Chapter 12

Evolution Theory Itself Evolves

12.1 Introduction

The purpose of this chapter is to do some housekeeping on the topic of evolution before we move on to other topics. The first couple of topics address some concerns regarding the language used in the theory. Then, we'll deal with whether or not neo-Darwinism is even relevant anymore. We will end up the chapter with a philosophical analysis of the creationist perspective on evolution.

12.2 'Natural selection' is a misleading and confusing metaphor

If we interpret the term, 'natural selection', in a strictly literal sense, we discover that it doesn't occur. I think Darwin erred when he used this expression. The expression, 'natural selection', is misleading because it implies choice. Traditionally, selection is defined as a conscious act of choosing; picking by preference; in agriculture to choose certain individuals for breeding.

Unfortunately, Darwin adopted 'natural selection' as a metaphor in an attempt to extend to natural environments that which had been practiced in agriculture for thousands of years, otherwise known as artificial selection. In terms of plant or animal breeding, selection is a very appropriate term. The different varieties of dogs and roses are evidence of breeders choosing the best of a crop for future reproduction, while preventing undesirables from propagating. In these instances, humans proactively make conscious decisions on reproductive opportunity with certain desired outcomes in mind. This is not the case in nature.

Despite the embedded term, 'natural selection', selection literally does not occur in nature (except in certain instances of sexual selection that I will discuss later). No individual is singled out by the environment and awarded reproductive priority. The natural environment does little more than present stresses that all individuals must cope with. The individuals that reproduce have not been 'selected' by the environment or anything else. They just happened to be the individuals who successfully negotiated the environment. They avoided premature death. This happens naturally.

It is a grand philosophical stretch to envision the survivors *as if* they were actually selected by the environment. I will attempt to explain using a metaphor of my own. Imagine a marathon race. The racecourse is equivalent to the natural environment and the runners are equivalent to the pre-adult generation of a population. Keep in mind that in any marathon not all runners actually finish the race. In this scenario, the finishers of the marathon are not *selected* by the racecourse. Instead, the finishers ascend to the finish line on the basis of their individual attributes. The finishers are victorious over other competitors as well as the racecourse itself. In this sense, victory happens in spite of the racecourse's stressful circumstances that might otherwise prevent it. Rather than acting to choose a victor, the racecourse unwittingly represents a stressful circumstance in which the finish line is preceded by obstacles and other stresses. Instead of actively selecting the finishers, the racecourse presents a circumstance that unintentionally but automatically separates runners based upon their individual attributes.

The theory of evolution is complicated enough. I believe that the expression, 'natural selection', does more to confuse the issue than to illuminate it. So, what do I suggest as an alternative? Rather than 'natural selection', I prefer the term, 'natural non-random survival.' Not as catchy, but it is more accurate.

12.3 There is confusion surrounding the expression, "survival of the fittest"

In the middle 1800s, Lamarckiain evolutionist, Herbert Spencer, coined the expression, 'survival of the fittest.' Darwin later adopted it. In my view it is today an outdated and inappropriate statement that only causes confusion. The controversy centers on the meaning of the term 'fit'. It has changed since Darwin's time. Darwin equated the expression, 'survival of the fittest' as equivalent to the outcome of natural selection. To Darwin, a 'fit' individual was an individual who possessed a suite of adaptations that enhanced the individual's chances for success in the struggle for existence. In this case, fitness, or the possession of adaptations, is used as an *explanation* for non-random

survival in a stressful world. This *view* still forms the core of Darwinian evolution and the new synthesis — but the *language* has changed since Darwin's time. The result is confusion.

In the early 1900s, genetic evolutionists, R.A. Fisher, J.B.S. Haldane and Sewell Wright began to use the term, 'fitness' in an entirely different context. As a result, the term 'fitness' became redefined to mean an individual's proportional genetic contribution to the next generation. According to this usage, an individual that reproduces much has great fitness. An individual that reproduces little has low fitness. And an individual that doesn't reproduce has zero fitness (is not fit). This assumes that any individual surviving to reproductive maturity will reproduce. So, we cannot determine if an individual is fit or not until it either reproduces or doesn't. Therefore, we determine fitness after the fact. In other words, the fit are those who survive to reproduce. So here is the philosophical problem. If we apply the modern usage of the term, 'fit', to the old expression 'survival of the fittest' we unintentionally end up with a circular statement that generally means "survival of those who survive". Another entangled mix of old usage and new usage is the statement, 'an individual attains fitness because the individual is fit'.

