our belief that we are somebody's cattle? What is there that could even have rationally first suggested this belief to our minds? ... what on earth, or in the sky, or in the sea, could have given the cleverest species of animals on earth reason to believe that it wasn't the cleverest? That it ranks only third, or tenth (or whatever subordinate degree your religion assigns us to) in the order of intelligent beings? I have never met with a satisfactory answer to this question, or even with a promising answer.

Stove does not attempt to disguise his own strong opinions on this matter, but cuts straight to the chase:

Religious beliefs are discreditable, and about equally discreditable to our heads and to our hearts: the beliefs are irrational, and the emotion from which they spring is bad.

What is original here is not the argument concerning irrationalism – any book on atheism by a philosopher (e.g., George Smith) will spell out in great detail the rational reasons why religion is defective – rather it is Stove's argument concerning the emotional basis of the religious impulse which is, to the best of my knowledge, novel:

The irrationality of the beliefs consists in their being groundless, and inconsistent with other beliefs which we know to be true. The bad emotion behind religion is, nearly enough, that "restless appetite for applause" which, as Hume said, Christianity ascribes to the deity; although it ought really be ascribed only to ourselves.

In other words, Stove is contending that religion is emotionally rooted in a deep-seated tendency for humans to be "attention junkies:"

... our care absorbing system is underfed absolutely, always, and extremely. It is simply impossible for us to ever have enough interest taken in us ... If you lie face-up in the open air on a clear night, you are suddenly reminded that, in a line drawn from your face outwards, there is nothing, however near or far, which takes or even could take the smallest interest in you. The reminder is extremely disagreeable while it lasts, and it is therefore fortunate that any optical barrier – clouds, a roof, or even closing your eyes – is sufficient to interrupt it.

Not only does the physical environment fail to satisfy our need for attention, the same is largely true of our human environment:

And even the best of human environments is far more like the void of space than we can bring ourselves to realize. How many people are there who feel, or could feel, any interest in you? A few kindred, a few friends; perhaps if you are a writer, a few readers. How many non-people? Well, you may have a dog or two. That is as far as it goes at the very best. How little way it goes

at the worst, and how common the worst is: these are among the many things which are not to be told to those, such as the young, who are fortunate enough not to know them.

Thus Stove concludes:

This is the emotional source of religious belief. We populate the world with superior non-humans who can take an interest in us, precisely because we know that there aren't any, and wish there were. Why this should be so – why Homo sapiens should be burdened with a demand for care which is grotesquely disproportioned to any empirically possible supply of care – may be hard for evolutionary theories to explain. But then, those theories are beset by any number of such problems of grotesque or "gratuitous" formations; the eight-foot spread of the antlers of certain species of deer, the peacock's tail, etc., etc.

Fundamentally there is no difference between the lonely child with its imaginary playmate and the lonely adult with his guardian angel or his friend in Jesus – or, for that matter, between either of these and the young girl who wants to be the perpetual center of attention by becoming a cheerleader, fashion model, movie actress, or recording star.

However, Stove is careful to note that neither human behavior nor religion is always driven by a desire for positive and loving attention:

Of course the gods are not just projections of our wishes; otherwise they would all be conceived in the image of ideal parents, which is notoriously not the case. Religious beliefs are, quite naturally, subject to some broad empirical constraints, including ones supplied by hostile and dangerous elements of our environment. Besides, what humans want from superintelligent agents is not necessarily love, or protection, or sustenance, it is necessarily attention. Even hostile attention is better, beyond all comparison, than no attention at all. It is a version of the vulgarism, "There is no such thing as bad publicity."

This last point speaks in part to the nature of evil. A juvenile delinquent seeking attention through bad behavior, an assassin seeking fame through the killing of a public figure, religious people obsessed with Satanic cults and evil spirits, persons who believe in "men in black" and in the imminent invasion of the earth by hostile extraterrestrials, are again all acting on the same emotional impulse.

One of the perpetual criticisms of humanism offered by religious conservatives is that it is based on the unspeakable conceit that humans are the most intelligent life form known and are totally responsible for the consequences of their actions – there are no last minute supernatural bailouts or second chances. But does this not pale before the conceit of the religious that a superintelligent, all powerful, infinite being has nothing better to do with its time than to be enthralled by our petty concerns and needs? To believe this is to act, as Stove claims, on a fundamentally bad, or at the very least, not very admirable, emotional impulse.

3. Steward Guthrie

The second writer whose insights into religion I would like to bring to your attention is Steward Guthrie, a Professor of Anthropology at Fordham University. These insights are developed in his 1993 volume, *Faces in the Clouds: A New Theory of Religion* (3). Guthrie's major thesis is that religion is heavily and unavoidably rooted in the human tendency to anthropomorphize, i.e., in the tendency to attribute human physical features, emotions, and motivations to non-human objects, whether living (e.g. other animals) or nonliving.

Unlike previous writers (Hume, Nietzsche, Feuerbach. etc.) who have linked anthropomorphism with religion, and who speculate that this tendency is based on a desire for familiarity or comfort, Guthrie argues that anthropomorphism has a biological basis which has been genetically programed into us by evolution and is rooted in our survival tactics as social animals:

Anthropomorphism may best be explained as the result of an attempt to see not what we want to see or what is easy to see, but what is important to see, i.e. what may affect us for better or worse.

In other words, it is based on the fact that other humans are simultaneously our most important allies in the struggle for existence and our most dangerous enemies, and that it is in our best interests, with regard to survival, to have evolved a highly developed ability to detect both their presence and to infer their moods and intentions.

In support of this premise, Guthrie cites many psychological studies of both children and adults:

Developmental psychologists show that children and even infants interpret phenomena as human-like, as caused by humans, or both. Clinical and experimental psychologists, and ethnographers, show that adults do so as well. In sum, the research shows that a generalized anthropomorphism is spontaneous and primitive in children and persists in adults.

Guthrie then demonstrates how this tendency pervades all aspects of human thought, including:

1. Our description of natural objects (the man in the moon, faces in clouds, star constellations, rock profiles, miraculous faces of Jesus, Mary, and Elvis seen on dirty windows and in wood-grain patterns, the face on Mars, etc.)

2. Our art and advertising (cartoon animals, the door knob in *Alice in Wonderland*, living cars [Herbie the love bug, King's *Christine*, etc], children's stories and myths concerning animals, etc.)

3. The history of philosophy (form and matter, Schopenhauer's will, etc.)

4. The history and vocabulary of science (most of ancient science, forces, causality, electrophiles, nucleophiles, attraction, repulsion, affinity, evolution as teleology, etc.).

Of course, as already noted, Guthrie is hardly the first to develop an anthropomorphic theory of religion. Perhaps his most famous predecessor was the German philosopher, Ludwig Feuerbach, who essentially argued that God is created in the image of man – in short, that God or the Gods is (are) a reification of a given society's psychological and ethical values. However, all of these previous writers have argued that this anthropomorphism was driven by a psychological desire for familiarity or comfort, whereas Guthrie is arguing that it goes deeper than this – that in fact we have no real choice in this matter, that we are biologically programmed to think in this manner, and that other alternatives are essentially unavailable.

Just as scientists and philosophers have fought a continuous battle to eradicate anthropomorphism from science and philosophy, so modern theologians have attempted to do the same with religion, arguing that attributing human behavior and motives to God debases religion (the ancient Greek Gods being the best example of this), and that such an anthropomorphic view of God is at best metaphorical (Unitarianism) and at worst out and out blasphemy (Islam). The net result of this, however, is to make God into an unintelligible, unsympathetic abstraction. As a consequence, and in direct contradiction to official doctrine to the contrary – most members of a given religion continue, at the personal level, to indulge in a highly anthropomorphized view of God as a protective father figure, or else substitute in his place lesser supernatural personages, more easily envisioned in human form, such as the Virgin Mary, assorted saints, guardian angels, etc.

This, in Guthrie's opinion, is the ultimate Catch 22 of all theistic belief:

If we cannot say anything anthropomorphic about God, we cannot say anything at all. The reason people do not want to say anything anthropomorphic is that it might demean the sacred ... yet anthropomorphism is unavoidable if the language of either the believer or philosopher is not to be emptied of all content.

Of personal interest to me is Guthrie's observation that one of the few Christian sects to avoid this dilemma is Mormonism, which believes that God is a superevolved human and thus inherently understandable to other humans. Having been raised as a Mormon, it explained to me why I have always found atheistic arguments based on the inherent unintelligibility of God both unconvincing and uninteresting compared to those based on the paradox of first causes.

4. Paul Thagard

The final writer I would like to bring to your attention this evening is Paul Thagard, who is Professor of Philosophy at the University of Waterloo in Canada. His observations on religion are taken from the 2000 volume, *Coherence in Thought and Action* (4).

Thagard is interested in cognitive science, that is, in questions of how we construct mental concepts and act on them – an area of philosophy that heavily overlaps with psychology. In particular, he is interested in the role of coherence in concept formation and action – in other words, in the question of whether the underlying assumptions of given concept or view are mutually compatible. Are its deductions and explanations logically related to its initial assumptions? Are they consistent with the facts of the external world or the behavior which they seek to explain?, etc., etc. This is in fact a rather complex question since, for most ideas or concepts, the number of interrelationships between assumptions, deductions, explanations, external facts and observed behaviors which must be simultaneously optimized in order to evaluate the overall coherence can be quite large. Thus if assumption 1 and 2 are initially coherent, but it is later found that a deduction from assumption 2 is inconsistent with a fact which is consistent with assumption 1, how does this affect the initial coherence between the two assumptions?

Thagard is interested in being able to reduce this complexity to a quantitative index that will give us an overall rating of the total coherence of an idea, concept, or world view. In order to achieve this, he has developed a series of computational algorithms which allow a computer to evaluate the relative coherence of

a concept if given a list of its initial assumptions or hypotheses, its deductive explanations, and the relevant external evidence for each. He then applies these algorithms to a wide range of conceptual situations involving such subjects as metaphysics, ethics, politics, and psychology.

Most relevant to our interests, however, is its application to three competing metaphysical world views, which Thagard calls:

1. *Materialism:* single causality based on the assumption that all phenomena, including mental or psychic, are reducible to the interactions of matter and energy.

2. *Dualism:* two kinds of causality – material and spiritual. In other words, mind or soul is separate from body, is not constrained by the same physical laws, and may survive the death of the body.

3. *Theism:* all causality is ultimately due to God, who can subvert normal physical causality if he so chooses (miracles).

Though dualism need not necessarily imply theism and vice versa, Thagard recognizes that these two views are generally linked together, at least in Western religions:

Dualism and theism are usually discussed in isolation from each other, but both psychologically and logically they go together. I have not conducted a survey, but I suspect that virtually all theists are dualists and almost all dualists are theists, whereas materialists are typically atheists.

After first listing the respective assumptions or hypotheses of each view, their deductive explanations, and the relevant external evidence for each, he submits them to his coherence algorithms with the result that materialism displays a positive coherence rating, whereas both dualism and theism display negative ratings. Of course, Thagard realizes that these results depend on his input lists and concludes:

Many people would disagree with the particular analysis provided here. My coherence calculation shows only that if you accept my input, then materialism has greater coherence than its competitors. To dissenters, I recommend the exercise of producing alternative coherence analyses. The main point of this section has not been to provide a definitive refutation of the existence of God, but rather to illustrate how coherence assessments can be applied to metaphysical situations.

From your collective sigh, I can tell that most of you in the audience think that Thagard has ingloriously wimped out in the end. Perhaps so, but I hope I have said enough this evening to inspire you to check out his initial assumptions for yourselves, as well as the stimulating books by Stove and Guthrie.

5. References and Notes

1. A lecture given to the Cincinnati Free Inquiry Group (FIG), Cincinnati, OH, on 20 December 2005.

2. D. Stove, *The Plato Cult and Other Philosophical Follies*, Blackwell: Oxford, 1991.

3. S. E. Guthrie, *Faces in the Clouds: A New Theory of Religion*, Oxford University Press: New York, NY, 1993.

4. P. Thagard, *Coherence in Thought and Action*, MIT Press: Cambridge, MA., 2000.

IX
Some Musings on the Nature of Pseudoscience

1. Introduction

This morning I would like to share with you some musings on the nature of pseudoscience which I have been mulling over for some time now. Though this lecture is my first tentative attempt to formalize these ideas and, as a consequence, may be rather rough around the edges, I hope you will bear with me, since the topic is obviously one which is central to the nature and function of your organization (1).

2. Some Definitions

Broadly defined, the term "pseudoscience" describes any activity which attempts to cash in on the authority of science by self-consciously advertising itself as such, when in fact it actually deals with unverifiable phenomena and/or theoretical constructs not generally accepted by the scientific community. Pseudoscience may be driven by a desire for reputation, for commercial success, or for the intellectual justification of certain political, religious, or superstitious beliefs. Pseudoscience may be the result of either deliberate fraud or self-delusion.

A variety of other terms have appeared in the literature which deal with various subsets of this broad definition, including:

Pathological Science
Fraudulent Science
Patent Medicine Science
Fringe Science
Junk or Litigation Science
Voodoo Science

The term "pathological science" was coined by the American chemist, Irving Langmuir, in 1953 to describe questionable experimental results and theories published in legitimate scientific journals, usually claiming the discovery of a previously unknown phenomenon, in which the authors have committed an honest error or misinterpretation (2). It becomes pseudoscience only when the authors pathologically persist in their errors after others have called attention to them. (e.g., polywater, cold fusion, facilitated learning, etc.) (3, 4).

"Fraudulent science," as covered in the books by Adler, Broad and Wade, and Kohn, is defined as science published in legitimate scientific journals in which the results have been deliberately falsified and/or plagiarized for purposes of gaining a scientific reputation and/or research funding (5-7). It becomes pseudoscience only when others persist in believing the results after the fraud has been uncovered (e.g., Piltdown Man, Marc Spector, etc.)

"Patent medicine science" is fraudulent science committed for purposes of commercial profit (e.g., various medical, weight loss, and sexual enhancement devices, miracle gasoline additives, perpetual motion machines, etc.) (8-9). Practitioners of the medical variety are traditionally referred to as "quacks."

"Fringe science" is science conducted outside the normal academic, governmental, and industrial channels by amateurs which claims to disprove current scientific theory and/or to revolutionize our current view of the universe through the discovery of new forces, extraterrestrial origins of humans and human civilizations, etc. (e.g., astrology, crop circle science, the various books by van Daniken, etc.) (10-13). Practitioners of this particular form of pseudoscience are usually referred to as "cranks."

"Junk or litigation science," as described in the book by Huber, is defined as the use of pseudoscience by lawyers to muddy the waters in the court room in order to win lawsuits irrespective of what the real evidence indicates (e.g., silicon breast implants, brain cancer and cell phones, birth defects and power lines, etc.) (14, 15).

"Voodoo science," as described in the recent book by Park, is essentially identical to pseudoscience as I have defined it above (16).

3. The Nature of the Problem

There are any number of reasons why it is important to be able to differentiate between science and pseudoscience:

1. The inherent human need to know what is true and what is not, or, in less pretentious terms, the need to possess reliable versus unreliable knowledge.
2. The need to prevent the diversion of public funding for scientific research from legitimate to illegitimate projects (e.g., cold fusion).
3. The need to prevent waste of public funding on useless and ineffectual techniques (e.g., medicare coverage of holistic medicine or chiropractic care).

4. The need to prevent economically disastrous decisions in the private sector (e.g., the use of dowsing by mining companies).

5. The need to prevent the gradual corruption of our educational system (e.g., creation science, parapsychology, etc.).

6. The need to prevent legal abuses involving unjust punishments for imaginary crimes (e.g., repressed memory syndrome and child abuse) and needless but costly law suits (e.g., silicon breast implants) based on the use of "junk science" in the court room.

7. The need to prevent fraudulent exploitation of individuals (e.g. astrology, harmful and/or ineffectual patent medicines, etc.)

But are we always able to tell the difference? How do we know when we are truly criticizing pseudoscience rather than misguidedly attacking potentially revolutionary discoveries? Are there criteria that would allow us to tell the difference?

4. Some Positive Criteria

Various past writers have attempted to formulate specific criteria for the identification of pseudoscience (10). Thus Langmuir (figure 1) in his famous 1953 talk on pathological science listed six, most of which are linked to pseudoscientific claims to have discovered or detected previously unknown phenomena (e.g., N-rays, Allison effect, cold fusion, and polywater) (2):

Figure 1. Irving Langmuir (1881-1957).

1. The maximum effect that is observed is produced by a causative agent of barely detectable intensity, and the magnitude of the effect is substantially independent of the intensity of the cause.

2. The effect is of a magnitude that remains close to the limit of detectability or many measurements are necessary because of the very low statistical significance of the results.

3. There are claims of great accuracy.

4. Fantastic theories contrary to experience are suggested.

5. Criticisms are met by *ad hoc* excuses thought up on the spur of the moment.

6. The ratio of supporters to critics rises up to somewhere around 50% and then gradually falls to oblivion.

In 1984 the Canadian philosopher and physicist, Mario Bunge, (figure 2) suggested seven additional indicators (17):

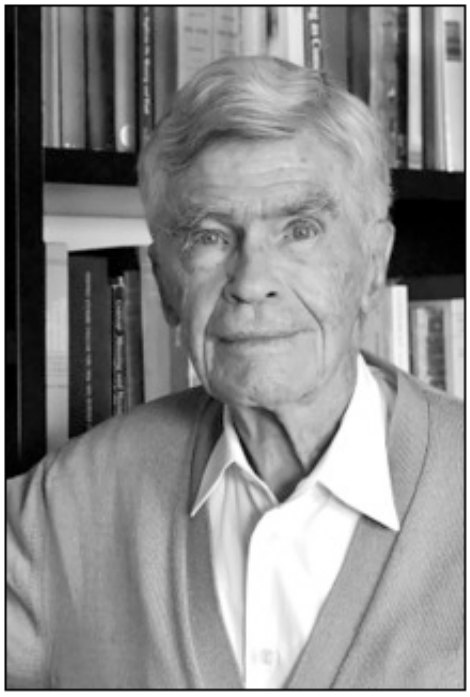

Figure 2. Mario Bunge

1. The new theory is generally rigid and resistant to new research results.

2. Adherents generally consist of believers who conduct no research of their own.

3. In some cases support comes from commercial interests.

4. Most of the new phenomena are unverifiable except by adherents and many imply supernatural effects.

5. Supporting arguments are drawn from outdated or discredited sources or are unverifiable.

6. The use of mathematics is rare and logical argument is often absent.

7. Many phenomena claims are very ancient and have shown little change over recorded history.

Finally, Martin Gardner (figure 3) in his classic volume, *Fads and Fallacies in the Name of Science*, has provided a psychological profile of the amateur or crank who engages in the variety of pseudoscience that we have labeled fringe science (11):

1. He considers himself a genius.

2. He regards his colleagues, without exception, as blockheads.

3. He believes himself unjustly persecuted and discriminated against.

4. He has a strong compulsion to attack the greatest scientists and best-known theories.

5. He has a tendency to write in complex jargon using terminology of his own invention.

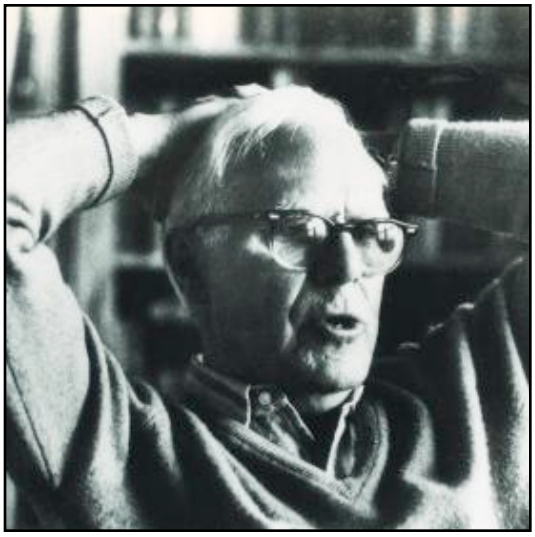

Figure 3. Martin Gardner

5. Some Negative Criteria

One can also indirectly define pseudoscience by directly defining the nature of science itself – pseudoscience presumably being any scientific claim which fails to meet this definition. Bunge has summarized many of the criteria, supposedly characteristic of true science, that have been proposed by past philosophers in his 2001 Prometheus Lectures, *Philosophy in Crisis: The Need for a Reconstruction* (18):

1. The empirical criterion, which maintains that science accepts only empirical data and inductive generalizations based upon this data.

2. The consensus criterion, which holds that, in contrast to nonscientific fields, true science is characterized by a core set of facts and theories on which all agree.

3. The success criterion, which maintains that science is only interested in ideas and techniques that actually work and which have practical consequences.

4. The formalist criterion, which equates the scientific content of a field with the level of mathematical sophistication.

5. The refutationalist criterion, which maintains that only hypotheses capable of being tested and refuted, whether logically, statistically, or experimentally, qualify as true science.

6. The methodological criterion, which maintains that science is characterized by certain procedures (the scientific method) for discovering the truth.

