GUSTAVUS ADOLPHUS COLLEGE

# REVOLUTION, REFORMATION AND PREDICTION: KUHN APPLIED TO MODERN ISSUES IN SCIENCE AND RELIGION

SENIOR THESIS
DEPARTMENT OF RELIGION

BY
TIMOTHY R. ANDEEN, JR.

SAINT PETER, MINNESOTA
MAY 2001

## Introduction

Change is one of the few certainties of life; no aspect of existence remains static. The universe grows and evolves, people learn and discover. All around us is change. Some change is very gradual, almost imperceptible, such as the wind wearing down a tall and jagged mountain until it because nothing more than a rolling hill. Some change is rapid and violent, such as landslide immediately altering the shape of a peak. Both types of change are connected: the erosion may occur in its usual slowness until a key grain is removed, causing the landslide. In human history both gradual and rapid change are present, and like the mountain, certain small changes can effect a great change, or revolution. The trick is to be able to find which grain of humanity is key and what factors are influencing it.

Revolutions come in all shapes and sizes, from the American Revolution to the Scientific Revolution to the Industrial Revolution. Not everything that was revolutionary has had the code word "revolution" tacked to the end. The Protestant Reformation, the invention of the computer, the works of the Gospel writers were all revolutionary. Revolutions happen frequently in all fields of study, and some will be of such great importance as to change the fundamental ways in which humans approach the world.

One of the most interesting and well-studied type of revolution is scientific revolution. Revolution is the heart of science. The everyday experiments and investigations, theories and laws are forged together and developed through revolution. A revolution changes deeply the way the world is observed. It is not a superficial change in our approach to life and the universe, but a change at the most basic level of understanding. The history of science is littered with such revolutions, from Ptolemy to

Copernicus, Newton to Einstein; the revolutions of science stand like landmarks in Western history. Naturally these monumental changes have attracted the interest of historians. For scientists, a group for whom the most natural question is "how?", the nature of these scientific revolutions has also become a subject of research and discussion. How does a revolution come about? What exactly is a revolution? What are the conditions that cause a revolution? These questions are at the heart of the philosophy and history of science. Though scientific methods of research cannot be applied directly to these topics, scientific thought can be. It is understandable that practicing scientists frequently find themselves drawn into the debate these questions generate.

Within the past half century the discussion has grown and expanded. Over this time a single dominant mode of thinking about scientific revolutions has been developed. The method proposed by Thomas Kuhn in his seminal work *The Structure of Scientific Revolutions* has become the standard method for approaching the question. He has used the language of paradigms to form a discussion of how science grows and changes from one revolution to the next. His work has been accepted by scientists and, though it obviously is not a perfect treatment, it can, with a few minor additions and changes in emphasis as proposed by several more recent works, be said to be a highly accurate and nearly complete picture of how scientific revolutions happen. For scientists this work is still at the forefront of discussion; current scientific journals frequently include a brief article or letter on the Kuhnian debate[1] and the status of the paradigm within the field at hand. This way of looking at scientific revolutions is so convincing and Kuhn's discussion is general enough that it seems potentially helpful to determine if the work can be applied to the other types of revolutions as well. For instance: can the language so

[1] For a recent example see *Physics Today*, March 2001.

successful in describing scientific revolutions be used to describe religious reformation as well? The argument presented here will demonstrate that the answer is a qualified "yes."

This in itself is a fascinating discussion, but it presents only a starting point. Kuhn has applied scientific reasoning to the questions surrounding revolutions; he has created a model of how revolutions happen. In science models are everywhere, there are models of stellar formation, models of chemical synthesis, models of cellular growth, models of quarks and leptons. Models are the basic units of science and all models are first descriptive, and second *predictive*. If one looks at a model of the solar system one will first see that it describes the positions of the planets with respect to each other, but then also that it predicts where the planets will be at some point in the future. Kuhn uses his model to describe revolution, but fails to go the next step and attempt to use the predictive power of his model. The aims of this thesis will be to demonstrate that Kuhn presents an accurate model of revolution, and then to argue that this same language may be applied to religious revolutions. Finally, we will use the predictive power of this model in examining current culture and propose that a religious revolution is pending and that it is spurred on by the issues of genetics and the science of life, ecological and environmental questions, and pluralism in a global society.

We will first investigate and examine the basic idea of a scientific revolution and Kuhn's language used to describe it. Our detailed overview of Kuhn will focus specifically on the steps involved in a revolution. Then we will raise objections to Kuhn and discuss any necessary additions to his work as proposed by others. We will conclude demonstrating Kuhn's strength of position as amended in the thesis. Following this we will discuss and compare religious revolutions and their typical features. This

preparation will lead to Luther's Reformation; the result will be a specific examination and description of Luther in a Kuhnian fashion. The entire time we will be demonstrating that the methods of scientific philosophy can be applied to religion and that the same language may be applied to both revolutions of ideas. In paying attention to the historical considerations leading up to Luther, we will provide a basis for later prediction. With a synthesis of Luther and Kuhn complete we will develop a current application of this language to religion and science. The modern areas of religion involving genetics and the science of life, ecology and environment, and pluralism will be dealt with, concluding with a claim that these areas are on the verge of causing a revolution in religious thought.

## Chapter 1. Revolution and Kuhn

As a seminal work in the philosophy of science Kuhn's book *The Structure of Scientific Revolutions* is a necessary beginning for this discussion. One does not have to be a scientist to find Kuhn's intricate arguments truly interesting; as we will demonstrate, the implications of his work stretch across many disciplines. Kuhn focuses on paradigm shifts. He argues that science follows a specific paradigm until experimental evidence builds against this paradigm and a new one rises in its place. The definition of paradigm that he chooses is "law, theory, application and instrumentation together... from which spring specific coherent traditions of scientific research."[1] Scientists working within a paradigm engage in "normal science."

### I. NORMAL SCIENCE

Normal science is the work of most scientists most of the time. Very few scientists break incredible new ground and become symbols of an age in the way Einstein did. Generally researchers focus on a particular aspect or problem in a specific theory and expand incrementally the existing knowledge on that topic. They apply methods of research that have already been proven worthwhile to a slightly different area of interest in order to demonstrate or enhance an existing theory. They fit the data obtained within the theory. As a result the theory will be slightly better grounded in experiment. This work is primarily puzzle solving, examining questions that are provided by the paradigm.[2] It is not any less intellectually challenging or less important for scientists

[1] Thomas Kuhn, *The Structure of Scientific Revolutions,* 3rd ed. (Chicago: University of Chicago Press, 1996), 10.

[2] One obvious example of successful normal science is the work done in the computer chip industry. Chips become steadily faster, but great shifts of paradigm do not result from these developments.

than discovering new paradigms. The puzzles are complex and require a detailed understanding of the theory and the ability to create a tool that will be useful in investigating the theory. In this case the puzzle is given to the researcher by the paradigm and then time is spent finding a solution that is theorized to exist. The researcher does not have to spend time finding a pertinent question, the question comes from the paradigm. As valuable as normal science is, Kuhn claims that normal science cannot directly test a paradigm against reality, because it depends on the paradigm for its questions. Even so it allows for research to proceed with greater speed: because all scientists working within an area accept the same paradigm, there is no need for the same basic questions to be answered over and over. Finally, the results of this research are often quite fruitful in many areas, and it is clearly true that this research forms the bedrock of scientific work. However, as research within a paradigm progresses, eventually anomalies will be discovered.

## II. ANOMALIES

Anomalies within research are routine. Data that does not conform to existing theory is commonplace. In research there is rarely a method precise enough or a machine perfect enough that does not present conflicting data from time to time. Scientists are therefore familiar with these discrepancies and work to filter out the data that results from a flaw in equipment or application. This is particularly interesting when one deals with a new machine. In a simple example, Galileo needed to prove to himself that what he was observing through the eyepiece of his newly invented telescope was not a speck of dust or an imperfection in the lens, but actually a moon orbiting Jupiter. The anomalies that

cannot be explained through flaws in equipment or research methods are true anomalies. Scientists will first attempt to fit these anomalies to the existing theory. Kuhn states that the theory will be slightly adjusted or a special case allowed and the anomaly will be absorbed. However, after this change, "the enterprise... is never quite the same again."[3] Eventually, if the area of research is something interesting and uncharted that has been overlooked in the past, the mass of anomalies may be sufficient to cause a crisis within the paradigm. The paradigm will only stretch so far before it can no longer absorb more anomalies and crisis arises.