Taken on their face, these expressions are examples of what logicians call a tautology. A tautology generally is a statement in which an idea is described in terms of the same idea, such that it cannot be any other way. For example, the expression, "all professors are teachers" is a tautology because by definition, professors are teachers who teach in college. The expression is barren of information.

Obviously, by placing the new definition of the word, 'fit' into the old expression, 'survival of the fittest' the result is empty and confusing. We can update this expression very easily by substituting the phrase, 'best adapted' for the word, 'fittest.' The statement then becomes, 'survival of the best adapted'. This modified statement is consistent with Darwin's original intent, which was to provide some *explanation* as to why certain individuals in an environment reached reproductive age while most of their cohorts did not. But we still need to justify this statement.

We still assume that, overall, the survivors are best adapted. And so, we could again fall into the tautological trap (How do we know they are best adapted? Because only the best adapted survived.). The only way to avoid this philosophical trap is to find empirical evidence that is consistent with our assumption of the presence of superior adaptations. This is the burden that the theory of evolution must bear. To the extent that we can explain non-random survival in terms of an individual's recognizable behavioral, developmental and anatomical features, we avoid tautology. It turns out that we can do this in many cases. The features that we see in living things appear to be consistent with their particular environments. We recognize these features as adaptations. As our knowledge about adaptations grows, we understand more *why* the survivors survived and the non-survivors did not.

The bottom line is that it is scientifically reasonable to assume that if a living thing survives to reproduce, it is largely because that individual possesses special adaptations. This assumption is justifiable because it is scientifically possible to demonstrate *how* an individual's mix of features (adaptations) helps that individual survive.

12.4 How relevant is neo-Darwinism?

Before we finish our discussion on evolution, I want to make a few comments on the current state of the science of evolution. I think you will find it interesting.

As we saw in chapter ?, humans have been trying to understand evolution for a long, long, time. Charles Darwin and A. R. Wallace provided the first solid theoretical basis for explaining how evolution might work. The genius of their theory was that they recognized the importance of individual variation and reproduction with inheritance in the context of stressful natural environments. But Darwinian evolution theory was inclomplete because of two principle shortcomings. First, scientists did not understand how offspring inherited the traits of their parents. And second, scientists did not yet understand the quantitative dynamics of living populations.

Soon after Darwin, scientists solved the first puzzle regarding traits and inheritance. The rediscovery of Mendelian genetics in the early 20th century advanced Darwin's theory to a more sophisticated level. Evolutionists, Sewell Wright, R. A. Fisher and J. B. S. Haldane integrated Mendelian genetics into evolution theory. The result was a revised theory of evolution that explained variation and inheritance in terms of genes. This new theory became known as the 'new synthesis' or neo Darwinism.' Neo-Darwinism and the emerging science of population genetics made it possible to consider evolution in quantitative terms. Evolutionary biologists began to use statistical tools like probabilities and gene frequencies in an attempt to understand the essence of evolution.

Neo-Darwinism is still the prevailing view amongst evolutionary biologists today. And it remains relevant. But there is a growing awareness that neo-Darwinism also presents an incomplete explanation of how evolution actually happens. Scientists continue to hammer away at the theory. As they do, its shape has become more sophisticated and more reflective of the actual way in which life evolves on this planet. The first

issue I will address concerns the tempo and destiny of evolution through the ages. Was its pace steady and gradual, or did it move in spits and starts? Will evolution eventually and always lead to intelligent life?

