DIVINE ACTION AND **NATURAL SELECTION** SCIENCE, FAITH AND EVOLUTION

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DIVINE ACTION AND **NATURAL SELECTION** SCIENCE, FAITH AND EVOLUTION

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volume will evaluate and judge the chapters by their own understanding and personal tendencies.

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Biography

Hillel (Harry) Furstenberg is an Israeli mathematician. He is known for his application of probability theory and ergodic theory methods to other areas including number theory combinatorics, and Lie group theory. He was born in Berlin in 1935, and soon immigrated to the US. He concluded his BA and MSc studies at Yeshiva University, New York in 1955. He obtained his Ph.D. under Salomon Bochner at Princeton University in 1958. After several years at the University of Minnesota he became a professor of Mathematics at the Hebrew University of Jerusalem in 1965 and has taught at Bar Ilan University, Israel as well. He is a member of the Israel Academy of Sciences and Humanities and U.S. National Academy of Sciences. He is the recipient of several prizes: The Israel Prize in Mathematics, the Rothschild Prize, the Harvey Prize, the Emet Prize, and the Wolf Prize for Mathematics.

Foreword

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1. Darwinism — A Two-pronged Challenge to Religion

In a discussion of magic and the prohibition in Judaism of practicing magic, the Talmud points out that the Hebrew word for witchcraft can be seen as an acronym for “encroachment on the heavenly domain”, or, in other words, curtailing the sphere of Divine intervention. It is fair to say that the Rabbis of the Talmud would find contemporary science also encroaching on the heavenly domain. The conflict may be inevitable. The task of science is to demystify phenomena, finding “everyday” laws governing as much of our experience as possible, whereas religion — as also poetry — seeks the miraculous in the mundane, heightening the “everyday” experience.

The classic example of this clash of interests — though by no means the earliest — is the development of Newtonian physics and its implication for celestial motion. In this context, Laplace, the author of a treatise on celestial mechanics, is famously reported to have responded to Napoleon’s query as to how he could have omitted God’s name from his work, “I have no need for this hypothesis.” Newton himself, a staunch believer, still had a need for this hypothesis, particularly so since he wasn’t able to explain all the known astronomical phenomena, whereas Laplace’s improved analysis did away with the gaps in Newtonian astronomy. The spokesmen for Christianity at the time criticized Newton’s theory of gravitation and laws of motion vigorously, arguing that he “took from God that direct action on his works so constantly ascribed to him in

Scripture, and transferred it to material mechanism”, or that he “substituted gravitation for Providence” (p. 16 in: White, AD: *A History of the Warfare of Science with Theology in Christendom*. New York: D. Appleton and Co.; 1896.)

Providence implies perpetual supervision, and is more in line with Aristotle’s physics whereby a persistent force is needed to maintain motion. Newtonian theory not only dispenses with this need, but in some sense obligates God to abide by laws capable of formulation by human hand.

This clash doesn’t spare Jewish thinkers who, following Nachmanides, emphasize the ongoing character of Divine Providence. On the other hand it wouldn’t disturb Maimonides, for whom immutable law is the clear indicator of Divine intelligence built into the Creation. Indeed religious thought has come to terms with the Newtonian challenge, with the idea of God functioning outside the realm of time harmonizing with timeless laws of nature, and not subject to whimsy. Newton’s explanation of the miracle of the clockwork-like movement of heavenly bodies is the prototype of scientific understanding, basing the observed phenomenon on universal laws of motion and gravity that can be confirmed at every level of experience.

