

Judaism and Darwinian Evolution

Baruch Sterman

INTRODUCTION

The question of science versus religion, a subsection of the *Torah uMadda* debate, has been widely discussed and disputed. Many of the arguments for and against the study of the natural sciences are in fact similar to those relating to secular studies in general. In certain ways, however, scientific inquiry and the issues involved are more crucial. Society cannot function, at least in the modern sense, without science and scientists. Even a religious community, assuming it wishes to be self sufficient, needs energy, communication, transportation, and medical attention, no less than its secular counterpart. All would agree that technicians, electricians, and doctors are essential to society.

The natural sciences, however, have often been feared for creating direct, explicit challenges to religion. When a technological society takes advantage of a scientific theory for a practical application essential to that society, there may be significant ramifications of that theory which conflict with accepted religious notions. The same atomic theory that is imperative for building a nuclear reactor to supply energy also predicts the radioactive decay of carbon 14 which has been employed in dating procedures, the results of which are often incompatible with a literal reading of the first chapters of the Bible. One who is trained in science can find himself convinced of the veracity of a theory which seems to yield results contrary to the teachings of religion, and the logical conviction associated with scientific inquiry is usually more compelling than the non-empirical theorizing associated with the "softer" secular studies.

Modern Orthodox Judaism as a whole has taken a positive position regarding *Torah uMadda*, and has clearly determined where its allegiances lie. Yet Rav Aharon Lichtenstein, perhaps the foremost contemporary thinker and spokesman for modern Orthodoxy writes:

But surely we do hold that if, indeed at some point and at some level, faith and reason, *Torah uMadda*, collide, then it is *Torah haketuva veHamesura*, text and tradition, which prevails. This is, of course, frankly illiberal... [regarding the] series of postulates of liberalism, the foremost being that there is no authority, moral or intellectual, higher than one's rational perception. That liberal position is one which I have said the Newman of the [eighteen] sixties rejected and, of course, so do we.

Despite his "illiberalism," Rav Lichtenstein is nonetheless quite flexible as to the possibility of minimizing the discord.

Confronted by evident contradiction, one would of course initially strive to ascertain whether it is apparent or real: to determine, on the one hand, whether indeed the methodology of *Madda* does inevitably lead to a given conclusion and, on the other, whether the received content of *Torah* can be interpreted or reinterpreted so as to avert a collision.¹

Rav Lichtenstein goes on to explain that this reinterpretation may take one of several forms, ranging from narrow focus on a particular term,² to explaining certain texts as

allegorical (as Maimonides often does), and even allowing for the contention that the Biblical text "intended to convey a moral and spiritual, but not necessarily historical and scientific, truth."

In this article, I would like to apply Rav Lichtenstein's prescription to the issue of evolution. First and foremost, one must determine whether indeed scientific evidence supports Darwin's theories enough to demand a reexamination of the sources of Judaism. If the answer is affirmative, then one can embark on an investigation of the areas of friction and potential reconciliation. There is, of course, a large region of overlap between issues and problems raised by the theory of evolution, and by other disciplines. For example, the difficulty presented by a literal interpretation of the first chapters of *Bereishit*, which contradicts the scientific cosmological timetable, exists whether or not one accepts evolution, since it arises not only from biology but also from geology, paleontology, physics, and chemistry. The resolution of these problems is not the subject of this essay.³ Rather, I intend to concentrate specifically on the challenges posed to Judaism by the theory that there was some sort of evolutionary development of life on Earth, and particularly by the mechanism that Darwin and his followers proposed for that development.

EVOLUTION AND ITS RELIGIOUS DETRACTORS

The attitude of people who reject Darwin and his theories usually ranges from condescending dismissal to indignant derision. The tacit respect afforded physics or chemistry (often grudgingly) is conspicuously absent with regard to evolutionary biology. Evidence such statements by the Lubavitcher rebbe as, "If you are still troubled by the theory of evolution, I can tell you without fear of contradiction that it has not a shred of evidence to support it."⁴ Even the great advocate of harmony between Science and Torah, Prof. Leo Levi, derides the theory in his discussion of evolution.

Looking at this theory [Darwinian evolution] as an attempt at a scientific formulation, it is very unconvincing, to say the least. Despite the beautiful and convincing descriptions in popular science books and high school texts, with their persuasive pictures, not only is the theory of evolution totally unproven, it is practically *disproven*.⁵

In *Challenge*, a collection of articles dealing with the problems posed to Judaism by science, six out of the eight essays devoted to evolution attempt to disprove the theory (though the article *Actual and Possible Attitudes to Evolution within Orthodox Judaism* is a cogent and interesting exception.) Yet, despite this summary dismissal by religious thinkers of evolution as unscientific, the basic theory of Darwinian evolution is *the* theory for the origin of species accepted by virtually every biologist. Every day in thousands of labs across the globe, scientists perform experiments based on assumptions and predictions derived from that theory. It is the cornerstone of modern biology on all levels. The words of the Nobel laureate James Watson, one of the discoverers of the structure of the DNA molecule, though written more than twenty-five years ago are no less true today.

Today, the theory of evolution is an accepted fact for everyone but a fundamentalist minority, whose objections are based not on reasoning but on doctrinaire adherence to religious principles.⁶

Perhaps one reason for the glaring disrespect towards the views of the experts, unique to evolutionary biology, is that the theory is popularly available. Its premises are easily explained, and the basic mechanisms do not require the complicated, almost mystical mathematics that shroud other scientific postulates like quantum mechanics or general relativity. As a result it can be readily understood, and is widely studied, even at the high school level. An amateur would be more willing to attack a theory like evolution, whose basic jargon he can comprehend, than one like quantum chromodynamics, of which he probably has never heard.

This reasoning, however, is not enough to explain the remarks of Prof. Levi, a preeminent scientist and author of a textbook on optics, nor can those remarks be explained by certain problems or scholarly conflicts in the field of evolution. A physicist would not countenance a biologist's flippant rejection of Maxwell's equations or Einstein's explanation of the photoelectric effect, two scientific descriptions of optical phenomena universally accepted within physics, even though the simultaneous acceptance of those two theories ostensibly leads to the paradoxical description of light as both wave and particle. It would certainly be maintained that the correlation between theory and experiment, along with the fact that the experts accept both these notions, should evoke a sense of humility in the would be detractor. A brusque dismissal of the widely accepted views of modern biologists is likewise not warranted, especially by someone who is not an authority in the field. The derision of evolution as high school or popular science, when graduate level courses in evolutionary biology are offered in virtually every university, is misplaced.

Evolution nevertheless evokes a disposition of derision and contempt in religious thinkers, even among those who are generally favorably disposed to *Torah uMadda*. It is constantly adorned with pejoratives: the "so called" or "alleged" theory is unscientific, implausible, disproven. I believe that a major reason for the difference in the tone some religious Jews adopt in discussing evolution as opposed to, say, physics, lies in the nature of the challenges posed by the disciplines. A theory like the Big Bang calls into question the belief in an emphatically literal interpretation of the first few chapters of the Bible - a section which in any event has baffled even the greatest commentators in their search for the text's *pshuto shel mikra*. Many traditional Jewish thinkers had no trouble explaining as allegorical or metaphorical those passages which contradicted their ideas. Judaism requires belief in God as the creator of the Universe, but is relatively unconcerned with exactly *how* or *when* He created it. Darwinism, on the other hand, seemingly challenges not just some passages or views, but the philosophical mindset of religion. I say seemingly because I hope to show that within Judaism, at least, there is ample room for Darwin's perceptions, and perhaps Darwinian evolution can even serve as an analogy to better understand certain problematical ideas in Jewish thought. In this article I will present what to my mind are the core points of contention between the Darwinian outlook and that of Judaism.