12.5 Evolution may be accelerated by mass extinctions and opportunity

There is the prevailing notion that, given enough time, evolution inevitably will lead to more and more sophisticated life forms, ultimately to sentient beings. New findings in the fossil record now provide compelling arguments against this view. For example, the analysis of the Burgess Shale of British Columbia by H. B. Whittington and Stephen J. Gould has resulted in a stark new view of the direction of life on Earth. That is, the life forms we see today are probably more the product of simple good fortune, and less a result of an inevitable arrow of life. In his book, *Wonderful Life*, Gould bases this new and somewhat disheartening view on the observation that a mass extinction occurred at the end of the Precambrian Era that wiped out nearly all of the bizarre life forms of the time. He establishes that the extinctions were largely due to chance. That is a wanton extinction event that was blind to the special adaptations that otherwise enabled organisms to thrive in their pre-extinction world. The significance of Gould's idea is that it discourages our quest for an organized picture of the march of life on Earth. Intelligent life is not always inevitable. Instead, the fate of intelligent life may have been the result of lucky passage through numerous and deadly mass extinctions on Earth. If so, humans and all living things are all the more remarkable.

Up until about 50 years ago, there was considerable and growing debate regarding the details of how the processes of natural selection could have acted to yield the kinds of organisms we have today. The core of the issue is, "Did life steadily evolve in a gradual way? Or were there bursts of evolution?" There is a growing support amongst prominent paleontologists that the diversity of life on Earth today that evolution may have been speeded up by mass extinctions. This widening belief is based upon evidence in the fossil record that the Earth has experienced thousands of extinction 'events', some of these were large enough to be classified as 'mass extinctions'. The fossil evidence indicates that mass extinctions were followed by a burst of evolution and diversification amongst the survivors. This cycle of mass extinction, rapid speciation, evolutionary stability and quiescence, and mass extinction presents the evolution of life on Earth as anything but gradual. In 1972, Niles Eldredge and Stephen J. Gould described this pattern of evolution, 'punctuated equilibrium'. Punctuated equilibrium is just gradual evolution that occurs at different speeds at different times. Following a mass extinction, gradual evolution happens rapidly for a time, then slows down. For example, the most notorious mass extinction happened at the end of the Cretaceous Period, 65 million years ago. This is when the dinosaurs and about 70% of other species went extinct. This extinction was followed by a rapid emergence of new mammal species that quickly filled the ecological niches left behind by the extinct dinosaurs and other life forms.

Other mass extinction events, some more deadly than the end of the Cretaceous, also have been followed by new rounds of speciation and innovation. It appears that the stable periods between the mass extinctions were a time of refining life form design after the initial round of innovation. This thinking seriously calls into question the power of prolonged, competitive environments to foster innovation. In fact, such an environment may actually penalize quantum innovation. Therefore, if the world had not been interrupted once-in-a-while by mass extinctions, the opportunity for large innovations might have been severely limited. In his book, *Extinction: Bad genes or bad luck?*, paleontologist David Raup states that, "According to this view, the principle role of extinction in evolution is to eliminate species and thereby reduce biodiversity so that space — ecologic and geographic — is available for innovation."

The causes of these mass extinctions are still unknown. However, there is a growing understanding that somehow life was presented with a situation that was extremely unusual and to which it fell victim. For mass extinctions, this meant an unusual perturbation on a global scale. Traditional favorites for mass extinctions include: 1) large changes in sea level and climate; 2) salinity changes in the world's oceans; and 3) oxygen depletion in the oceans.

These standby explanations are beginning to fall out of favor, and are being replaced by growing interest in the idea that Earth may have been harmed by forces originating outside of the planet, and possibly even outside the solar system. For example, more and more energy is being concentrated on the asteroid or comet impact idea as a cause of mass extinctions. Although this idea had been floating around the scientific community for decades, it was elevated to legitimate hypothesis with the paper published in 1980 by L. W. Alvarez, W. Alvarez, F. Asaro, and H. V. Michel. Their provocative article provided a persuasive argument that the dinosaur extinction was caused by a giant comet or asteroid striking the Earth, and disrupting the global climate system. Since this paper appeared there has been a flurry of activity to explore this possibility, and to question whether similar catastrophes might explain other mass extinctions. Much new work supports the notion.

Recent work by Hildebrand *et al.* (1991) have dated the huge Chicxulub underground crater in Yucatan, Mexico as a strike point related to the Cretaceous holocaust.