However, the problem, as Bunge is quick to point out, is that each of these various criteria is defective in one way or another (18):

1. The empirical criterion fails to account for the large number of nonobservable theoretical entities found in almost all areas of science, and especially in such abstract theoretical fields as cosmology, as well as for the fact that much scientific activity deals with the testing and refinement of the deductive consequences of theories rather than with their inductive formulation.

2. The consensus criterion fails to account for the controversy that is always present in cutting edge science, which is where much of the potential danger from pseudoscience occurs.

3. The success criterion fails to account for the fact that many scientific concepts do not have practical consequences.

4. The formalist criterion fails to note that, without empirical input and testing of deductive consequences, purely mathematical theories, however sophisticated, can be just as devoid of scientific significance as qualitative concepts (e.g., the equilibrium theory of economics, string theory). This is essentially the GIGO argument.

5. The refutationalist criterion requires that we consider such concepts as astrology and graphology as

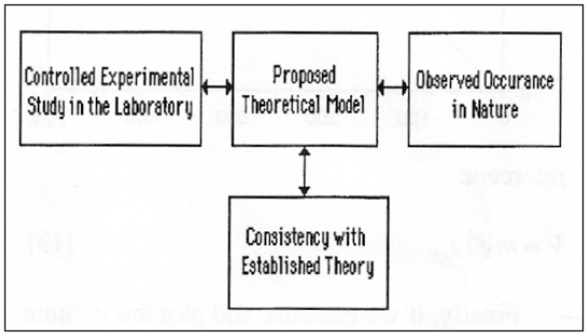

Figure 4. A primitive representation of the consilience model of science

scientific since they are potentially capable of being refuted by comparison with measurable data.

6. The methodological criterion fails to provide guidelines for how we select scientifically meaningful questions.

6. The Consilience Model

I think that much of what is of value in these various criteria may be subsumed in the very simple model of science summarized in the flow diagram given in figure 4. This diagram is intended to show that a proposed theoretical model or hypothesis may originate in any of the three terminal boxes:

1. It may be inductively suggested by controlled experimental data in the laboratory.
2. It may be inductively suggested by field observations in nature.
3. It may be deductively inferred from existing theory.

But irrespective of the box of origin, either the model and/or some of its predicted consequences must ultimately pass the criteria established by the other two boxes. Thus, for example, an hypothesis or model originating from field observations should, if possible, also be experimentally tested under controlled laboratory conditions and should also be evaluated for its consistency with already established theory. If contradictions with any of these criteria are found, the model must be modified accordingly and the comparison process repeated. The double arrows in the diagram are intended to suggest both the interactive and self-correcting nature of this feedback process.

In my opinion much pseudoscience results from a failure to apply all three conditions and especially the condition requiring consistency with established theory. This neglect can lead to the formulation of a model

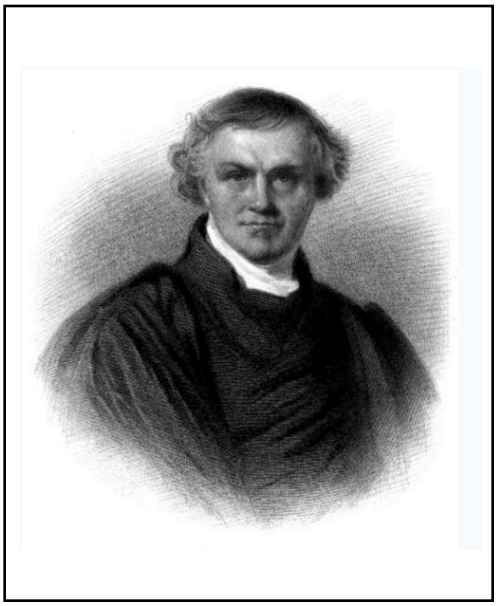

Figure 5. William Whewell (1794-1866).

tailored to explain only the phenomenon at hand but which lacks any connections with the rest of science or which, even worse, is at variance with existing science. This requirement that all serious models and hypotheses must ultimately be consistent with established theory is called "consilience." This term was originally introduced by the 19th-century British philosopher of science, William Whewell (figure 5), to describe the way in which discoveries and theories in various branches of science tend to mutually support one another and to point to a single unified view of nature and its operations (19).

This concept has also led some historians of science to argue that, as science progresses and more and more of the big picture is in place, the discovery of the missing pieces becomes in a sense inevitable and cases of simultaneous discovery become increasingly common (20). An analogy would be the assembly of a jigsaw puzzle. The more complete the puzzle, the easier it is to fit in the remaining pieces, especially if these correspond to gaps within the center of the puzzle. The filling in of these gaps may be characterized as *interpolative consilience*.

7. A Recipe for Pseudoscience

The consilience model suggests that a great deal of pseudoscience is based on the following scenario:

Given several alternative explanations of an apparently novel phenomenon, including the choices that it is:

a) Really nothing more than statistically random noise.

b) A special case of a known phenomenon which already has a well established explanation.

choose instead the least likely explanation, such that:

a) It has the least consilience with established science.

b) It has the most exciting extra-scientific consequences (e.g., political, religious or supernatural).

c) It has the largest potential media impact.

The fact that the chosen explanation shows the least consilience with established science is not taken as a negative but rather as a positive, as it means that one has not just discovered a new phenomenon, one has discovered a phenomenon which requires a complete revision of all previous knowledge. In other words, one has initiated a new scientific revolution.

8. The Generalized Correspondence Principle

But, you will object, doesn't the consilience model fail to account for radical scientific revolutions which extrapolate or extend our knowledge in ways which are not predictable or reconcilable with established knowledge? Did not the mechanics of Galileo and Newton totally overthrow the physics of Aristotle and quantum mechanics and relativity theory do the same with the mechanics of Newton? If the pseudoscientist is claiming that his discovery does just that – overthrows current science – how can we use interpolative consilience with current science as a measure of its probable truth?

The answer is that not all scientific revolutions are the same. The first scientific revolution of the 17th century, and the one most commonly appealed to by pseudoscientists, was not the replacement of one scientific model by another, it was the replacement of proto-scientific philosophical speculation and anthropomorphism by experimental science. In other words, it led to the foundation of science not to its expansion. Subsequent scientific revolutions have been quite different and involve the replacement of one scientific model with another having greater explanatory power but which usually gives the older model as a special limiting case under certain conditions. Thus relativity theory yields Newtonian mechanics at normal everyday velocities as does quantum mechanics when applied to large masses moving in macroscopic spaces.

The principle that the more general theory gives the less general theory as a limiting case under certain limiting conditions is called the "correspondence principle" and it was first formulated for the case of quantum mechanics by the Danish physicist, Niels Bohr

Figure 6. Niels Bohr (1885-1962).

(figure 6). It is the reason why pseudoscientific attempts to explain such questionable phenomena as telepathy, precognition, etc. through an appeal to the paradoxes of relativity theory or such quantum mechanical concepts as the uncertainty principle and quantum tunneling are essentially nonsense. We are macroscopic, slow moving, beings living in an environment in which most of the surrounding objects are of the same nature. Our immediate environment, our physical bodies, and our brains, in contrast to the interior of a black hole or the center of an atomic nucleus, are and, for all practical purposes, will always remain, strictly Newtonian in nature.

In the case of the first scientific revolution there was no limiting-case correspondence between the mechanics of Galileo and Newton and the proto-physics of Aristotle which it replaced. However, in the case of subsequent internal scientific revolutions this has not been the case, and the requirement of correspondence between the new and the old forms the basis of the required *extrapolative consilience* test for any radical extension of knowledge beyond the current limits (21). Rephrasing this in terms of our earlier puzzle analogy, we would say that, although we may not know how far the puzzle extends beyond the part that we have solved, we do know that the edges of that extension must mesh with the outer edges of what we have already assembled.

Consequently, I would argue that the terms "consilience" and "correspondence" should loom large in the vocabulary of all skeptics as essential tools in the unending war to defend reliable knowledge against those relentless assaults of intellectual bullshit and pseudo-knowledge which are, and I suspect always will be, with us.

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X
The Great Baking Powder War

1. Introduction

In April I was invited to attend a ceremony at the Clabber Girl Baking Powder Museum in Terra Haute, Indiana, celebrating the recent selection of the Rumford Chemical Works in Providence RI, which Clabber Girl now owns, as a National Historic Chemical Landmark (1). This event reminded me, in turn, of the fact that many years ago I had uncovered, on browsing through the treasures in the Oesper Collections, a surprising number of books and pamphlets dating from the early 20th century which dealt with what I can only describe as "The Great Baking Powder War." That such a mundane and common product as baking powder was once the subject of a series of extensive and bitter law suits ostensibly dealing with issues of nutrition and health may come as a surprise to many in the audience. But not only was this the case, the issues involved illustrate some important lessons about the ways in which science can be used and abused by our legal system.

As members of an organization devoted to skepticism and the fight against pseudoscience, we tend to think of our legal system as a means of prosecuting those who attempt to sell goods and services based on fraud and pseudoscience. Unhappily, however, the law is a two-edged sword and has just as often been subverted by the purveyors of pseudoscience as a means to silence their critics and to eliminate legitimate competitors in the market place (2). With these thoughts in mind, I thought it was time that I finally dusted off my ancient notes on this subject and put them into a presentable form for your consideration. However, before we delve into the legal details of the great baking powder war, I would like, by way of introduction, to say a little about the nature and history of baking powder itself, since an understanding of the chemistry involved is central to an understanding of the resulting legal disputes.

2. What is Baking Powder?

At some unknown point in human history bakers discovered the art of making baked goods lighter and more desirable by leavening the dough or batter with bubbles or pockets of carbon dioxide (CO_2) gas and air. The traditional way of doing this involved the use of yeast to ferment a small portion of the carbohydrate present:

$$\text{yeast} + \text{carbohydrate} \rightarrow \text{alcohol} + CO_2(g)$$

the by-product of this process being ethanol or drinking alcohol. Though only a small quantity of alcohol is produced, most of which is immediately dissipated by the heat of the subsequent baking process, this has not prevented this seldom appreciated fact from becoming the object of satire. Thus, in the distant days of my youth, a popular folk group called the Chad Mitchell Trio recorded a satirical tune called "The Song of the Temperance Union," one verse of which went (according to my not always reliable memory):

We never eat cookies because they have yeast,
And one little bite turns a man to a beast.
Can you imagine a more horrible fate,
Then a man in the gutter with crumbs on his face?

In addition to this ancient biochemical approach to leavening, the modern baker now has access to a variety of chemical leavening agents or baking powders, all of which work on the same principle as *Alka-Seltzer* or what, in the 19th century, used to be called *Seidlitz Powder*:

$$\text{acid} + \text{bicarbonate} \rightarrow \text{carbon dioxide gas} + \text{water}$$

or in more explicit chemical terms:

$$H_3O^+(aq) + HCO_3^-(aq) \rightarrow CO_2(g) + 2H_2O(l)$$

All baking powders use sodium hydrogen carbonate, also called bicarbonate, baking *soda,* or *saleratus* (and not to be confused with the baking *powder* of which it is an ingredient) as their source of bicarbonate anion:

$$Na(HCO_3)(s) + H_2O(l) \rightarrow Na^+(aq) + HCO_3^-(aq)$$

Their differences lie solely in the choice of the acid or $H_3O^+(aq)$ source which they employ, of which the following four varieties are the most common:

a) *Clabbers*, which employ the lactic acid formed from sour milk:

$$CH_3CH(OH)COOH(l) + H_2O(l) \rightarrow CH_3CH(OH)COO^-(aq) + H_3O^+(aq)$$

b) *Tartrate Powders*, which employ solid cream of tartar or potassium hydrogen tartrate:

$$KH(C_4H_4O_6)(s) + H_2O(l) \rightarrow C_4H_4O_6^{2-}(aq) + K^+(aq) + H_3O^+(aq)$$

c) *Phosphate Powders*, which employ solid calcium hydrogen phosphate:

$$CaH(PO_4)(s) + H_2O(l) \rightarrow PO_4^{3-}(aq) + Ca^{2+}(aq) + H_3O^+(aq)$$

d) *SAS Powders*, which employ solid SAS or sodium aluminum sulfate:

$$NaAl(SO_4)(s) + 6H_2O(l) \rightarrow SO_4^{2-}(aq) + Al(OH)_3(s) + Na^+(aq) + 3H_3O^+(aq)$$

This latter substance does not contain H^+ as one of its original components, like the other acid sources, but rather generates the requisite H_3O^+ ion via the hydrolysis of water by the Al^{3+} ion.

4. The History of Baking Powder

Both baking soda and tartrate baking powder were first introduced in England in the 1830s and in the United States in the 1840s (3). In 1856 the Harvard chemist, Eben Horsford (figure 1), introduced phosphate baking powder under the label "Rumford Yeast Powder" (figure 2). Calcined alum baking powders were first introduced in the 1870s and the even less expensive SAS baking powders in the 1890s.

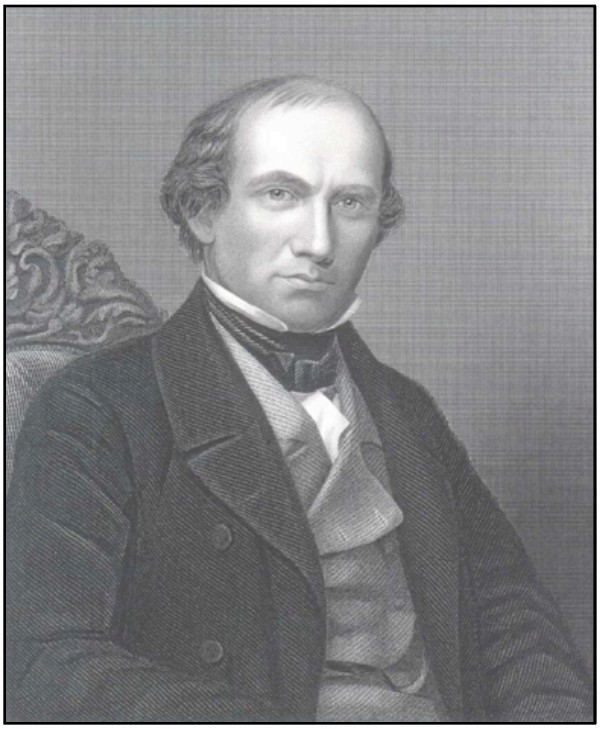


Figure 1. Eben Horsford (1818-1893).

Figure 2. An early bottle of Horsford phosphate baking powder. Note the misleading implication that it contained yeast rather than a chemically based yeast substitute.

The solid acid source and bicarbonate were originally sold in separate packets and were mixed together at the time of use. However, in 1869 Horsford discovered that, if one added starch to the acid-bicarbonate mixture, it acted as a drying agent which prevented the activation or ionization of the acid source, thus allowing one to sell the powders premixed and to package the product in cans rather than in glass bottles.

Since sodium bicarbonate is common to all varieties of baking powder, the ingredient which ultimately determines the cost of the final product is the choice of the acid source, which, for the three most popular varieties, has always followed the price sequence:

tartrate >> phosphate > SAS

Thus, in a recent trip to the grocery store, I collected the following sample data:

Cream of Tartar: $2.20/oz
Rumford Brand Phosphate Powder: 26.9¢/oz
Clabber Brand SAS Powder: 16.9¢/oz

This disparity means that the only way the inherently more expensive powders can stay in business is through advertising claims involving either largely imaginary differences in taste (or rather lack of taste) or claims related to long-range health and nutrition factors, the latter of which, as we will see, were ready-made grist for the lawyers and the law courts.

5. The Law Suits

Our story begins in Great Britain in 1875 with the passage of a food and drug act which prohibited, among other things, the addition of alum to any item of food (4). No medical evidence was given to justify this ban. Rather it was based on the popular prejudice that alum or $KAl(SO_4)_2 \bullet 12H_2O$, as commonly sold by druggists, was a well-known astringent and irritant used for cuts and for pickling and, since it produced puckering of the mouth when ingested, there could be no doubt that it must be the cause of equally distressing effects in the stomach and digestive tract.

Four years later, in 1879, the Norfolk Baking Powder Company of England was indicted for violation of this law on the grounds that it had sold baking powder made with calcined alum. Calcined alum or $KAl(SO_4)_2$ is simply normal alum which has been heated to remove the water of hydration and is a close chemical analog of SAS or $NaAl(SO_4)_2$. When dissolved in water all three compounds form $SO_4^{2-}(aq)$ and $Al^{3+}(aq)$, of which the latter was thought to be the dangerous component. Hence, from a chemical point of view, all three compounds were either equally dangerous or equally innocuous.

The company was found guilty, but the ruling was overturned on appeal:

After the evidence we have just heard, I do not think this baking powder is an article of food or that bread made with it becomes an article of food injurious to health.

Seven expert witnesses appeared, three of whom testified that the powder was unhealthy, three that it was safe, and one who remained neutral.

In 1893 a British grocer named James James was convicted of selling a product called Excelsior Baking Powder made with calcined alum in violation of the Food & Drug Act of 1875. Nine expert witnesses testified that the powder was injurious and three that it was harmless.

In 1899 the State of Missouri passed a law prohibiting the manufacture or sale of any item used in the preparation of food which contained, among other things, alum. To test the law William Layton of St. Louis was charged with manufacturing and selling baking powder made with SAS or sodium aluminum sulfate, the sodium analog of the calcined potassium alum which was the subject of the earlier lawsuits in Great Britain. Layton was found guilty in the lower court and also on appeal to the State Supreme Court. The lower court ruled that it:

... was unable to find any evidence in this case or just grounds for ruling that alum baking powders, of themselves, when used in the preparation of food are in any wise less wholesome than any other.

Nevertheless, the defendant had clearly violated the law, however groundless its scientific basis, and was therefore declared guilty. Six expert witnesses testified that the powder was harmless, whereas three expert witnesses provided by the manufacturers of the competing and far more expensive tartrate baking powders testified that it was harmful.

In 1901 the State of Missouri prosecuted The Great Western Coffee and Tea Company for selling SAS baking powder in violation of the 1899 law. No evidence was presented as to the safety of the product. The company was found guilty but the ruling was overturned by the State Supreme Court on the grounds that the law was directed against the manufacturer rather than the seller.

In 1903 the State of California prosecuted two Los Angeles grocers named Saint and Zimbleman for selling "KC" brand baking powder made with SAS in violation of state laws prohibiting the adulteration of food. Both cases were dismissed on the grounds that baking powder was not an article a food and SAS was an active ingredient rather than an adulterant.

In 1906 the baking powder war moved from the state to the federal level with the passage of the first federal food and drug act under President Theodore Roosevelt. However, Roosevelt, who was a diabetic and loved his sweets, was upset when he discovered that Harvey Wiley (figure 3), the chief architect of the new law and the Head of the Department of Agriculture's Bureau of Chemistry, had included, apparently with little supporting evidence, a ban on saccharin, a substance which Roosevelt had been safely using for many years. As a result of this incident and extensive complaints from the food industry concerning bans on common food preservatives, Roosevelt created a five-man referee board (figure 4) of consulting scientific experts in 1908 to review Wiley's proposed bans under the 1906 law. One of its duties was to determine the influence of aluminum on nutrition and health relative to a possible ban on alum. After extensive experimental testing, the board concluded:

Figure 3. Harvey Wiley (1844-1930). The Head of the Chemistry Bureau and the chief architect of the 1906 Federal Food and Drug Act.

Aluminum has not been found to exert any deleterious action injurious to the health beyond the production of occasional colic when very large amounts have been ingested.

When aluminum compounds are mixed or packed with a food, the quality or strength of said food has not been found to be thereby reduced, lowered, or injuriously affected.

Despite the findings of Roosevelt's consulting board, in 1910 the Commonwealth of Pennsylvania indicted one Meyer Gross for selling SAS baking powder in violation of a state law prohibiting the sale of food containing, among other things, alum. The court refused to hear evidence relating to the safety of the product or the claim that it was not an article of food, but rather focused instead on the question of whether SAS was really alum.

Drug store or potassium alum is really only one example of an entire class of compounds that chemists call alums, all of which have the same general formula:

$M^{I}M^{III}(SO_4)_2 \bullet 12H_2O$

where:

$M^{I} = K^{+}, Na^{+}, NH_4^{+}$, etc,

$M^{III} = Al^{3+}, Cr^{3+}, Fe^{3+}$, etc.

Though the defense tried to argue that SAS wasn't an alum because it lacked the water of crystallization ($12H_2O$), Meyer was found guilty. However, the court reversed its decision on appeal based on the premise that the law used the word alum in the singular rather than the plural tense and thus could only be reasonably interpreted as referring to the common or potassium alum of the drug store. Of course, relative to possible health problems it is irrelevant whether a potassium or sodium alum is used and whether it does or does not contain water of crystallization. Rather the key issue, as recognized by Roosevelt's board, was the possible health effects of the Al^{3+} ion common to both compounds.