## III. CRISIS TO PARADIGM SHIFT

The crisis[4] is the next stage of revolution. For Kuhn crisis is key. In the crisis scientists will start looking for new explanations and all avenues of research once excluded by the paradigm will become open. The crisis is naturally the result of a breakdown in normal science as anomalies build and the old theories become unworkable, but this is definitely not the only contributor to crisis. Social and cultural pressures also play a profoundly important role in the development of a crisis. For instance, the need for calendar reform, criticism of Aristotle, the rise of Renaissance Neoplatonism and a variety of other historical influences were factors in the crisis that led to the Copernican Revolution. Although Kuhn correctly places the technical theoretical breakdown due to the anomalies as the primary cause of crisis and the cultural and social factors as secondary his treatment of these secondary causes is quite weak. He declares

---

[3] Kuhn, 52.

[4] It is interesting to briefly look at the etymology of the word "crisis." Coming from Greek it literally means the "turning point," particularly in reference to a disease. In Kuhn a crisis is definitely a turning point. (See the *Oxford English Dictionary*, 1989 ed., s.v. "crisis.")

them to be more influential in respect to the historical timing, the ease with which one may recognize the revolution, and the area where the breakdown first occurs. Then he notes that these questions, though "immensely important," are "out of bounds for this essay."[5] This is an unfortunate limit that Kuhn imposes on his work and requires closer examination.

First, it is difficult to understand how, in an investigation into the "structure of scientific revolutions," the questions as important and interesting as those of timing and area would be out of bounds. Furthermore, it appears that by placing these aspects out of bounds Kuhn allows himself to ignore and gloss over the social and cultural factors effecting revolution. It is correct that analysis of these factors is challenging and complicates the treatment of the question, but they seem quite necessary. Although in this restriction Kuhn overlooks the cultural and social factors external to science, he does include the internal cultural and social pressures that are a part of the scientific community. This exclusion of external factors is a mistake made routinely by scientists. It is the general desire, even for Kuhn, to develop a philosophy of science that is as objective as possible and the tradition of science has been to ignore the external factors. Even one as open minded as Kuhn is guilty of this error. Despite these concerns we will move on in Kuhn's discussion of crisis.

Once a crisis has been recognized by the breakdown in normal, puzzle solving science, the attitudes toward research will change. These changes are typified by a "proliferation of competing articulations, the willingness to try anything, the expression of explicit discontent, the recourse to philosophy and to debate over fundamentals."[6]

---

[5] Kuhn, 69.
[6] Ibid., 91.

Taken together these are the hallmarks of a revolution and mark the change from normal science to the crisis that creates paradigm-shifting work. In science this period generally lasts for one to two decades before a novel paradigm arises. It is important to note that the new theory is a direct response to the crisis.

The new theory answers not necessarily only new questions but also ones that had been considered solved in the previous paradigm. Furthermore, although many of the problems had actually been considered and their solutions at least partially anticipated in periods before a crisis, they were promptly dismissed. The most famous incidence of this is Aristarchus in 3rd century B.C.E. Greece, who anticipated Copernicus nearly completely.[7] Kuhn writes that Aristarchus was not taken seriously because there was no crisis in his society. Without a need for a new theory Aristarchus' scientifically superior theory was promptly dismissed. Kuhn goes on to state the reason Copernicus was accepted was because of the crisis of his time, a crisis that was cultural in nature.[8] If, as Kuhn suggests in this case it was the influence of a cultural crisis that was directly responsible for the dismissal of Aristarchus and the acceptance of Copernicus, then it seems that Kuhn has clearly understated the importance of cultural factors.[9] An interesting analogy is that of a Petri dish. When culturing bacteria one finds that even the most tenacious bacteria will not grow if merely left on the plastic dish. Only when placed in a nutrient rich medium will the bacteria flourish. Similarly, revolution will not flourish unless there is a culture[10] that is prepared to nurture its growth, no matter how strong the revolutionary idea is. That new theories are ignored without a crisis

[7] Kuhn, 75.
[8] Ibid., 69.
[9] This crisis of the general culture is an important aspect of revolution Kuhn has overlooked, but it is not a *requirement* for revolution.
[10] Scientific culture at least, though general culture as well.

emphasizes the importance of crisis in revolution. Furthermore, as was mentioned above, though the crisis is primarily a breakdown in theory due to experimental anomaly, it is greatly influenced by cultural and social considerations outside of science. The crisis cannot occur without these cultural and social factors. Kuhn elevates crisis to its rightful position as the cause of revolution. Since crisis requires certain cultural and social factors it is difficult to understand why Kuhn would place these out of the bounds of his essay. With this in mind we will move onto the conclusion of these paradigm shifts.

Eventually the new theories and a new paradigm will rise and a reshaped normal science will resume. The actual manner and speed with which the new paradigms are disseminated varies. It is rare that by force of reason the new ideas win over quickly because in individuals the old patterns are so rigorously ingrained. Generally it is the new members of the field that adopt the new paradigm. As Max Plank remarked of his own work, "a new scientific truth does not triumph by convincing its opponents and making them see the light, but rather its opponents eventually die, and a new generation grows up that is familiar with it."[11] Kuhn does not address the ways in which Plank's comment indicates the existence of strong cultural and social factors even during this final stage of a paradigm shift, though in this case they could be considered internal to the scientific community.

## IV. KUHN SUMMARIZED AND APPLIED

As we have seen, Kuhn argues that a revolution is typified by five distinct stages: normal science, anomalies, crisis, paradigm shift, and dissemination / acceptance. Each of these stages has distinct aspects and characteristics that allow them to be readily

[11] Kuhn, 151.

identified. The key stage is the paradigm shift, which is not really a stage at all but rather a single moment of human creativity. Overall, most scientists conclude that Kuhn's description of this process accurately explains how science and scientific paradigms change.

One of the events that is best described by this process is the change from Newtonian to Einsteinian physics. The ability of the Newtonian worldview to explain reality was being seriously questioned in the late 19th century. Several experiments were beginning to yield results that could not be accounted for with classical physics. These technical anomalies began to cause a crisis, but the influence of modern thought and industry allowed Einstein to carry his ideas in new directions. In light of the desperate state of physics Einstein was able to attempt radical new approach, a new paradigm. Finally, with Einstein's ideas an entirely new explanation of the nature of space, time, mass and energy took hold. Even though Newtonian mechanics is entirely derivable from relativistic mechanics[12] and even though every law or equation from Newton could be found as a subset of Einsteinian laws and equations this does not mean that Einstein's work is merely an expansion of what Newton's theory.[13] That would not be a paradigm shift. What makes this a paradigm shift is that Einstein dramatically changed the scientific understanding of such fundamental terms as motion and space-time.

The fact that this is a paradigm shift is not affected by its universal acceptance or lack thereof. In fact, the basic postulate of Special Relativity, that of the universally limiting nature of the speed of light, has been known to be quite false for some years. Einstein, Podolsky and Rosen published a paper in 1935 raising the question that

[12] For $v^2/c^2 << 1$.
[13] Kuhn, 101.

quantum mechanics appeared to paradoxically require instantaneous transfer of information or "spooky action at a distance." In 1981 the Aspect experiment (and several more recent experiments) proved conclusively that the universe was non-local[14] at least on a quantum level.[15] This means that events do happen simultaneously and an event on one side of the universe can be affected immediately by an action millions of miles away. This merely serves to demonstrate that the revolutionary nature of Einstein's work is not hampered by not being universally accepted.