DARWINIAN EVOLUTION

Before discussing the problems raised by evolution, I would like to present a brief outline of the evolutionary mechanism proposed by Darwin, and why biologists find the theory so compelling. It should be noted that religious thinkers often take advantage of the word *theory* to emphasize the lack of commitment or certainty that even biologists have towards evolution. In fact, *theory* here denotes a scientific theory - i.e. a proposition as to the mechanism or general law behind a given set of empirical observations. For example, Newton's theory of gravitation is the mechanism used to explain the observed motion of the planets in the sky and falling apples on Earth, but, needless to say, (leaving aside the minor corrections of relativity) no self respecting scientist doubts the validity of that *theory*.

Darwin argued that since the globe has undergone and is continuing to undergo systematic transformation, life on Earth must change in order to survive. Nature provides an unlimited supply of fortuitous hereditary novelties which spring into existence without any regard to their biological usefulness. The fertility of nature leads to an unremitting struggle for existence. Therefore, in such a struggle, individuals endowed with favorable novelties will survive, whereas less fortunate individuals will perish. In spite of the fact that each novelty is more or less negligible, their successive accumulation from one generation to the next will lead to the establishment of changes which are far from negligible.⁷

Darwin tried to prove his case according to the methods of science as understood by the 19th century British philosopher of science William Whewell.

Whewell argued that the best kind of science tries to bring many disparate areas of enquiry under one unifying principle. This integration, which Whewell termed a 'consilience of inductions', works two ways. On the one hand, the unifying principle throws explanatory light on the various sub-areas. On the other hand, the sub-areas combine to give credence to the unifying principle. Indeed, argued Whewell, you can thus have confidence in the truth of the principle, even without direct sensory evidence. Much as in a law-court, where one assigns guilt indirectly through circumstantial evidence, so in science you move beyond speculation indirectly through its circumstantial evidence.⁸

A distinction should be made between the *fact* of evolution and the *path* of evolution. Michael Ruse, a philosopher of science and leading proponent of Darwinism defines the fact of evolution as the "natural unfolding and change of organisms down through the generations, from earlier forms widely different."⁹ Darwin, in his monumental work *On the Origin of Species* attempted to establish evolution as fact. He showed that many problems which arise in various areas of biology are resolved by the hypothesis of evolution.

Thus in biogeography, oceanic islands pose a puzzle. Why on the Galapagos archipelago, for instance, do we find different species of finch, mocking bird, or tortoise, from island to island, within sight of each other? Why does this happen when, on the South American mainland, one single species might roam the length, from steamy jungle to frigid desert? Obviously, because ancestors came to the Galapagos and then evolved, cut off from their fellows. In comparative anatomy, homologies [likenesses in structure between parts of different organisms] pose a puzzle. Why do we get isomorphism [similarities] between the bones of the arms and hand of

man, the fore-leg of horse, the wings of bird and of bat, the flipper of whale, and the paw of mole? Why do we get these, despite of the very different uses to which these limbs are put? Because of descent from common ancestors. In embryology, virtually everything poses puzzles. Why are the embryos of man and dog indistinguishable, when the adults are so very different? Because they have a common evolutionary origin.

Then, reversing the thread of thought, Darwin argued that the Galapagos finches, the fore-limb homologies, the identical embryos, are the fingerprints, the bloodstains, the broken alibis, of evolution. Gathering together all the wide evidence, the case for evolution is thus made overwhelming. It is 'beyond reasonable doubt'. Moreover, modern evolutionists agree in this with Darwin, simply following his method and adding yet more strands of evidence. For instance, recently molecular biology has opened up dramatic new veins of support. The essential macromolecules of life speak no less eloquently about the past than does any other level of the biological world.¹⁰

But Darwin went beyond establishing a theory about the occurrences of evolution; he also proposed a method by which evolution occurs, what Ruse calls the *path* of evolution, and this mechanism, natural selection, is still the central feature of evolutionary thinking. Given that populations can increase at a great rate, yet resources essential for sustenance (e.g.. food, space, etc.) are limited, this potential for growth can never be realized. There will be a 'struggle for existence' that may manifest itself in obvious ways, such as an actual brawl between two individuals, or in more subtle ways, such as one organism's greater fertility. Since there is clearly a wide range of variation that occurs naturally, like differences in size, weight, speed, strength etc., one would expect those better equipped to survive in their environment to succeed. Darwin drew on the analogy of animal and plant breeders' skill at transforming species through choosing the desired forms (artificial selection), and termed his mechanism natural selection.

Darwin himself had little idea about the nature of new organic variation. Subsequent work in genetics and later in molecular biology has shed much light on the nature of heredity and variation. The modern interpretation of Darwinian evolution, which incorporates these contemporary ideas, is known as the New Synthesis. Although, as is the case with virtually every scientific theory, there have been modifications in the theory of evolution in light of ongoing research and expanded data acquisition, the essential mechanism proposed by Darwin is still widely accepted within the scientific community.¹¹

OBJECTIONS TO DARWINIAN EVOLUTION

One type of objection to Darwinism can be termed "meta-scientific" namely an attack on the logical foundations upon which all science, including evolution, rests. Whewell's consilience is the basic methodology of all science, not just evolution, and a rejection of its validity calls into question the correctness of every scientific theory.¹² Indeed, such a sweeping critique of science is leveled by Lubavitch, i.e. that science is valid only in its purely empirical manifestation, but as soon as it abandons the strictly descriptive and

moves into the predictive, it loses its validity. Prof. Haim Branover, an advocate of *Habad* ideology, elucidates this point of view:

When we perform laboratory experiments in physics or chemistry and establish a regular pattern of behavior, we are involved in objective scientific facts. Likewise, when we interpret indirect measurements made beyond the spatial or cognitive reach of direct human sensory perception, such as spectral or radio-telescopic measurements or micro-particle tracing, we are not concerned with objective science. Conclusions dealing with the consequences of phenomena as they appear in a definite process of measurement or observation are objective, whereas attempts to theorize about the essence of objects causing these phenomena and even more about the history of these objects are, and always will be, scientific speculation.¹³

What Prof. Branover seems to be saying is that anything not observed or experienced in the most direct manner should be labeled 'speculative' and therefore not "true". But in that sense nothing can be one hundred percent true. This position may be logically sound but I don't believe that anyone really lives his life in such a fashion. Humans work on the principle of *plausibility*. One may claim that even though the odds against something happening are 10^{125} to one, that still doesn't mean that it can *never* happen.¹⁴ Nevertheless, if I have to sit and wait billions of years in order to reasonably expect something to happen, I will still use the word never, and the common sense, everyday use of language here is perfectly justified. People, including scientists, accept the notion of induction (even though some philosophers like Hume argued that such a notion is not epistemological valid). If something was true every day of my life, and every day of my father's life, and I have never heard it to be different, then I can reasonably assume that it will be true tomorrow. We do not sit and ponder before taking each step whether the floor that yesterday supported our weight might not behave according to another set of rules today. The logical hair-splitting that Branover presents asserts the old notion that humans can never know *the* truth - if indeed there *is* a truth. As a scientist I spend most of my day testing my theories by making predictions and then devising experiments to confirm those predictions. We scientists are very fond of Whewell's notion of consilience, and even though everyone knows in the back of his mind that nothing can ever be proven beyond a shadow of a doubt, the longer a theory stands up to experiment and the more successful it is at explaining the data, the more plausible it becomes, till at some point we use the word *true* to describe that theory even though we may not be applying the term in its most rigorous and absolute sense. In any event, it is difficult to accept a stance that invalidates any notion of reason other than direct sensory perception, and I think the success of modern science and the vast improvements in technology that are a direct result of the predictions derived from its theories can serve as an overwhelming confirmation of the validity of Whewell's methodology.