Since Luis and Walter Alvarez's first proposed the asteroid/extinction connection, exciting new discoveries have been made — and new controversies. Astronomer Eugene Shoemaker has estimated that asteroids 150 kilometers (93 miles) in diameter strike the Earth on average about once every 100 million years. Paleontologist David Raup has proposed that an asteroid of this size could cause 65% of all species to go extinct. How do they kill? Raup argues that asteroids can trigger mass extinctions by representing a first strike that reduces the geographic range of many species, which then experience a run of bad luck that finishes them off. Raup and Jack Seposki proposed in 1984 that the Earth's principal extinctions happened every 26 million years. Several researchers have suggested that craters and extinctions happen at regular intervals. They noted some evidence suggesting a correlation between the age of craters on Earth and major extinction events, and that they happen together every 26 million years. However, most scientists involved don't believe that extinctions happen at regular intervals.

The upshot of this work is that, for the most part, gradual climate and sea level changes are no longer held as the most likely explanations for mass extinctions. This is extremely important because of our understanding that life may have a powerful part to play in influencing the global climate. There is no doubt that climate and sea level changes will and probably have re-organized the distribution of life on Earth. But such changes might fall within life's normal tolerance of Earth conditions, and as such might not necessarily be "bad" for life as a whole — as long as the changes happen slowly, and as long as ecosystems have the freedom to move to new locations, unfettered by obstacles.

The mass extinction scenario also testifies to the resiliency of life. Although life can be occasionally interrupted, it resumes its march over the planet. It also demonstrates that the availability of real estate represents a significant opportunity, and that innovations have greater chance for success in a world of opportunity. For the Earth's diverse physical settings certain innovations may be a prerequisite for success in the new frontiers.

12.6 Non-linear dynamical systems theory helps explain life better: Life is so chaotic

Population biologists have great difficulty in modeling natural populations. They simply don't behave the way they are 'supposed to'. Sometimes life is, well, chaotic.

The problem is that living systems cannot be modeled in the old, Newtonian, deterministic way. According to Newton's mechanistic view of the Universe, scientists should be able to construct reliable models to predict the behavior of a system — if they can just understand the system well enough. The bread and butter of population ecologists is to develop predictive models. But it turns out that there are non-linear and dynamical circumstances impacting live populations that are impossible to predict or model. For example, a population that fluctuated widely high one year and low the next was traditionally explained as oscillating about some presumed equilibrium. It never occurred to them that there might be no equilibrium. To biologists, the revelation of order was the key to understanding. But life simply is not completely orderly. There was a nagging feeling that disorder was an inherent property of life that had not been adequately considered. New findings in mathematics and physics are presenting a whole new way to think about living systems.

Starting in the 1970s, a new field of mathematics began to evolve. It became known as 'dynamical systems theory.' James Gleick gives an excellent history of this science in his book, *Chaos*. Dynamical systems theory includes such subfields as complexity theory, the 'butterfly effect', and chaos. Its mathematics describe patterns and relationships amongst variables rather than quantitative outcomes. The beautiful fractal patterns like the one in figure ? are exquisite representations of dynamical systems in action. What is a dynamical system?

A dynamical system is a non-linear system of many parts whose state is constantly changing. Its current state at any instant in time influences the qualitative and quantitative nature of the system at the next instant in time. A cloud is an example of a dynamical system. Turbulence in the air constantly twists and shapes the particles that make up the cloud. As a result, the shape of the cloud evolves. The crowd of people at a carnival would be another example of a dynamical system that stretches and pulsates as rides begin and as food is dispensed. Dynamical systems theory argues that it should be possible to predict exactly the different shapes a dynamical system like a cloud or a crowd go through. But there is just one catch. It is not possible to know with enough accuracy the exact starting conditions upon which your predictions can be made. This is called 'sensitivity to initial conditions', otherwise known as the 'butterfly effect.'