## V. CRITICISM

Kuhn finds many instances such as the Einsteinian Revolution to support his paradigmatic model of scientific revolution. However, Kuhn's own bias is evident in this work. With an initial background as a theoretical physicist, much of his writing centers on work in theoretical science. Focusing on the "great men" of science, he presents a picture of a few men or women turning their indomitable intellects to a particular problem and solving it. This extreme view could be used to support the argument that science is just a social construct that has resulted from the opinions of a few people. Kuhn rarely mentions the experimental side, the side of science where the actual connections to reality are made. He even goes so far as to state, "Led by a new paradigm, scientists adopt new instruments" subjugating the instruments of the experimentalists to the advanced work of theorists.[16] This division between theory and experiment is quite

---

[14] A local universe would restrict events and information to the location in space that they inhabit, a non-local universe allows for information and events to be several places simultaneously without having been in between these places.
[15] John S. Townsend, *A Modern Approach to Quantum Mechanics* (Sausalito, California: University Science Books, 2000), 142.
[16] Kuhn, 111.

prevalent. Very few people who have not been directly involved in scientific research realize the depth to which this division runs. Kuhn has written a book on scientific revolutions for the theorists and from this position he has an excellent thesis. However, in his neglect of experiment he forgets half the story. In an example given to support his idea of anomalous data eventually causing a paradigm shift Kuhn sites the discovery of X-rays by Roentgen.[17] Here Kuhn details the work with cathode rays that allowed Roentgen to observe X-rays, and he describes this as an anomaly that causes a paradigm shift. He ignores the fact that without the new tool of the cathode ray tube Roentgen would have never discovered X-rays. Kuhn sees this only in terms of the resulting concept changes, not as a result of new tools.

## VI. DYSON

Recently, the noted physicist and philosopher of science Freeman Dyson has taken a more balanced approach to scientific revolutions in his book *The Sun, the Genome, and the Internet: Tools of Scientific Revolutions.*[18] Dyson acknowledges that Kuhn's analysis is definitive in terms of theory, but he disagrees that this concept driven approach to revolution is the only determining factor. As important, if not more important, are the tools that scientists make and use. Kuhn leaves one with an image of the great man of science working alone with his mind and pencil and paper to discern the laws of the universe. Dyson starts with three young, unkempt and unshod grad students in a basement lab at Cornell putting together a cryostat to study physics near absolute

[17] Kuhn, 57-58.
[18] Freeman Dyson, *The Sun, the Genome, and the Internet: Tools of Scientific Revolutions* (New York: Oxford University Press, 1999).

zero.[19] Dyson is much closer to the workings of science but naturally there are the great men with their pencils in the offices above. The implication is that their work builds on the foundations of experiments.

Dyson concedes that in certain cases a paradigm shift as Kuhn describes it (i.e. plate tectonics) is responsible for scientific progress, but in many instances it has more to do with tools. Dyson traces the revolution of the double-helix in biology to the discoverer of the radar. After becoming famous, the discoverer of radar, Sir Robert Watson-Watt, founded a new department at King's College and endowed it with new tools that resulted from the invention of radar. This allowed for the imaging of the double helix structure of DNA.[20] In this case the new tool prompted the revolution.

Dyson cites many examples of new tools resulting in revolution, but by far the most interesting is that of the genome. At the time Dyson wrote *The Sun, the Genome, and the Internet* in 1999 the Human Genome Project was less than one tenth of the way complete, and Dyson observed that the goal of trying to finish by 2005 was ridiculous and unachievable with current technology.[21] During the summer of 2000 the human genome was sequenced in its entirety. The papers and television hailed this as a remarkable accomplishment; scientists and government officials lauded it as a scientific innovation of the first rank. What could have possibly happened in less than a year that would make even the often-prophetic Freeman Dyson sound dated? Obviously a theoretical, concept based revolution has not occurred. A paradigm shift in which the most basic understanding of what genes and DNA are has not rocked biology departments around the world. What happened was this: the genome shotgun sequencing

[19] Dyson, 10.
[20] Ibid., 4.
[21] Ibid., 31.

method, a new tool invented by Craig Venter, enabled the extremely rapid sequencing of genetic code. A project that was supposed to take fifteen years or more to sequence one human's genetic material turned into a nine-month project that sequenced five different people. More generally, an instrument was invented entirely apart from theoretical concerns that altered the field in such a way as to cause a paradigm shift in how one thinks of genetic research. The tool itself is intrinsically linked to the paradigm shift, but it does not require a paradigm shift to build a novel new tool. In this case the new tool did not follow in the wake of an amazing new theory of genetics but has preceded it.[22] In this manner the revolution in genetics will be driven by a new tool, and not a theory. While it clearly takes both theory and instruments to create a paradigm shift in the case of genetic sequencing it is difficult to imagine a more obvious example of a tool-led revolution.

The idea of a tool-based revolution is immensely helpful for those trying to avoid placing science on a purely subjective ground. The concept based revolution sounds dangerously close to saying that it is merely the opinion of scientists that determines the current scientific reality. To a reader without a proper training in science, it would seem that science is a rather fickle endeavor, one that is determined more by social concerns than by any objective reality. By including the tool-based revolution one has a complete picture that includes an image of scientists using experiments to constrain their theory to reality. Tools and experiments are invented to observe new aspects of reality that were invisible before. Dyson remarks, "If the tools are bad, then nature's voice is muffled. If

[22] What will often become the exciting new tool that leads to a paradigm shift is an accident of research in some other area.

the tools are good nature will give a clear answer to a clear question."[23] In part, the work of science is to create better tools that will lead to a clearer understanding of nature.

## VII. GALISON

Galison's book *Image and Logic*[24] is accurately mentioned by Dyson as being a Kuhn-like work from the experimentalist point of view. In contrast to Kuhn's work, this book is full of pictures of machines, for Galison is interested solely in the tools that lead to a clearer view of nature. Galison's primary interest is in examining the tools used in science, the actual machines used to take the data and then even the computers and programs used to analyze the data. He claims, "I want to expose ... these images, to peer into all that grubby, unplatonic equipment that lies such a long way from Lie algebras and state vectors."[25] He includes numerous examples of how scientific revolution proceeds on a tool based level connecting the theory with the engine grease that results in raw data. Galison's book roundly prevents any sort of subjectivist approach to scientific research and when taken with Kuhn's work it serves to correct Kuhn's weaknesses in this area.

## VIII. KUHN ACCEPTED

Although Dyson's and Galison's objections to Kuhn's work definitely have merit and their inclusion of the experimental side of science is absolutely necessary, both do agree that Kuhn is basically correct in his description of paradigm shifts. While it is vital to include experiment, the concept-based paradigm shift is a real and useful way of

---

[23] Dyson, 28.
[24] Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago: University of Chicago Press: 1997).
[25] Ibid., xvii.

describing how science actually works. As a result most practicing scientists have in some way been influenced by these ideas. Few would disagree outright with Kuhn. Therefore, it is fair to conclude that science has found a philosophy that accurately describes itself and its workings. In the language of paradigm shifts, work is done within a paradigm until the anomalies build up and cannot be adjusted to fit the existing theories. These anomalies result from experiment. When the theories can no longer accurately describe the world there is a period of chaos while new theories are tried out, but eventually the experiments and theories will mesh and a new paradigm will emerge. While the terminology used within the theories may remain the same (e.g. both Newton and Einstein use the term "mass") the meaning of these terms will change at a deep level. A paradigm shift is not something that merely adjusts the idea of mass, refining it in some subtle way, or finding a new method of characterizing it. A paradigm shift that is part of a scientific revolution would completely change the idea of mass and requires an entirely new way of thinking about the world. Leaving scientific terms behind one could describe such a revolution in terms of a change in dogma or ideology. Scientific revolutions do happen and can be described by Kuhn's work, with only minor modifications to include the role of experiment within this process. This inclusion dismisses subjectivist claims. With this overview it is possible to explore the application of Kuhnian[26] theories of scientific revolution to revolutions in another field, that of religion.

[26] "Kuhnian theories" will henceforward refer to Kuhn's basic ideas as modified and expanded in this chapter.

## Chapter 2. Reformation

Religious revolutions are far easier to find in history than scientific revolutions. This is generally because religion has influenced more of humanity for a longer period of time. Only recently have we entered the age of science. Furthermore, wars and turmoil across society as a whole are also characteristic effects of religious revolution. One can immediately identify the religious revolutions affecting history. From Moses to the Prophets to Jesus to Mohammed to Luther and the reformers of the 16th century there have been many western religious reformations. In the eastern tradition there have also been religious revolutions brought about by Siddhartha Gautama, Confucius, and even a Shin reformation in Buddhism that has interesting parallels to Luther's reformation. Revolution in religion appears to be an aspect of all religions, not just those in the west.