The 1920s saw the culmination of the baking powder war. In 1920 a collective suit was filed with the Federal Trade Commission by various manufacturers of SAS baking powders against the Royal Baking Powder Company of New York (figure 5), the major

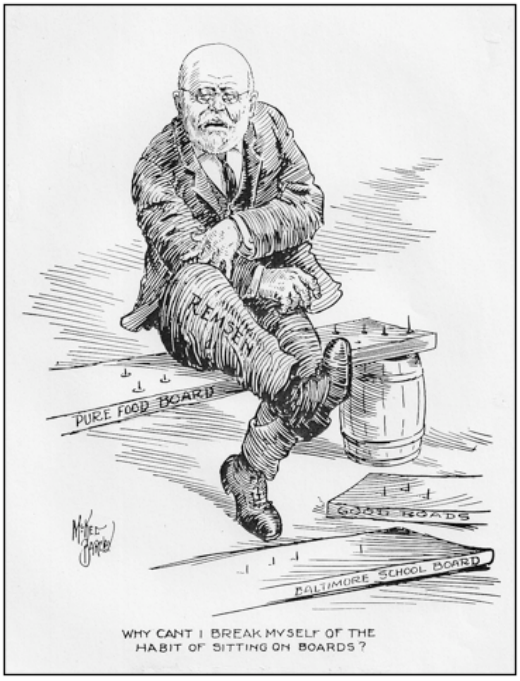


Figure 4. An editorial cartoon depicting the woes that befell the chemist, Ira Remsen, of Johns Hopkins after his appointment to head Roosevelt's review board for the 1906 Federal Food and Drug Act.

manufacturer of tartrate baking powder, charging it with:

... unfair methods of competition in that it had disparaged and defamed goods of its competitors and had falsely charged competitor's baking powders as being poisonous and had published such statements as the following: that they were made from ground-up aluminum baking utensils; that such competitive baking powders did not come within the pure food laws; that competitor's powders puckered up the mouth; that competitor's powders were made of the same substance which is used for styptic purposes after shaving.

The complaint also alleged that the Royal Baking Powder Company, in addition to these false and malicious statements, had:

... anonymously disparaged and attacked the wholesomeness of competitor's baking powders by causing the publication of derogatory opinions and statements with regard to the wholesomeness of its competitor's powders but carefully concealed its connection with such publications.

In addition they complained about Royal's advertising slogan:

Royal contains no alum – leaves no bitter taste

Over the next few years considerable evidence was presented by both sides relative to the questions of whether aluminum was or was not injurious to the health and whether SAS was or was not an alum.

In 1926 the Federal Trade Commission dismissed the complaint against Royal on the grounds that it had since discontinued its slanderous ad campaign and that its slogan was truthful in claiming that tartrate powders contained no alum and left no bitter taste – a ruling that perfectly illustrates the sarcasm which distinguishes between the letter and the spirit of the law, let alone the spirit of the English language. In triumph, the next year Royal published a book entitled *Alum in Baking Powder* in which it reproduced the commission's findings as well as all of the evidence presented in court relative to the negative effects of alum on human health. Even more disingenuously, it also reproduced all of its negative advertising and press releases which had been introduced into evidence by the complainants (5).

That same year (1927), in rebuttal, William Richardson published a small booklet entitled *The Current Significance of the Word Alum,* in which he concluded that SAS was not an alum because it lacked the water of crystallization (6). This was followed the next year

Figure 5. A typical Royal Baking Powder ad from the 1920s, albeit one lacking the infamous slogan attacking its SAS competitors.

(1928) with the publication by The Calumet Baking Powder Company of Chicago, a major manufacturer of SAS powders, of the book *The Truth About Baking Powder,* which reproduced, not surprisingly, all of the testimony concerning the harmlessness of SAS presented at both the 1910 Pennsylvania trial and at the Federal Trade Commission hearings (7). Indeed the war even reached into the classroom with the publication in 1928 of an informational chart on baking powder by the Jaques Manufacturing Company of Chicago for use by high-school chemistry teachers (8). Entitled the "Graphic Baking Powder Chart," it outlined the composition of the various competing powders and reproduced in full the official definition of baking powder given under the Federal Food and Drug Act, as had the book published earlier by The Calumet Baking Powder Company (figure 6).

6. The Smith Report

However, the closing shot in the great baking powder war came from the pen of Ernest Ellsworth Smith, an expert witness in many of the above trials and a member of Roosevelt's 1908 referee board, with the publi-

cation in 1928 of his definitive 378-page monograph *Aluminum Compounds in Foods* (4). Smith was concerned only with health claims and not with red herring issues, such as the question of whether SAS was or was not an alum.

In his book, Smith summarized the various negative health effects attributed to the aluminum in SAS during the above trials:

1. It combines with various essential constituents in food, such as phosphates and vitamins, thus making them inaccessible to the body and thereby rendering the food less nutritious.

2. It hardens the gluten, thus making the baked goods less digestible.

3. It acts as an irritant on the gastrointestinal tract and thus impairs digestive efficiency.

4. It accumulates in certain tissues, such as the liver, thyroid and adrenal glands.

5. It is a so-called protoplasm poison.

6. It attacks the blood cells and leads to anemia and reduced resistance to disease.

7. It retards growth, fecundity and fertility.

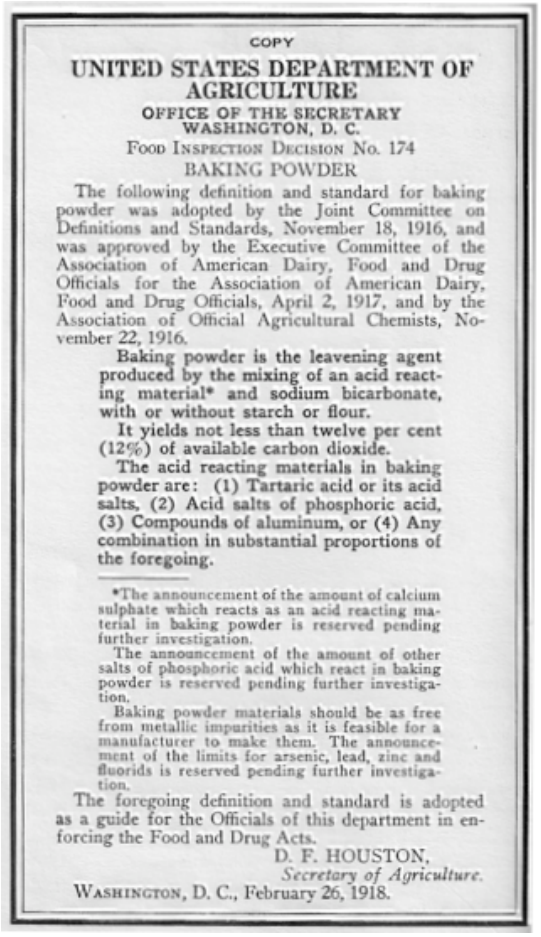
Smith then cited extensive biochemical and medical experimental evidence showing that all of these claims were without scientific foundation, and concluded that the ingestion of aluminum in moderate doses was perfectly safe for the following reasons:

1. Aluminum is a normal constituent of food stuffs and is as much ingested via normal food as via baked goods made with SAS baking powder.

2. Aluminum is a normal component of living matter (including humans) and life has obviously evolved to accommodate it in various ways.

3. Aluminum behaves biochemically much like iron, which is recognized to be essential to human health.

4. Extended scientific research has shown that food leavened with SAS baking powder is not injurious when ingested by man or animal. Reports to the contrary have always involved the administration of massive overdoses through abnormal channels (such as direct injection).



COPY

UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF THE SECRETARY
WASHINGTON, D. C.

FOOD INSPECTION DECISION No. 174

BAKING POWDER

The following definition and standard for baking powder was adopted by the Joint Committee on Definitions and Standards, November 18, 1916, and was approved by the Executive Committee of the Association of American Dairy, Food and Drug Officials for the Association of American Dairy, Food and Drug Officials, April 2, 1917, and by the Association of Official Agricultural Chemists, November 22, 1916.

Baking powder is the leavening agent produced by the mixing of an acid reacting material* and sodium bicarbonate, with or without starch or flour.

It yields not less than twelve per cent (12%) of available carbon dioxide.

The acid reacting materials in baking powder are: (1) Tartaric acid or its acid salts, (2) Acid salts of phosphoric acid, (3) Compounds of aluminum, or (4) Any combination in substantial proportions of the foregoing.

*The announcement of the amount of calcium sulphate which reacts as an acid reacting material in baking powder is reserved pending further investigation.

The announcement of the amount of other salts of phosphoric acid which react in baking powder is reserved pending further investigation.

Baking powder materials should be as free from metallic impurities as it is feasible for a manufacturer to make them. The announcement of the limits for arsenic, lead, zinc and fluorids is reserved pending further investigation.

The foregoing definition and standard is adopted as a guide for the Officials of this department in enforcing the Food and Drug Acts.

D. F. HOUSTON,
Secretary of Agriculture.

WASHINGTON, D. C., February 26, 1918.

Figure 6. The official definition of baking powder according to the Federal Food and Drug Act, reproduced as a frontispiece to the book *The Truth About Baking Powder* to counter claims by the manufacturers of tartrate powders that SAS baking powder was not covered under the Act.

5. Millions of people have ingested SAS baked goods without a detectable pattern of ill health and the same is true of workers in SAS factories. Opponents have repeatedly failed to present any properly documented evidence, other than hearsay, of ill health having resulted from SAS usage or exposure.

7. Lessons Learned

At least three lessons may be extracted from this sad tale of endless legal litigation and manipulation:

1. Legal bans on certain materials are often the result of popular bias rather than actual scientific evidence and are sometimes motivated by companies attempting to eliminate their competitors.

2. Legal decisions often avoid the basic scientific

problems, such as health issues, and are instead resolved on the basis of word definitions and legal technicalities.

3. So-called expert scientific testimony is often based on personal opinion and untested theories rather than actual experimental evidence.

8. Insidious Effects

Though the above lessons seem clear enough, there is a far more ambiguous and subtle problem which was briefly touched on in one of Smith's passing remarks concerning the claims of those who argued for the dangerous long-range effects of aluminum and SAS baking powders:

The failure to substantiate the claims of actual injury had with the passing of time altered the claims of the opponents until at the present time [i.e. 1928] "injurious" has been qualified to "unwholesome" and "demonstrable" to "insidious" effects. The right to claim insidious effects exists only when the facts of such insidious effects are established. Insidious effects may not be claimed merely because of an inability to demonstrate actual ill effects. Nor, when the natural protective resources of the body have been overpowered in experimental study, either by the introduction of the substance of investigation through unnatural channels or by quantitative abuse of administration through normal channels ... Such claims, based merely upon inability to demonstrate inimical effects, are tantamount to the admission that ill-effects are unproven.

Yet many legal cases today are based on just such claims of insidious effects – micro exposures over time leading to long terms effects 20 or 30 years later. How many of these are real and how many are imagined? How many violate Langmuir's first law of pseudoscience?

The maximum effect that is observed is produced by a causative agent of barely detectable intensity, and the magnitude of the effect is substantially independent of the intensity of the cause.

This is not an issue that is easily resolved on a "one size fits all" basis, yet it is one that the true skeptic must always consider when confronted with fresh claims in the press and the courts of some newly discovered "insidious long-range health effect," and especially when those claims are coupled with demands for excessive monetary compensation.

9. References and Notes

1. A lecture given to the Cincinnati Association of Rational Thought (ART), Cincinnati, OH, on 09 June 2007.

2. For a popular discussion of some of these issues, see P. Huber, *Galileo's Revenge: Junk Science in the Courtroom*, Basic Books: New York, NY, 1991.

3. P. Ciullo, *Saleratus: The Curious and Complete Uses of Baking Soda*, Maradia Press, 1994.

4. Unless otherwise stated, our summaries of the various lawsuits are based on E. E. Smith, *Aluminum Compounds in Foods,* Hoeber: New York, NY, 1928.

5. *Alum in Baking Powder*, The Royal Baking Powder Co: New York, 1927.

6. W. Richardson, *The Current Significance of the Word Alum,* Commonwealth Press: Chicago, 1927.

7. *The Truth About Baking Powder,* The Calumet Baking Powder Co: Chicago, IL, 1928.

8. J. R. Chittick, *Graphic Baking Powder Chart*, Jaques Manufacturing Co: Chicago, IL, 1928.

XI
Alternative Fuels
Facts and Fantasies

1. Introduction

As I am sure I do not need to remind you, thanks to Al Gore and his movie, the problem of global warming has now become the most recent *cause célèbre*. When combined with the recent election of President Obama and the announcement that the new administration plans to commit millions to the development of new, eco-friendly fuels and other alternative energy sources, such as wind energy, we have created the perfect storm – a combination of urgency and available money – which is almost sure to attract the con man and crackpot alike. In other words, not only is it time to act, it is also a time to exercise extreme caution and skepticism lest we waste vast amounts of time and money on unrealistic proposals and short-term fixes.

And, as always, the resulting media coverage is filled with misinformation on this subject, thus presenting the would-be skeptic with the usual problem of how to sort the hype from the facts – whence the motivation for this morning's lecture. But, before I begin, I must warn you that you will hear nothing of carbon emissions, carbon points, and carbon trades. The substance at issue is not carbon, C, but rather carbon dioxide, CO_2, an entirely different beast altogether. Thus we find that, even before we begin, the media has succeeded in mudding the waters by creating a misleading terminology which is at variance with the simplest facts of introductory chemistry – a confusion for which I would, without hesitation, flunk any student in my Freshman chemistry course.

2. The Threefold Problem

Global warming is actually only one part of the much larger problem of how to achieve a sustainable supply of energy for future generations – a problem which, in turn, involves at least three distinct issues:

1. The issue of the inevitable depletion of the world's fossil fuel reserves. Many estimates of these reserves have been made, of which those given in Table 1 are typical.

2. The issue of global warming and of pollution and ecological degradation in general.

3. The issue of independence from foreign oil.

Figure 1. William Stanley Jevons (1835-1882).

Issue 1 was first recognized and discussed in detail by the British philosopher and economist, William Stanley Jevons (figure 1), in a book published in 1865 entitled *The Coal Problem*. At the time of its writing, coal was the only major fossil fuel in use so the prospect of an impending coal crisis, which was the subject of Jevon's book, was, for all practical purposes, synonymous with an impending energy crisis. I can't resist pointing out that, prior to moving into the fields of philosophy and economics, Jevons had been trained as a chemist and so had a sound understanding of the chemistry and physics of his day.

Issue 2 was first recognized and discussed in detail by the Swedish chemist, Svante Arrhenius (figure 2), in a paper published in 1896 and was originally known as the "Greenhouse Effect" (2). Arrhenius is,

Table 1. Current Estimated Fossil Fuel Reserves

Fossil Fuel	*Projected Time Before Exhaustion*
lignite coal	250 years
hard coal	185 years
natural gas	67 years
petroleum	43 years

Figure 2. Svante Arrhenius (1859-1927).

of course, well known to anyone who has suffered through a Freshman chemistry course as the originator of the theory of ionic dissociation, the concept of activation energy, and of our most common set of acid-base definitions.

Issue 3 did not become a serious political concern until the formation of OPEC in the early 1970s and the Arab oil embargo of 1973. As a result, between 1970 and 1980 oil prices rose by some 1300 percent, leading many to believe that the United States was at the mercy of the Arab oil producing nations and could only reassert itself by establishing some form of energy independence.

Unhappily, the situation is further complicated by the fact that the solutions to these three issues are not always mutually compatible. Thus issue 3, for example, could be most easily solved through the production of synthetic liquid fuels from America's vast coal deposits. However this solution would be incompatible with a viable solution to issue 2.

3. The Choices

Our available energy alternatives essentially fall into three categories:

A. Natural Energy Flows
solar energy
wind energy
hydroelectric energy
geothermal energy
tidal energy

B. Chemical Fuels

fossil fuels (coal, petroleum, natural gas)
renewable plant biomass (carbohydrate, ethanol, butanol)

C. Nuclear Fuels

fission reactors (uranium, plutonium)
fusion reactors (theory only)

Aside from draft animals and slaves, the only energy sources used by mankind for most of recorded history were the natural energy flows of wind and water power and the direct burning of renewable plant carbohydrate (e.g. wood) as a heat source. The rise of modern industrial civilization, starting in the late 17th century, was made possible by the increasing use of fossil fuels coupled to the discovery of heat engines (steam engines and internal combustion engines) which allowed the conversion of the heat produced by burning these fuels into useful mechanical and electrical work.

Energy derived from natural flows is often variable and cannot be stored in large amounts. Unless used as generated, the energy is simply wasted. The sun will shine, the wind will blow, and the rivers will flow to the sea whether we do or do not turn on the electric lights in our homes. Chemical fuels, on the other hand, represent concentrated potential energy sources which can be stored indefinitely and used when and where required. Both for reasons of high energy densities (energy per unit volume) and ease of transport and storage, liquid fuels are preferred to either gaseous or solid fuels – which is why petroleum so quickly triumphed over coal after World War I.

Of the natural energy flows, hydroelectric is already close to being maximized, whereas solar and wind power are still open to considerable expansion. Though these natural energy flows, unlike fossil fuels, are renewable and do not contribute to global warming, it is doubtful whether, even when maximized, they would be capable of supplying the vast quantities of energy currently generated by the consumption of fossil fuels. In addition, it should be pointed out that they also have ecological consequences. Most of you are aware of the ecological problems resulting from the damming of rivers and the flooding of entire valleys, but few realize that the extensive use of wind farms also has the potential to alter weather patterns. All of this is a consequence of Hardin's first law of ecology:

You can't change just one thing.

Nuclear energy is probably the only alternative to fossil fuel consumption capable of generating the vast amounts of energy demanded by modern industrial societies and, of course, it is also ultimately nonrenewable and has serious issues when it comes to the disposal of the radioactive waste-products which it generates.

Given these facts, I am convinced that chemical fuels will not only continue to play a key role in our future energy development, but that, in light of the severe problems associated with the proposed alternatives I will be discussing today, these fuels will probably continue to be carbon based-fossil fuels.

4. Not All Carbon-Based Fuels Are Created Equal

All practical chemical fuels, whether fossil or ambient biomass in origin, are carbon based and derive their energy from oxidation and the concomitant generation of carbon dioxide and/or water:

$$C_xH_yO_z + (x\text{-}z/2 + y/4)O_2(g) \rightarrow xCO_2(g) + (y/2)H_2O(l) + \text{heat}$$

Here I have generalized the equation for the combustion or oxidation of these fuels so that it is equally applicable to the burning of biomass in the form of cellulose, in which case C, H, and O are all present in the fuel and x, y and z all have finite values, to the burning of hydrocarbons, such as gasoline, oil and natural gas, in which case O is absent in the fuel and z = 0, to the combustion of coal or pure C, in which case both y and z = 0, and to the combustion of pure hydrogen (x = z = 0).

What differentiates fossil fuels from ambient biomass fuels is not their chemistry, but rather the fact that combustion of fossil fuels adds CO_2 to the atmosphere from carbon that has been in storage for millions of years, thus leading to an net increase in the ambient CO_2 concentration and to global warming, whereas combustion of fuels from fresh biomass simply replaces CO_2 extracted months earlier from the atmosphere via photosynthesis by the growing plants and so maintains a steady-state CO_2 concentration in the atmosphere. In addition, ambient biomass fuels are renewable whereas fossil fuels are not.

5. Ethanol

The advantage of using ethanol produced by fermentation of plant carbohydrate, rather than directly burning the carbohydrate itself, is that it leads to the conversion of a bulky, inconvenient, solid fuel into a convenient, high energy-density, liquid fuel, comparable to gasoline and oil. As with the recognition of the problem of future fossil fuel depletion and the greenhouse effect, this is not a recent idea. Among the books in the Oesper collections is a 323-page monograph published in 1922 by G. W. Monier-Williams entitled *Power Alcohol: Its Production and Utilisation*, in which we read:

The use of alcohol as fuel for internal combustion engines is by no means a new development. Since the beginning of the present century it has been employed to a limited extent in farm engines, more especially in the neighborhood of agricultural distilleries on the Continent. Alcohol engines have also been used successfully in some of the chief sugar-producing countries of the tropics, the fuel being derived from the fermentation of molasses. It is only in recent years, owning to the shortage and high prices of petrol following the war [i. e. WW I], that employment of alcohol as a fuel for light motor transport has been seriously advocated.

The environmental rationale for ethanol production and use is as follows:

Photosynthesis (formation of plant glucose):

$$\text{light energy} + 6CO_2(g) + 6H_2O(l) \rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$$

Condensation (formation of cellulose and starch):

$$nC_6H_{12}O_6(aq) \rightarrow (C_6H_{10}O_5)_n + nH_2O(l)$$

Hydrolysis (reconversion into glucose):

$$(C_6H_{10}O_5)_n + nH_2O(l) \rightarrow nC_6H_{12}O_6(aq)$$

Fermentation (formation of ethanol):

$$C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(l) + 2CO_2(g) + \text{heat}$$

Combustion (oxidation of ethanol):

$$2C_2H_5OH(l) + 6O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l) + \text{heat}$$

When these equations are added together, the net overall process is equivalent to:

Net: light energy $\rightarrow$ heat

Hence there is no net consumption of fuel and no net production of pollutants.

Note, however, that part of the energy is given off in the fermentation step rather than in the final com-

bustion of the ethanol. This means that the ethanol contains less energy than the carbohydrate from which it is formed via fermentation. This is the tradeoff for converting the solid bulky carbohydrate into a convenient liquid fuel. It is also a general principle of all fuel conversions.