The Darwinian challenge, at the heart of what probably remains the most contentious of science/religion debates, is of a more complex nature, the role of the Creator being usurped not by a universal deterministic law, but by a combination of what Darwin himself called “blind chance and necessity.” The role of chance in evolutionary theory is seen by many as directly implying the lack of any governance, and a phenomenon enabled by chance events surely has “no need” for the implicit intelligence of a Creator. The component of necessity in Darwinian Theory appears in the fact that in a highly competitive environment, the underperformer will not pass its genes to successive generations. This is a law of simple logic — or common sense. There is some irony in the idea that chance events which are compatible with Divine intervention (though not giving testimony to such intervention) and may have been thought to be repudiated by the strict determinism of Newtonian mechanics, are fully restored in Darwinism, but, nonetheless “encroach on the heavenly domain.” Once again the Church responded vigorously: “The principle of natural selection is absolutely incompatible with the word of God” (p. 70 in White); “Christians have a right to protest the arraying of probabilities against the clear evidence of the Scriptures”; “to ignore design as manifested in God’s

creation is to dethrone God” (p. 79 in White). In 1996, however, the Church presented the very constructive comments of the late Pope John Paul II: “New knowledge has led us to realize that the theory of evolution is no longer a mere hypothesis.... The convergence, neither sought nor fabricated, of the results of work that was conducted independently is in itself a significant argument in favor of this theory” (Paul II, J: Address to the Pontifical Academy of Sciences, October 22, 1996. In: *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*. Edited by Russell RJ, Stoeger WR, Ayala FJ: University of Notre Dame Press; 1999:2-9).

We have two ingredients appearing in the Darwinian scientific upheaval that do not play a role in the Newtonian revolution, and these will be at the focus of many of the studies in the present volume. These features, related to one another in a natural way, are the place of chance in scientific theory, and the evidence of design in scientific phenomena. Darwinism welcomes the former and the latter lies beyond its frontiers. Religion is ambivalent about chance, but insists on the significance of design.

2. Blind Chance and Random Process

In Darwin’s theory chance is called upon to account for variability among members of a species. The mechanism for this is made precise in contemporary evolutionary theory, with variability stemming from “random” mutations within genes. Many mutations will be detrimental to the carrier of the affected gene, but some mutations, if not directly beneficial, may lead to a version of the organism better adapted to its environment. With this pinpointing of the place of chance, there is a subtle evolution of the notion of “blind chance” to the more respectable idea of “random process”, an established notion in contemporary science. One shouldn’t fail to see the oxymoronic character of this expression; randomness referring to inexplicability of a phenomenon, and “process” implying an understandable mechanism driving the phenomenon.

Nevertheless the notion has been very fruitful, and random processes with precise mathematical definitions serve as important models for physical and chemical phenomena (nuclear fission, diffusion). As a consequence a physical law involving random behavior may well be granted the same status as a deterministic law. This is particularly the case when a large number of chance

events are involved and one encounters a “Law of Large Numbers” which guarantees a high probability to certain outcomes. This latter circumstance, however, is not present in Darwin’s evolutionary theory. The chains of events called upon in the Darwinistic paradigm are enormously complex, and the probabilities involved defy estimation. Conceivably at some point the theory will be sufficiently developed so that the adaptive tendency of organisms appears as a rigorous outcome of a random process. In the present state of the theory, the adaptive tendency observed in the bio-world appears as an unlikely — but possible — outcome of chance events.

In the absence of Laws of Large Numbers virtually ensuring the occurrence of certain fortuitous events with some frequency, such events must be seen as “accidents”, ostensibly not subject to scientific analysis. Accidents do happen, but no more can be said. To what (or whom) an accident is ascribed depends very much on one’s philosophical agenda, and there is no objective guide in this matter. Anatole France is quoted as saying with some cynicism that “chance is the pseudonym of God when He didn’t want to sign”. In the *Bible*, the two are hardly distinguished and chance is most clearly regarded as the expression of Divine intervention. An extreme formulation is the prayer in Genesis (Chapter 24) by Abraham’s servant Eliezer asking God to “chance before him” and lead him to a suitable wife for Abraham’s son Isaac.