One can observe the effects of religious revolutions in history without a great deal of searching; their artifacts are in society today. It is more difficult to determine the causes of these revolutions. From a purely religious perspective one could say that God has brought about these revolutions because they are His will. God came to Moses, or was Jesus, or spoke through Mohammed or gave Luther inspiration and that is the end of the story. However, it is possible to examine these changes without invoking the divine from a perspective that examines the secular causes of these changes. In this respect it will be most beneficial to examine Luther's reformation of the 16th century, as it is the nearest to the present historically and many of the facts surrounding it have not received the distortion of millennia of conflicting history.

## I. HISTORY OF THE REFORMATION

The history leading to the Protestant Reformation is well known, but a brief review with Kuhn's theory in mind will enable an application of his theory to these events. The Church in Rome at the end of the 15th century had undergone much tribulation. In the one hundred years before Luther the Church had endured the "Babylonian Captivity" of the Avignonian Popes[1] (when a series of Popes lived solely in France), and the Papal Schism (when more than one Pope had presided at once). These events, recent to Luther, shaped his opinion of the Church.[2] The Popes had returned to Rome, but from Rome they ruled as temporal princes of an Italian city-state with little regard for the ecclesiastical aspects of their post. They did not forget their position as Vicar of Christ, but became increasingly interested in the position of the Papacy as a European power.[3] The Renaissance was flowering in Italy so that in their public lives several of the Popes became patrons of the arts and Renaissance men themselves, excelling at the worldly activities that suited such a man. The Bishoprics were rife with corruption and were bought and sold without shame. Furthermore, it was not uncommon for a man to emulate the Pope by being a Bishop on one hand and a Baron on the other. The parish Clergy (with their Church-taxed concubines) were not so much corrupt as uneducated, filling the heads of their rural flock with less than precise doctrine, mixing the local myths with Bible stories.[4] The selling of indulgences[5] was rampant and the Pope was thought of as having the power to release souls from Purgatory by opening the

---

[1] Roland Bainton, *The Reformation of the Sixteenth Century* (Boston: The Beacon Press, 1956), 12.
[2] Ibid., 15.
[3] Ibid., 10.
[4] Charles Guignebert, *Ancient, Medieval and Modern Christianity* (New Hyde Park, New York: University Books, 1961) 387.
[5] A remission of sins (see *Oxford English Dictionary*, 1989 ed., s.v. "indulgences.").

vast treasury of the good works of the saints. Church councils were called in an attempt to reform the obvious misdeeds but they often proved impotent, affecting only minor reform. This was the state of the Church in Rome when Luther began his work.

## II. CAUSES OF THE REFORMATION

The specific causes of Luther's revolt are often thought to be the basic corruption of the Church and the sale of indulgences. Many general histories cite the indulgences sold by Tetzel as the impetus for the posting of the *95 Theses* and Luther's general dissatisfaction with the church.[6] The circumstances were significantly more complicated, because Luther's work did not arise out of a vacuum. Therefore the biography of Luther's life is quite important. Though a detailed discussion here is not possible, it is suitable to note that Luther had spent the years immediately before 1517 engaged in a great deal of religious reflection. It was during this period (specifically 1512 to 1513) that he developed the principle of justification by faith alone.[7] Up to this point Luther had been struggling with his salvation and how a sinful man such as himself could possibly confess enough or be contrite enough or perform enough good works to warrant salvation.[8] This new idea, that one is not saved by trying to be perfect in the eyes of God, but rather by simply believing in the merits of Christ's crucifixion, allowed Luther a path out of his impasse.

The revolutionary nature of his insight was that if one were saved by belief alone, then neither the mediatory priesthood nor the indulgences would be necessary. The entire

---

[6] Henry Lucas, *The Renaissance and the Reformation* (New York: Harper Publishing, 1934), 433.
[7] Bainton, 33.
[8] Ibid., 25.

dogma of the Roman Church was completely disposed in this idea.[9] Luther himself remarked, "Others have attacked the life, I attack the doctrine."[10] Previously, the meaning of Christ's death on the cross held an ambiguous place in the Church in terms of salvation, with the priests in the role of reenacting it to provide salvation and forgiveness of sins. As a result of the Reformation the death of Jesus on the cross gained significance as the act of salvation for the world, while the priests lost their special role in reenacting the sacrifice at Calvary during the Eucharist every Sunday.[11] Through thought and faith and reflection a person could directly come to know God. The sacraments were reduced in number (and to some degree importance) and the role of the priest changed from being a "little Christ" to merely an aid and helpful teacher.

## III. CONSEQUENCES

From this change in dogma resulted the practical consequences of the reformation: the elimination of the corrupt clergy,[12] the new priesthood that (that within Protestant churches) was no longer required to be celibate, the completely unnecessary nature of indulgences and the fact that the Pope in Rome no longer needed to be afforded a special position as Vicar of Christ. The dogmatic shift that Luther proposed caused the many reformatory effects that could be seen as the root of the Reformation. However, many of the reforms may have occurred otherwise and these superficial changes would not have been revolutionary. One could simply identify the problems with indulgences or the Papacy as the cause of the Reformation because these were problems corrected by the

[9] Lucas, 431.
[10] As quoted in Bainton, 24.
[11] Bainton, 34.
[12] Of course this did not end clerical corruption completely, but it did succeed in making it less frequent.

Reformation, but to be revolutionary these could not be the only causes. For the Reformation to be truly revolutionary and have the effect that it did, faith needed a dogmatic change.

The non-revolutionary nature of the previous reform movements within the Church demonstrates this point. During the 14th and 15th century it was no secret that the Church was undergoing difficulties. The "Babylonian Captivity" and the Schism were both obvious signs that the Church was under duress. With these problems increased money had to be raised in order to support the power of the Church. The result was an increase in indulgences and simony. People within the Church attempted to correct these moral faults and the Councils of Constance and Basle were called. Both met with failure as the problems were well beyond their ability to correct.[13] The problems became so pronounced that the States-General of Tours presented a prayer for the whole of France in 1484 asking that the clergy set the example for the Godly life and not to lead scandalous lives of decadence. The Popes themselves drew back from reform for fear of limiting their power, but did not discourage the individual efforts by the Humanists being put forth for reform. This too was not enough. Wyclif and Huss both realized that a complete revision of the faith was necessary, but they could not draw enough popular support to take hold and were instead branded heretics.[14] In all of this unrest only Luther was able to create a revolutionary dogmatic change that would in turn reform the Church.

[13] Guignebert, 384.
[14] Ibid., 389.

## IV. INSTRUMENTALISM

At this point it may seem that in this case Luther was indeed the great man working alone to cause the revolution in the Church. In fact Luther's revolution was influenced just as much by "instrumentalism" as the scientific revolutions previously discussed were. For Luther's revolution the tools of change were sometimes just as abstract as calculus and sometimes just as real as the telescope. The best example of an actual tool would be the invention of the printing press by Gutenberg in 1455. With moveable type Gutenberg published the famous 42-line Bible. This coupled with Luther's translation of the Bible into German suddenly far greater numbers of people had access to the scriptures. By 1517 new translations of the Bible were appearing everywhere. In German dialects alone there were twenty-five editions of the Gospels and Epistles, twenty-two editions of the Psalms, and eighteen editions of the entire Bible.[15] This undoubtedly influenced Luther's ability to declare the priests unnecessary and claim that anyone could gain faith and understanding of God through reflection on the scriptures. Before the printing press even if one held the belief that anyone could know God through the scriptures, only priests had the ability to read the Bible. Under these conditions Luther's work would have been ineffectual. In short, Luther's reformation depended just as much on the invention of the tool of the printing press as Copernicus depended on Galileo's invention of the telescope.