It takes fuel to make fuel

When we compare ethanol with other fuels, we find some additional disadvantages as well. These are illustrated in Table 2, where I have used octane to idealize the composition of gasoline and methane to idealize the composition of natural gas. Three methods of characterizing each fuel are shown. The kilojoules of energy released per gram of fuel (-kJ/g), shown in column 3, is the conventional index for intercomparing fuels. Since, in transport, part of the energy is consumed in carrying around the remaining fuel supply, the more energy produced per unit mass of fuel, the more efficient the fuel. As may be seen, this index gives the order:

hydrogen >> natural gas > gasoline > coal > ethanol

The reason for the low rating for ethanol is apparent from its chemical formula which reveals that, unlike the other fuels, it is already partially oxidized.

The kilojoules of energy released per milliliter of fuel (-kJ/mL), shown in column 4, is perhaps a more natural comparison for liquid and gaseous fuels since we tend to think in terms of miles per gallon when it comes to our automobiles. This index, which excludes solid coal, gives the order:

gasoline > natural gas ≈ ethanol > hydrogen

The values used for both natural gas and hydrogen are those for the liquified gases and, because of low densities, would be far worse for the gases themselves. More pertinent, however, is the fact that column 4 reveals that ethanol provides only 69% of the energy per unit volume provided by gasoline. This means that your car will get 31% fewer miles per gallon using ethanol than it does with gasoline and in order for ethanol to be economically competitive with gasoline it must be produced, not at the same price per gallon, but at one which is 69% that of gasoline.

The kilojoules of energy produced per mole of carbon dioxide generated (-kJ/mole CO_2), given in column 5, is our environmental index and gives the order:

hydrogen >> natural gas >> gasoline ≈ ethanol > coal

Again there is no mystery here as this index directly correlates with how much hydrogen is present in the fuel and how little carbon. Thus H_2, with no carbon, has the highest index and least impact per kJ, whereas coal, with no hydrogen, has the lowest index and the highest impact. Note that this index reveals that ethanol and gasoline produce comparable amounts of energy per unit of CO_2 generated. The difference, of course, is that the CO_2 from the ethanol is being recycled whereas that from the gasoline is being added.

When writing in 1922 Monier-Williams recognized that ethanol could not at that time be produced at a competitive price relative to gasoline, but hoped that as the latter became scarce and its price increased, there would eventually be a crossover point. This requires an increase in the true cost rather than one resulting from artificial price fluctuations due to market manipulation and speculation, as was the case with the most recent jump in oil prices.

But there are more serious problems. As already stated, *it takes fuel to produce fuel*. In the case of corn-based ethanol these are the energy costs of planting, fertilizing, insect-proofing, cultivating, harvesting, transporting, processing, hydrolyzing, and fermenting the

Fuel	Formula	-kJ/g	-kJ/mL	-kJ/mole CO_2
Coal	C	32.80	------	393.51
Ethanol	C_2H_5OH	28.71	23.43	683.46
Gasoline	C_8H_{18}	48.24	33.72	689.10
Natural Gas	CH_4	55.65	23.51	890.36
Hydrogen	H_2	142.23	11.72	--------

Table 2. A comparison of various chemical fuels.

Figure 3. Jules Verne (1828-1905).

corn, as well as distilling and distributing the ethanol. Estimates quoted by Probstein and Hicks in 1982 concluded that 107% of the fuel value of ethanol was required for its manufacture (3). In other words, it actually required more energy to make ethanol from corn than was obtained from its subsequent combustion. More recent estimates range from 90% to a figure similar to that of Probstein and Hicks (4).

Even if the more optimistic 10% net energy gain is the correct one, there are other serious problems associated with ethanol production from corn:

1. Most of the energy used to produce ethanol currently comes from conventional fossil fuels, so its use would have only marginal impact on global warming, at least for the immediate future.

2. Even if the entire current annual corn crop of the US was diverted to ethanol production, it would replace only 7% of our annual gasoline consumption.

3. It is foolish to make fuel production competitive with food production.

For ethanol to be even remotely practical, it will be necessary to :

1. Recognize that not all carbohydrate is created equal. Plants which store carbohydrate primarily as either simple sugars (cane & beet) or as starch (corn & potatoes) are human food sources, those that store it as cellulose (trees and grasses) are not. Sugar and starches are easier and less expensive to process than cellulose.

2. Genetically engineer microorganisms which can produce ethanol directly from cellulose grown in the form of inexpensive grasses which do not require annual replanting, fertilization, cultivation etc. Though such organisms currently exist, safely tucked away in the guts of cows and termites, consider the possible environmental dangers of creating one that could exist independently and attack trees and wooden houses.

3. Replace the use of fossil fuels in the processing stages with the burning of lignin-rich plant residues left over from the cellulose processing.

Even then it is doubtful that enough cultivated land is available to produce sufficient ethanol to replace all of our current gasoline consumption (5).

6. The Hydrogen Economy

Next to ethanol, the most frequently hyped alternative fuel is hydrogen (H_2), a suggestion first made by none other than Jules Verne (figure 3) in his 1874 novel *The Mysterious Island*:

Yes, my friends, I believe that water will one day be employed as fuel, that the hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light of an intensity of which coal is not capable. Some day the coal-rooms of steamers and the tenders of locomotives will, instead of coal, be stored with these two condensed gases, which will burn in the furnaces with enormous caloric power ... I believe that when the deposits of coal are exhausted we shall heat and warm ourselves with water. Water will be the coal of the future.

The technical details of such a proposal were first presented a century later by the controversial South African electrochemist, J. O. Bockris, in his 1975 monograph, *Energy: The Solar-Hydrogen Alternative*, and more recently in a series of books written for the popular science market by such authors as R. Siblerud, (*Our Future is Hydrogen!*, 2001), and J. Rifkin (*The Hydrogen Economy*, 2002) (6).

It is based on the fact that of all of the fuels listed in our earlier table, H_2 has the highest yield of energy per unit mass (142.93 kJ/g) – indeed almost 257% more than that of the most effective hydrocarbon fuel, methane (55.65 kJ/g) and 436% more than that of coal (32.80 kJ/g). In addition, upon oxidation, H_2 produces

no carbon dioxide gas:

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l) + \text{heat}$$

and hence makes no contribution to global warming.

Unfortunately, in his novel Verne neglected to inform his readers just how one was going to extract all of this hydrogen fuel from water, which is an extremely stable compound. This is a serious omission since, unlike coal, petroleum, and natural gas, free H_2 is not found in significant amounts on earth and must instead be manufactured from other sources. Currently this is done by one of three processes:

Steam reformation of coal:

$$\text{heat} + C(s) + 2H_2O(g) \rightarrow 2H_2(g) + CO_2(g)$$

Steam reformation of methane:

$$\text{heat} + CH_4(g) + 2H_2O(g) \rightarrow 4H_2(g) + CO_2(g)$$

Electrolysis of water:

$$\text{electrical energy} + 2H_2O(l) \rightarrow 2H_2(g) + O_{2(}g)$$

The first two of these processes offer no major advantages over direct use of the initial fossil fuels (coal and methane). Since they consume energy, the net energy gain from burning the resulting H_2 must be much less than that obtained by burning the initial fossil fuels themselves (recall that it takes fuel to make fuel) and, since both processes generate fossil based CO_2, they also offer no ecological advantage either. The only slight advantage is that the CO_2 is produced at a few reformation plants rather than being spread over billions of individual homes and automobiles.

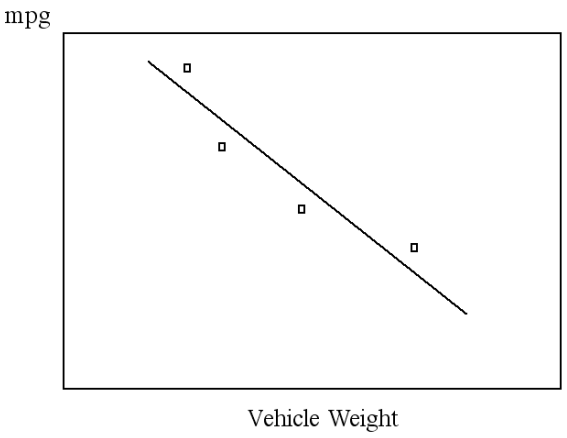
At best, the third process consumes as much energy as is released on burning the resulting H_2 (in reality electrolysis is only about 75% efficient), and so offers no net advantage over using the electrical energy directly rather than first converting it into H_2 (remember every energy conversion step leads to energy loss). Its only advantage is that it could be used to convert excess electrical energy generation from solar, wind, hydroelectric or nuclear power sources, which would otherwise be wasted, into a "green" chemical fuel for storage and later use in various high-temperature industrial processes such as metallurgical extraction.

In addition, while the energy per unit mass is impressive for H_2, the energy per unit volume is quite the opposite. Even when used in the form of liquid hydrogen, its energy density (11.72 kJ/mL) is only 35% that of gasoline (33.72 kJ/mL). Liquefaction of H_2 requires extremely low temperatures and high pressures and is therefore relatively expensive. Attempts to absorb it in various solids, (e.g. Pt or Pd) which would allow controlled release are impractical and expensive as well and, because of the weight of the absorbents, cause the energy per unit mass to decrease drastically.

Given these considerations, I think it is unlikely that H_2 will ever be an effective fuel substitute for automobiles, including those running on so-called hydrogen fuel cells. It simply makes no sense to convert electrical energy into H_2 and then H_2 back into electrical energy when one could use the original electrical energy to charge a storage battery for a conventional electric car. Indeed, it ultimately makes no sense to employ a fuel which must first be extracted from its combustion product. The use of hydrogen extracted from water is the equivalent of a 19th-century chemist, in response to Jevon's projected coal shortage, proposing that we simply extract the necessary carbon from carbon dioxide. In short, though H_2 will never be a major primary energy source, it may have a secondary role to play as a form of chemical storage for surplus electrical energy generated by other means.

7. Some Sociological Solutions

If you plot miles per gallon (mpg) versus body weight for typical motor vehicles with conventional gasoline engines, you will get a graph like the following:



This tells you that vehicle weight, rather than supposed improvements in engine efficiency and aerodynamic body design is the single most significant factor in determining mileage efficiency. If we really want a reduction in our rate of gasoline usage it is far simpler to pass a law restricting vehicle weights than investing in questionable programs such as ethanol production from corn or the hydrogen economy.

Indeed this argument can be taken further. The

average passenger vehicle weighs about 3000 lbs and the average passenger about 150 lbs. This means that about 95% of your fuel consumption is used to move your vehicle rather than yourself from place to place. This is also why public transportation and car pooling, though originally advocated for reasons of traffic congestion, also have a significant impact on fuel consumption. If five of you came to this lecture this morning, each in you own vehicle, you used over 420% more fuel than you would have if all five of you had come in just one car. Hence the cancellation of many air flights during the recent spike in fuel costs. Most of the cost in flying is in transporting the plane itself, not in transporting the passengers, and hence flying a half empty plane is not very cost effective.

If people are irreversibly fixated on private rather than public transportation, then this result further suggests that the development of very small, light, single or dual passenger vehicles, like the 130 mpg MDI compressed air car (figure 4) or the Smart Car (figure 5) are the way to go for purposes of the daily commute, with a second, more conventional-sized, car for family use on weekends. As is apparent from figures 4 and 5, much of the so-called improved mileage efficiencies reported for these vehicles are actually due to their much smaller sizes and weights rather than to any changes in their propulsion systems.

In passing it should be further noted that claims that both compressed air and electric cars are pollution free and thus do not contribute to global warming are disingenuous to say the least. Both the battery of an electric car and the tank in a compressed air car must be recharged, so ultimately both vehicles run off of whatever fuel is required to generate the municipal electric supply used to run either the charging station or the air compressor. In most states this is a coal-fired

Figure 4. A prototype of the MPI compressed air car.

Figure 5. The Smart Car.

power plant. As indicated in our earlier table, coal gives the lowest output of energy per mole of CO_2 generated of all fossil fuels, so, once allowance is made for the slightly greater efficiency of steam powered electric generators versus gasoline powered engines, these vehicles are probably no better than a conventional gasoline powered vehicle of comparable size when it comes to the generation of greenhouse gases. The difference, of course, is that as more and more electrical power is produced by wind, hydroelectric and nuclear power plants, this scenario will decisively shift in favor of the compressed air and electric cars.

But, to return to our original point, none of these solutions require the invention of new technologies. What they do require, however, is a change in our social norms and expectations and, as a consequence, they are substantially less attractive to the public and politician alike, both of whom usually prefer the promise of some futuristic technological fix instead.

For an interesting study of how more subtle aspects of social behavior, especially among males fixated on speed and competition, have contributed to our current woes, I strongly recommend the historical study by Schiffer, Butts and Grimm of the rise and fall of the original electric car in the early decades of the 20th century (7).

8. The Three P's

In the end any realistic discussion of the energy issue requires not only a discussion of potential energy or power sources (P) and environmental pollution costs (P') but also the question, as Jevons recognized as early as 1865, of human population growth (P''). These three factors – the three P's – are related by the equation:

economic quality of life =
watts per person = $(P - P')/P''$

While most politicians are willing to discuss P, many have tried in the past to ignore P' and all refuse to recognize the role of P'' which is certainly the proverbial elephant in the room that no one is willing to acknowledge.

The relation between P and P' is governed by the law that short-range economic needs always trump long-range environmental needs and I strongly suspect this will also prove to be the case with global warming. This is true not only of the US but was also true of the former Soviet-block countries, as became painfully obvious after the fall of Communism and the discovery of the legacy of massive pollution and ecological damage left behind by most former Eastern European governments in their mad race to industrialize. And, of course, the same is currently true of China and India, both of whom have now surpassed the United States and Europe in the generation of air pollutants.

The relevance of P'' is that, if we want to replace fossil fuels with alternatives, we not only need to replace current usage levels but every-increasing levels, not only as the world population as a whole continues to increase, but as more and more third world countries demand energy consumption levels comparable to those of the US and Europe. As of 2009 the world population was about 6.77 billion (e.g. 6.77×10^9) with an annual growth rate of 1.14%. Though 1.14% may not seem like much, it translates into an increase of 77.2 million per year, or 212,000 persons per day, or about 147 per minute. This means that during the 50 minutes taken by this lecture the world population increased by 7350 people, all of whom will eventually demand their share of the available energy resources.

In my opinion the challenge presented by this depressing fact causes all of the others to pale by comparison. You can blame big business and the politicians for our woes, but the truth is that pollution, the ecological destruction of our environment, energy shortages, and global warming are all ultimately being driven by uncontrolled population growth – the very topic no one wants to discuss. Our fate will ultimately be determined by whether we are able to transcend the biological imperative to reproduce at all costs, since I can state with absolute confidence that there is not a chance in hell that we are going to transcend the laws of thermodynamics.

9. Summary and Conclusions

All of our current energy problems, including global warming, have been recognized for more than a century, as have many of the proposed solutions, and seem to flicker in and out of public consciousness as a function of economic fluctuations. Two paths are required to attain eventual energy and environmental stability and long-range sustainability:

1. The development of new energy technologies.

2. The modification of current social behavior and cultural expectations, of which the most serious is population growth.

The American public is fixated on the first of these paths and will strongly resist the necessity of having to confront the second. Most countries will continue to pursue their own economic self-interest and will demand that any necessary social and economic sacrifices be made by others.

Skeptics must walk a fine line. We need to be skeptical of pie in the sky energy schemes that will waste resources and time and divert people from facing the accompanying social and cultural problems, but we must not be so skeptical that we discourage the development of innovative technologies. In general we should be critical of any technological scheme that promises a quantum jump in energy production and/or a quantum decrease in cost. Almost always the proponent is either:

1. A con artist (fuel additives and motor add-ons).

2. Is ignorant of the basic laws of thermodynamics (perpetual motion machines).

3. Is selling his scheme on the basis of what he hopes to achieve rather than on the basis of what he has actually achieved (switch grass fermentation).

4. Has neglected to take into account hidden energy and pollution costs (compressed air and electric cars).

10. References and Notes

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XII
Atheism and Free-Thought in 19th-Century Cincinnati
Some Historical Snapshots

As members of a free-thought organization which was founded only a few decades ago, it may come as a surprise to learn that your group has actually had several distinguished predecessors and that, indeed, the city of Cincinnati has been home to a free-thought tradition which extends back to the early decades of the 19th century. This evening I would like to provide you with some brief snapshots of this earlier tradition and will do so through direct quotation from the writings of several distinguished 19th-century visitors to Cincinnati who were kind enough to leave us with their passing impressions of this unique American phenomenon (1).

1. Francis Trollope

We will begin, as all things concerning early 19th-century Cincinnati must, with the impressions of Francis Trollope (figure 1), as recorded in her classic volume, *Domestic Manners of the Americans*. Born Francis Milton in Bristol, England, she contracted a rather late marriage to an unsuccessful lawyer named Thomas Trollope in 1809, which eventually produced six children, including the future British novelist Anthony Trollope. In 1827 she and her three youngest children (Anthony remained at school in England) decided to join the feminist and social reformer, Francis Wright, at her utopian community in Nashoba Tennessee.

Figure 1. Francis (Fanny) Trollope (1780-1863).

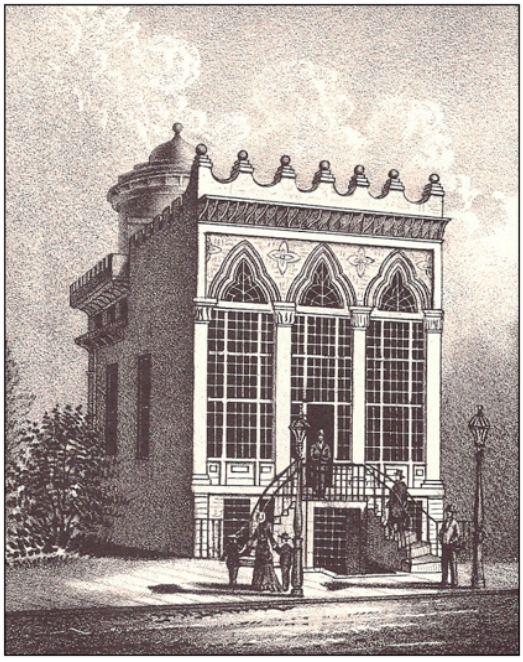

Figure 2. Mrs. Trollope's "Bazaar."

Quickly disillusioned by what she found at Nashoba, Trollope soon moved to nearby Cincinnati, where she opened a four-story combination coffee-house, bar, market place, ball room, and import store known locally as "Trollope's Bazaar" (figure 2). By 1829 this venture had collapsed and in 1831 she returned to England, where in 1832 she published her first and most famous book, *Domestic Manners of the Americans*, containing her rather jaundiced impressions of life in early Cincinnati. This was followed by over a hundred novels and general travel books, which kept her successfully employed until her death 31 years later.

In *Domestic Manners* Trollope left us with a general impression of the state of religious activity in early 19th-century America which strongly implied that, as always, there was a significant gap between theory and practice (2):

Church and State hobble along, side by side, not withstanding their boasted independence. Almost every man will tell you that he is occupied in labors most

abundant for the good of his country; and almost every woman will tell you that, besides those things that are within her house, she has coming upon her daily the care of the churches. Yet in spite of this universal attention to the government, its laws are half asleep; and in spite of the old women and their Dorcas societies, atheism is awake and thriving.

As with many other claims concerning the spread of atheism, this one must be taken with a grain of salt, since, like many other commentators on this subject, Mrs. Trollope undoubtedly used the word to describe not only true disbelief but also all forms of religious activity and/or religious indifference which failed to conform to her own Church of England biases.

2. The Great Owen-Campbell Debates

But perhaps the most interesting incident in Mrs. Trollope's book his her account of a series of public debates over the truth of religion which took place in Cincinnati in the Spring of 1829 between the utopian reformer Robert Owen (figure 3) and the Church of Christ revivalist Alexander Campbell (figure 4) (2, 3):

It was in the early summer of 1829 that Cincinnati offered a spectacle unprecedented, I believe, in any age or country. Mr. Owen of Lanark, of New Harmony, of Texas, well known to the world by all or either of these

Figure 3. Robert Owen (1771-1858).

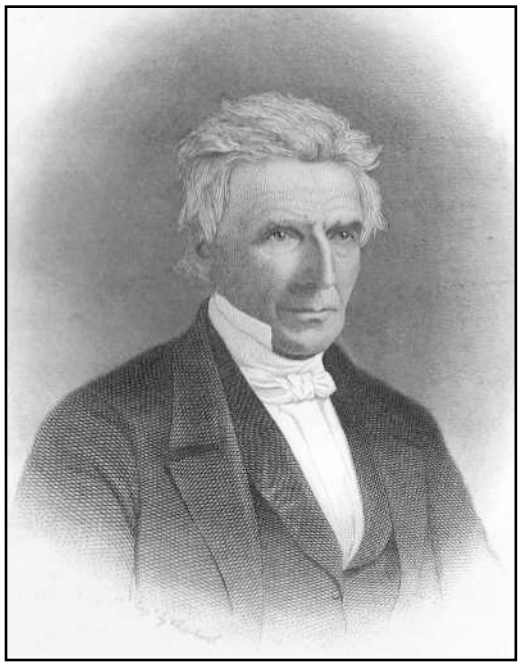

Figure 4. Alexander Campbell (1788-1866).

additions, had challenged the whole religious public of the United States to discuss with him publicly the truth or falsehood of all the religions that had ever been propagated on the face of the earth, stating further that he undertook to prove that they were all equally false, and nearly all equally mischievous. This most appalling challenge was conveyed to the world through the medium of New Orleans newspapers, and for some time it remained unanswered. At length the Reverend Alexander Campbell, from Bethany, Kentucky, proclaimed, through the same medium, that he was ready to take up the gauntlet. The place fixed for this extraordinary discussion was Cincinnati; the time, the second Monday in May, 1829, being about a year from the time the challenge was accepted; thus giving the disputants time to prepare themselves.