When the religiously inclined person attributes a chance event to Providence, he is regarding the event not as Divine whim, but as manifestation of Divine intelligence. It is seen as part of some larger scheme whose rationale escapes the human observer, but is confidently believed to be present. There is no real clash here between our state of ignorance and the intelligent workings of an omniscient Deity.

Probability theory uses human ignorance systematically to create a useful scientific discipline. This in itself is something of a miracle.

There remains however — at least on the psychological level — a clash between our perception of chance events and the presence of intelligence.

The conception of God as Supreme Designer does not square with assigning to Him the role of Random Processor. It is thus the stochastic element in Darwinism that remains most objectionable to the religious mind. But

independent of the religious ramifications, the aspect of design and purposiveness in the bio-world on the one hand, and the aspect of randomness on the other, is a feature of Darwinism that, at least superficially, creates a tension within evolutionary theory. It is to this tension that the contemporary notion of Intelligent Design is addressed.

3. Design as Paradigm

The inescapable appearance of design in the bio-world has been an essential feature of biological science since its beginnings. The teleological nature of explanation in biology with its emphasis on function tacitly posits a Designer in the background. And while the Designer hypothesis is no longer in vogue, the appearance of design (or “designoid” as Dawkins refers to this) remains a basic feature in the study of the animate world (Dawkins, R: *Climbing Mount Improbable*. New York: W.W. Norton & Co.; 1996; Dawkins, R: *The Ancestor’s Tale: A Pilgrimage to the Dawn of Evolution*; 2004). The phenomenon of adaptation is a sine qua non in the domain of living matter, and adaptation is essentially synonymous with design, the phenomenon that living creatures are endowed with properties enabling them to survive and reproduce. Explaining the phenomenon of adaptation is the central problem of evolutionary theory.

The scenario that would be welcomed by proponents of Intelligent Design would envision the development of a scientific discipline that might be called “Design Processes” which would achieve recognition alongside the theory of Random (Stochastic) Processes. Such a theory would provide an alternative mechanism for evolution, which while not invoking supernatural forces, would accord more harmoniously with theological assumptions. It is difficult in the present state of scientific development to give credence to such a scenario. Yet it shouldn’t be ruled out, and its possibility sets limits on how compelling are the consequences of the contemporary Darwinian paradigm.

Withal, alongside the phenomena suggesting design in the bio-world are features which exhibit a lack of design, and in fact are suggestive of the kind of randomness encountered in Darwinism. These features are often overlooked by the proponents of Intelligent Design, and deserve more extensive treatment. The outstanding example is the appearance of “homologous” structural similarities in different species where in some of these species no recognizable purpose is

served by the organs in question (e.g., vestigial organs). There are even disadvantageous homologies. An example of this is one of the cranial nerves which runs from the brain to the larynx passing close to the heart. In fish this is a direct route, but in giraffes this path involves an unexplainably long detour. Phenomena of this type fit well with a paradigm of small random modifications of organisms, and place a limit on Intelligent Design.

These phenomena also challenge the widely held view (shared by the rabbis) of a sharp delineation of the animal world (and plant world for that matter) into distinct species traceable to Creation. Orthodox Darwinism goes beyond this with the belief that a single progenitor represents the origin of all animal life on earth. But the more basic message of Darwinism is the affinity of all life forms.

The religious individual holding to his belief in an Almighty God, though resisting forming a visual picture of God, nevertheless maintains some mental model of God's activity (e.g., as king, as warrior, as judge, etc.) This model is infringed upon by the laws science uncovers, which we naturally, if not justifiably, perceive as the world running itself. This took place centuries ago with regard to the physical world, and may now be inevitable in our perception of the animate world. But while changing the details of one's mental model, this need not diminish devoutness, no small part of which is constituted by human appreciation for the wonders of God's creation. In this context it is most instructive to read Darwin's concluding lines in the "*Origin of the Species*":

"Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been and are being evolved."