The other type of opposition to evolution accepts the scientific method, but claims that according to that method, Darwin was wrong. From the day Darwin published his theory, it has been attacked and challenged both from within the scientific community and from without. It may be instructive to discuss some of these difficulties since they are often raised as justification for the dismissal of Darwinism, without regard to how they are dealt with by biologists. One of the problems in responding to queries is that the questions are usually simple to comprehend, whereas their resolution is often complex and involved.

Prof. Levi raises some objections which are characteristic and representative of the types of challenge religious thinkers pose to Darwinism. Concerning two of his objections, the question of the supposedly fantastic probability against evolution, and whether the fossil evidence supports or contradicts Darwinism,¹⁵ I refer those interested in examining the position of the evolutionists to the book *Scientists Confront Creationism* (ed. L. R. Godfrey, W. W. Norton & Co. 1983), and specifically to the articles "Probability and the Origin of Life" by R. F. Doolittle and "Creationism and Gaps in the Fossil Record" by L. R. Godfrey. I would however, like to discuss one of Levi's questions (in detail that I hope remains within the bounds of this essentially non-technical article), that is often raised by those who reject Darwin as proof to the feeble-mindedness of evolution.

According to the evolutionist, the development of any complex organ requires many thousands of generations before it becomes useful and an aid in survival. In many instances (e.g. the bird's wing) it must have been a handicap up to this point and individuals carrying it should have been eliminated by the same process of natural selection which assures the survival of the more favored individuals. In addition, there are a number of giant steps which pose profound riddles to the evolutionist. In the face of these, one has to muster an inordinate amount of faith to maintain allegiance to the theory.¹⁶

Levi is arguing that while it may be true that an organ is wonderfully adapted for a certain use, until the organ went through many intermediate steps to reach that final usefulness, it could not have had any evolutionary advantage. Therefore, it should not have been able to survive throughout those generations when it had no purpose, and thus should never have evolved.

Like many criticisms, this one has been around for quite some time. It often seems as if detractors just shrug off all the scholarship and research that has been going on over the past century. This particular critique of Darwinism was originally raised by St. George Mivart (1817-1900), a British zoologist, who called the problem (the title of a chapter in his book *On the Genesis of Species*) "The Incompetency of 'Natural Selection' to Account for the Incipient Stages of Useful Structures." A detailed and cogent response to this objection can be found in an article by Stephen J. Gould, "Not Necessarily a Wing".¹⁷ I would like to briefly summarize the argument he puts forth.

Darwin himself was troubled by Mivart's question about incipient stages and rejected Mivart's solution that complex structures must have arisen all at once. "To admit all this is, as it seems to me," writes Darwin, "to enter the realms of miracle, and to leave those of Science." Darwin offered another solution, namely that organs can perform two functions, one primary and the other subsidiary, and then relinquish the main use and develop the formerly ancillary function. Much has been written, for instance, on the thermodynamic efficiency of insect wings. They present a large surface area to the sun for quick heating, something of great importance to small bodies. Since even now they perform that secondary function, perhaps initially that was their primary function. Thus, a possible scenario for the evolution of wings has the organism developing an outcropping which selection favors for heating and cooling purposes. As the protowings increase in size under selection for that purpose, they begin to offer the added advantage of stabilizing the organism in landing, or gliding. Eventually that function becomes primary and selection

favors even larger wings for flying. Gould cites an article by Kingsolver and Koehl in which they attempted to verify this hypothesis. Through a painstaking and methodical series of experiments they built models of fossil insects and measured the efficiency of the wings both for aerodynamic benefits and thermoregulatory effects. The results were consistent - the wings worked suitably thermodynamically at smallest sizes, with the benefits growing with wing size. Beyond a certain size, however, further increase offers no additional effect. For aerodynamic benefits, the results were symmetrically opposite, above a certain size the wings worked well, and the benefits increase as the wings get larger.¹⁸

I chose to discuss this objection at length because it dramatically illustrates a few of my previous assertions. The challenges posed to evolution do not warrant the pat dismissal of the theory. There are a number of highly intelligent men and women who have studied it, grappled with its difficulties, and yet subscribe to it. Devoted scientists are treating it seriously, testing its hypotheses, refining and qualifying it. Evolution is a scientific theory which has enjoyed tremendous success in explaining the diverse experimental data and in predicting results. Like all current scientific theories, it has gaps and areas which are not totally understood. Often such questions regarding the details of one area do not affect the validity of the theory as a whole. Although experiments on the neutrino flux of the Sun, for example, yield results incompatible with prevailing theories, the fact that the Earth circles the Sun is still not under question. Even if one chooses not to accept evolution or Darwinism, there is certainly no justification for the dismissal of the theory as unscientific. I think we have adequately shown that the methods and arguments used by biologists to establish Darwinism are sound and reasonable, and a great deal of thought has been devoted to the subject. Evolution should be treated with the same dignity as the theories in physics are, and it speaks poorly of the theory's detractors to smugly discharge this serious scientific discipline.

Before discussing the main issue of this article, namely the religious implications of Darwinism and the resulting challenges posed by it to Judaism, I would like to discuss one more objection to evolution. Professor Nathan Aviezer, a physicist at Bar-Ilan university, recently published a book, *In the Beginning*, which I believe to be the most sophisticated attempt yet at reconciling modern scientific knowledge with the first chapter of Genesis. Aviezer draws on a wealth of data from diverse areas such as astrophysics, paleontology and meteorology in his claim that the 'days' of *Bereishit* can be understood as describing major 'events' in the history of the Universe and Earth. Aviezer has no problem accepting virtually all the regnant scientific theories including the Big Bang theory and the fifteen billion year age of the universe. In terms of evolution, Aviezer makes the same distinction that we have previously noted.

When discussing the scientific evidence to Darwin's theory of evolution one must carefully distinguish between the *fact* that many species have become extinct and many new species have appeared and the *theory* proposed to explain this change in species.¹⁹

Aviezer accepts the *fact* that evolution occurred, but rejects Darwin's mechanism (what Ruse called the *path*) of evolution. His major objection rests on the following assertion.