The butterfly effect was discovered by physicist Edward Lorenz while he tried to model long-term weather conditions. What Lorenz found was that for otherwise identical weather simulations, the tiniest differences in initial conditions resulted in huge differences in weather down the line. A butterfly flapping its wings in Beijing today will influence storm weather next month in New York. The significance of this situation in dynamical systems to the science of evolution is that even the most subtle changes in an environment or a population have the potential to cause big changes in the future. And since we cannot ever know the exact initial conditions of

any living system, we can never make long term predictions about the future evolution of a species. It also makes it very difficult if not impossible to retrace the historical evolutionary steps that led to an existing species or adaptation.

Most neo-Darwinist genetic and population models that are widely used today are interpreted based on linear mathematics. According to linear logic, a population will exist in one of three possible states. It will be growing at a steady rate. It will be shrinking at a steady rate. Or it will stay constant. Still, biologists have long recognized that such linear models of life are unsatisfactory.

Instead, the environment and living populations can best be understood as nonlinear dynamical systems that exist either in steady states, regular oscillations, or chaos. The components of the physical environment are constantly undergoing small changes that may have unpredictably large effects on the living inhabitants. And the living inhabitants are undergoing constant change, however slight, that may powerfully influence future conditions of the biological and physical environments.

One of the most surprising insights of the study of dynamical systems was the discovery that the same forces that cause chaotic behavior in dynamical systems will eventually lead to order. That is, randomness and chaos do not exist as wholly independent processes but must be thought of as components of a larger system of order.

For example, the logistic equation is used by biologists to describe patterns of growth and fluctuation in populations. In the 1970s. biologist Robert May discovered that if he pushed one parameter of the standard logistic equation beyond its traditional limits, the results were surprising. At first the population fluctuated high and low. Then, as the parameter was increased, the population size became chaotic. As the parameter is increased further, the population once again fluctuated in an orderly way. This pattern of order, then chaos, then order repeated itself indefinitely. What looked like randomness and chaos actually was part of a complex and orderly system.

The discovery of chaotic non-linear dynamical systems has the potential of transforming all of the sciences that deal with complex systems, including evolutionary biology. Let's think about evolution in terms of the lessons learned in the last two chapters. First of all, you may ask, "How can evolution possibly get any more complicated?" But it is complicated, and our understanding of it must rise to meet it on its own terms. I have always felt uncomfortable thinking about evolution as discrete 'processes' of gene flow, genetic drift, or natural selection. Too sanitary. Better to think about all of the circumstances of the environment and the individual fluctuating constantly and simultaneously. Out migration is happening in multiple directions at one instant, while in migration is happening from multiple directions, while mutations are emerging in some individuals, while the climate is in a 2-year cycle of drought and rain, while migratory predators are trekking through the environment, while random changes are occurring in the allele distribution of gametes, while food species populations are fluctuating. An instant later, all of the factors in the system have changed. And it is likely that the theory of evolution also will change by incorporating dynamical systems.

Biologists, Regis Ferriere and Gordon Fox argue that evolution can best be understood in terms of nonlinear dynamical systems theory. For example, even in simple models of population genetics, gene frequencies can undergo cyclic or chaotic change. When they do, neo-Darwinist models of the sort proposed by Wright are no longer sufficient. Ferriere and Fox speculate that nonlinear dynamical properties of populations also can produce unexpected situations when less fit genes actually are favored by selection. This kind of counterintuitive theoretical thinking is the result of trying to come to terms mathematically with the highly complex, versatile and dynamic nature of living systems.

12.7 Additional challenges to neo-Darwinism by scientists

There are several additional philosophical challenges to neo-Darwinisn on the horizon. In his book, *The Web of Life*, physicist Fritjof Capra presents a summary of this new thinking he refers to as the 'systems view of evolution.' According to the systems viewpoint, evolution must be considered as a system of multiple interlinked feedback loops. The most controversial aspect of this view stems in part from Stuart Kauffman's idea that living systems posses inherently emergent properties that are naturally inclined to produce new forms of order. We await a comprehensive systems theory of evolution.