Biographies

Professor Joseph Seckbach is the initiator and chief editor of **Cellular Origins, Life in Extreme Habitats and Astrobiology (COLE)** series. www.springer.com/sereis/5775. He is the author of several chapters in this series. Dr. Seckbach earned his Ph.D. from the University of Chicago, Chicago, IL (1965). Recently he spent three months in Ludwig Maximilians University in Munich with a DAAD fellowship from the German service of exchange academicians, where several forward steps of this volume have been performed.

Among his publications are books, scientific articles concerning plant ferritin (phytoferritin), cellular evolution, acidothermophilic algae (mainly on *Cyanidium caldarium*), and life in extreme environments. He also edited and translated several popular books. Dr. Seckbach is the co-author (with R. Ikan) of the Chemistry Lexicon (1991, 1999) and other volumes, such as the *Proceedings of Endocytobiology VII Conference* (Freiburg, Germany, 1998) and the *Proceedings of Algae and Extreme Environments Meeting* (Trebon, Czech Republic, 2000) (<http://www.schweizerbart.de/pubs/books/bo/novahedwig-051012300-desc.ht>). His recent interest is in the field of enigmatic microorganisms and life in extreme environments.

Professor Julian Chela-Flores was born in Caracas, República Bolivariana de Venezuela and studied in the University of London, England, where he obtained his Ph.D. in quantum mechanics (1969). He was a researcher at the Venezuelan Institute for Scientific Research (IVIC) and Professor at Simon Bolivar University (USB), Caracas until his retirement in 1990. During his USB tenure he was Dean of Research for six years.

He is a Fellow of The Latin American Academy of Sciences, The Academy of Sciences of the Developing World, the Academy of Creative Endeavors (Moscow) and a Corresponding Member of the Venezuelan “Academia de Física, Matemáticas y Ciencias Naturales”. His current positions are Staff Associate of the Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Research Associate, Dublin Institute for Advanced Studies (DIAS) and Profesor-Titular, Institute of Advanced Studies (IDEA), Caracas. His particular area of expertise is astrobiology, in which he is the author of numerous papers. He organized a series of Conferences on Chemical Evolution and the Origin of Life from 1992 till 2003. In 2001 he published the book: *The New Science of Astrobiology From Genesis of the Living Cell to Evolution of Intelligent Behavior in the Universe*.

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Preface 1

Where Did We Come From?

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This book appears 200 years after Darwin’s birth and 150 after the publication of the principle of natural selection (co-discovered by Alfred Russel Wallace). It focuses on the implications of his landmark contribution to the study of evolution. His seminal contribution has played a significant role in the dialogue between faith and reason. Evolution is currently a subject of much religion-inspired discussions while, at the same time, significant related progress has been achieved from the scientific point of view. Darwin’s classical scientific masterpiece *The Origin of Species* is especially relevant for the educational system, as well as for the scientific community. This issue is not new. Science and religion have been the focus of debate for centuries. Evolution of life on Earth is revisited in this volume to encourage a dialogue on the old question: *Where did we come from?* There are multiple sources that deal with these evolutionary issues. One can find relevant information in journals, magazines, a number of books, as well as in the ‘Internet ocean of information’.

In spite of the abundance of previous publications, there is room for the present book. It attempts to encourage a constructive dialogue between two approaches to the origin and evolution of life on Earth. Firstly, the book discusses a scientific theory that is strongly and convincingly supported by observation and experiments. Secondly, this volume contains an approach to life on Earth within the domain of theology. The following chapters address the ongoing dialogue between Darwinian theory and Intelligent Design (ID), the latter being a new

term that refers to divine action by a theistic designer of all life on Earth. Within the theological domain ID views God's creation and guidance as influencing all living creatures, as expressed in the book Genesis, and other Books of the *Bible*. Within the scientific domain Darwinism assumes that natural selection is the main mechanism for evolution.