The confrontation itself took place in a Methodist hall in downtown Cincinnati and the entire debate (figure 5) was recorded verbatim by stenographers (2):

A Methodist meeting-house, large enough to contain a thousand persons, was at last chosen; a small stage was arranged around the pulpit, large enough to accommodate the disputants and their stenographers ... Another platform was raised in a conspicuous part of the building, on which were seated seven gentlemen of the city, selected as moderators. The chapel was equally divided, one half being appropriated to the ladies, the other to the gentlemen; and the door of the

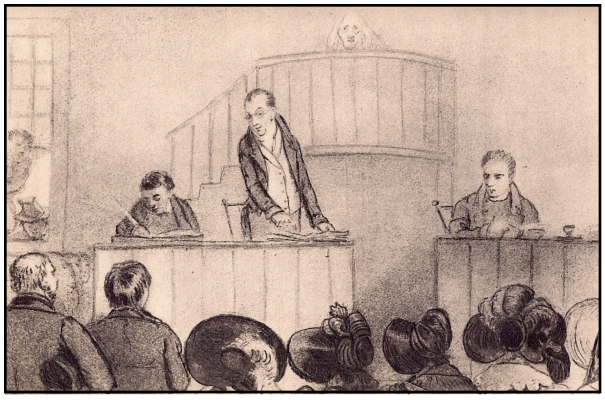

Figure 5. The Owen-Campbell debate on the truth of religion which took place in Cincinnati in the Spring of 1829.

entrance reserved for the ladies was carefully guarded by persons appointed to prevent any crowding or difficulty from impeding their approach.

Despite her strong bias toward the Church of England brand of Christianity on which she had been raised, Mrs. Trollope found herself charmed by Owen's personality and sense of humor (2):

When Mr. Owen rose, the building was thronged in every part; the audience, or congregation (I hardly know which to call them) were of the highest rank of citizens, and as large a proportion of best bonnets fluttered there, as the "two horned church" itself could boast. It was in the profoundest silence, and apparently with the deepest attention, that Mr. Owen's opening address was received; and surely it was the most singular one that ever Christian men and women sat to listen to. When I recollect its object, and the uncompromising manner in which the orator stated his mature conviction that the whole history of the Christian mission was a fraud, and its sacred origin a fable, I cannot but wonder that it was so listened to; yet at the time I felt no such wonder. Never did anyone practice the "suaviter in modo" with more powerful effect than Mr. Owen. The gentle tone of his voice; his mild, sometimes playful, but never ironical manner; the absence of every vehement or harsh expression; the affectionate interest expressed for "the whole human family," the air of candor with which he expressed his wish to be convinced he was wrong; if indeed he were so – his kind smile – the mild expression in his eyes – in short, his whole manner, disarmed zeal and produced a degree of tolerance that those who did not hear him would hardly believe possible.

Half an hour was the time allotted for each haranguer. When this expired, the moderators were seen to look at their watches. Mr. Owen, too, looked at his and, without pausing, smiled, shook his head, and said in parenthesis "a moment's patience," and continued on for nearly another half hour.

Though less charming than Owen, Campbell's defense of orthodoxy, not to mention his strict adherence to the alloted time limits, also greatly impressed Mrs. Trollope (2):

Mr. Campbell then arose; his person, voice, and manner all greatly in his favor. In his first attack he used arms, which in general have been considered as belonging to the other side of the question. He quizzed Mr. Owen most unmercifully; pinched him here for his parallelograms; hit him there for his human perfectibility, and kept the whole audience in a roar of laughter. Mr. Owen joined in it most heartily himself, and listened to him with the air of a man who is delighted at the good things he is hearing, and exactly in cue to enjoy all the other good things that he is sure will follow. Mr. Campbell's watch was the only one which reminded us that we had listened to him for half an hour; and having continued speaking for a few minutes after he had looked at it, he sat down with, I should think, the universal admiration of his auditory.

After this initial confrontation, Owen proceeded to state his own utopian alternative to organized religion (2):

Mr. Owen again addressed us, and his first five minutes were occupied in complimenting Mr. Campbell with all the strength his exceedingly hearty laughter had left him. But then he changed his tone, and said the business was too serious to permit the next half hour to pass so lightly and so pleasantly as the last; and then he read us what he called his twelve fundamental laws of human nature ... To me they appear twelve truisms that no man in his senses would ever think of contradicting; but how anyone could have conceived that the explanation and defense of these laws could furnish forth occupation for his pen and his voice, through whole years of unwearying declamation, or how he can have dreamed that they could be twisted into a refutation of the Christian religion, is a mystery which I never expect to understand.

From this point on, however, the debates (which went on for fifteen consecutive evenings) pretty much settled into a predictable groove during which the two disputants talked past, rather than at, one another (2):

From this time Mr. Owen entrenched himself behind his twelve laws and Mr. Campbell, with equal gravity,

confined himself to bringing forth the most elaborate theological authorities as evidence of the truth of revealed religion. Neither appeared to me to answer the other; but to confine themselves to the utterance of what they had uppermost in their own minds when the discussion began.

At the end of the last session there was an attempt to determine the winner of the debates by popular vote (2):

*At the conclusion of the debate, which lasted for fifteen sittings, Mr. Campbell desired the whole assembly to sit down. They obeyed. He then requested that all who wished well to Christianity to rise, and a very large majority were in an instant on their legs. He again requested them to be seated, and then desired those who believed not in its doctrines to rise, and a few gentlemen and one lady obeyed. Mr. Owen protested against this maneuver, as he called it, and refused to believe that it afforded any proof of the state of men's minds or of women's either, declaring that not only was such a result to be expected in the present state of things, but that it was the duty of every man who had children to feed not to hazard the sale of his hogs, or his iron, by a declaration of opinions which might offend the majority of his customer*s.

But, when all was said and done, the debates, as Mrs. Trollope sagely observed, largely failed to convince anyone to change their preconceived opinions on the subject of religion (2):

It is said that, at the end of the fifteen meetings, the numerical amount of the Christians and the Infidels of Cincinnati remained exactly what it was when they began. This was a result that might have been perhaps anticipated; but what was much less to be expected, neither of the disputants ever appeared to lose their temper. I was told they were much in each other's company, constantly dining together, and on all occasions expressed most cordially their mutual esteem. All this I think could only have happened in America. I am not quite sure that it was very desirable it should have happened any where.

3. Isabella Bird

Our second snapshot comes from the travel account of the English writer, Isabella Bird (figure 6). Born in Boroughbride England, the daughter of an English clergyman, Bird became a well-known author of travel books, publishing sixteen during her life, many dealing with exotic locations, such as Tibet, Persia, and the Malay Peninsula. Indeed, so famous did she become as a world traveler that in 1892 she became the first woman to be elected to the Royal Geographical Society.

Figure 6. Isabella Bird (1831-1904).

Our selection this evening is from her very first travel book, *The Englishwoman in America*, which was published in 1856 and which contained a chapter on her impressions of Cincinnati – a chapter which also revealed that she suffered from a stereotypical English distain of the Irish (4):

There are [in Cincinnati] nearly 50,000 Germans, and I believe 40,000 Irish, who distinctly keep up their national characteristics. The Germans almost monopolize the handicraft trades, where they find a fruitful field for their genius and industry; the Irish are here, as everywhere, hewers of wood and drawers of water; they can do nothing but dig, and seldom rise in the social scale. The Germans, as at home, are a thinking, skeptical, theorizing people: in politics, Socialists – in religion, Atheists. The Irish are still the willing and ignorant tools of an ambitious and despotic priesthood.

Commenting on the German area of Cincinnati known locally as "Over the Rhine," she also revealed that a xenophobic fear of immigrants was already a well-established feature of the American landscape by the middle of the 19th century (4):

The Germans, in that part of town almost devoted to themselves [i.e., Over the Rhine], have succeeded in practically abolishing the Sabbath, as they utterly ignore that divine institution even as a day of rest, keeping their stores open the whole day. The creeds

which they profess are "Socialism" and "Universalism," and at stated periods they assemble to hear political harangues, and address invocations to a universal deity. Skilled, educated, and intellectual, they are daily increasing in numbers, wealth, and political importance, and constitute an influence of which the Americans themselves are afraid.

Again it is not always possible to decide whether Bird's use of the label "atheist" necessarily refers to true disbelievers or merely to unorthodox religious views and practices of which she did not approve.

3. Mark Twain

Our next witness needs no introduction for it is none other than the famous American writer and humorist, Mark Twain (figure 7). Born Samuel Langhorne Clemens in Florida MO and raised in Hannibal MO, Twain was apprenticed at age 12 to his brother Orion to learn the art of typesetting, and also soon began contributing humorous articles to his brother's newspaper, *The Hannibal Journal*. At age 18 he left Hannibal to work as a typesetter for various printers in New York City, Philadelphia, St. Louis, and Cincinnati. At age 22 Twain became a steamboat pilot on the Mississippi until river traffic was closed down by the Civil War, after which he began to seriously pursue his career as a writer.

Our selection this evening is taken from Twain's autobiography, which was published posthumously in 1924 (5):

[In late 1855] when I turned twenty, I wandered to Cincinnati, and was there several months working in the printing-office of Wrightson & Company. Our boarding-house crew was made up of commonplace people of various ages and both sexes. They were full of bustle, frivolity, chatter, and the joy of life, and were good-natured, clean-minded, and well-meaning; but they were oppressively uninteresting for all that – with one exception. This was Macfarlane, a Scotsman.

This Scotsman proved to be self-educated and to have evolved a unique world view of his own which Twain found most interesting (5):

He was forty years old – just twice my age ... six feet tall and rather lank, a serious and sincere man. He had no humor, nor any comprehension of it. He had sort of a smile, whose office was to express his good nature, but if ever I heard him laugh, the memory of it is gone from me. He was intimate with no one in the house but me, though he was courteous and pleasant with all. He had two or three dozen weighty books – philosophies, histories, and scientific works – and at the head of this procession were his Bible and his dictionary.

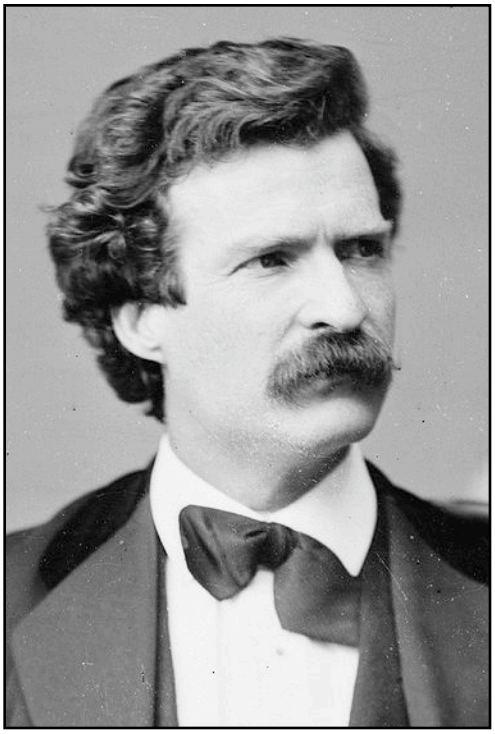

Figure 7. Mark Twain (1835-1910).

I always spent my evening by the wood fire in his room, listening to his tireless talk and to the dulled complainings of the winter storms, until the clock struck ten ... Diligent talker as he was, he seldom said anything about himself. To ask him a personal question gave him no offense – nor the asker any information; he merely turned the matter aside and flowed placidly on about other things. He told me once that he had had hardly any schooling, and that such learning as he had, he had picked up for himself. That was his sole biographical revelation, I believe. Whether he was a bachelor, widower, or grass-widower, remained his own secret. His clothes were cheap, but neat and caretakingly preserved. Ours was a cheap boarding house; he left the house at six, mornings, and returned to it toward six, evenings; his hands were not soft, so I reasoned that he worked at some mechanical calling ten hours a day for humble wages – but I never knew.

As it turned out, among Macfarlane's beliefs was a crude version of biological evolution, though one based on theology rather than survival of the fittest (5):

Of course his thinking and reasoning and philosophizing were those of but a partly taught and wholly un-

trained mind, yet he hit by accident upon some curious and striking things. For instance, the time was the early part of 1856 – fourteen or fifteen years before Mr. Darwin's "Descent of Man" startled the world – yet here was Macfarlane talking the same idea to me there in the boarding house in Cincinnati.

The same general idea, but with difference. Macfarlane considered that the animal life in the world was developed in the course of eons of time from a few microscopic germ seeds, or perhaps one microscopic seed germ deposited on the globe by the Creator at the dawn of time, and that this development was progressive upon an ascending scale toward ultimate perfection until man was reached; and that then the progressive scheme broke pitifully down and went to wreck and ruin! He said man was ... the sole animal in whom was fully developed the base instinct called patriotism, the sole animal that robs, persecutes, oppresses and kills the members of his own immediate tribe, the sole animal that steals and enslaves the members of any tribe. He claimed that man's intellect was a brutal addition to him and degraded him to a rank far below the plane of the other animals, and that there was never a man who did not use his intellect daily all his life to advantage himself at other people's expense.

Anyone familiar with Twain's later and darker writings on the nature of man and the Bible will recognize that they contain many of the views that Twain attributed to Macfarlane, and consequently one cannot help but wonder how many of these were projections of Twain's later opinions on events that had occurred nearly a half century earlier (6).

4. Moncure Daniel Conway

Moncure Daniel Conway (figure 8) was born in Falmouth, Virginia, to a slave-owning family and began his career in 1849 as a pro-slavery Methodist minister. By 1852, however, he had come under the influence of Emerson's transcendentalism and soon became, much to the distress of his family and friends, an avid abolitionist. This "conversion" inspired him to earn a degree from the Harvard Divinity School in 1854 and resulted in his appointment the next year as minister to the First Unitarian Church of Washington DC.

Dismissed for his abolitionist views in 1856, Conway was appointed minister for the First Congregational Church in Cincinnati, where he remained until 1861, when he was dismissed once again, this time for his rejection of supernaturalism. While in Cincinnati he married Ellen Davis Dana, a member of his congregation, in a ceremony that was attended by the poet Longfellow.

Figure 8. Moncure Daniel Conway (1832-1907) and his wife, Ellen Davis Dana.

In 1862 Conway moved to England where he eventually became minister of the South Place Unitarian Church in the Finsbury section of London. Having by now also rejected theism, both Conway and his congregation soon left the Unitarian Church to become the South Place Ethical Society. Upon his death, this society inaugurated the annual Conway Memorial Lecture, which would draw on the talents of many of the leading British intellectuals in the years before the Second World War. These lectures were given at Conway Hall in Holborn London, which still exists and was shown as part of the series on atheism hosted by Jonathan Miller on PBS several years ago. Tim Madigan, whom many of you know from his frequent visits, tells me that he will be lecturing at Conway Hall this August.

Our selections this evening are taken from Conway's *Autobiography, Memories and Experiences*, which was published in 1904, three years prior to his death in 1907.

5. Thomas Paine and the Infidels of Cincinnati

It was while serving as Minister to the First Congregationalist Church that Conway discovered a small conclave of "infidels" and Tom Paine (figure 9) worshipers in downtown Cincinnati (7):

There was in Cincinnati a small society of so-called "infidels" who gathered every Sunday afternoon in a room on Fourth Street. I attended some of their meetings, taking an obscure corner place. The speakers were partisans, the most prominent of them Englishmen, who, with somewhat faulty grammar, had good sense and a certain rude eloquence. I was impressed by the fact that, although these men had no belief in God or immortality, nearly every speech expressed enthusiastic homage for Thomas Paine, a fervent apostle of theism. Paine had become to them, more than the founder of a deistic church; he was the standard-bearer and apostle of religious freedom; to these freethinkers he was what George Fox was to the Quakers and John Wesley to the Methodists.

This encounter stimulated a growing interest in Thomas Paine on the part of Conway (7):

In early life I had heard Paine occasionally mentioned by preachers with abhorrence, but it was only in Cincinnati that I discovered that those denunciations were of interest to me as a student of myths and legends. In listening to the freethinkers in their humble hall I became aware of the large mythology grown and growing around Thomas Paine ... These clerical fictions also reminded me that towers may be measured by the shadows they cast. I could not help be interested in a writer whom Jehovah was said to have chosen for the object of his special wrath.

Thus it was that Conway soon found himself researching the life and thought of Paine (7):

The immediate result of these researches was an announcement that on Paine's birthday, January 29, 1860, the subject of my sermon would be Thomas Paine. The church was crowded. I had feared that my pleading for Paine might excite some opposition in my congregation, or at least some remonstrance on my imprudence; but instead of that I received next day a request to publish my discourse. It was signed by many eminent and wealthy citizens, some of whom did not belong to my congregation; their letter and names were printed as the preface of the sermon, which bore the title "Thomas Paine. A Celebration." From that time the freethinkers frequented my church, and I arranged that there should be each week an evening discussion with them. I had gained their good-will, and Moreau, a leading writer of their faith – for it was a fervent faith – dedicated a volume to me as the first who had ever uttered from a pulpit any word favorable to Paine.

Figure 9. Thomas Paine (1736-1809).

It was perhaps inevitable that these encounters with both the local infidels and the writings and thought of Paine would also begin to impact on Conway's own religious beliefs (7):

My vindication of Paine and its unexpected success was felt by the freethinkers of Cincinnati as a vindication of themselves also, and I felt it my opportunity for grappling with what I considered their errors. My theism was not indeed of the Paine type – I had passed from all dynamic theism to the theism evolved from pantheism by the poets – but I found that in criticizing these atheists I undertaken a difficult task. Several of them – I remember the names of Colville, Miller, and Pickles – were shrewd disputants and steadily drove me to reconsider the basis of my beliefs. I entered upon a severely logical statement of the corollaries of theism. In a course of discourses I had already rejected supernaturalism, to the distress of a third of my congregation, this being the first time that simple theism had invaded any western pulpit.

And, perhaps not unexpectedly, Conway's increasingly secular reinterpretation of Christianity soon got him into trouble with his congregation (7):

That, however, was less disturbing than a sermon on "God" in which I maintained that the creation and government of the universe by an omnipotent and omniscient deity was incompatible with any free will. I affirmed that the so-called free agency of man was a much overrated notion. I contended that what theolo-

gians called the Will of God was a misconception; an all-wise and morally perfect deity could have no freedom. There is only one very best and to that he must adhere; the least deviation from it would undeify him.

The end result was that a split occurred in his congregation which led to a subsequent argument and law suit over how to divide up the church property between the two opposing congregations and eventually to Conway's own resignation (7):

My theological and philosophical heresies reported in the Ohio journals excited discussion far and near ... I do not find anything in the church broil at Cincinnati of sufficient interest to dwell on here. The secessionists who went off on account of my series of sermons on "Miracles," and established the "Church of the Redeemer," were sufficiently numerous for our committee to agree to a division of the church property as a measure of peace.

6. Darwin, Emerson and Cincinnati

As you all know, we are celebrating the 200th anniversary of Darwin's birth this year. Consequently I think it appropriate to note that Cincinnati, or at least a very small part of Cincinnati, also celebrated the publication of Darwin's most famous book, *Origin of the Species*, more than a hundred and fifty years ago. Thus Conway recalled that (7):

In December 1859 Darwin's "Origin of Species" was hailed in my sermon:

"*Now comes Darwin and establishes the fact that Nature is all miracle, but without the special ones desired; that by perfect laws the lower species were trained to the next higher and that to the next – until striving to be a man, the worm mounts through all the spires of form ..."*

Soon after the appearance of Darwin's volume Emerson visited Cincinnati to give a lecture in the regular course of the Mercantile Library Association, and I had the delight of talking over with him the great discovery of Darwin. I can now see that neither Emerson nor any of us – the pre-Darwinite Evolutionists – in our joyful welcome of Darwin's work sufficiently weighed his words concerning the boundlessness of the time in which nature had wrought. We were still in the Twilight of the Gods, reverently spelt nature with a big N, and saw our goddess ever at her loom, but weaving with swift strokes.