There were further tools that made Luther's revolution successful, although these are more abstract than the printing press. One of these was the rise of nationalism. A brief overview of the social and political factors that were at play at the end of the 15th and beginning of the 16th centuries demonstrates change on a scale virtually

[15] Harold Grimm, *The Reformation Era.* 2nd ed. (New York: Macmillan, 1973), 45.

unprecedented in western history. The Holy Roman Empire, which had never been the central, monolithic creature that one imagines, was coming completely apart. The English, French and Italian city-states were increasingly weary of a militarily powerful union between Spain, the German principalities and the Netherlands under Charles V (1519-56). The Turks on the western border, who were increasingly better-organized and armed, managed to march to the walls of Vienna. Although Charles V was a strong emperor, those before him were hindered from exercising their authority by the electors and could hardly levy taxes, let alone raise armies. They depended primarily on their own family fortunes and holdings for income and would not pay much heed to the empire as a whole. With a weakened empire the kings and princes of Europe were free to form their own alliances and since the Papal Schism they had also enjoyed a certain level of freedom from papal authority. The Church, whose laws and courts came under increasing secular control, continued to use its weapons of excommunication and interdiction, but their frequent application dimished their force.

The ostensibly monolithic empire that had never really existed was even weaker at the time of Luther. This vacuum left more room for nationalism to exert its power. Nations were strengthened by expansion overseas in the discovery of new trade routes, markets and whole new continents. Gold flowed back from the Americas and the Indies and kings and courts became even more independent and wealthy. A notable example is Portugal, which had extensive interests from South America to Japan. Coupled with nationalism and increased wealth, commercialism and capitalism sprung up from the outdated guild system. Corporations of businessmen pooled their resources to fund large

ventures and share the risk, allowing for significant returns on their investments.[16] This created a new class of people, those who did not have titles or nobility but controlled as much wealth as the aristocracy. This new class was less interested in the old systems of hereditary titles and paying tithes to Rome than it was in hard work and a person's individual worth. With the advent of nationalism and capitalism one finds a Europe ready to throw off a Church that was rife with corruption. This new class of wealthy people with no hereditary interest in the old power structures gave Luther a powerful ally. As the new nobility discovered that it could manage without the Pope's blessing, Luther was able to find protection. Finally, and of great importance, were a peasant class that was restless from centuries of subjugation and a Church that was increasingly a money making enterprise and not a source of help or inspiration. This gave Luther a mass of support that was ready to fall behind him. This paints a picture of the western world during the late 15th and early 16th century, the world in which Luther was active.

## V. LUTHER'S WRITINGS

It is additionally important to look into Luther's actual writings for further understanding of exactly how he was a revolutionary figure. One of the more interesting examples is in Luther's *Preface to the Epistle of St. Paul to the Romans* of 1522. Here he is primarily concerned with an explication of Romans in light of the relationship between the Law and the Gospel. In order to properly accomplish this in his mind Luther engages in a series of definitions. Luther examines terms such as "sin," "grace and gift," and "faith and spirit" as they appear in Romans. In parallel he also examined how they were commonly used by the Church of his day. He then redefines these words fundamentally.

[16] Grimm, 10.

For example, Luther examines the word "law." He writes that it is usually defined to be something that explains which acts are forbidden, but in fact in the context of Romans it means far more than this. He finds that in Romans it means something which "must be fulfilled in your very heart, and cannot be obeyed if you merely perform certain acts."[17] He engages in this redefinition within the context of the crisis of the time and the personal crisis of faith that he experienced. This redefinition is characteristic of a revolution.

Another example of Luther's thinking at this time is found in his *Treatise on Christian Liberty* of 1520. Of particular interest is his statement[18] that "In doing these works, however, we must not think that a man is justified before God by them, for faith... is alone righteous before God." Here Luther knows that he is making revolutionary statements about the Church. At the time of publication Luther even included an open letter to Pope Leo explaining exactly how this work was revolutionary. Interestingly, the letter detailed that Luther had been attacking the doctrine and corruption surrounding the papacy and not the person of Pope Leo. This elevates the attack from merely a personal level to something institutional and hence potentially revolutionary.

Luther's *Appeal to the Ruling Class* of 1520 sheds additional light on Luther's thought regarding the current state of the Church. He draws a parallel between the Church and its leaders and a town in which the Mayor's house is burning and the Mayor is not able to sound the alarm. He claims "In such a case is it not the duty of each citizen to stir up the rest and call upon them for help?"[19] The parallel is drawn such that the

[17] Lewis Spitz, ed., *The Protestant Reformation* (New Jersey: Prentice Hall, 1966), 37.
[18] Ibid., 67.
[19] Ibid., 58.

Papacy's corruption, the "fire," is destroying the Church and Luther is the citizen sounding the alarm. Clearly Luther believed that the time he lived in was one of crisis.

Finally, in Luther's *Babylonian Captivity of the Church* of 1520 he attacks directly the sacramental system of the Church that was so important in everyday practice. To this point Luther had been acting within the Church. It is interesting to see that as soon as he made a move away from the theoretical side of the discussion and toward the very practical nature of how the Church interacted with its followers he became a true revolutionary. It was observed best by Erasmus when he exclaimed, "The breach is irreparable!"[20] Here Luther had broken with the tradition and could no longer be less than revolutionary.

Luther's works provide an important insight into the actual process of his reformation. With this and the background provided by the historical period surrounding Luther's life one may proceed to a discussion of the actual revolution in Kuhnian terms.

[20] Bainton, 58.

## Chapter 3. Synthesis

From this position it is now possible to scrutinize Luther's Reformation and observe why it clearly follows Kuhn's examples of paradigm shifts. First, there was the paradigm within which society had been functioning. As we saw in the previous chapter, the Church was viewed as the seamless robe of Christ without division. Ecclesiastical Popes and Bishops had been as earthly princes lording over other worldly kings. The role of the Church was to save souls, and this was done at least in part through indulgences and appeals to the Virgin and the Saints. God was an angry father and Christ was his avenger on earth. Salvation came through confession, the Eucharist provided by a priest, or performing works and pilgrimages. This sets the background explaining the existing paradigm. This is analogous to the normal science that is described in Kuhn. The normal work of religion was adequately carried out by priests and popes in the administration of the sacraments and the salvation of the Baptized. Tithes were collected and cathedrals built and the people presumably felt secure with their place in the world. Small anomalies were found (the occasional debate requiring a council to solve or a scandal that needed covering up) but these were generally not the worry of the general populace.

### I. ANOMALIES

The anomalies arrived in several forms. First, with the Babylonian Captivity and particularly the Papal Schism, the rival factions and conflicting interpretations that characterize a coming revolution were evident. Just as before the Copernican revolution there were a variety of new theories of planetary motion to explain the new data, shortly before Luther there were a variety of new reformative ideas to explain the current

situation. Wyclif and Huss are examples of a number of people who engaged in failed reformative attempts. The Church councils played the role of attempting to fit the anomalies into the existing paradigm as they worked to survive with only minor changes to the existing structure. As Kuhnian analysis would suggest these naturally failed, since acting within the paradigm they could not understand the extent of the changes required. Additional anomalies arose as a result of new instruments. The printing press and the translation into the vernacular allowed people who were not clergy to read the Bible. These people were then able to draw their own conclusions about the material. The varieties of translations did not help to unify the resulting views. The simultaneous emergence of nationalism and capitalism, replacing in part feudalism and the guilds, brought to light new situations and regions of exploration where the medieval religious paradigm had not been tested. This forms the instrumental aspect of the Kuhnian analysis of the Protestant Reformation. In this new field problems to which the pre-Luther paradigm had been blind (or which simply did not exist) suddenly became evident. As with Newton, without the new material provided by Galileo's telescope he would have not been able to arrive at as quickly at the calculus and physics he discovered. Eventually the existing paradigm even fought violently in order to maintain the status quo. This conflict is also found in science, but the intensity of resistance to change was significantly greater in the case of Luther as the paradigm shift resulted in changes to a system that had been deeply entrenched in power and luxury. Kuhnian analysis indicates that clearly there was a revolution on the horizon.

## II. CRISIS

Revolution does not simply require a man and an idea, it requires a crisis. In the early 16th century, crisis emerged in several ways. First, there was Luther's personal crisis of his own salvation. Upon entering the monastery in 1505 Luther began to dwell upon his own sinful nature. He was greatly concerned with how a sinful man such as himself could come into God's kingdom. He engaged in such fasting and vigils that, in the words of Bainton, "he appeared a walking death's head."[28] Luther made a trip to Rome in 1511 and visited all of the sacred pilgrimage sites and wondered if even this could save him. He would regale his confessor with the slightest sins and wondered how he could confess everything if he was not even aware of some of his sins. Finding God to be cruel and vengeful, Luther even began to doubt his ability to love such a God. In his doubt Luther was sent to take a doctorate and become a preacher, studying the Bible.[29] Luther was in despair and in a personal crisis. It was this personal crisis that brought the problems of the Church to Luther's immediate attention and served as the crucible for Luther's theological creativity to flourish. A personal crisis is obviously not enough to spark a revolution. There was, of course, the greater crisis within Luther's society.