Both sides of the dialogue have proponents, as well as opponents that frequently express some degree of skepticism. Furthermore, currently there are debates as how evolution should be inserted in the high school and college science curricula. In the USA and Europe there are arguments at government level on the relevance of evolution in education. However, there is some opposition to teaching Darwinian evolution, or at least there are requests that ID should also be introduced into science classes. In this context there has been an official decision. A court case involved the U.S. District Judge John E. Jones of Pennsylvania (USA), whose verdict ruled that teaching ID would violate the separation of church and state. This decision has influenced the selection of topics that should be taught in those schools.

Chapters in this volume cover both approaches to the question of the origin and evolution of life on Earth. But we emphasize that the frontiers of science and the humanities should be clearly outlined. Prominent authors have written these contributions. We have gathered together over 40 chapters. The majority of these contributions come from USA and Israeli scholars, while manuscripts arrived from many other countries. All the manuscripts in this volume have been peer-reviewed, or sent out to external referees.

Some contributors suggest definite answers to what they consider to be a debate between science and religion, while others encourage a dialogue, rather than a debate. Indeed, these discussions are not new to Christianity, Islam or, to a lesser extent, to Judaism. We should hope that the dialogue between science and faith should not be sterile in either direction, but rather that it should lead to a deeper understanding of these issues: *What is the domain of divine action, and where are the boundaries of experiments and rational hypotheses?*

Our personal view is that a dialogue rather than a debate in faith and reason is to be encouraged for the reasons we shall enumerate. Firstly, it is not relevant for science to address the question of divine action, because science and religion have their own specific frontiers. Secondly, controversy arising from discussing faith and reason should be paid due attention, especially when it concerns the

proposal of teaching both science and creationism in the same school as part of training in science (cf., section on “Background in theology, philosophy and science” in this volume). The origin and evolution of life can be considered either within philosophy, or within science. ID does not necessarily have to reject a scientific approach to the origin of life, since astrobiology lies outside the domain of religion. In the following pages it is advocated that observant believers may well accept the scientific approach of evolution (cf., for instance, the chapters in this book by Halperin and by Chela-Flores).

Finally, there is the question of whether the book of Genesis should be interpreted literally. One should remember that the Holy Books can be interpreted allegorically, as advocated by Augustine of Hippo in his classic masterpiece *The City of God*. The six days of creation do not have to be necessarily interpreted as six periods of 24 hours each, but rather Genesis can be interpreted in terms of eras consisting of long periods of time, in agreement with well-established geologic measurements, or astronomical observations. Or, the attractive story for youngsters of Noah’s ark and the flood could be interpreted just as a moral lesson for human beings to behave properly. To take literally the first sections of Genesis, or specifically the first Books of the *Bible* (*Old Testament*), is not the aim of the *Torah* (*Pentateuch*). One should conclude that “creation” (in its religious interpretation) and the scientific approach to Darwinism are not necessarily contradictory, but are opposite sides of the same coin.

All manuscripts and dialogues in this volume are solely the views of their authors and do not necessarily reflect the opinion of either the editors or publisher. We present both interpretations of the origin and evolution of life on Earth with the intention of encouraging a dialogue. Consequently, we expect all the authors of this book to be entitled to their own opinions, and hopefully not to accept all the editors’ views, since in that case there would be no room for a dialogue. Likewise, the editors do not necessarily agree with every idea expressed in this volume. Furthermore, the editors are not responsible for the views of the contributors. It is our hope and expectation that careful readers of the present volume will be exposed to various aspects and issues related to the origin and evolution of life on Earth, and will draw their own conclusions. We also expect some readers to find some views expressed in this book that might be different from their own. If this were the case, we believe that the effort invested in the production of this book has been worthwhile.