7. Darwin's Funeral

As I mentioned earlier, Conway spent his later years in England and, in light of the Darwin Bicentennial, I cannot resist quoting his description of Darwin's funeral in 1882, which he had the honor of attending, though, strictly speaking, this topic is not in keeping with the subject of this evening's lecture (7):

The scene in Westminster Abbey at the funeral of Darwin was impressive. From the chapel of St. Faith the body of the great man was borne by the procession along the remote cloisters. We who had long been in our appointed seats in the Abbey presently heard a faint melodious strain; nearer the dirge of the invisible choir approached; and when the great door of the Abbey opened, and the choristers appeared, and the coffin laden with wreaths from all parts of Europe, a stir of emotion passed through the waiting company. There were following that coffin more than a hundred of the first men in England and some from other countries. On many faces the grief was visible. Huxley, Tyndall, Francis Galton, Sir John Lubbock, Sir Joseph Hooker, could with difficulty control their grief.

It was dark in the Abbey and the lights but feebly struggled with the gloom. There was something almost spectral in the slow moving of the procession with noiseless tread. Around in every direction the throng of marble statues were discernible, as if a cloud of witnesses gathered to receive the newcomer into their Valhalla. But it was an earthly Valhalla. The darkness of the Abbey, only made visible by occasional lamps, might have been regarded by saints of the still radiant windows as emblematic of the curtain drawn by knowledge beyond the grave. To me the gloom deepened when the service thanked God for removing such a man out of this wicked world, but lifted a little when the white-robed choristers gathered around the three graves – those of Newton, Herschel, and Darwin – and sang a new anthem, "Happy is the man who findeth wisdom."

But then, as now, there were, as Conway observed, those who detested Darwin rather than honored him (7):

*Amid the universal homage to Darwin one adverse sentiment is widely noted and rebuked. "l'Univers," the Roman Catholic organ of Paris said, "When hypothesis tends to nothing less than the destruction of faith, the shutting out of God from the heart of man, and the diffusion of the filthy leprosy of Materialism, the savant who invents and propagates them is either a criminal or a fool. Such, we would have to say, is the case with that monk*ey *Darwin.*

8. Lincoln and Cincinnati

As a final selection from Conway's autobiography, I would like to read his impression of yet one more famous personage whom he encountered in the streets of Cincinnati. Though once again not a topic strictly in keeping with the subject of this evening's lecture, it does touch upon a fundamental belief of all humanists and was certainly a subject very dear to Conway's own heart (7):

One warm evening in 1859, passing through the market-place in Cincinnati, I found a crowd there listening to a political speech in the open air. The speaker stood in the balcony of a small brick house, some lamps assisting the moonlight. I had not heard of any meeting, and paused on the skirts of the crowd from curiosity, meaning to stay only a few moments. Something about the speaker, however, and some words that reached me, led me to press nearer. I asked the speaker's name and learned that it was Abraham Lincoln.

Browning's description of the German Professor, "three parts sublime to one part grotesque," was applicable to this man. The face had a battered and bronzed look, without being hard. His nose was prominent and buttressed a strong and high forehead; the eyes were high-vaulted and had an expression of sadness; his mouth and chin were too close together, the cheeks hollow. On the whole Lincoln's appearance was not attractive until one heard his voice, which possessed variety of expression, earnestness, and shrewdness in every tone. The charm of his manner was that he had no manner; he was simple, direct, and humorous. He pleasantly repeated a mannerism of his opponent – "This is what Douglas calls his gur-reat perrinciple;" but the next words I remember were these: "Slavery is wrong."

Cincinnati is separated from Kentucky only by the narrow Ohio, which is overlooked in its deep bed, so that the streets of the town on the Kentucky side appear as continuations of some in Cincinnati; [and] one might see the slaves at their work. Kentuckians swarmed over to our political meetings, and their large contingent was revealed at this Lincoln meeting by the murmurs and hisses that followed his declaration, "Slavery is wrong!"

9. Summary and Conclusions

In closing, I hope I have succeeded in giving you a glimpse of the rich historical legacy of free-thought in the city of Cincinnati. It is a history which you will not read about in the textbooks or in coffee-table histories of Cincinnati and about which there is still much to learn. It is, nevertheless, a history that is in many ways quite remarkable: the city which was the site of a two-week long debate on the truth of religion in the 1820s; the city which became home to large numbers of religiously liberal Germans in the 1850s; the city where, in a long-vanished boarding-house, a future great American novelist and an obscure mechanic discussed the theory of evolution several years before Darwin; the city where a group of Thomas Paine enthusiasts succeeded in edging a local minister towards humanism and where the publication of Darwin's *The Origin of Species* was celebrated from the pulpit. In short, it is a history of which you can be proud.

10. References and Notes

1. A lecture given to the members of the Cincinnati Free Inquiry Group (FIG) of Cincinnati, OH on 26 May 2009 and once again as part of the conference in honor of the 20th anniversary of the founding of FIG on 15 October 2011.

2. F. Trollope, *Domestic Manners of the Americans*, Knopf: New York, NY, 1949, pp. 110, 147-153. This is an annotated edition of her famous book of 1832.

3. Stenographic copies of the Owen-Campbell debates were published simultaneously by both disputants and are available on line. See: C. H. Simms, Ed., *Debate on the Evidences of Christianity*, 2 Vols., Robinson and Fairbank: Cincinnati, 1829 and *ibid*, A. Campbell: Bethany, VA, 1829. Consultation of these books shows that Mrs. Trollope made a number of errors in her account. Bethany was in Virginia rather than Kentucky and the debates occurred between 13 and 21 April 1829 rather than in May of that year.

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5. A. B. Paine, Ed., *Mark Twain's Autobiography*, 2 Vols., Harper & Brothers: New York, NY, 1924, Vol. 1, pp. 143-147. See also C. Neider, Ed., *The Autobiography of Mark Twain*, Harper & Brothers: New York, NY, 1959, pp. 95-97.

6. M. Twain, *What is Man and Other Philosophical Writings*, P. Baender, Ed., University of California Press: Berkeley, CA, 1973 and H. Baetzhold, J. B. McCullough, Eds., *The Bible According to Mark Twain*, University of Georgia Press: Athens, GA, 1995.

7. M. D. Conway, *Autobiography, Memories and Experiences*, 2 Vols., Houghton, Mifflin & Co: Boston, 1904, Vol. 1, pp. 281-281, 304-306, 317-318; Vol. 2, pp. 360-361.

XIII
Ambiguous Icons of Skepticism

1. Introduction

As you may be aware, I was asked to step in today as a substitute for the originally scheduled speaker and the only material of possible interest to the members of ART that I had readily at hand is still in the formative stages, so I must apologize ahead of time if today's presentation seems a bit on the rough side. Indeed, in keeping with this, I must also begin by apologizing for a certain ambiguity in my title (other than my use of the word ambiguous). Here I have used the term "skepticism" – and will continue to use it throughout this lecture – in the same sense as it is used by the members of this organization and by the Center for Inquiry in Amherst New York – namely a healthy skepticism concerning paranormal, supernatural, and pseudoscientific claims that are unsupported by either proper scientific evidence or methodology and which are at variance with current scientific theory.

As it turns out, professional philosophers use this term in a much broader sense to include not only those who are skeptical of the above claims, but those who are also skeptical of science itself and of many of the values which this organization seeks to defend. As a consequence they often label those philosophers whom I will be criticizing today as far better examples of true skeptics than either myself or the members of this audience.

The origins of today's lecture lie in the writings of the Australian philosopher, David Stove, who has, over the years, repeatedly drawn attention to the pernicious role played by the writings of both the 20th-century Austrian philosopher, Karl Popper, and the 18th-century Scottish philosopher, David Hume, in fostering what Stove calls an "irrationalist" attack by various 20th-century philosophers of science on the traditional model of science and the scientific method that the members of ART and other skeptics groups seek to defend (2-4).

This claim caught my attention because both Popper and Hume are frequently quoted by skeptics when criticizing both pseudoscience and supernaturalism – Popper for his famous dictum that for a claim to qualify as true science it must be capable of being empirically falsified, and Hume for his equally famous maxim that extraordinary claims require extraordinary evidence. As with an earlier talk that I gave to FIG on the misuse of Einstein quotes to defend atheism, the question naturally arises as to whether these are yet further examples of a blatant appeal to authority and prestige via quotation out of context.

Figure 1. Francis Bacon (1561-1626), who is widely considered as the founder of the classic model of the scientific method.

2. The Classical View of the Scientific Method

Before exploring the manner in which Popper and Hume have been used to attack the traditional or classical view of the scientific method, we need to be clear on just what we mean by this latter phrase. This classic model is usually traced back to the writings of the 17th-century statesman and philosopher, Sir Francis Bacon (figure 1), and was elaborated during the 19th century by a number of British writers, including William Whewell (1794-1866), John Stuart Mill (1806-1873), and William Stanley Jevons (1835-1882). It places heavy emphasis on the roles of both induction in theory formation and experiment in empirical verification.

A competing view of science, known as positivism, which accepted both of the above premises, but which placed greater constraints on the nature of acceptable theories by stressing the central role of empirical correlations and the elimination of unnecessary hypothetical entities, such as atoms and molecules, was developed by such writers as August Comte (1798-1857)

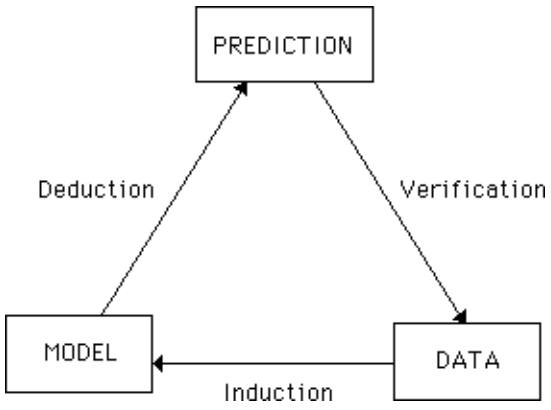
and Pierre Duhem (1861-1916) in France and by Ernst Mach (1838-1916) in Austria, though the subsequent successes of both atomic and nuclear physics in the 20th century have largely invalidated this point of view.

This classical view of the scientific method is the version still taught in most science textbooks and is, I suspect, the version that most practicing scientists still hold, though very few of them ever explicitly think about this subject. As the eminent biologist, Sir Peter Medawar, once slyly observed:

Ask a scientist what he conceives the scientific method to be, and he will adopt an expression that is at once solemn and shifty-eyed: solemn because he feels he ought to declare an opinion; shifty-eyed, because he is wondering how to conceal the fact that he has no opinion to declare.

Rather than rehearse the historical details of how this classical view originated and evolved over time, I am instead going to give you my own version, since, as a modern-day practicing scientist, I feel that it is fairly representative of both the standard textbook account and the beliefs of most of my fellow scientists, however inarticulate.

I like to visualize the overall process in terms of the following triangular diagram:



Here the box in the lower right-hand corner labeled "Data" represents the initial input data. This may be in the form of original experimental data, field observations, or previously published data found elsewhere. This leads, in turn, via the base of the triangle and the process of induction, to the box in the lower left-hand corner labelled "Model" and the formation of a mental hypothesis or theory of some sort designed not only to correlate the data but to rationalize in some fashion the origin or "cause" of that correlation.

The plausibility or probability of the theoretical model is usually a function of both the amount of data used to support the initial induction and the model's ability to predict future behavior under similar circumstances. Indeed, this somewhat trivial predictive component is implicit in the initial induction (what is true today will be true tomorrow under comparable circumstances) and has been singled out by many past writers as the most distinctive feature of the scientific method. Thus, writing over 360 years ago, the 17th-century English philosopher, Thomas Hobbes (figure 2), gave the following definition of science (5):

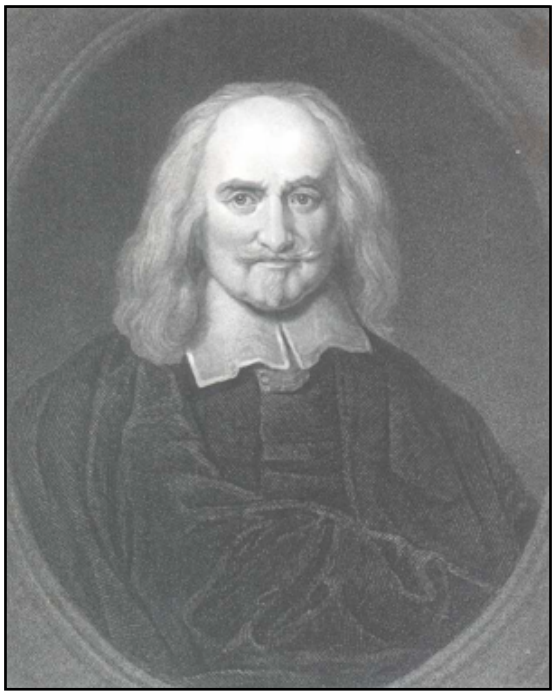


Figure 2. Thomas Hobbes (1588-1679).

And whereas sense and memory are but knowledge of fact, which is a thing past, and irrevocable; science is the knowledge of consequences, and the dependence of one fact upon another: by which, out of that we can presently do, we know how to do something else when we will, or the like, another time. Because when we see how anything comes about, upon what causes, and by what manner; when the like causes come into our power, we see how to make it produce the like effects.

Likewise, the German chemist, Wilhelm Ostwald (figure 3), writing 260 years later, said much the same thing (6):

The prophecy of future events based upon the knowledge of the details of recurring events is called science in its most general sense.

Figure 3. Wilhelm Ostwald (1853-1932).

However, truly scientific models are not only capable of making inductive predictions concerning future behavior under similar conditions or "when like causes come into our power," but also of making explicit deductive predictions concerning the results of as yet unreported experiments or observations under novel conditions, or the possible existence of previously unsuspected correlations with other apparently unrelated data sets. This deductive function forms the left-hand side of the triangle leading to the box at the apex labelled "Prediction," and this, in turn, leads, via the right-hand side of the triangle and the process of empirical verification, back to the initial "Data" box.

If the deductive prediction is verified, then the new experiments, observations, or previously uncorrelated data sets are added to the initial data set as yet further supporting evidence for the original induction. It should be noted, however, that not all of these verifications necessarily carry equal weight. In general, unusual predictions carry more weight than mundane predictions, quantitative predictions carry more weight than qualitative predictions, and quantitatively precise predictions carry more weight than quantitatively approximate predictions.

If, on the other hand, the deductive prediction is not verified, then a range of responses is also possible, depending on the circumstances. If, for example, there is a great deal of supporting evidence in the initial data set, or the model has repeatedly proven correct with respect to previous deductive predictions, then a single falsification may be temporarily ignored on the assumption that the falsifying experiment or observation is somehow defective. Only when there are repeated falsifications by independent investigators will the issue demand a rejection of the original model. Even then such falsifications may lead instead to a modification or refinement of the initial model rather than to an outright rejection. This was the case, for example, when the application of Newton's laws of motion to high velocity objects or to subatomic particles led to repeated falsifications and to the modifications known today as relativity theory and quantum mechanics, respectively, both of which give the original Newtonian model when applied to moderate velocities and everyday sized objects.

It is this continual tweaking or refinement of scientific theories and laws, which results from repeated passes through the triangle, that leads over time to ever more general and ever more powerful scientific laws and thus to ever better approximations of physical reality. Along with the inductive predictive component singled out by Hobbes and Ostwald, I would rate this corrective feedback refinement mechanism as one of the most distinctive features of the scientific method.

Before moving on to our discussions of Popper and Hume, I should warn you about the pitfalls of applying the classical model in an overly naive manner – something which has been repeatedly done by some modern philosophers of science in their attempts to discredit it as a prelude to peddling their own alternatives. If you examine various historical accounts of scientific discovery, you will often find that the original discoverer has failed to apply one or more of these steps. Here it is necessary to appreciate that science is a quintessentially social activity, and that many, many scientists may be involved in taking a model through its paces. In addition, this process may be spread over many years and even decades. The more times the model is put through the cycle, the more confident we are of its ultimate validity – a confidence level that was expressed by the classical sequence: "hypothesis" (induction stage only), "theory" (one or more cycles) and "law" (many cycles).

Not only may the initial discoverer fail to take his model through all the stages of the cycle, his initial induction may be subconscious and thus take the form of an apparent inspiration, a sudden flash of insight, or even of a dream. Examples from the history of chemistry include Kekulé's account of the origins of his famous benzene structure and Werner's account of the origins of coordination theory. Consciously or subconsciously, there is, however, no doubt that the initial stage is still one of induction. Indeed, as Bertrand Russell pointed out many years ago, most of the inductions

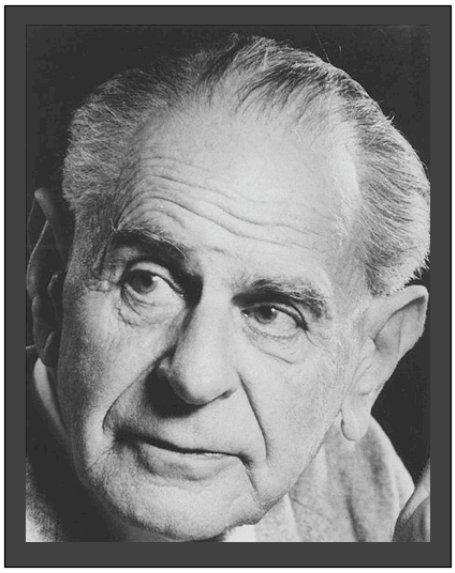


Figure 4. Karl Raimund Popper (1902-1994)

which we employ on a regular basis in our everyday lives are made at the subconscious level (7).

3. Karl Popper

This brings us, at last, to Karl Popper (figure 4) and the reasons why Stove feels that Popper's views on the nature of science have provided fertile ground for those seeking to undermine the classical rationalist account of the scientific method. Born in Vienna in 1902, Popper's fame as a philosopher of science rests on his first book, *Logik der Forschung* (literally "The Logic of Investigation"), published in 1934 and finally translated into English in 1959 under the title of *The Logic of Scientific Discovery*. Of Jewish descent, Popper was forced to leave Austria in 1937. He immigrated to New Zealand, where, during the war years, he lectured at Canterbury University College. In 1946 he moved to England, where he held positions at both the London School of Economics and the University of London. Though, by all accounts, an extreme egotist and a thoroughly disagreeable man, he nevertheless soon attained the status, particularly in England, of one of the 20th-century's most influential philosophers of science.

Among the criticisms of Popper raised by Stove and by Martin Gardner, who has made Popper the subject of at least one of his columns in *The Skeptical Inquirer Magazine,* is that much of what Popper has to say about science is nothing more than the classical model restated in terms of negations rather than affirmations and rephrased using Popper's own personal jargon. Thus, rather than talk about empirical verification, Popper insists on talking about empirical falsification, and instead of talking about the manner in which models become progressively better approximations of physical reality, he insists on talking about the progressive elimination of invalid models and the survival – using an explicit Darwinian metaphor – of only the "most fit" of the various competing models.

Stove attributes this "contrariness" to the *Zeitgeist* of post World-War I Vienna and the tendency of the intellectual *avant guard* during this period to turn all of the older classical values, whether in art, science, politics, or philosophy, on their heads and to aggressively assert the exact opposite. Indeed, Stove titled one of his later articles on Popper "Cole Porter and Karl Popper: The Jazz Age in the Philosophy of Science" because he felt that this tendency on Popper's part was a perfect illustration of the lyrics to Porter's popular song of the time "Anything Goes" – not because Popper was a philosophical nihilist, but because of the song's recurring theme of reversal: "And good is bad today," "Day is night today," etc. (3).

Gardner, on the other hand, feels that this tendency was rooted in Popper's personal jealousy of Rudolf Carnap, one of the leading lights of the Vienna School of Logical Positivism in the 1930s, and a personal hero of Gardner, and that it was this personal competitiveness that drove Popper to repeatedly assert the exact opposite of whatever Carnap happened to maintain (8-9).

However, I do not think it is fair to dismiss Popper's philosophy of science as a mere restatement of the classical model in terms of negations. There are good reasons for Popper's choice of his negative stance and these reasons are bound up in his rejection of the inductive base of our earlier process triangle. It is not that Popper denies that most scientific models are arrived at by a process of induction, but rather that he denies that there is a necessary correlation between the amount of data used to support an induction and the probability of its ultimate truth. No matter how large the initial data set, no matter how many times the model successfully survives the cycle of deductive prediction and empirical verification, there is, in his opinion, no logical basis for assuming its ultimate truth or for preferring it over alternative models having a smaller supporting inductive data set.

The fact that the sun has risen every morning for all of human history is no guarantee that it will rise tomorrow. Consequently we can never logically prove the truth of an inductive model, all we can do is eliminate defective models. Science is not the prediction of future events based on a knowledge of recurring past events and the assumptions of both uniformity in Nature and the existence of inflexible causal laws, as Hobbes and Ostwald thought, rather it is the elimination of error through empirical falsification. Our pro-

gress is measured not in terms of ever greater generalizations and approximations of physical reality but rather in terms of an ever greater confidence that we have eliminated more and more false leads. When it comes to induction, we cannot logically prove truth, we can only logically detect and eliminate error. Thus science is reduced to a series of "conjectures and refutations," as Popper was later fond of saying.

So in what sense is Popper's point of view irrational, as maintained by Stove? The answer, in a nut shell, is that Popper's rejection of induction and the accompanying concepts of accumulative evidence and probability, is ultimately equivalent to the assertion that "we can learn nothing from experience." Much of the rest of Stove's critique is consumed in unravelling how Popper managed to make such an irrational assertion acceptable to both his readers and himself through obfuscation and the abuse of language, and I will not further bore you with the details.