A key point of Darwin's explanation is that evolution works in small cumulative steps through vast periods of time to make primitive species gradually evolve into more complex species.¹⁹

Aviezer then goes on to show that many scientists dissent with the notion that species evolve gradually, based on diverse evidence including the fossil record and modern theories of mass extinctions. He quotes the Cambridge Encyclopedia of Earth Sciences as stating that gradualism has been rejected in favor of the "model of 'punctuated equilibria' which has recently been widely accepted." (This theory, developed by N. Eldredge and S. J. Gould asserts that species tend to undergo long periods of stasis with relatively short periods of change.) It should be noted that although Darwin personally believed that natural selection happens gradually, the notion of gradualism is not essential to his theory. Thomas Henry Huxley, Darwin's ardent champion and friend warned Darwin on the eve of the publication of *Origin of Species*

You have loaded yourself with an unnecessary difficulty in adopting *Natura non facit saltum* [Nature does not make leaps] so unreservedly.²⁰

Gould discusses this point in an article explaining his theory of Punctuated Equilibria and clearly states, "Natural selection required no postulate about rates; it could operate just as well if evolution proceeded at a rapid pace."²¹ According to Gould, the objections regarding the validity of 'gradualism' are essentially irrelevant to Darwinism as it is understood according to this view.

In fact, Aviezer is well aware of the difference between invalidating the notion of gradualism and disproving Darwinian natural selection. If one reads his words carefully, one can see that Aviezer does not claim that the theory of evolution has been undermined, but rather that "the theory of *gradual* evolution" had proven problematical. Aviezer uses the phrase "Darwin's theory of evolution" in its most exact meaning - namely the theory of evolution according to Darwin's personal understanding of the details of natural selection.²²

Prof. Aviezer's tone is markedly different in his discussion of evolution than in the rest of his book. Whereas throughout his work he tries to reconcile regnant scientific thought with the Torah, here he goes out of his way to show that the theory of evolution, at least in its most popular form, is not valid scientifically. One reason for Aviezer's presentation is that evolution is seen as the scientific theory most at odds with Judaism. Many believing Jews are unwilling to accept the notion that there can be compatibility between the two. Perhaps Aviezer is so vague in his discussion of evolution in order to allow the reader who does not pay careful attention to find comfort in the idea that the whole theory of evolution has been discredited, rather than just the aspect of gradualism.

But there is another problem that disturbs Aviezer. The notion of gradualism has been taken by many scientists to mean *inevitability*. They view the evolution of complex life (including man) as a direct consequence of the fundamental setup of the world, given enough time. According to this view, God becomes superficial, and since scientists prune away that which is not necessary in their theories, they believe gradual evolution by natural selection belies belief in God. Peter Atkins in his book entitled "The Creation" puts forth this notion with no ambiguity.

Once molecules have learned to compete and to create other molecules in their own image, elephants, and things resembling elephants, will in due course be found roaming through the countryside... Some of the things resembling elephants will be men.

The question that now arises is the following. Suppose you prefer to be an infinitely lazy creator... Can the whole universe be taken back to a *single* thing, which, if it is appropriately specified, leads inevitably to elephants? Could you (being infinitely lazy) avoid, in fact specifying and making even that? If you could (and we shall come close to seeing that you can), there would be no role for you in the creation of your universe.²³

I chose to present this idea in the current section and not in the next where I discuss the challenges of Darwinism to religion, because I do not believe that gradualism, and certainly not inevitability, are essential components of Darwinism; in fact, they are contrary to the modern perception of the history of life. In this I am adhering to Rav Lichtenstein's admonition that we be sure that science does in fact demand acceptance of some tenet before indulging in reexamination of Jewish sources. We have already shown that natural selection need not be synonymous with gradualism and that in fact gradualism has been abandoned by many modern evolutionists. Furthermore, Stephen J. Gould, in his book *Wonderful Life*,²⁴ strongly dissents from the notion that natural selection necessarily and inevitably leads to the kind of animals that are today present (and certainly not to consciousness). He recounts the discovery of a fossil bed known as the Burgess Shale and explains how the contemporary perception of the evolution of life based on a new understanding of the forms of life found there, refutes the notion of inevitability.

We once thought that the history of life moved upward from simple beginnings in a few primitive, ancestral lines to ever more and ever better - the conventional notion that I have called the cone of increasing diversity... But the reinterpretation of the Burgess Shale, and our burgeoning interest in the early history of multicellular life in general, have indicated that the cone model is not only wrong but also backward.²⁵

Clearly, then, one can accept evolution while totally and wholeheartedly rejecting gradualistic inevitability, and if indeed the latter is incompatible with religious belief, one need not throw out the infant evolution with the bath water of inevitability.

This having been said, I believe, however, that within the Darwinian conception of the world and life, certainly lie challenges to religion in general and Judaism in specific. I am not referring to particulars such as the contradiction of a passage here or a Midrash there, neither do I allude to the use of evolution by some scientists with anti-religion sentiments to further their personal agenda. I am concerned with the philosophy of Darwinian evolution and how that contends with the ideology of Judaism.

JUDAISM AND EVOLUTION

The position often presented by both evolutionists (e.g. Eldredge²⁶) and by Jewish thinkers (e.g. Yeshayah Leibowitz²⁷) that essentially there can be no conflict between science and religion is from a certain standpoint quite sophisticated, yet to a degree it is

also somewhat naive. It insightfully delineates the nature of scientific inquiry and its limitations; that science generally makes no statements about those most crucial and complex aspects of the human situation - aesthetics, humanities, ethics. (Leibowitz points out that the list of Nobel laureates in the sciences includes at once great humanitarians as well as members of the Nazi party.) This position is also sophisticated in its appreciation that the profundity of the Biblical text goes beyond mere historical or scientific truth and reaches for psychological, moral, and spiritual truth.

However, I believe that there is a certain naivete associated with this total separation of science and religion. Momentous theories like relativity, quantum mechanics and evolution make statements about *how* the world works that must certainly have religious implications. A religious personality that believes in a Creator who chose to run the universe according to a certain set of rules must acknowledge that those rules tell us something about the Creator. The psalmist realized this quite well when he exclaims, "The heavens tell the glory of God; the works of his hand are spoken by the firmament."²⁸ In addition, the claim that science has nothing to offer in terms of, say, ethics, is not necessarily an accurate assertion. The relatively new field of sociobiology attempts to understand human culture in light of its Darwinian history.²⁹ More significantly, Michael Ruse has pioneered an attempt at developing an entire philosophical system, including epistemology and ethics, based on Darwinism.

This leads me to the last part of this essay, the major point of this work. Up until now I have been involved in a defense of the validity of Darwinism as a scientific theory, but this is not intended to be an article on science or even on Darwinism. The extended introduction was required solely because of what I perceive to be a lack of willingness within the Jewish intellectual community to face Darwinism in an open-minded fashion. I believe that the time has come to open discussion on this issue, because, after all, if it is correct, then it's not going to go away. Specious arguments, diatribe, and condescension will not satisfy the curious intellect for long.

Moreover, there is a crucial and positive reason to discuss Darwinism, precisely because it is such a major challenge to the regnant religious mindset. The primary cause, I believe, for the disparaging attitude of religious people towards evolution, *is that the theory provides an alternative to religion*. Ruse argues that secular philosophy still seemed incomplete and unsatisfying to most people. Even those who were not necessarily Jew or Christian, for example Deists who believed in an unmoved Mover, generally had some vague belief in something more spiritual.