Biography

Dr. Richard Gordon is a theoretical biologist whose endeavors range from AIDS prevention to breast cancer imaging on the medical side and from the effects of microgravity on amphibian embryos to the delights of diatom motility and morphogenesis on the basic science side. He inadvertently wrote the first paper on diatom nanotechnology. He has a B.Sc. in Mathematics from the University of Chicago (1963) and a Ph.D. in Chemical Physics from the University of Oregon (1967), and is now a Professor of Radiology at the University of Manitoba, where he has also held appointments in Botany, Computer Science, Electrical & Computer Engineering, Pathology, Physics and Zoology, perhaps foretold by his 1981 Rh Institute Grant for Outstanding Contributions to Scholarship and Research in the Interdisciplinary Category. His forays into how people treat one another include articles on democratization of the science granting system, a proposal for world minimum wage, havatars (human, avatar pairs) for a new approach to understanding epidemics such as HIV/AIDS, and a campaign to get up to date books to medical schools in Afghanistan via Books With Wings (<http://www.bookswithwings.ca>). His varied mentors, to whom he is grateful, include James S. Dwyer, Susan Meschel, E. Peter Geiduschek, Edward Anders, Aaron Novick Terrell L. Hill, Theodore Puck, Stanislaw Ulam, Jack Carmichael, Antone G. Jacobson, Cyrus Levinthal, Robert Rosen, Conrad H. Waddington, James F. Danielli, Lewis Wolpert, Zim Hearon and Lewis Lipkin.

Preface 2

To the Scientist Who Feels Above the Creationist Debate

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First, let me say that I am not a creationist, but this book demonstrates that creationists vary enormously in their understanding of modern science. For example, the profoundness and vastness of the evidence for evolution evades many of them. Some will give you a good argument, while others just won't understand you. So why am I and other anti-creationist scientists in here with them? Because science has not answered some of the most fundamental questions that people want answers to. This is deeper than the question of missing links in evolution. It extends to basic unsolved problems:

1. origin of our universe
2. origin of life
3. origin of cellular differentiation (origin of progress during embryogenesis)
4. origin of species (origin of progress during evolution)
5. origin of mind
6. origin of purpose

In origin of mind, for example, is tied up the yet unsolved problem of the relationship of the observer to the observed phenomenon, even in our over century old quantum theory. The formation of the observer from matter, i.e., embryogenesis, is just beginning to be explored in the new field of embryo physics. The origin of progress, whether in the self-building of an embryo from

egg to organism through cell differentiation or the evolutionary building of the phylogenetic tree from simpler to more complex organisms through speciation (Gordon, 1999), is not yet well enough understood. With up to date conclusions such as “Life was born complex...” (Glansdorff, Xu & Labedan, 2008), we cannot but wonder how it started, or whether the origin of life was not on earth (i.e., arrived as panspermia), and perhaps much more ancient than we have dreamed (Gordon & Hoover, 2007). Step back from the vast study of emergent phenomena of all sorts, and one sees that they are all in the eye of the beholder, i.e. of the observer, who needs somehow to be included in the equation. The above six unsolved problems may be summarized by saying that we do not yet have a firm grasp on the origin of novelty. Physics has arrived at some tentative answers in the realm of the nonliving through the mathematics of nonlinearity and chaos theory (Dixon, Tuszynski & Clarkson, 1997), although the role of the observer has still not been spelled out.

Creationists have assorted agendas, from charlatans having fun making fools of scientists and misleading young minds, to theologians seeking to preserve traditional concepts despite the evidence (which they often selectively ignore), to religious scholars with a deep need to fathom our existence. In all of these endeavors they challenge scientists, sometimes infuriating them to the point of sacrificing the concept of academic freedom, to the embarrassment of the rest of us (Brackman, 2008). Some creationists are scientists themselves, contradicting the presumption that “we are all, of course, atheists” (<http://thesciencenetwork.org/BeyondBelief2/>). The best response is to listen, to educate, to challenge in return, and to probe, understand and teach where scientific evidence fades off into guessing. Debating creationists sharpens the mind, and, may I say, leads us to new directions for research, where we just might solve some of these deep problems. What they claim is our Achilles heel could prove to be our vein of gold.