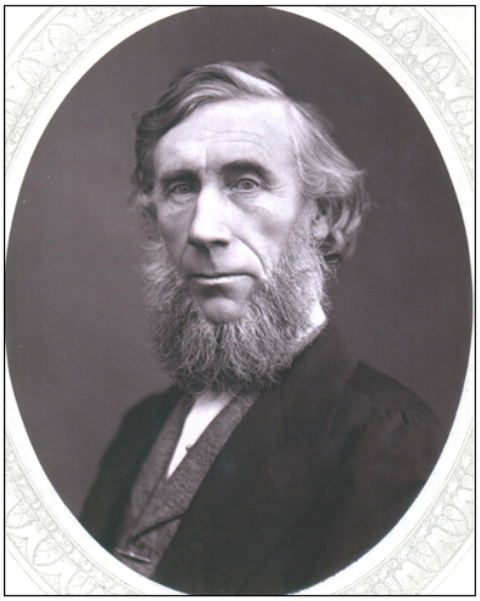


Figure 5. John Tyndall (1820-1893)

Of far greater interest is how this rejection of inductive evidence soon led to far more explicit irrationalist calms about the nature of science – consequences which, interestingly enough, were anticipated more than a 140 years ago by the Irish physicist, John Tyndall (figure 5), in a popular essay recounting his experiences in investigating the claims of various mediums and spiritualists (10):

When science appeals to uniform experience, the spiritualist will retort, "How do you know that uniform experience will continue uniform? You tell me the sun has risen for six thousand years: that is no proof it will rise tomorrow; within the next twelve hours it may be puffed out by the Almighty." Taking this ground, a man may maintain the story of "Jack and the Beanstock" in the face of all the science in the world.

Figure 6. Imré Lakatos (1922-1974)

In Stove's opinion, just such a "Jack and the Beanstock" scenario was eventually played out in the writings of the other three members of Stove's irrationalist quartet: the 20th-century philosophers of science Imré Lakatos (figure 5), Thomas Kuhn (figure 6), and especially Paul Feyerabend (figure 7). Lakatos, who was an

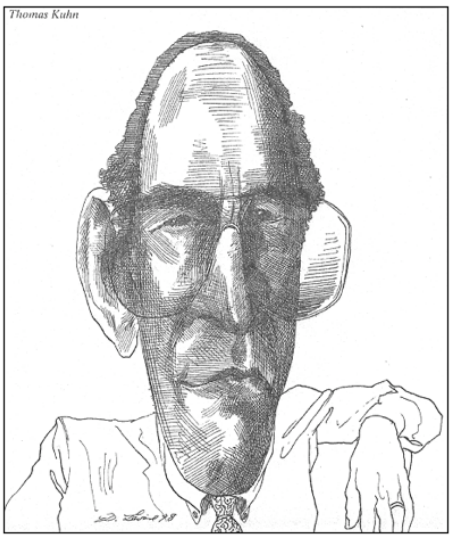


Figure 7. Thomas Kuhn (1922-1996)

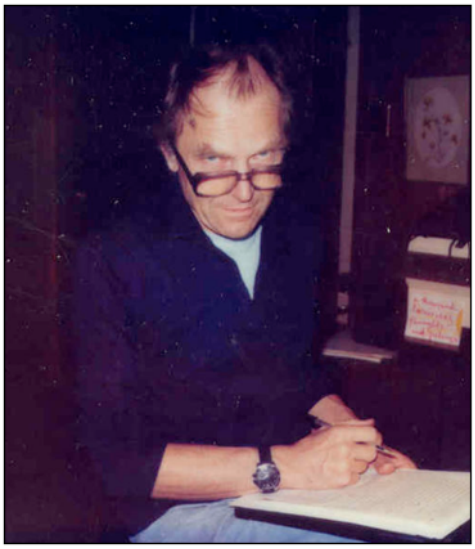


Figure 8. Paul Feyerabend (1924-1994)

associate of Popper at the London School of Economics, proposed that what was ultimately falsified in science is not individual models and theories, but rather entire research schools or programs, and much the same idea is present in Kuhn, though he preferred to talk of scientific paradigms instead. Implicit in these views was the assumption that there is no universal scientific methodology operative over time, classical or otherwise, but rather only socially constructed criteria that vary from one research school to another or from one paradigm to another. In other words, what changes with time is not just the scientific models but the very definition of what counts as legitimate scientific knowledge.

But if Lakatos and Kuhn were only tentatively nibbling around the edges of radical relativism, it was Feyerabend who took a full and unambiguous plunge into its very depths by literally taking the title of Cole Porter's song "Anything Goes" to heart and advocating a totally nihilist methodology in which such pseudosciences as astrology, folk medicine, voodoo, and witchcraft were accorded equal status with legitimate science (11). Needless to say, Feyerabend's role as the "epistemological antichrist," soon made him the darling of those intellectuals who were disaffected from the scientific establishment and who regrettably include many of the nonscience faculty at our colleges and universities (12).

Popper, who was a firm believer in the existence of an objective, external, physical reality and whose falsification criterion was in many ways specifically crafted to sort science from pseudoscience, was violently opposed to these developments and yet, to the end, he remained curiously blind as to the role which his own denial of the importance of inductive evidence had played in their development.

4. David Hume

What is the origin of Popper's particular dislike of induction? There is no need to speculate on this question, since, as Stove points out, Popper repeatedly stated that his critique of induction was based on the writings of the 18th-century Scottish philosopher, David Hume (figures 9 and 10), and indeed, Hume had been the subject of Popper's doctoral thesis at the University of Vienna.

Born in Edinburgh in 1711, Hume published his famous *Treatise on Human Understanding* in 1739, at age 28. Since, in his own words, this book "fell deadborn from the press," in 1748 he published a shorter and more readable reworking of parts of the original book under the title of *An Enquiry Concerning Human Understanding*. Since Hume regarded this later work as an improved presentation of his final views on various philosophical subjects, I will take it as my source for the following comments.

Though the first significant statement of the "problem of induction," which Popper sought to solve (or rather to side-step) using his falsification criterion, is usually credited to Hume, it is interesting to note that Hume himself never uses the terms deduction and induction. Rather he refers to the first as "demonstrative"

Figure 9. David Hume (1711-1776)

Figure 10. A caricature of Hume by David Smith

reasoning and to the second as "moral" or "probable" reasoning. Demonstrative reasoning involves logical necessity and is characteristic of mathematics. Given the premises, the conclusions are certain, because any alternative conclusion is, in light of the initial premises, inconceivable. Given that a = b, and that c = b, it necessarily follows that a = c. The alternative conclusion, that a ≠ c, is irrational. In sharp contrast, with probable reasoning the alternative conclusion is always conceivable, though not necessarily of equal probability. Thus the induction that the sun has always risen in the past implies that it will also rise tomorrow, though highly probable, doesn't preclude the logical possibility that it will, for some unexpected reason, not rise tomorrow.

Hume's maxim that extraordinary claims demand extraordinary evidence, which appears in his comments on the nature of miracles, is, of course, in direct contradiction to the view that the frequency with which an event has occurred in the past has no bearing on the probability of its future occurrence, since it amounts to the claim that miracles lack just this sort of supporting evidence. The Bible's claim that Joshua made the sun stand still is in direct contradiction to the accumulated evidence of history that it has never done so in the past and therefore requires more supporting evidence than just this single claim that it once did otherwise.

This is not the only contradiction found in Hume's writings. As Hume's 19th century editor, L. A. Selby-Bigge observed (13):

Hume's philosophic writings are to be read with great caution ... he says so many different things in so many different ways and different connections, and with so much indifference to what he has said before, that it is very difficult to say positively that he taught, or did not teach, this or that particular doctrine ... This makes it easy to find all philosophies in Hume, or, by setting up one statement against another, none at all.

In actual fact Hume was fully aware that inductive or probable reasoning forms the basis of virtually all of our daily behavior as well as that of other animals and is the source of all of our knowledge of the surrounding world. His point was not that this sort of reasoning was invalid and should be rejected but simply that it could never be logically conclusive. Indeed, he even suggested that the mental process of induction was an innate part of our biological programming and was, in a sense, a sort of inborn instinct – a point of view also adopted by Ostwald and hinted at by Bertrand Russell.

5. The Metaphysical Foundations of Science

But why, if induction is logically inconclusive, does it work so well in science? The answer lies in what I would call the two fundamental metaphysical assumptions of modern science, both of which have been tangentially hinted at earlier in this lecture:

1. There is an objective physical reality which exists independently of human beings, and it is the job of science to describe that physical reality as accurately as possible.

2. Nature is not random, but is governed by invariant physical laws and it is the job of science to discover these laws.

I use the term "nonrandom" in the second assumption, not in the sense of denying the role played by random collisions at the molecular level, or the role of chance in such long-range processes as evolution, but rather in the sense that Nature does not randomly decide when to obey and when to ignore the laws of thermodynamics, electromagnetism, relativity theory or quantum mechanics. Likewise, I continue to use the term "physical laws," though there are some who object to this traditional term on semantic grounds because of its unavoidable anthropomorphic overtones.

The point is that scientists do not view their inductive models as random guesses or "conjectures," to use Popper's favorite term, about an unknown chaos of

experience, but rather as stages in the progressive uncovering of a set of pre-existing and interconnected rules and regularities. As an 1818 textbook of logic phrased it over 190 years ago (14):
Induction is founded on the belief that the course of nature is governed by uniform laws and that things will happen in the future as we have observed them happen in time past. We can have no proof of a permanent connexion between any two events or between any two qualities of either body or mind. The only reason for supposing such a connection in any instance is that we have invariably found certain things to have been conjoined in fact; and this experience, in many cases, produces a conviction equal to that of demonstration.

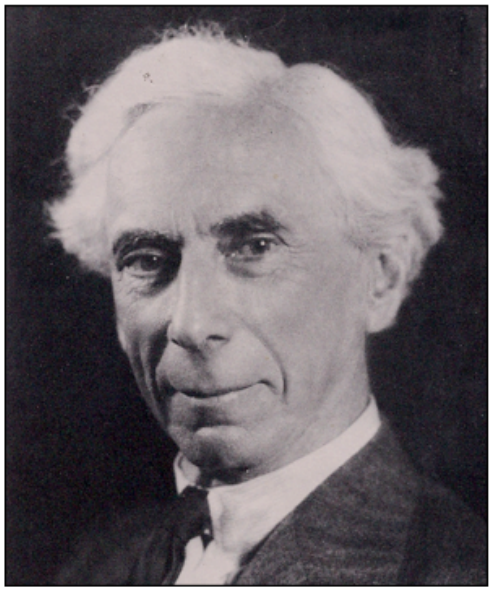
Indeed so confident are scientists of these metaphysical assumptions, that many are willing to entertain serious discussions on such subjects as the "inevitability" of scientific discovery, as reflected in the following passing comment by the sociologist of science, Derek de Solla Price (15):

If Michelangelo or Beethoven had not existed, their works would have been replaced by quite different contributions. If Copernicus or Fermi had never existed, essentially the same contributions would have had to come from other people. There is, in fact, only one world to discover ...

Though the assumptions of an external objective physical reality governed by invariant physical laws form the initial premises which underlie all inductive scientific reasoning and explain why scientists have faith that induction works, they, of course, do not negate Hume's original point that induction can never be logically conclusive. However, I think most scientists would feel that this failing, while a possible problem for the discipline of logic, is ultimately a trivial one and of little concern to science, which must work with things as they are and must ultimately justify its assumptions by their ultimate success. As John Kenyon has noted:

Reason might manage to raise a doubt about the truth of a conclusion of natural inductive inference just for a moment in the study, but the forces of nature will soon overcome that artificial skepticism, and the sheer agreeableness of animal faith will protect us from excessive caution and sterile suspension of belief.

Many a ponderous tome has been written since Hume, by both philosophers and scientists, on the so-called problem of induction, but in the end I feel that the long-forgotten author of that 1818 logic textbook, quoted earlier, probably said about all that was worth saying on the subject. As Bertrand Russell succinctly summarized the situation in 1945 (16):



Bertrand Russell (1872-1970)

The principle [of induction] itself cannot, of course, without circularity, be inferred from observed uniformities, since it is required to justify any such inference. It must, therefore, be inferred from an independent principle not based upon experience. But if this one principle is admitted, everything else can proceed in accordance with the theory that all our knowledge is based on experience ... What these arguments prove – and I do not think the proof can be controverted – is that induction is an independent logical principle, incapable of being inferred either from experience or from other logical principles, and that without this principle science is impossible.

Whereas Russell felt that this independent principle would be one of logic, I feel that it is based on the second of our two metaphysical assumptions – namely that Nature is governed by invariant physical laws – and that this is just another example of the fact that all forms of human reasoning – whether deductive or inductive – must ultimately begin with some sort of initial assumption.

6. Conclusion

The fact that Popper approached his subject from the standpoint of a logician rather than from that of the sciences which he and his successors purported to de-

scribe, says a great deal about their final results and is an excellent example of a pithy observation made almost 90 years ago by the brilliant science journalist J. W. N. Sullivan (15):

The well-meant and industrious efforts of professional metaphysicians to explain to men of science in what sense science is true, in what sense it has meaning, and in what its value really consists, practically all suffer from the defect that men of science do not recognize the subject of investigation to be science at all. It is almost true to say that the professional philosopher is only convincing when he is talking about the Absolute, for that is a subject with which nobody else is concerned; but when he devotes his attention to subjects with which other people are familiar, it often becomes possible to put the book down before finishing it. Thus treatises on aesthetics are usually convincing to everybody but poets, painters, and musicians ... If a poet cannot recognize what they call poetry as being the subject of the discussion, then, as a discussion of poetry, that discussion is worthless. Practitioners, whether artists or men of science, seldom have the inclination to dissect what is to them an instinctive and delightful process; but it is quite easy for them to see (or, rather, to feel) that a suggested explanation is unsatisfactory, although they may find it wholly impossible to give reasons for their dissatisfaction.

While it is true that many scientists find aspects of both Popper and Kuhn to be reasonable descriptions of science, as they know it, I suspect this is because they fail to take the totality of what is being said into account and are selectively quoting fragments. In the case of Popper, I suspect that they are merely responding to what appears to them to be a novel rewording in negative terms of aspects of the classical model of the scientific method, whereas in the case of Kuhn they are responding to the sociological aspects of his writing, rather than to his advocacy of relativism. As with so many things in life, the ultimate lesson is that you should always be careful whom you quote.

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XIV

Auguste Comte and the Religion of Humanity

1. Introduction

Beginning in the late 1970s, the religious right, as it began to lose more and more ground in its attempts to oppose the teaching of such subjects as evolution and sex education in American schools, the banning of school prayers, the gradual repeal of blue laws, and the progressive legalization of abortion and homosexuality, began to rely more and more on the argument that all of these trends were part of a larger plot by the Supreme Court and the American legal system to impose the values of secular humanism on the population and schools of the United States. Secular humanism, they argued, was a religion like Christianity, and to legally impose the values of this religion, while simultaneously banning those of Christianity, was both blatantly unfair and a violation of the separation of church and state.

The only just resolution of this conflict was to give Christian values equal billing in our schools and laws or, better still, to once more return completely to the values of Protestant Christianity, which most fundamentalists erroneously believed to be the official state religion endorsed by the founding fathers. Entire books devoted to this argument, such as Homer Duncan's *Secular Humanism: The Most Dangerous Religion in America* (2) and Tim LaHaye's *The Battle for the Mind* (3), soon made an appearance, and eventually even the law journals became involved (4). Though much of the initial hubbub has since died down, this argument has not gone away and periodically makes a return appearance.

It should come as no surprise that various humanists writers and humanist organizations were quick to respond to this argument, all of them vehemently denying the claim that secular humanism was a religion, let alone the center of a massive legal plot to impose its beliefs on the American people. Many of these counterarguments were summarized in Paul Kurtz's 1983 book, *In Defense of Secular Humanism* (5), and obviously center around the issue of how to properly define what is or is not a religion. Though we will return to this definition problem once more near the end of this evening's lecture, I wish to spent most of our time together telling you about an episode now largely, if not conveniently, forgotten by modern humanists – namely a time in the 19th century when a French philosopher by the name of Auguste Comte attempted, in direct contradiction of our modern views, to explicitly give secular humanism all of the trappings of an organized religion, which he called the "Religion of Humanity."

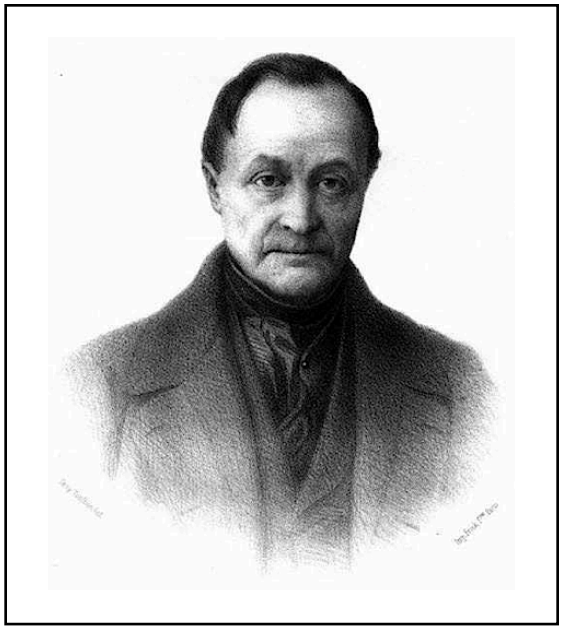

Figure 1. Auguste Comte (1798-1857).

2. The Life of Comte

Auguste Comte (figure 1), or rather Isidore Auguste Marie François Xavier Comte, to use his full name, was born on 19 January 1798 in Montpellier (6). He began his advanced education at the famed École Polytechnique in Paris (figure 2), where he studied mathematics and engineering. However, he and the entire student body were expelled in 1816 for political activism and the school temporarily closed in order to cleanse it of radicalism. Returning to Montpellier, Comte attempted to finish his education at the local medical school but soon found that the values of republicanism and progress that he had so eagerly embraced while at the École had created an unbridgeable gulf between himself and his conservative family, who were both devout Catholics and monarchists.

Thus in 1817 Comte once again moved to Paris, where he began an association with the French social reformer, Henri de Sainte-Simon (figure 3), that would last until 1824, when the two parted ways, due once

Figure 2. The original entrance to the École polytechnique in Paris as it appeared in the late 19th century.

more, as with the earlier case of Comte's family, to "irreconcilable differences." Whatever these might have been, there is no doubt that their seven year association – during which Comte acted as both student and secretary to Sainte-Simon – exerted a strong influence on Comte's thinking and a debate still rages among Comtean scholars over how many of Comte's later ideas were in fact derived from Sainte-Simon.

However, it is of interest to note that as early as 1822 Comte appears to have had a philosophical epiphany concerning the hierarchical structure and historical interrelationships of the various branches of science and how they could potentially culminate in a new science of society for which he would eventually coin the word "sociology." This he summarized in a lengthy essay entitled "Plan of the Scientific Operations Necessary for Reorganizing Society"(7).

Once the break with Sainte-Simon was complete, Comte began the arduous task of fleshing out his "Plan." He began by giving a series of public lectures in his home on his new "positive philosophy," as he now called it. Greatly expanded versions of these lectures began to appear in book form in 1830 under the title of *Cours de la philosophie positive* and would require a total of six thick volumes before publication was finally completed in 1842 (8). This work is considered to be Comte's most important and forms the basis of most of his current reputation.

During the 18-year period required to complete this work, Comte lived in strained economic circumstances, supporting himself by working as a tutor in mathematics at the École polytechnique and later as an entrance examiner. Occasional donations from admirers of his philosophy also helped out from time to time. It was during this period that Comte began to exhibit signs of emotional instability. In 1826 he had a mental breakdown and was hospitalized for eight months, followed the next year by an unsuccessful attempt at suicide. In 1825 he entered into an unhappy marriage with a woman named Caroline Massin and in later years he would claim that the emotional stress of this relationship was largely responsible for prolonging the completion of his six-volume masterpiece. In any case, the couple would finally divorce in 1842, the same year that the publication of the six-volume *Cour* was completed.

In 1843 Comte published a textbook on analytical geometry (9) and in 1844 another on astronomy (10). That same year he lost his appointment as an examiner at the École and from this point on was largely supported by a subscription fund established for his benefit by the English philosopher John Stuart Mill – a source of income that would become even more crucial after Comte further lost his position as a tutor at the École in 1851. Even more crucial for his later philosophical development was his encounter in 1844 with a married woman and devout Catholic by the name of Clotilde de Vaux (figure 4), who had been deserted by her husband. This meeting would result, on the part of Comte at least, in a passionate – albeit totally Platonic – love affair that would terminate two years later with de Vaux's premature death in 1846 of tuberculosis at age 31.

With de Vaux's death, Comte embarked upon the second phase of his philosophical development – a phase so radically different from his earlier work that many of his devoted followers were appalled – some even going so far as to hint that he was suffering from early senility or, at the very least, from delusions of grandeur. In 1848 he founded the *Société positiviste* devoted to propagating his philosophy and in 1849 he

Figure 3. Henri de Sainte-Simon (1760-1825).