On another horizon, biologist Lynn Margulis adds further complication to the emergence of complex living systems. In, *What is Life?*, by her and Dorian Sagan, the authors argue that living individuals on all levels exert a measure of 'choice' in the day-to-day affairs of their lives — an idea first proposed by 19th century author Samuel Butler. That is, living things influence the evolution of their species by making sentient decisions about their own lives. 'Each living thing, Samuel Butler argued, responds sentiently to a changing environment and tries during its life to alter itself.' The result is a phenomenon called 'phylogenetic memorization', in which the conscious strivings of one generation are converted into the activities and biological systems of the next generation. According to Butler, it might be possible that after many generations

of learning how to read, humans may evolve such that one day babies will be born with the ability to read. For good reason Margulis and Sagan differ with Butler on this point.

This line of argument, loosely grouped under the heading of 'vitalism', has a somewhat Lamarckian tone that attempts to say, "Life has purpose and direction." Perhaps in reaction to Darwin's indifferent and materialistic portrayal of life, Samuel Butler remarked that Darwin had "taken the life out of biology." And as Arthur Koestler put it, "if you take out finality and purpose you have taken the life out of biology as well as psychology." (see Barlow p. 100). Koestler's view of living things saw then as having two opposite tendencies. The first was the self-assertive tendency, or the tendency to survive in the struggle for life. The second tendency was the integrative tendency. This was the tendency for individuals (or holons, as Koestler redefines individual) to function as part of a larger whole.

The very premise of the neo-Darwinist theory of evolution is does not accommodate the desires of some invstigators that life have purpose. The basic postulate of Darwinism is that life just is. Although scientists should not rule out 'purposiveness' with the wave of a hand, they still cannot ignore that the vitalist approach seeks to reject Darwinism altogether. If that can be successfully done, it would be one of the most exciting revelations ever to happen to the study of evolution and life itself. Until then, the scientific community awaits a cohesive and demonstrable theory.

So, where does this place the neo-Darwinist approach to evolution? Neo-Darwinism remains a solid entrée into evolution theory. Neo-Darwinist evolution theory gives a basic core of ideas upon which to build. But it is probably incomplete in light of new findings regarding the dynamical nature of environmental and living systems, regarding and the role of genes and alternate sources of innovation. For example, neo Darwinism advocates that genes are possessions protected by and for the species. But different species of bacteria freely exchange genes with one another. Different species of plants also widely exchange genes with one another. Innovations are not just genetic. They can arise as a result of new symbiotic relationships too.

So, the relatively straight forward, neo-Darwinist approach so far remains at the core of evolution theory. But this center is becoming overlain with spherical shells of additional understanding.

12.8 Creationism disagrees with evolution theory

No biology textbook would be complete without addressing the claims by Christian creationists that evolution is wrong. Although I am somewhat obligated to alert the reader that such a controversy exists, I do not intend to use this book as a vehicle to vociferously refute the creationists. For a comprehensive explanation of the whole creationist and creation science movement, please read Numbers' excellent book, *The Creationists: The evolution of scientific creationism*. Denton's book, *Evolution: a theory in crisis*, lays out the creationist arguments against evolution theory. Berra's book, *Evolution and the Myth of Creationism*, presents science's perspective. On the internet, check out the *talk.origins* newsgroup for a flaming debate on this issue.

However, I will argue that attempts to use scientific thinking by creationists to support their claims has resulted in two philosophical problems for them: 1) it has demonstrated their misunderstanding of the scientific philosophy; and 2) it ironically imperils the very belief they seek to defend. Let's look at the nature of the controversy from the perspective of the scientist.

Briefly, the Creationist viewpoint is that the theory of evolution is utterly wrong. Creationists view their world as it was described in the Holy Bible's book of Genesis. Instead of evolution, the Universe, the Earth and all its living beings were created all at once (well, over a span of six days) some 5000 years ago. There have been no extinctions except those plants and animals lost during Noah's Great Flood. There have been no new species since the creation. The Earth is now as it was then with no changes. There has been no continental drift. Humans were the special creation of God who fashioned them after His own image.