In my pass through of editing this volume, I was tempted to argue with many of the authors, scientists and creationists alike. For example, when I hit the three chapters by our Turkish creationist colleagues, I noticed that large blocks of the same text, albeit (ironically) in mutated form, appeared between all three of them, suggesting descent from a common ancestor. I started removing the redundancies but then realized that this is not appropriate. It should be left as a mark of their form of scholarship and mechanism of self-reproduction (with variation). So we shall see if this means of scholarly speciation (akin to that which has given us a multitude of religions) is more fit and continues to evolve

into all niches of the world, or goes extinct by being overwhelmed by Darwinian predators. In the latter case, this book will be part of their fossil record. To be fair I must carry this analogy to the other Abrahamic religions. For example, I've pointed out in my own chapter what amounts to evolutionary convergence represented by a Christian creationist speaking before a gathering of Jewish creationists. Undoubtedly, divergence of predator and prey from a common ancestor, convergent evolution, and horizontal meme transfer would link every chapter in this book, including those touching on Eastern religions, save for the one on the parallel universe of the Mexican Nauhas. The latter makes us wonder how quaint or profound our current global mix of science and religion may look a century hence.

In regards to Charles Darwin himself, it is repeated by many of our authors, almost as a catechism, that Darwin was a gradualist. But "it ain't necessarily so", as the song goes. His clear statement of what we now call punctuated equilibrium and stasis, (and also the fractal nature of the phylogenetic tree, an even more "modern" concept), which I discussed in Gordon (1999, p. 1037), occurs in the 1866 4th and later editions of *Origin of Species* (Rhodes, 1983; Penny, 1983, 1985; Clark, 1984, p. 330; Gingerich, 1984; Gingerich & Rhodes, 1984; Scudo, 1985). Stephen J. Gould (2002, p. 1014) defended his punctuated equilibrium priority over Darwin, dismissing "later editions that compromise original statements".

We all keep coming back to Charles Darwin, praising or belittling him, because he did indeed start a revolution in the way we think of ourselves, which has not yet seeped into the core of our being.

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Dialogue

Juan G. Roederer

I have followed with interest the case of the visit of two Turkish creationists to Hebrew University. Why is it that I am reminded so much of our own evangelical creationists in the US? As director and dean here at the University of Alaska in the past, I had several encounters with such individuals. But I never denied them a forum in my institute and college. What I deliberately refused to do was to engage personally in a *public* “debate” on creationism (to which they had challenged me repeatedly), on the grounds that in the official capacity as a university professor and administrator in the environmental sciences, I do not mix science with religion. That might be done within another school or department—for instance, philosophy, psychology, history or political sciences. The challengers of course retorted with the matter of “*scientific* creationism”. That, I always did and still do denounce publicly as being both phony science and phony religion, which can flourish only in a country with a dismal public education record like ours.

Richard Gordon

In this book we do indeed debate the Turkish gentlemen, our authors Drs. Oktar Babuna and Cihat Gündoğdu, who were invited to Hebrew University and then told they could not speak. Now I don’t agree with their conclusions, but their reasoning is as compelling as many a distinguished rabbi, and in fact we have Jewish scholars writing in this book who pretty much concur with them. The political fact of the matter is that this group in Turkey has single handedly kept the question of Darwinism central to modern Islamic thought around the whole world, and this affront will not go unnoticed. As with problems of innumeracy and de facto scientific illiteracy, Darwinism has not really taken hold anywhere in the West, in Islamic nations, nor in Israel. Even many people who pay it lip service do not understand its deep, and to some, disturbing, implications. The revolution in thought that Darwin started is far from over. I go for academic freedom and the desirability of a clash of ideas. The world is too small for separate solitudes of science and religion.

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Preface 3

Monotheism: The Basis for Unifying Abrahamic Religion and Science?