The coming of evolution, of Darwinism in particular, altered all of that. Now, for the first time, one could confidently suspend belief in any kind of God. The natural development of organisms explains everything, most especially adaptation. Even if you did not want to become a full-blown atheist, you could become what Darwin's already mentioned supporter, T. H. Huxley labeled an 'agnostic', neither believer nor disbeliever.³⁰

It must be pointed out and underlined, however, that just because some people use Darwinism to reject God, that is no justification for the assertion that acceptance of Darwinism is incompatible with belief in God. Therein lies the challenge and the positive reason to discuss Darwinism. Judaism has not been confronted with such a powerful

alternative philosophical system since Aristotelianism. Though supporters of Aristotle rejected the crucial and fundamental religious notion of a God who was involved in the world and in the life of the individual, nevertheless the dialogue between Judaism and Aristotelianism was extremely fruitful *for Judaism*. Abraham Ibn Daud and the Rambam developed their understandings of Judaism in light of the conflicts and tensions with Aristotelianism; indeed, one of the greatest works of Jewish philosophy of all time, the *Moreh Nebukhim*, is a direct result of the Rambam's attempt to confront that philosophy with Judaism. Darwinism poses challenges in much the same way today. These challenges do not simply take the form of scientific facts (e.g. the age of the universe) contradicting certain religious beliefs (e.g. a literal acceptance of the Biblical text); that type of contradiction can easily be dealt with and does not (in my opinion) pose a critical threat to religion. The more fundamental confrontation, however, stems from an understanding of Darwinism as a philosophical system, a recognition of its assertions about the fundamental properties of the universe. When these conceptions are compared to those of Judaism, one can determine if they are mutually exclusive - one must choose either Darwinism or Judaism - or if perhaps some sort of conciliatory posture may be adopted.

Classical Jewish literature contains many statements that seem to hint at an evolutionary conception. The Creation story itself follows a somewhat evolutionary pattern. Midrashim abound about worlds before ours, eras before the present. Were the Rabbis of the Midrash and Talmud curious about fossils of creatures that no longer existed? Did they wonder about the diversity of organisms, specifically about the many varieties of humans? The Talmud³¹ records a story of a man who came to Hillel and asked him why the Tarmutians have squinted eyes, to which Hillel responded that it was because they live between the sands. Asked why the Africans have wide feet, Hillel answered that it was because they live in the swamps. Rashi explains regarding the Tarmutians, that the wind blows sand into their eyes and their environment has changed them. This answer may hint at a Lamarckian evolutionary view. More recently the *Tiferet Yisrael*³² claimed that modern discoveries in paleontology and geology bear witness to the conceptions of the Midrash and Zohar regarding previous worlds. Rav Kook believed that evolution vindicates the notion that the world is constantly progressing toward the higher and more superior.

The theory of Evolution, which is capturing the modern world, accords to the secrets of the world of the Kabbalah, more so than all the other philosophical systems. Evolution, which follows a path of exaltation, provides the basis for an optimistic world view, for how can one possibly be discouraged when he sees that everything develops and becomes higher. When we penetrate into the essence of this evolutionary elevation, we find in it the Godly principle shining with absolute clarity, precisely the Infinite in deed, acting to bring into actuality that which is infinite in potential.³³

The acceptance of certain evolutionary conceptions by Jewish thinkers notwithstanding, I believe, that the mindset of Darwinism and its philosophical ramifications, pose challenges to the foundations of religion in general and to Judaism in particular. These are the underlying assertions of Darwinism that I previously mentioned. The list I present here is by no means exhaustive, but I think the issues are representative of the major problems.

CHALLENGES POSED BY DARWINISM

Torah Judaism encompasses many ideas and varied conceptions, perhaps even conflicting opinions. Though Darwinism seems to go against some concepts, it may fit in with and actually enlighten others. The following presentation does not presume to be a definitive response to Darwinism, but rather I would hope that this serve to open up the channels and engage the interest of religious thinkers to consider this most formidable but crucial issue.³⁴

1. The place of man

The conception of Darwinism as to the nature of man is radically different than the religious view. Judaism believes that man was created in the image of God. Evolution claims that all complex life is part of a chain stretching back to the simplest life forms. One of Darwin's great achievements was being able to break with the intellectual inertia of his time and apply his theories to man as well. Alfred Wallace, for example, who independently developed the theory of natural selection, always stopped short of applying his theories to humankind. Needless to say, Darwin did not agree with Wallace and claimed that not only is there evolutionary continuity in physical attributes of man, but also in human emotions. 19th century British resistance to evolution was largely due to the perception of man and the origin of mankind. Noble and dignified man, the English gentleman, was so different and so far superior to the beast, that the thought of any type of ancestral connection was nothing short of incredible. (A similar idea is expressed in the apocryphal story that students used to chide evolutionists with the claim that anyone who could believe that man had descended from apes must never have seen the Hafetz Haim.) Darwin's voyages had brought him into contact with the other end of the spectrum, the most primitive of tribes -- the Fuegians. He wrote, "How entire the difference between savage & civilized man. - It is greater than between a wild & [a] domesticated animal ... I believe if the world was searched, no lower grade of man could be found."³⁵ Darwin was in the singular position to comprehend the fine line between man and brute, and where evolution details and accents the similarities, kinship, and connection between the two, Judaism stresses the opposite. How can one reconcile the central principle of religion, namely man's unique relationship with God, with the assertions of evolution that blur the distinction between man and animal?

One possible way to bridge these two views is to examine the nature of man within Judaism. The Biblical description of the creation of man is narrated - "And God formed man from the clay of the Earth." From a philosophical standpoint, why is coming from dirt any more favorable than coming from monkeys? To religion, what is important is the spark of God within, that is unique to man. The essential question, with or without Darwin, is where to draw the line between man and animal. What is a soul? Aryeh Kaplan suggests that the inception of man as a spiritual being should be the demarcation line.³⁶ Kaplan even argues that one could accept the order of magnitude of Biblical chronology if one claims that Adam was indeed the first spiritual being. I believe that in light of the fact that we have evidence for art, culture and religion from much more than six thousand years ago, the vague description "spiritual" is not sufficient. I would differ from Kaplan and claim that the distinction be drawn at man capable (intellectually, socially, culturally) of understanding

the concept of monotheism. In essence, according to the Torah, Man that cannot understand the notion of one God is not a responsible being. Even the moral code of the nations, the Noahide laws, includes a commandment to believe in one God. The Bible speaks only to responsible, accountable Man, and the evolutionary distinction of a species as a reproductive community is irrelevant to the Bible. According to Judaism, *Homo Sapiens* capable of understanding monotheism is as different from previous *Homo Sapiens* as he is from a squirrel. Kohelet writes,³⁷ "In the end, after everything has been heard, fear God and guard his commandments, for that is the sum of Man." Indeed, the Bible's definition of the human species (*Homo monothiestis*?) rests solely on the criterion of being able to follow God's word.³⁸

2. The argument from lack of design

Religion asserts that the world's perfection is evidence of God as designer. The Reverend William Paley (1743-1805) put forth this argument in perhaps its most eloquent form, one which influenced Darwin as a young man. Paley gave the famous example of someone finding a watch in the street, and inferring from the complexity and obvious purpose of the structure that it had a creator.