Creationsts take exception with Darwin's theory of evolution mainly because here is a comprehensive explanation of the development of life on Earth and all its species that doesn't involve or require a God in any way. The theory of evolution exists quite independently of the book of Genesis. Henry M. Morris is the director for the Institute for Creation Research in San Diego, California. Eugenie Scott is the executive director for the National Center for Science education. As Eugenie Scott puts it, Henry Morris has blamed evolutionary theory for communism, fascism, Freudianism, social Darwinism, behaviorism, Kinseyism, materialism, atheism and, in the religious world, modernism and neo-orthodoxy. The main worry of creationists is that if children learn about evolution, they will reject God, and this will surely lead to lives filled with immorality and evil. As a scientist, I would question this host of fears as a legitimate motivation for scientific inquiry.

As part of his doctoral research in the early 1990s, Christopher Toumey accompanied a group of creation scientists at their monthly meetings in North Carolina. They were a congenial group of two science professors, two medical doctors, a computer engineer, an electronics technician, and two lab scientists. The mission of the group was to study the scientific case for creationism. An anthropologist, Toumey's interest was to observe the group in an attempt to more fully

understand the creationist viewpoint. He published his findings in his book, *God's Own Scientists: Creationists in a Secular World*. Among his many interesting observations, two findings stand out.

First, Toumey observed that on occasions where the group disagreed on how to scientifically interpret a natural phenomenon (such as the speed of light), the teachings of Henry Morris were invoked, which ended the debate on the spot. Morris was their charismatic spiritual leader and scientific authority. The significance of this observation is that such capitulation to authority is exactly the opposite of what you would expect from minds acting truly in science mode. In the face of uncertainty, the scientific mind endlessly seeks creative solutions. In the presence of such uncertainty, the worst thing any scientific mind can do is surrender to some authoritarian doctrine. Once this group yielded to authority, the scientific process stopped, and was displaced by spiritual belief.

In his book, Evolution: *The History of an Idea* (p. 354), Peter Bowler points out that creationists and creation scientists have a mistaken impression about how science works. To a creationist, science is just another competing ideology whose followers are obliged to agree on and promote scientific 'truth'. Scientists themselves are partially responsible for this misunderstanding. Evolutionists as well as the general 20th century scientific community (especially during the Cold War with the Soviet Union) traded on this myth of infalibility, that whatever science says, goes. And there have been one or two science professors who have been known to spew science as ideology (i. e., scientism). What creationists (and some professors) fail to grasp is that science is not in the belief business. It is in the 'open possibility' business. Its ultimate product is the scientific theory.

A scientific theory is nothing more magical than a attempt to explain some large phenomenon. Scientists find theories useful because they bring together otherwise disconnected understandings into a larger whole. As I mentioned in chapter 1, theory means 'to see.' Scientists are free to question everything, including the theory of evolution. All complex scientific theories steadily evolve as a consequence of skeptical scrutiny by scientists. That there are doubts about a theory is not evidence in any way that a theory is invalid.

Continuing on this note, creationists frequently point out that the theory of evolution is invalid because scientists are still arguing about it. This claim demonstrates a fundamental misunderstanding about the scientific process. First of all, science is a field that attracts some of the most independent and aggressive egos in the world. Many scientists tend to be independent operators following their own creative paths to discovery. This is just the way it is. No matter how solid a theory is, this group of free thinkers will always find some way to pick it apart. The ongoing debates between evolutionists, Stephen J. Gould and Richard Dawkins are perfect examples. They snipe at each other in the popular literature like two championship wrestlers in a locker room interview.

Back to Toumey and the creationists. Next, Toumey observed that the application of scientific thinking was not rigorous and that spiritual belief took precedence. For example, in a talk to the group, creationist paleontologist, Arleton C. Murray argued that actually there were two great floods on Earth instead of just one. Known and despised by many creationists as the Gap Theory, the first flood was called Lucifer's Flood. According to this idea, the Earth experienced two separate creations. The first Earth was inhabited by the dinosaurs and other primitive beings. Lucifer's flood wiped them out, leaving a world "without form, and void" (Gen. 1:2). Then, the six-day creation followed and humans were placed on the Earth. Noah's flood was a catastrophe of this second world. Murray based his theory of Lucifer's flood on a combination of fossil interpretation and spiritual inspiration, saying that it came to him, "as the spirit moved me." And for good measure, Murray attacked Morris with the claim that "Morris and his friends know nothing about fossils; Morris is an engineer, not a paleontologist."