A building Kuhnian crisis in the Church coincided with Luther's personal crisis. As has already been discussed the Church was facing problems on several fronts, the least of which was corruption at the highest levels. The sale of indulgences brought the crisis to the people. Luther spoke for the people when he said the Pope would not build

---

[28] Bainton, 29.
[29] Ibid., 30-33.

the Basilica of St. Peter with the bones of German peasants if he only could see their state.[30] Having survived the Babylonian Captivity and reunited under one pope the Church had still suffered a great blow to its prestige from which it had not recovered. The nascent nation states moved in to fill the power vacuum that the Church left and with new over seas expansion became even more powerful. The Church was left with a very new and rapidly changing world to which it had to adjust. Finally, the growth of capitalism that went along with the new nationalism also changed the manner in which people lived and necessitated a new approach to religion. Certainly a Kuhnian crisis was upon the Church, from both within and without.

## III. A KUHNIAN REVOLUTION

Finally, Luther's work itself was clearly revolutionary in the Kuhnian sense of the word. It caused a complete paradigm shift in the way people thought about God, Christ and themselves. With Luther a Kuhnian redefinition of terms took place. God was no longer the Judging Father and Christ no longer His enforcer with the Pope on earth to intercede. The clergy were no longer the only way that one could come to know God and no longer was it necessary to buy indulgences. The Eucharist was not a literal remaking of Christ's death by the priest that resulted in salvation. In this manner the priest lost the power to control who received salvation. Jesus had died once and the way to salvation was eternal and through faith. What was meant by the very terms of "sin" and "faith" and "grace" and even "God" were changed. With Luther, one could know God individually through faith. All that was required for salvation was a belief in Christ's ability to save humanity; acts of contrition and pilgrimages were no longer necessary. It

[30] Martin Luther, *95 Theses* 1517. No. 50, 51.

was a dogmatic change resulting from the doctrine of justification by faith alone. With the revolution came the changes in the working of the Church that had been looked for in the other reformative measures, for example the reform of the clergy or the end of indulgences and other superstitious practices of the Church in Rome that had little or no scriptural backing.

It is immediately obvious that Luther's reformation did not completely eliminate the Roman Church; it is clearly still around today. However, as was previously discussed with reference to Einstein, the continued presence of some form of the previous paradigm would not make the reformation less than a Kuhnian revolution. Furthermore, Luther's reformation did influence the Roman Church dogmatically, as evidenced by the Council of Trent and the counter-reformation. Catholicism undertook many Luther-like reforms and essentially took part in the revolution. Naturally this was not complete; in some respects is still happening, but this does not change the fact that Luther's reformation was a revolution in Kuhnian terms.

## IV. PARALLELS TO EINSTEIN

The Protestant Reformation parallels Einstein's revolution in physics strikingly. Before Einstein there was dispute within the scientific community concerning how one should most correctly view light and how light was transmitted. A variety of problems had arisen (some directly related, some seemingly disconnected), and there were numerous explanations (the most famous of which was the now outmoded idea of *ether*) for how to resolve them. Einstein concluded that it was not enough to address a few specific problems in physics where the laws appeared to be breaking down. Instead he

suspected an entirely new way of looking at the most fundamental concepts was necessary. This change in the fundamental concepts is similar to a dogmatic change in thought such as the justification by faith doctrine. Like justification by faith, introducing the Special and General Theories of Relativity solved more problems than were expected, even providing a most unexpected approach to exploring the origin of the universe in the Big Bang Model. There were attempts to modify the old paradigm to contain Einstein's ideas, but the ideas were too different and revolutionary and the crisis too great to allow for this. As in the case of Luther, with no amount of compromise could Roman Catholicism contain Luther's ideas as the crisis of culture presented too great of a challenge.

Revolutions in science and religion have similar characteristics, which can be analyzed using the same language. Kuhn's concept of the paradigm shift is applicable to both science and religion. Luther's Reformation fits neatly into the framework of a paradigm shift. Luther's doctrine of justification by faith alone and the changes that it effected are similar even to a classic scientific revolution such as the Einsteinian Revolution. Overall one finds that the model of a paradigm shift, originally used to describe scientific revolution, may also describe similar upheavals in religion.

## Chapter 4. Conclusion

In the previous chapter we saw how one could apply a modified Kuhnian model to religious revolutions as well as scientific revolutions. The ease with which this model fits perhaps reveals a more profound overlap between science and religion; at the very least one should investigate possible applications to current society. One of the great successes of science is its predictive power. The accuracy with which certain, sometimes very complex, events can be predicted with mathematical precision is astounding. While Kuhn's work does not have the mathematical precision of true science it does have an inherent predictive power. If one of the characteristics of a paradigm shift is the existence of a particular set of conditions immediately prior to its occurrence then by examining current conditions one may be able to discover whether a revolution in a certain field is soon likely. As expected, it would be impossible to predict the outcome of the revolution, but the area of culture in which it will occur should be discernable. Similarly, if this is possible with scientific revolutions then it follows that this is also possible with religious revolutions. While this at times comes almost too close to fanciful prophecy, a certain predictive ability is possible. Looking back at the example of Luther, one can note that the stage was set for a revolution. From the perspective of Kuhn, if we start with accumulation of anomalies in general and religious culture up to the time of Luther, Kuhnian thought requires a crisis to develop and lead to a paradigm shift. While interesting in application to historical situations, it is even more interesting to envision where this predictive ability may be applied today. Keeping in mind the five hallmarks of revolution[1] there are three areas in which conditions favorable to revolution

[1] 1. Proliferation of competing articulations
2. The willingness to try anything -(continued on next page)

seem to exist: genetics and the science of life, ecology and environmentalism, and religious pluralism and globalism. These areas each raise difficult questions in the fields of both science and religion. Since Kuhnian theory may be applied to both of these fields it will be interesting to determine what new light Kuhn brings to these topics.

## I. GENETICS

The field of genetics has already been discussed in reference to scientific revolution,[2] and today it is the most exciting of scientific disciplines in terms of rapid change. Dyson and many others have suggested that the scientific revolutions of the coming century will be in biology and biological engineering. The power that humanity is rapidly gaining over life of all sorts is nearly frightening. This fear is one aspect of an expressed discontent with the current paradigm. It does not take any predictive effort to tell that this is where the next scientific revolution will take place that will change fundamentally how people view life in the world. The conflict between competing articulations that currently embroils genetic research is precisely what one would expect before a paradigm shift as described by Kuhnian theory. The antagonism between the Human Genome Project (the bureaucracy-laden, government-lead public effort) and the corporate work being done (quick, nimble, effective and for sale) fills even the popular press. With new abilities and avenues of exploration, the genetic community itself seems to be having trouble focusing on what it should even be studying or doing. Formerly unthinkable paths of research, from fetal testing and engineering to human cloning, are

---

3. The expression of explicit discontent
4. The recourse to philosophy
5. Debate over fundamentals -See p. 8

[2] See Chapter 1, pp. 13-15

becoming open to investigation; as a result moral questions immediately ensue. These research paths demonstrate the willingness to try anything that comes before a paradigm shift; the moral questions demonstrate the recourse to philosophy. Biologists and doctors are now being forced to develop real answers to questions about what constitutes a human being or what it means to be alive. Questions that were previously the realm of philosophers and theologians are now part of what science engages regularly. The similarities to the revolutions in physical science of the past are striking once again. Whereas once the heavens and the beginning of space and time were the sole province of theologians they became, over several hundred years, the work of physicists. Similarly, biologists are now finding their way into a once abstract realm.