There cannot be a design without a designer; contrivance without a contriver... The marks of design are too strong to be got over. Design must have had a designer. That designer must have been a person. That person is God.³⁹

Darwin contested this reasoning and argued that the inefficiency and wastefulness in the world belies the notion of design. He realized that the perfection of organisms gave no proof to his ideas, but rather the oddities and imperfections were what gave support to his theory. Why should man possess the remnants of a tail or an appendix if he was perfectly engineered by the hand of a divine architect?

But, Darwin reasoned, if organisms have a history, then ancestral stages should leave *remnants* behind. Remnants of the past that don't make sense in present terms - the useless, the odd, the peculiar, the incongruous - are the signs of history.⁴⁰

Darwin offered an alternative to Paley's assertion that design implies a divine designer, and claimed rather that natural selection was an equally valid means of realizing the well-suited order of the world. Furthermore, though both Darwin and Paley could explain the harmonious patterns in nature, only natural selection offered a rationalization for the dissonant and anomalous; the explanation, according to Darwin, was to be found in the organism's history. How does Judaism deal with that history and the subsequent implications for the argument from design?

First and foremost, Cardinal Newman's point should be noted, that a religious person sees design because he believes, he does not believe because he sees design. Moreover, in essence, the issue of history, is not only associated with biological bodies; if we admit that the present world has a history that extends beyond the 6000 years of the Biblical record, then all that past and everything associated with it presents the same difficulty. The background microwave radiation relates the story of the birth of the universe and its

subsequent cooling. Light reaching us from stars billions of light-years away lets us glimpse the early universe while the spectra from nearer stars recount the evolution of our own galaxy and solar system. The composition and formation of rocks and the remnants of life forms imbedded in them tell of the development of our planet and life on it. The history of the world is not only evident in stars and fossils, but also in the genes of present day organisms.

The question that a religious person must ask when confronted with evidence of the universe's long and complicated history is why God chose to fashion and develop the world according to natural laws, and what we can learn from those laws. The Midrash contends that the reason Man was created last, is to teach us humility - how small a part of the universe we really are, in that even the lowly flea was created before us. Perhaps evolution can teach us a similar lesson.

Neither did the inconsonant and bizarre in nature escape the attention of Jewish thought. In presenting the awe inspiring wonder of nature to Job, God presents a certain bird as an example.⁴¹ The bird is a marvel of flight, yet is so feeble as to leave her eggs on the ground for all to trample. Through this bird's incongruous behavior, God demonstrates to Job both the complexity of nature and its magnificence. The imperfection of nature, and yet the brilliant way it still gets the job done, challenges Man to ponder his relative significance regarding the world, nature, and God.

Moreover, setting up evolution as an rejoinder to the argument from design can be viewed as one more instance of the post-Kantian breakdown of theological "proofs" for God's existence. This may not necessarily be a detrimental or adverse trend from a religious vantage. The value and significance of faith may even be increased, in spite or because of the profound philosophical obstructions placed before the religious thinker in the modern world. As Rav Soloveitchik *z"tzl* has noted, the tension between the clear evidence of God's design on the one hand, and the utter incomprehensibility of His existence on the other, is the dialectic which characterizes the man of faith. He has further pointed out that such "proofs" are, at best, of only secondary importance in Jewish theology, and are merely "abstract logical demonstrations divorced from the living primal experiences in which these demonstrations are rooted." As such, these abstractions can scarcely address the urgency and passion of the religious person's relationship with God.⁴²

3. Negative world view of Darwinism

A more subtle ramification of Darwinism is that it claims that the world is not "the best of all possible worlds." The phrase most conspicuous in the Biblical creation narrative is "And God saw that it was good." We associate God with mercy, kindness, fairness, and equity, and Jewish sources have traditionally seen evidence for these aspects of God within nature.

The world according to Darwin, on the other hand, is terribly inefficient and thousands are lost along the way to establishing a suitable lifestyle for the one. The secret of natural selection lies in the fact that variation is ubiquitous and there are many more losers in the struggle for existence than there are winners. In addition, winning doesn't always happen in the most elegant fashion. The ichneumon, a type of wasp, for example,

lays its eggs inside a caterpillar, and as the larva grows it eats the unfortunate host in the most productive manner - i.e. so as to keep the poor bug alive as long as possible. Once again, Darwin himself was aware of the difficulty this view of nature posed to religion. He wrote in a letter to his friend Asa Gray, a botanist at Harvard:

I own that I cannot see as plainly as others do, and as I should wish to do, evidence of design and beneficence on all sides of us. There seems to me too much misery in the world. I cannot persuade myself that a beneficent and omnipotent God would have designedly created the Ichneumonidae with the express intention of their feeding within the living bodies of Caterpillars, or that a cat should play with mice.⁴³

Darwin emphatically summarized his position, "What a book a devil's chaplain might write on the clumsy, wasteful, blundering, low, and horribly cruel works of nature!" How can one accept religion's basically positive view of the world order in light of Darwinism's emphasis on the negative?⁴⁴ In fact, though Darwin started his career, like many naturalists of his time, with a devout religious bent, he eventually followed the path of Elisha ben Avuya as his contemplation of the issue of suffering in the world slowly drove him from organized religion, and from a naive belief in a magnanimous deity. His life was one filled with physical torment, punctuated by personal tragedy. Darwin's sensitivity to suffering extended beyond the parochial awareness of human misfortune, and embraced an acute cognition of and empathy with the misery found throughout the animal kingdom, anguish that he felt was indeed central to the fundamental operation of nature.

Although Judaism generally asserts the positive within nature - that everything was created precisely for its station, ideas regarding the imperfection of nature and the persistence of chaos can also be found.⁴⁵ Since the Torah is far more concerned with human history than with natural history, it is instructive to examine the 'imperfection and inefficiency' of history and compare that with Darwin's world view.

Within Judaism there is a notion of *sh'erit hapleeta* - the faithful remnant. As early as the *Brit ben haBetarim* with Abraham, Jewish history is predicted as a path where there will be devastation and hurt, but the remnant shall survive. This notion is developed in *Tanakh* and the commentaries on *yetziat mitzraim*, *parashat Haazinu*, and the first chapters of Isaiah, to give but a few examples.⁴⁶ The point is that God would rather have a core who believe in Him for the right reasons than a multitude who worship Him out of fear, even at the cost of great destruction. This conception of Jewish religious evolution is remarkably similar to Darwin's mechanism of natural evolution. In fact, it could be argued that the notion of the desirable emerging from the ashes of destruction is even more compatible with Jewish thought than is the rosy picture of all being designed perfectly well-suited for its station. One of the issues that Jewish philosophy deals with in a most detailed manner is theodicy - why God allows for evil in the world. The issue raised here with respect to Darwinism is really a subset of that discussion. The notion that evil does not exist may be one way Jewish thinkers dealt with the matter, but it is certainly not the only course taken; it is not even the predominant one. Conceding the reality of the heinous, of the diabolical, is certainly in line with much of Jewish thought, from the Talmud, through the medieval thinkers, the mystical tradition of the Zohar, Lurianic Kabbalah and Hasidism, to modern day, post Holocaust Jewish philosophers.