This example presents many problems with the field of creation science. I will address just two of them. First, the invocation of science to study of supernatural phenomena is a fundamental problem in the field of creation science. By definition, science is a natural philosophy that is completely unaware of and disinterested in supernatural phenomena. The instant spirituality is addressed, science stops and spiritual belief takes over by default. So, any attempt to use science to explain supernatural belief is philosophically corrupt. But in the meantime, the greatest risks are to the belief itself.

Next, the issue of greatest significance in this example is that if creationism is available for scientific scrutiny by its believers (as in the case of Murray), then why not by its detractors as well? The use of science to study religious beliefs presents a situation of great irony. If science is used in an attempt to defend religious belief, the belief itself is necessarily jeopardized. This is because science depends upon objective interpretation of empirical evidence. Belief doesn't. A supernatural belief system could have come about in the absence of any supportive evidence.

If, in an attempt to stay relevant to modern times, more credence is given to the requirement of evidence, unsupported beliefs must fall. In their book, *Jesus Under Fire: Modern Scholarship Reinvents the Historical Jesus*, Michael Wilkins and J. P. Moreland confront this problem. The problem is that a 'radical' group of Christian scholars are using scientific investigation techniques to assess the viability of the Bible, particularly Jesus of Nazareth, in the context of modern

times. Calling themselves 'The Jesus Seminar', their findings are quite unsettling to the Christian community at large. The claims of The Jesus Seminar include: rejection of the deity of Christ, a declaration that Jesus' pedigree — including his virgin birth in Bethlehem — is all myth-making by the writers of the Gospels; that stories of Jesus' death, burial and resurrection were latter-day wishful thinking of the early church. In response to such claims, the book pursues a vigorous refutation of the Jesus Seminars that belies its religious obligations. Their argument is based on the following model: Christian faith by definition cannot and will not be disproved, therefore the findings of the Jesus Seminars are necessarily wrong. Clearly religious belief and scientific thought exist in two separate intellectual realms.

This example demonstrates two things: 1) that using science to investigate the basis for supernatural belief presents terrible consequences for the belief. As Wayne Carley, of the National Association for Biology Teachers put it, "The real threat to having religion in the science classroom is to the religion, not to science. Evolution can and will stand up to scientific scrutiny over time. But the very testing of religious beliefs such as creationism in a scientific setting destroys the basis of the religion: faith." To continue, even if the theory of evolution eventually falls to scientific scrutiny, there is no reason to suspect that creationism will ascend to take its place. And 2) that when faced with challenges of a rational, objective and scientific nature, spiritual beliefs will defend themselves with an arsenal of still more spiritual belief, with the justification that should the defense fail, the belief might be proved wrong, and this can never be allowed to happen, no matter what.

To sum up, creationism presents a view of the world that may or may not be true. By the same token, evolution presents a view of the world that also may or may not be true. The question to the reasonable mind is, "which explanation is closest to reality?" The difference is that science is willing to entertain the notion that evolution may be incomplete or wrong altogether. But creationists will tolerate no such dissent in their camp, or any other camp for that matter. To the scientific mind, the evidence powerfully argues against creationism. Although the theory of evolution is incomplete, it remains the best scientific explanation to-date for the development of diversity and adaptations amongst living things. Creationist seeking to discredit evolution on scientific terms have demonstrated a misunderstanding of the philosophy and practice of science. Contrary to the creationists complaint, scientific debate about the theory of evolution is evidence of its vitality and relevance, not its demise. Creation scientists also misunderstand that the philosophy of science is utterly incompatible with supernatural belief systems. Because scientific thinking demands evidence and fosters skepticism, the practitioners of any supernatural belief should use extreme caution when accessing the tools of science to prop up their belief. Creationism is a spiritual belief that cannot and should not be presented or analyzed using the scientific technique. And evolution is a scientific theory that is neither available nor interested in accommodating any religious ideology. The two viewpoints originate from two distinctly different and incompatible philosophies. However different, they can cohabitate — as long as one leaves the other alone.

12.9 References

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