A paradigm shift in the field of genetics is an example where the effect on religion will naturally be profound, as in many previous scientific revolutions, but this may also be an instance where religion can and should affect the revolution. The terms and concepts that will be changed with the new abilities of geneticists are as fundamental as life itself. From the prenatal testing that is already done today to the cloning that is not far off geneticists are changing the definitions of life in the same way Einstein changed the definition of time. The question of abortion with which churches struggle will seem straightforward compared to the coming difficulties with defining life.[3] The Church cannot and should not try to stem the tide of scientific advance as it did with Galileo. Although the United States Congress is currently working to attempt a ban on human cloning (see Senator Campbell's "Human Cloning Prohibition Act" S.704, entered into

[3] The word "straightforward" may seem strong, and the core question will be the same: What is life? However, with a host of new options the new instances will become more numerous and far reaching. Perhaps a new paradigm will find a way to simplify everything into a simple framework but for now it appears that the coming problems will be immensely more challenging than today's.

the Congressional Record April 29, 2001), in the end this will be an unenforceable law due to the ease with which one could conduct this work virtually anywhere (biological research is not like the Manhattan Project). Both Church and State need to work to develop a morally responsible and workable approach to using and controlling the new abilities that will certainly arrive, while at the same time scientists need to approach their research with an eye towards the moral implications that they sometimes ignore. Genetic research has raised ethical questions that are, in a Kuhnian sense, anomalous. This new work raises questions that have never been dealt with before and are therefore not a part of any existing paradigm. Current ethical and religious paradigms are ill equipped or fundamentally unable to address these issues adequately, pointing to the necessity of a paradigm shift. Another area where a similar change in paradigm may be observed developing is in how we address ecological and environmental concerns.

## II. ECOLOGY AND ENVIRONMENT

Over the several hundred years since the beginning of the industrial revolution technology and science have progressed and given people great power over their environment. Global civilization now has the ability to alter greatly the basic climate of the world. Climatologists have pointed out that in the case of global warming this is indeed what we are doing. For much of history, because humanity has been too insignificant to significantly influence the global climate this has not been a concern. Public policy and government have never had to deal with a society as dominant over nature as ours is today; the existing paradigms are inadequate in this respect. The idea that our power over the natural world was a moral, "God-given" right evolved along with

society as people slowly began to exercise their influence over nature.[4] Even with Luther nature fell into the background as a stage for God's real work of redeeming.[5] This attitude was understandable as long as people were in constant conflict with a cruel nature that would almost always have the upper hand, but as society was able to tame and capture nature and relegate it to zoos and parks this attitude that domination over nature as something "God-given" begins to be inadequate.

Frequently groups will adopt a Christian viewpoint as support for the total subjugation of nature. From the great white hunter hunting species of animals in colonial Africa nearly to extinction to the oil companies of today attempting to drill in the Alaskan reserves this attitude has regularly been supported with vague Christian rhetoric. Only recently has the Church come to realize that an environmentally responsible theology is necessary in a world where extinction and global warming are real and pressing concerns. In the past the Church, while not condoning the veritable rape of the natural world, has not stood against it and now a realization of the necessity to stand firm for the world becomes evident. This is shown notably in feminist theology, such as with Elizabeth A. Johnson, who speaks of going "beyond the human world to the ecology of the earth, ... a vital move in this era of planetary crisis."[6] The crisis Johnson speaks of is a crisis in the Kuhnian sense of the word. In an even more powerful example, the work of Sallie McFague addresses the anomalies of the ecological crisis. Her most recent book exhibits many of the Kuhnian features of a revolutionary work. The title itself, *Super, Natural Christians*, is a redefinition of the word "supernatural." She considers the old paradigm,

---

[4] Sallie McFague, *Super, Natural Christians* (Minneapolis: Fortress Press, 1997), 26.
[5] Ibid., 58.
[6] Elizabeth Johnson, *She Who Is: The Mystery of God in Feminist Discourse* (New York: Crossroad, 1992), 166.

that of the "Arrogant Eye,"[7] our current way of looking at nature. In the "Arrogant Eye" paradigm people look down on nature as a backdrop, something to be used as a means to do our will. She then proposes a new way of looking at the world, a new paradigm that "acknowledges complexity, mystery, and difference"[8] within the world, the "Loving Eye."[9]

Scientifically speaking, in the case of the environment the coming paradigm shift is not revealed by conflicting theories, although a brief survey of scientific work on global warming immediately reveals that there is anything but consensus on the issue, but by a crisis. The ecological crisis that looms with the threat of global warming and a plethora of other issues (mass extinction, ozone depletion, energy crisis etc.) demands new approaches and new ideas. In the crisis stage of Kuhn's framework the imaginative takes over from the mundane and as a result of necessity creativity erupts. An ecological crisis will cause no different reaction than any number of previous situations detailed in Kuhn's treatment of science. In this crisis religion and science must act together to enable a solution. Moreover, a global solution is required. A global solution can only occur in a global society and globalization and the attendant issue of pluralism are the final topic.

## III. GLOBALIZATION AND PLURALISM

"Globalization" is the watchword of the early 21st century. In a world connected by satellites and computers and next-day air shipping, cultures that formerly had separate, distinct traditions now merge together into one true human society. In terms of religion

[7] McFague, 32.
[8] Ibid., 34.
[9] Ibid., 32.

James Heisig states, "the age of religious conquest is over."[10] No longer do most mainstream religions compete in wars of conquest and forceful conversions. Now the move is towards the conversation and discussion; attempts to understand one's own faith in light of another's faith. Different religions learn and share and grow from one another. In one sense these different religions may be thought of as differing theories that are in conflict, waiting for a revolution to provide a creative new approach, however it is unproductive to consider religions in these terms.

One example of religious interfaith dialogue can be found between Buddhism and Christianity in the work of Aloysius Pieris. In his book *Fire and Water* he discuses both the theological aspects of interfaith dialogue and the more practical aspects. On the theological side Pieris examines who Christ is from a Buddhist perspective. In one example he cites a Buddhist friend and scholar who rewrote Christ's paschal story as he had understood it.[11] Pieris describes how this retelling of the Passion from an Asian perspective "opened for me a new program of theological research."[12] He was "deeply moved by the text... hearing a Word that was ever ancient and ever new."[13] Through his dialogue with Buddhist scholars, Pieris discovers Christianity in a new way, outside of existing Christian paradigms. Furthermore, Pieris goes on to devote a significant portion of his book to a discussion of Liberation Theology from an Asian perspective. Pieris clearly is an example of dialogue between faiths taking place profitably today.[14]

---

[10] James Heisig, "Converting Buddhism to Christianity, Christianity to Buddhism." *Japanese Religions* 22 (1996): 107.
[11] Aloysius Pieris *Fire and Water: Basic Issues in Asian Buddhism and Christianity* (Maryknoll, New York: Orbis Books, 1996), 131.
[12] Ibid.
[13] Ibid., 132.
[14] An additional example was the negative reaction the Southern Baptists received when they began a prayer campaign for the conversion of Jews during September of 1999. For example see: Jeffery Sheler, "Unwelcome Prayers," *U.S. News and World Report,* 20 September 1999, 60.

In Kuhnian terms, globalism and religious pluralism may be thought of as instruments. Religious pluralism provides amazing new tools for understanding ones own experience. The body of tradition now accessible to the educated western person has increased amazingly with the introduction of each new tradition. In some sense it is almost as potent as the importation and reintroduction of preserved classical works from the Arabic world during the Renaissance. People now are able to experience rich traditions that were previously unknown and this increased diversity serves to enhance the human condition. Additionally it sows the seeds for revolution. Without access to classical thought, the era of Luther would not have been prepared for the reformation that he led.[15] Similarly the modern tools of globalism, intercultural exchange and religious dialogue may be paving the way for a revolution. An additional issue that is related to the global community is how it communicates and remembers. The focus of the final topic is the computer.