Figure 4. Clotilde de Vaux (1815-1846)

announced the formation of a new religion based on positivism, commonly known as the "Religion of Humanity," with himself as high priest and overseer. During this same period he published numerous books and booklets relating to the rationale and rituals of his new religion, the most important of which were his *Système de politique positive*, which appeared in four volumes between 1851 and 1854 (11), his *Catéchisme positiviste* of 1852 (12), and his *Synthèse subjective* of 1856 (13), which was still incomplete at the time of his death on 5 September 1857 at age 59 (figure 5).

Figure 5. A commemorative statue (complete with a live pigeon) dedicated to Comte which stands in the *Place de la Sorbonne* in Paris. The figure to the left represents Clotilde de Vaux as the modern "Madonna" of the Religion of Humanity and the figure on the right represents the common man being instructed in the truths of positivism.

3. Phase One: The Positive Philosophy

Before entering into the details and rationale of his new religion it is necessary to take a closer look at the earlier nonreligious phase of Comte's work as detailed in his *Cours de la philosophie positive* of 1830-1842. This was based on two central ideas. The first of these was an hierarchical classification of the known sciences (figure 6), beginning with mathematics at the base and passing successively through astronomy, physics, chemistry, and biology, until it culminated in sociology at the top. As one ascended this hierarchy, the phenomena being studied became increasingly complex and the resulting laws less and less general. Each science was dependent to some extent on the more fundamental sciences lying below it on the hierarchy but independent of those lying above it.

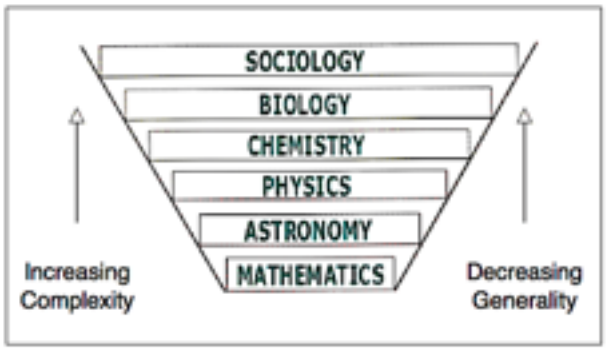

Figure 6. Comte's hierarchical classification of the known sciences.

The first thing that strikes the modern reader is that certain sciences, such as geology and psychology, are not found in this classification. This is because Comte either considered them to be totally dependent on these more basic sciences or as mere specialized subdivisions of these sciences. Thus geology was dismissed as chemistry and physics applied to the study of the earth, and psychology as a subdivision of the more general science of biology or physiology, as Comte preferred to call it.

	Theological	Metaphysical	Positive
Mathematics			x
Astronomy			x
Physics		x	x
Chemistry		x	
Biology	x	x	
Sociology	x		

Figure 7. A summary of Comte's evaluation of the historical development of each of the six sciences in his hierarchy.

The second central idea of Comte's thought was his so-called "law of three stages" which asserted that all of the above sciences, or indeed all of human thought, exhibited three stages in the course of its historical evolution, which he labelled as the fictitious or theological stage, the abstract or metaphysical stage, and the scientific or positive stage. In the most primitive or theological stage causality was attributed to the intervention of the supernatural, beginning with primitive fetishism or animism and evolving through various stages of polytheism to monotheism. In the metaphysical stage these supernatural causes were divested of their anthropomorphism and were instead abstracted as inherent powers, forces, or affinities working towards predetermined or teleological ends. Comte viewed the metaphysical stage as transitional in nature and as helping to smooth the path for the acceptance of the final or positive stage during which the search for ultimate causes was finally abandoned as being futile.

Comte's use of the word positive to describe the final stage of conceptual development strikes most American readers as an odd use of this word until it is understood that Comte is employing it as a synonym for "certain" or "true" and thus to describe knowledge that has been divested of all theological and metaphysical speculation and which is therefore reliable or dependable. Such knowledge, in his opinion, is obtainable only through scientific observation and experimentation and relates only to the discovery of empirical laws that describe and predict the interdependence of various observable phenomena. In other words, it refers to scientific laws that have been shorn of all speculation concerning hypothetical hidden and/or final causes and which deal therefore only with the question of "how" rather than the question of "why."

Comte was well aware that not all of the sciences in his hierarchy had yet achieved the final positivistic stage of development in their historical evolution and much of his multi-volume *Cours* was consumed in trying to evaluate the current stage of development for each of them as of the year 1830 (figure 7). In particular, he felt that sociology was still stuck at the most primitive level and it was his dream to map out a path of development that would allow it to finally achieve the status of a truly positive science.

Much of what Comte had to say concerning the history and philosophy of science has now become so commonplace that the modern reader has trouble appreciating just how novel and exciting it was to his contemporaries. Based on this achievement, many current historians feel that Comte should be considered not only as the founding father of sociology but as a founding father of philosophy of science as well.

4. Comte's English Disciples

Interestingly the first country to embrace the early phase of Comte's positivism was not France but rather England. This was largely due to the efforts of an authoress by the name of Harriet Martineau (figure 8), who in 1853 published a 838-page translation and condensation of Comte's six-volume *Cours* entitled *The Positive Philosophy of Auguste Comte* (14). That same year the British philosopher and critic, George Henry Lewes (figure 9), published a more manageable 345-page critical summary of the *Cours* under the title of *Comte's Philosophy of the Sciences* (15). Lewes had also given Comte's work a favorable notice in his earlier 1846 *Biographical History of Philosophy,* where it was presented as the crowning achievement of modern

Figure 8. Harriet Martineau (1802-1876).

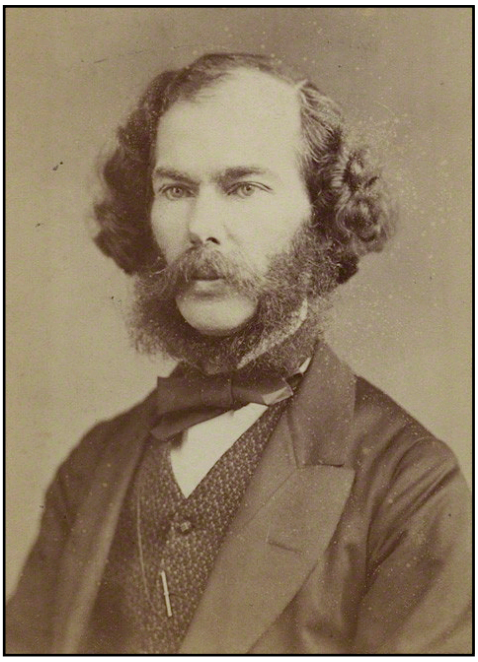

Figure 9. George Henry Lewes (1817-1878).

philosophical thought (16). All of these books remained in print for the remainder of the 19th century and are still available as photo reproductions. Lewes, by the way, is perhaps best known today as the paramour of the English novelist George Eliot (Mary Ann Evans).

However, the most significant of Comte's British admirers was, without a doubt, the English philosopher John Stuart Mill (figure 10). Mill had begun corresponding with Comte as early as 1841 and, as we have seen, was instrumental in establishing a subscription fund for his support after Comte lost his position as an examiner at the École in 1844. It has been further claimed that Comte's views on the nature of science strongly influenced the writing of Mill's 1843 treatise on logic (17).

In 1865 Mill published a small volume on Comte and his philosophy based on a series of articles written for the *Westminster Review* in 1861 and 1865 under the title of *Auguste Comte and Positivism* (18). Whereas in 1853 Martineau and Lewes were either unaware of the second or mystical phase of Comte's philosophy or purposely chose to ignore it, writing nearly a decade later Mill could not and included a separate section, occupying nearly a third of his book, entitled the "Later Speculations of Auguste Comte." Here he made it clear that he was not only appalled by the second phase of Comte's career, but also apologetic, as is apparent from his concluding remarks upon completing his outline of Comte's new "Religion of Humanity" (18):

Others may laugh, but we could far rather weep at this melancholy decadence of a great intellect. M. Comte used to reproach his early English admirers for maintaining a "conspiracy of silence" concerning his later performance. The reader can now judge whether such reticence is not more than sufficiently explained by tenderness for his fame, and a conscientious fear of bringing undeserved discredit on the noble speculations of his earlier career.

5. Phase Two: The Religion of Humanity

So what was it that so embarrassed Mill? Though obviously influenced by various personal events in his emotionally chaotic life, such as his estrangement from his family, his failed marriage, and his obsession with Clotilde de Vaux, Comte himself felt that this final phase of his career was simply the logical culmination of the scheme he had outlined in his initial essay of 1822 – namely the establishment of a new science of society based on positivistic rather than theological principles.

In his later books he proceeded to outline a system of positive morality that was to determine everything from the nature of government and politics, to the role of art and industry in society, down to the nature of marriage and how children should be educated. The central principle of this morality was *altruism* – a word of Comte's own coinage. The moral worth of a person was measured by their willingness to live for mankind

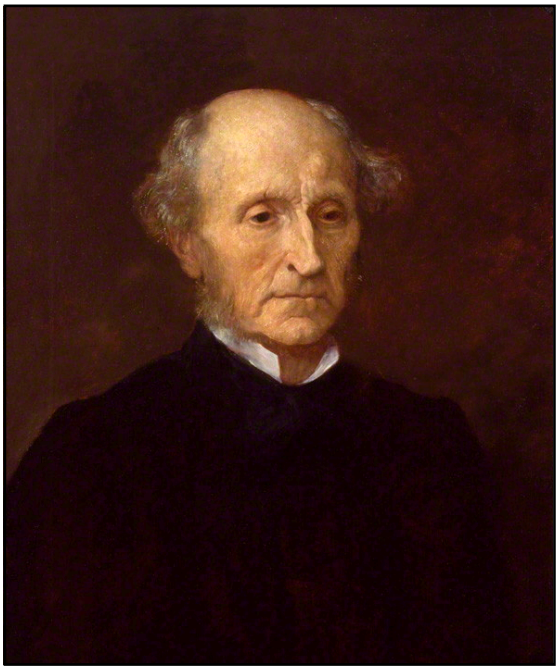

Figure 10. John Stuart Mill (1806-1873).

and serve others by suppressing their own egotism or individuality, and all other aspects of society were to be directed toward reenforcing this behavior, including religion. Since Comte was an atheist and also did not believe in either spirits or in life after death, his religion was devoted, not to the worship of a supernatural God or to the saving of human souls, but rather to the worship of mankind in the abstract – whence the name "Religion of Humanity."

However, when it came to formulating the rituals of his new religion, Comte displayed a singular lack of originality and instead chose to slavishly imitate those of the Catholicism of his youth. Thus, as high priest of the new cult, Comte took the place of the Pope; Paris took the place of Rome; mankind, the earth, and space itself, known respectively as the *Grand-Etre*, the *Grand Fétish*, and the *Grand Milieu*, took the place of the holy trinity; adoration of women, as personified by Clotilde de Vaux, took the place of the cult of the Madonna; the great scientists, philosophers and writers who had done so much to enrich mankind took the place of the saints, etc.

Comte also proscribed rituals to sanctify the significant milestones of a convert's life. These were labelled as *Introduction* (nomination and sponsorship for membership), *Admission* (completion of positivist indoctrination), *Destination* (choice of life career), *Marriage*, *Retirement* (at age 63), *Separation* (or death), and, for a select few, *Incorporation* (absorption into history). This latter ritual was the secular equivalent of conferring immortality in the sense that the person in question was now to be remembered forever in the collective memory of mankind. In addition, Comte proposed a reform of the calendar. There were to be 13 months of 28 days each with both the months and days named in honor of famous benefactors of the human race.

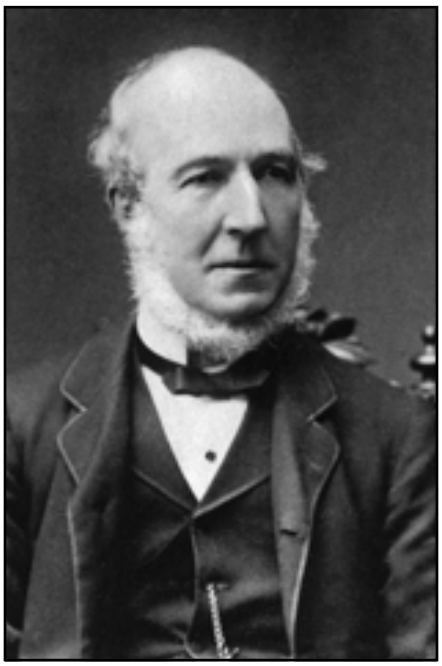

Figure 11. Richard Congreve (1818-1899).

Unhappily Comte's utopian fantasies did not end here. He also proscribed a list of 150 great books that every positivist should read and even went so far as to suggest that all other books should be destroyed since they had contributed nothing of significance to mankind (19). He further proposed that all science not directly aimed at serving the practical needs of man should be suppressed, suggested a reformed method of writing that required all sentences to contain the same number of words and, in his final, unfinished work, which supposedly dealt with the philosophy of mathematics, even descended into the mire of numerical mysticism.

No wonder Mill was appalled by this flawed vision of what he felt to be a form of ruthless secular theocracy intent on suppressing all individualism in the name of mankind, order and unity. Indeed, it has been suggested that Mill's famous 1859 essay, *On Liberty*, was intended as a response to Comte's dystopian fantasy (20, 21). The English biologist, Thomas Huxley, on the other hand, was far more succinct, dismissing Comte's religion in 1868 as "Catholicism minus Christianity," whereas the American historian, George Bancroft, would characterize it as early as 1854 as nothing more than the "Catholic Church of the Materialist" (22, 23).

6. The Spread of the Religion of Humanity

Not everyone was as repulsed as Mill, Huxley and Bancroft by Comte's secular religion. In England it was soon embraced by a medical doctor by the name of Richard Congreve (figure 11), who in 1858 published an English translation of Comte's *Catechism of Positive Religion* (24). Indeed, by the end of the century, all of Comte's later works would appear in English translation (25-27). In 1867 Congreve founded the *London Positivist Society* and in 1878 he split from this organization in order to found his own *Comtist Church of Humanity,* with branches in several other English cities. Though few of Congreve's positivist congregations survived the First World War, the original London society remained operative until 1974, following its merger with the *English Positivist Committee* in 1934.

Similar positivist chapels or temples of humanity were established in France, though apparently the only one to survive is now located in the former Parisian apartment of Clotilde de Vaux in the Rue Payenne (fig-

Figure 12. The positivist chapel located in the former Parisian apartment of Clotilde de Vaux in the Rue Payenne.

ure 12). Comte's own Parisian apartment in the Rue de Monsieur-le-Prince has also been restored and is now a museum open to the public.

Rather unexpectedly, the Religion of Humanity had its greatest success in Brazil, where at one time positivists held sufficient political power to influence the design of that country's flag (figure 13), which bears the Comtean slogan "Order and Progress" In fact, an active Comtean chapel may still be seen in the Brazilian city of Porto Alegre (figure 14). It was, by the way, the Brazilian government that paid for the restoration of Comte's apartment in Paris.

Figure 13. The national flag of Brazil with its positivist slogan "Order and Progress."

7. Comte's Religious Critics

The rise and fall of Comte's influence in the United States, and especially the response of the 19th-century American religious community, has been documented in great detail by the Bernards in their massive 1965 history of American sociology (28). These authors feel that the rise of positivism represents the first significant confrontation between science and religion since the 17th century. By the 18th century, they argue, science and religion had reached a tacit compromise. The proper roll of science was to provide religion with edifying proofs of God's wisdom in creating the universe – an approach that became known as "natural theology" or "argument from design." However, all issues dealing with questions of ultimate meaning and with the nature of human behavior and morality were to remain under the jurisdiction of religion alone.

Figure 14. The positivist chapel in Porto Alegre Brazil.

Comte violated all of these tacit agreements by his assertion that the positive or scientific method, rather than theological authority, was the only true source of knowledge, by his declaration that questions of "why" were illegitimate and ultimately unanswerable, and by his attempt to construct a positivistic basis for both human society and morality. In short, positivism was based on the assertion that science, rather than religion, was to be the ultimate authority of the future.

Most religious writers were quick to recognize the threat to religious authority that positivism represented and were also quick to label it as a form of creeping materialism and atheism. This was especially true of those Protestant sects, such as the Presbyterians, that had developed a significant reliance on the use of natural theology, rather than blind faith, to prove the truths of religion. Thus the eminent Scottish-American philosopher and President of Princeton, James McCosh

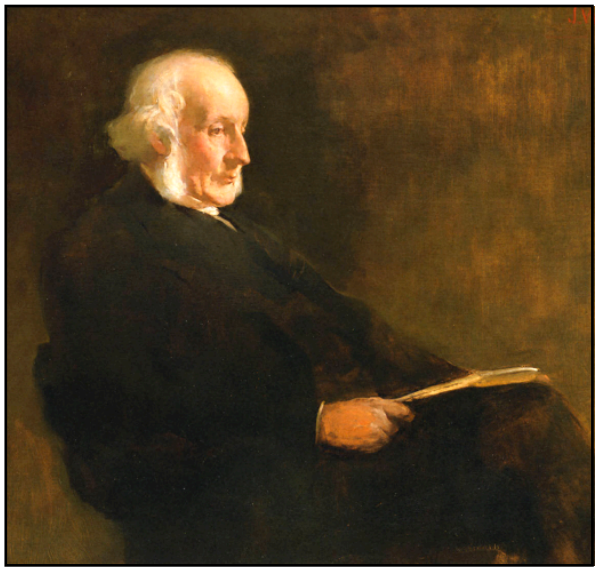

Figure 15. James McCosh (1811-1894).

(figure 15), would publish an entire book in 1871 defending natural theology against positivism under the wordy title of *Christianity and Positivism: A Series of Lectures to the Times on Natural Theology and Apologetics* (29).

As for the specific response to Comte's Religion of Humanity itself, the Barnards have the following to say (28):

Although Comte had produced a Catholic sect of very superior character, based on his positivist philosophy, on the one hand, and on Catholic ritual and hierarchical organization, on the other hand, and although it made a strong appeal to the more enlightened Catholic, as it did to the more scientifically minded Protestants, in the end both rejected his Religion of Humanity – the Protestants and free thinkers because of the Roman ritual and hierarchy, and the Catholics because of the replacement of theology and mysticism by positivist science. As a consequence only the positivist philosophy has survived, although Catholics respected his religion because of its ritualistic and formal emphasis, and the Unitarians and other liberal groups because it rejected magic and supernaturalism and placed the emphasis upon human social relations.

8. Life Philosophy or Religion?

It is now time to once again return to our initial question: what is a religion and does modern secular humanism, or indeed even Comte's religion of humanity, qualify as a true religion? Historians of religion have long known that such issues as immortality, morality, explanations of the origins of things, the use of formal rituals and priests, etc. are not universal attributes of religious belief, whereas belief in supernatural or anthropomorphic causality is (30). In polytheism this causality is attributed to a wide variety of spirits and gods specific to certain classes of phenomena. In monotheism it is attributed to a single spiritual being. Thus monotheism is, so to speak, the unified field theory of anthropomorphic causality, as Comte had intuited early in his career.

Given their explicit rejection of anthropomorphic causality, both modern humanism and Comte's religion of humanity – despite its complex pseudo-religious trappings – fail, in my opinion, to qualify as true religions. Rather they are best thought of as life philosophies, as are the various religions themselves. In other words, humanism is not just another religion, as members of the religious right maintain, rather religion is just another life philosophy. Humanism and secularism are the collective terms reserved for life philosophies based on naturalistic sources of evidence and rational methods of verification, whereas religion is the collective term reserved for life philosophies based on supernatural sources of evidence and irrational methods of verification, such as mystical visions, conversion experiences, faith, personal testimony, and superstition in general.

In principle, one cannot debate supernatural sanctions, one can only acquiesce or coerce, as history amply demonstrates. This is why democracy, and the public debate and discourse on which it is predicated, must be based on secular rather than religious sanctions. Religion and science are ultimately incompatible as they involve radically different assumptions concerning the origins and verification of knowledge. In a democracy we believe in rule by law, be it natural or legislative, not in rule by revelation.

The fact that humanists accept the findings of modern science as part of their life philosophy does not mean that all science is therefore humanist religious propaganda. Most fundamentalists support the teaching of reading and writing in our schools. Yet no one would be so foolish as to suggest that these subjects are therefore a form of hidden religious propaganda for the religious right. The same logical fallacy should be attributed to those who mistakenly believe that, because humanists support the teaching of evolution in our schools, this subject must therefore automatically be considered as a form of religious propaganda for secular humanism.

9. References and Notes

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... the completest system of spiritual and temporal despotism which ever yet emanated from the human brain, unless possibly that of Ignatius Loyola: a system by which the yoke of general opinion, wielded by an organized body of spiritual teachers and rulers, would be made supreme over every action, and as far as in human possibility, over every thought, of every member of the community, as well in the things which regard only himself, as in those which concern the interests of others ... The book stands as a monumental warning to thinkers on society and politics of what happens when once men lose sight in their speculations of the value of Liberty and Individuality.

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