CONCLUSION

Anyone who has ever been instructed to take antibiotics for a full ten days in order to avoid selection of strains that are resistant to the medicine, should be aware of the basic mechanism of Darwinian evolution. That mutations occur and that organisms better suited to an environment are most likely to survive are facts that virtually no one would question or doubt. It is clear that evolution as Darwin described it is currently taking place, continually and consistently.⁴⁷

The scientific community, as a whole, accepts Darwin's conceptions. It is certainly true that scientists sometimes introduce personal beliefs into their science, and many are anti-religious, a sentiment not difficult to understand given religion's (especially Christianity's) record on freedom of expression in science. Judaism, however, was never closed on issues like science.⁴⁸ Indeed, one of the most frightening ramifications of adopting a stance against evolution, is the identification with Christian Fundamentalists. This is not an unwarranted fear. I was deeply embarrassed to read Niles Eldredge's remarks, "Creationism... is most closely associated in the U.S. with various sects of fundamentalist Christianity. Other religions (for instance, some orthodox Jewish sects) also reject the scientific notion of evolution in favor of a literal Biblical rendition of the origins of the earth and living things."⁴⁹ The Bible states "Keep, therefore, and do them: for this is your wisdom and your understanding in the eyes of the peoples, who shall hear all these statutes, and say, Only this great people is a wise and understanding nation" (Deut. 4:6). If the world is looking at us and laughing, then perhaps, we should reexamine our position.

No scientist will claim that his theories are one hundred percent correct. Science is constantly revising and correcting itself, and the regnant views are often current for a very short while. Anyone wishing to realign his philosophic or religious priorities in light of science, should certainly take that into consideration. In addition, even accepted scientific knowledge has its boundaries. It must be noted, though, that science cannot introduce God as the answer every time it comes to an impasse. The moment God is introduced into a theory, there is no longer any opportunity to develop or advance the boundaries of human knowledge. As long as smallpox was regarded only as a divine punishment, it could never be eradicated save by repentance or grace. It is the duty of the scientist to continually strive to better understand the workings of nature, to never be complacent until all of the mysteries are solved. This may not be possible; there may always be frontiers beyond which science has nothing intelligent to offer, but science cannot accept those limitations. Science, however, is but one constituent of human endeavor which also includes religion, art, literature, history, philosophy, etc. Each province has its own benefits and boundaries; to ignore any area makes one's decisions less intelligent, less informed. To build a skyscraper armed only with the knowledge of Bible or Talmud is as irresponsible as to lead one's ethical and moral life armed only with science.

Judaism has been greatly enriched and profoundly influenced by the confrontations it had with disparate philosophies and viewpoints, and perhaps the same will be true of the issues associated with Evolution. The task ahead is to study all and grapple with the contradictions until solutions are found, and though this may be unachievable, perhaps what is important is the process rather than the realization of the goal. If challenges are posed,

then we must rise to meet them in the best spirit of Judaism and science, as the Rambam wrote, "One who practices truth simply because it is true, and in the end good will come from it."⁵⁰

¹*Torah uMadda: Congruence, Confluence and Conflict*, - a transcript of a lecture delivered by Rav Lichtenstein in 1987 at Yeshiva University in conjunction with the institution's Torah uMadda project, published in a compendium of Rav Lichtenstein's articles by Yeshivat Har Etzion, p. 6.

²The example that he provides is the Talmud's discussion of spontaneous generation.

³An overview of the sources which discuss the specific conflict between the *Bereishit* and science can be found in Prof. Shalom Rosenberg's book *Torah u'madda beHagot haYehudit haHhadasha* (Jerusalem: Misrad haHinukh vahaTarbut, 1988).

⁴*Challenge: Torah Views on Science and its Problems*, A. Carmell and C. Domb, eds. (Jerusalem: Feldheim, 1976), p. 138.

⁵Leo Levi, *Torah & Science* (Jerusalem: Feldheim, 1983), p. 105.

⁶D. J. Futuyma, *Science on Trial* (New York: Random House, 1983), p. 23.

⁷J. Miller and B. Van Loon, *Darwin for Beginners* (New York: Pantheon, 1982), p. 114.

⁸Michael Ruse, *Taking Darwin Seriously* (Oxford: Blackwell, 1986), p. 2.

⁹*Taking Darwin Seriously*, p. 1

¹⁰*ibid.*, p. 4.

¹¹The argument is often raised that modern views of evolution including Neo-Darwinism and punctuated equilibrium are inconsistent with Darwin's own views and can therefore hardly be called Darwinism. While it may be true that Darwin himself had different notions regarding the details of the means and rates of natural selection, the essential elements of the theory presented here remain. Moreover, the biologists who are proponents of the modern theories consider themselves to be following in Darwin's path. For these reasons I believe that the term Darwinism can still justifiably be applied to the modern theories of natural selection.

¹²In a recent correspondence, Prof. Cyril Domb commented that today, scientists tend towards Popper's criterion for validating a scientific theory, namely that it must make predictions that can be tested and *falsified*. I believe, however, that although falsifiability is indeed an important element in a theory, certain disciplines, by their inherent nature, are less suited for such a criterion. Generally, theories which try to explain the past have a problem with falsifiability. For example, theories in astrophysics and cosmology tend more towards consilience for substantiation, as does Darwinism. Again, cosmology is a much more tentative field, with theories grounded on less direct confirmation than other more experimental areas, but no one dismisses cosmology as an illegitimate field of science. Neither should Darwinism be so dismissed. In fact, Darwinism does make predictions (like the Hardy-Weinberg law) which have been verified. Any molecular biologist will swear by mutation rates, similarity of genes from related species, etc. Indeed, what happens to religion if falsifiability is applied? Can God be falsified? (In fact, theistic philosophers are among the staunchest champions of consilience for this very reason.)

¹³H. Branover, "Basic Principles in the Discussion of Torah and Science," in *Encounter* (Jerusalem: Feldheim, 1989), p. 235.

¹⁴See *Eemunah uMadda*, (Kefar Habad, 1980), p. 130 where the Lubavitcher Rebbe z"tzl discusses the issue of spontaneous generation.

¹⁵This problem can also be alleviated through the modification of classical Darwinism proposed by punctuated equilibrium. See *The New Evolutionary Timetable*, Steven M. Stanley (New York: Basic Books, 1981).

¹⁶*Torah & Science*, p. 105.

¹⁷Stephen Jay Gould, *Bully for Brontosaurus* (New York: W. W. Norton & Co., 1991), ch. 9. I quote Gould extensively throughout this article, not only because his popular essays on Darwinism are highly acclaimed and widely accepted, but also on account of his clear style and presentation, which is usually more instructive

for our purposes than quoting the primary sources. There is another personal motive. The present article was largely inspired by Gould's essay on William Paley and design (which I discuss in detail later on). In that work, Gould throws out a challenge to religion "In Darwin's translation, the invisible hand [of natural selection] dethrones the God of natural theology." I took this challenge personally, and set out to determine if indeed the evolutionary theory according to Gould himself was categorically incompatible with Judaism or if some sort of *rapprochement* was possible.

¹⁸A similar argument can be applied to the avian wing. Feathers, which are modified reptilian scales, have excellent insulating properties and could have initially developed to exploit that utility.

¹⁹Nathan Aviezer, *In the Beginning* (Hoboken: Ktav, 1990), p. 54.

²⁰Huxley is quoted in Gould's article. See the next footnote.

²¹S. J. Gould, *The Panda's Thumb* (New York: Norton, 1982), ch. 17.