## IV. TOOLS OF REVOLUTION: THE COMPUTER

The case has been made that by using the Kuhnian approach one can determine that a paradigm shift is coming in several areas: genetics, ecology, and globalism. Within these areas the foremost Kuhnian tool of any coming revolution will be the computer meshed within the Internet. Computers are at the root of each of the three issues discussed, plus virtually any other potentially revolutionary field one could think of. In genetics it is computers that allowed the invention of the new sequencing methods and computers that allow scientists to manipulate and decode the data they obtain. In dealing

[15] The Italian revival of classical learning led, at least in part, to the Renaissance. Without Renaissance ideas the Reformation would not only have not happened, but could very well have not been necessary.

with environmentalism it is once again computers that help scientists understand global climate models and our changing atmosphere. Also, computers connect the grass-roots organizations that work to change people's opinions regarding how we see nature. Finally, in the area of globalism and pluralism these topics would not even exist if it were not for the computers that connect the communications systems that link the billions of people in the world so closely together. This is the most obvious sign of a coming revolution; it is a tool that has not been used to its fullest potential, and whose potential for interdisciplinary application is virtually limitless. Imagine Galileo using his telescope only to survey distant hills and mountains, never turning his newly invented machine toward the sky. Right now the manner in which the computer is used is similar. From accounting and number crunching to word processing and web surfing the computer and the Internet are used in the most pedantic of ways. However, the effect of this new ability to communicate and store information and ideas on a global scale can only be revolutionary. Its use would not have to be intentional. Luther did not intentionally use the printing press, but its existence was necessary for the Protestant Reformation to succeed. The current historical state is similar to the stage between the invention of the printing press and the Protestant Reformation. An amazing new tool exists, but no one has yet determined how to use it most effectively. The computer and the Internet have such power as intellectual tools it is would be difficult to suggest that it would not have a revolutionary effect. That a revolution has not happened yet merely points to the ripeness of the time.

## V. SUMMARY AND FINAL THOUGHTS

We began with a critical reading of Kuhn's work *The Structure of Scientific Revolutions* and ended with an investigation into the prediction of modern revolutions. How exactly was this path traced out? What logic was followed? Briefly, after reading Kuhn we noted that his work, though not perfect, seemed general enough to apply to other fields, notably religious revolutions. After methodically dissecting Kuhn and patching up what seemed to be lacking (particularly his discussion of instrumentality and culture) we proceed to review the Protestant Reformation of the 16th century. We carefully examined Luther's work in particular, questioning in what manner he was revolutionary and how his culture was in a state of crisis. From this review we applied Kuhn and discovered that Kuhn's modified language fit well to a discussion of Luther. Making the assertion that Kuhn's model had predictive ability we went back to the history of the Reformation. We decided that the cultural conditions leading up to Luther were indicative of a revolution and that a revolution could have been anticipated. Key to this discussion were the five hallmark signs of crisis as explicated by Kuhn.[16] Having confirmed that, at least historically, Kuhn's model had predictive power, we moved on to an investigation into modern culture to determine whether or not we could observe signs for developing revolutions that would be pertinent to scientific and religious discussion. The conclusion was "yes," particularly in the areas of genetics and the science of life, ecology and environmentalism, and globalization and religious pluralism. It is important to note that this list of three is not in any way complete. These particular instances merely happened to be three areas found to be especially interesting.

---

[16] See page 8.

After reviewing the work to this point, two fundamental conclusions may be made. First, the language of Kuhn definitely applies to religious revolutions and has predictive power. Second, in examining the three fields discussed a revolution is approaching. Kuhn carefully chooses five distinct features of crisis and in each of these areas most or all of the conditions are being met. Returning to the analogy of the Petri dish one could say that the bacteria are preparing to swarm over the sides of the dish. The cultural aspect of crisis that Kuhn neglects, that of a crisis in the general culture is, however, not currently met. Although at any point the world may be altered dramatically through war, disease, discovery or famine in such a manner as to cause a crisis that necessitates a paradigm shift it has not happened as of *today*. This general crisis and the actual paradigm shift are the inherently unpredictable elements of revolution as only something genuinely newly created can be. However, it is interesting to consider what a paradigm shift might bring together.

Many problems have been raised within the three proposed areas of revolution and it is not hard to imagine that a paradigm shift would solve many of them in a unique and unforeseen manner. Exactly what would this look like though? The questions at the very core of each of these areas are as follows. What is life? What does it mean to be human? What should our relationship with the environment be and how can we achieve this? How can we deal with pluralism in a global age and how can the economics of a global society allow for social justice between third and first world nations? Imagining the possibilities of genetic science and how it will interact with a connected global society that is concerned with its environment and justice among nations is impossible. One cannot even begin to consider what may or may not happen, the possibilities are

innumerable. One can expect terms such as "life" and "human" to be expended in new directions. One can expect that worrisome problems with the environment will be solved in fascinating manners. Even still, the most exciting aspect will be the new questions and anomalies that will be arise as the old ones are answered. Will this be progress, a progress toward some sort of truth, toward a better world? Yes! Looking at the history and life span of species humanity is young; astronomically speaking the Earth is younger still. We live in a youthful ignorance but with the hope that growth and learning promises.

Even with the exact nature of the paradigm shift hidden, the claim that a revolution is ripening in a particular area is fascinating and quite powerful. Even the most distorted glimpse of the future is interesting for anyone and a useful reminder to everyone to keep our minds nimble and open to new ideas. As the Teacher says, "For everything there is a season, and a time for every matter under heaven."[17] Perhaps with this modified Kuhnian model that season and time may be predicted.

[17] *Ecclesiastes* 3:1, NRSV.

## Bibliography


Bainton, Roland H. *The Age of the Reformation.* Krieger Publishing, Malabar, Florida: 1956.

Bainton, Roland H. *The Reformation of the Sixteenth Century.* Beacon Press, Boston Massachusetts: 1952.

Barbour, Ian G. *Religion and Science: Historical and Contemporary Issues.* HarperCollins, San Francisco: 1990.

Dyson, Freeman J. *The Sun, the Genome, and the Internet: Tools of Scientific Revolutions.* Oxford University Press, New York: 1999.

Fuller, Steve. *Thomas Kuhn: A Philosophical History for Our Times.* University of Chicago Press, Chicago: 2000.

Galison, Peter. *Image and Logic: A Material Culture of Microphysics.* University of Chicago Press, Chicago: 1997.

Grimm, Harold. *The Reformation Era.* 2nd ed. Macmillan, New York: 1973.

Guignebert, Charles. *Ancient, Medieval and Modern Christianity.* University Books, New Hyde Park, New York: 1961.

Hacking, Ian, et al. *Scientific Revolutions.* Oxford University Press, New York: 1981.

Heisig, James. "Converting Buddhism to Christianity, Christianity to Buddhism." *Japanese Religions* 22 (1996): 107-117.

Hurstfield, Joel, ed. *The Reformation Crisis.* Barnes and Noble, New York: 1966.

Johnson, Elizabeth. *She Who Is: The Mystery of God in Feminist Discourse.* Crossroad, New York: 1992.

Kittelson, James. *Luther the Reformer.* Augsburg Press, Minneapolis: 1986.

Kuhn, Thomas S. *The Structure of Scientific Revolutions.* 2nd Ed. University of Chicago Press, Chicago: 1972.

Lohse, Bernhard. *Martin Luther: An Introduction to His Life and Work.* Fortress Press, Philadelphia: 1980.

Lucas, Henry S. *The Renaissance and the Reformation.* Harper Publishing, New York: 1934.

Lull, Timothy, ed. *Martin Luther's Basic Theological Writings*. Minneapolis: Fortress Press, 1989.

Luther, Martin. *Three Treatises*. Trans. C. M. Jacobs. Philadelphia: Muhlenberg Press, 1947.

McFague, Sallie. *The Body of God: An Ecological Theological*. Fortress Press, Minneapolis: 1993.

McFague, Sallie. *Models of God: Theology for an Ecological, Nuclear Age*. Fortress Press, Philadelphia: 1987.

McFague, Sallie. *Super, Natural Christians*. Fortress Press, Minneapolis: 1997.

Peters, Ted. *Playing God*. Routledge, New York: 1997.

Peters, Ted. *Science and Theology*. Westview Press, Colorado: 1998.

Pieris, Aloysius. *Fire and Water: Basic Issues in Asian Buddhism and Christianity*. Maryknoll, New York, Orbis Books: 1996.

Rothman, Barbara K. *Genetic Maps and Human Imagination*. W. W. Norton & Company, New York: 1998.

Sptiz, Lewis, ed. *The Protestant Reformation*. Prentice Hall, Englewood Cliffs, New Jersey: 1966.

Townsend, John S. *A Modern Approach to Quantum Mechanics*. University Science Books, Sausalito, California: 2000.

Tudge, Colin. *The Engineer in the Garden*. Hill and Wang, New York: 1993.