²²I am grateful to Prof. Aviezer for clarifying his position to me. Prof. Domb, however, does explicitly make the correlation between gradualism and natural selection in any form. In his article "Faith and reason in Judaism," (*Can Scientists Believe?*, N. Mott ed. (London: James & James), p. 139) Prof. Domb writes:

They consider that the hypothesis of gradual change as a basis for the origin of species has been totally discredited; new species appear suddenly, exist for very long periods of time without significant evolutionary changes and then suddenly disappear; there is no evidence of natural selection.

For more on the attitude of Judaism to gradualism see two recent essays by Aviezer, and Moshe D. Tendler in *Jewish Action*, Fall 5754/1993, pages 50 and 51 respectively.

²³P. W. Atkins, *The Creation* (Oxford: Freeman and Co., 1981), pp. 3-7.

²⁴S. J. Gould, *Wonderful Life* (New York: Norton, 1989).

²⁵S. J. Gould, *Eight Little Piggies* (New York: W. W. Norton & Co., 1993), p. 351.

²⁶Niles Eldredge, *The Monkey Business*, 1982, p. 18.

²⁷Yeshayah Leibowitz, "HaDat uMaddaei haTeva," *Ben Madda lePhilosophia* (Jerusalem: Akadamon Press, 1987).

²⁸Psalms 19:2.

²⁹See for example, *The Third Chimpanzee*, Jared Diamond (HarperPerennial, 1993).

³⁰*Taking Darwin Seriously*, p. 30.

³¹Shabbat 31a.

³²*Drush Or haHayyim* (usually found in Mishnayot at the end of seder Nezikim).

³³*Orot Hakodesh*, p. 537. Rav Kasher justified this position within the classical sources in his article "Torat haBeria veShittat haHitpatkhut," in *Talpioth*, Vol VI. March, 1953, p. 205. It should be noted that Rav Kook's interpretation is a misreading of Darwin's theories. In fact it is more in line with Herbert Spencer's ethics of evolution. "He finds the ultimate source of value in the progressive upward climb of the course of evolution. As we go higher and higher, things get better and better. The ultimate culmination is humankind, the very apex of the evolutionary process. It is the existence of humans which makes all worthwhile." (*Taking Darwin Seriously*, p. 75) Indeed, I believe that a proper understanding of natural selection would actually pose great challenges to Rav Kook's system of spiritual and natural harmony. The notion that Darwinism "provides the basis for an optimistic world view" is antithetical to Darwin's ideas, as I shall point out shortly.

³⁴One can not ignore the philosophies and movements which have been based, in whole or in part, on Darwinism, from Social Darwinism and Nietzsche through the eugenics movement in America to the Nazi party. No group has sustained more torment at the hand of these than the Jews, and that may contribute somewhat to the emotional response and wholehearted rejection of Darwinism by some Jewish thinkers. I do not see this, however, as a legitimate religious challenge of the sort that I describe here since these ideas are not necessarily implied by and need not ensue from Darwinism. In fact Darwin himself, as well as his most ardent followers were categorically opposed to any attempt to use the notion of natural selection as a basis for social justice. Most recently, Gould has published a book discrediting these conceptions and debunking their "scientific" foundations. See S. J. Gould, *The Mismeasure of Man* (New York: Norton, 1981).

³⁵Adrian Desmond and James Moore, *Darwin*, (New York: Warner Books, 1992), pp. 132-133.

³⁶In a keynote address to the OU convention. Some of Rabbi Kaplan's observations have been recently published in his *Immortality, Resurrection, and the Age of the Universe: A Kabbalistic View*, especially pp. 20-22.

³⁷Kohelet 12:13.

³⁸Rabbi Jonathan Sacks develops a similar line of reasoning in his article on evolution *Issues in Jewish Thought - Evolution* (United Synagogue Publications, 1982). In that article he also deals with another issue, one that I chose to leave out, namely the problem of randomness. This indeed is a formidable difficulty, how can one jive the notion of *Hashgaha Pratit* - God's emphatic control over the Universe - with a system whose fundamental units follow random patterns. The reason that I do not discuss this here is because I believe it is not a problem unique to evolutionary theory. Randomness, at the most basic level, seems to be a feature of many physical laws. In Darwinism it takes the form of random genetic mutations, but randomness is also at the core of statistical mechanics, quantum mechanics, and chaos theory as well.

³⁹*Eight Little Piggies*, p. 142.

⁴⁰*The Panda's Thumb*, p. 28.

⁴¹Job 38:13--14.

⁴²R. Joseph Soloveitchik, *The Lonely Man of Faith* (New York: Doubleday, 1992), pp. 48-52.

⁴³S. J. Gould, *Hen's Teeth and Horse's Toes* (New York: W. W. Norton & Co., 1983), p. 41.

⁴⁴Dr. Carl Feit in his article, "Darwin and Drash: The Interplay of Torah and Biology," (*The Torah uMadda Journal*, vol. 2 1990, pp. 25-36), has commented on the pessimistic nature of evolution. The source of the pessimism in his view is the fact that certain theories regarding mass extinctions foresee the termination of humanity by some extraterrestrial cataclysm. I believe that the presentation given here shows that a negative world view is far more fundamental to Darwinism, regardless of whether a giant asteroid will destroy mankind in another 11 to 13 million years. Nevertheless, Dr. Feit goes on to explain that Judaism is not necessarily utterly and exclusively optimistic, and presents an analysis of Rav Soloveitchik's ideas related to this point, which certainly apply to the question as presented here as well.

⁴⁵See *Creation and the Persistence of Evil* by Jon D. Levenson (Harper & Row, 1988). Also see, for example, Rashi on Gen. 1:11, s.v. *etz peri*.

⁴⁶The sixth chapter of Isaiah develops this notion most emphatically. God tells Yeshaya to "blind the people's eyes and stop up their ears." Yeshaya asks bewildered as to the purpose of such a mission, "How long?," to which God replies, "Until the houses are destroyed and the cities lay waste from their inhabitants... like the trees in the autumn a strong foundation will remain." Rabbi Shalom Carmy, in a 1980 Yeshiva University course, explained that God is here telling the prophet to present to the Jews the notion of free will. If God makes it known that man has the authority to choose between good and evil, and that he will not be struck down on the spot for his choice, the inevitable result is that some will choose evil. God, however, is more interested in the quality, not the quantity, of the faithful. Carmy derived some elements of his approach from R. Azaria Pigo's *Bina leItim*, which deals with the hardening of Paro's heart.

⁴⁷Many people, nevertheless, believe that the mechanism of Darwinian evolution can not sufficiently explain the complexity and diversity of life on Earth. Religious thinkers will often allow for evolution as complementary to creation, proposing Divine direction of the development of life punctuated by certain explicit acts of creation (i.e. the initial life forms and Man). It should be noted that Darwinism is primarily a theory detailing the history and manner in which life unfolded and developed. Many of the issues discussed in this paper are relevant and germane to any view of life which admits Darwinian evolution in any way or form.

⁴⁸Rav Nahum Rabinovitch discusses this in his article, "Torah and the Spirit of Free Inquiry," *Challenge*, pp. 54-67.

⁴⁹*The Monkey Business*, p. 16.

⁵⁰Yad, Hilkhot Teshuva, 10;2