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Our new rabbi has set a dangerous precedent, asking a university professor to give a so-called short sermon. Rabbi Larry Lander doesn't know that my typical lecture takes three hours, which I rush through in 1 hour with 100 PowerPoint slides. I thought of setting up a computer projector here on Friday afternoon, to let it run continuously. But this would change our ambience more than a mechitza [partition to separate men and women during religious events]. So I'll struggle with no slides, and condense my thoughts so you fall asleep in 10 minutes instead of the usual hour. It's okay. I've slept through many lectures myself, and even an occasional sermon.

I was asked to give a book review, and of course I chose Judaism versus science as the topic, for honestly, in the chronology of my world path, I am a scientist first and a Jew second. This is common amongst Jewish scientists (Cantor & Swetlitz, 2006). Let me elaborate. I was raised knowing I was Jewish, but

[☆] After I drafted what is now Preface 2 for this book, I was asked to give a sermon at my Conservative synagogue, Congregation Etz Chayim in Winnipeg, Canada, so in what follows I have incorporated and expanded upon it. The original title was "Science and Judaism".

without Judaism. I decided in 1953, at age 10, to become a scientist. I did not begin with Judaism until I immigrated to Winnipeg in 1978.

I have annoyed Reconstructionist (Kaplan, 1937) and Lubavitch rabbis (Ginsburg, Branover & Schneerson, 2004), and every kind in between, with my questioning that was clearly framed to seek hints in Judaism for answers to scientific questions, not vice versa. For this sermon, I picked one book, then another, and the more I dug the more I found (Branover & Attia, 1994; Cantor & Swetlitz, 2006; Carmell & Domb, 1978; Efron, 2006; Jammer, 1999; Nelson, 2005; Pollack, 2000; Slifkin, 2006; Wahrman, 2002). Jews have been muddling over the relationship between science and Judaism at least since Moses Maimonides' *Guide of the Perplexed* published in 1190 CE (Maimonides, 1190), and it's clearly an unsolved problem. So I've given you a whole reading list. There will be a quiz next week.

Traditionally, Jews have approached the relationship between science and Judaism four ways (Robinson, 2006):

1. Rejection of science. This is the head in the sand approach.
2. Looking for weaknesses and limitations of science. While reaping the benefits of science, we say it's not so great anyway. One problem this generates is that as science grows, religion shrinks, and God becomes the God of the gaps, which keep getting filled in.
3. Reinterpret *Torah* to make it look consistent with science. Deny there's a conflict. So we don't take Genesis literally, and try to stretch the 5768 years since the Creation to cover the 13.7 billion years since the Big Bang, a ratio of 2 million to one. But major events, like the global Canadianization of the earth 2 billion years ago when it all froze over, are left out (Walker, 2003).
4. Claim Kabbalistic transcendence of science, that there is a deeper mystery that science just can't handle. Science and religion just have different domains. Well, maybe, but that's just another gap.

I think there may be a fifth, and perhaps better way. Let's start at the top of the problem, with the relationship between monotheism, for which Judaism takes credit, and science. The shema, the central prayer of Judaism is:

“Hear, O Israel: The Lord our God, the Lord is One” (Harlow, 1985).

Science is also based on the faith that the universe is one, subject everywhere and at all times to the same laws (de Duve, 2008). This is not changed one whit by new Star Trek theories of parallel universes or the crazy notion that every quantum event splits the universe into two new universes. These are just bizarre arguments between scientists about what the really universal laws are. In this regard, nothing changed when we made the transition from Newton's Euclidean geometry universe to Einstein's relativity and curved space, or from Newton's deterministic universe to quantum statistics and chaos, or from separate creation of each species of plant and animal to one universal evolutionary tree. The law is the law. Scientists are just trying to figure out exactly what it is.

Where does this scientific belief come from? I would suggest that it stems from monotheism itself, the idea of one God, one set of rules for everyone and everything, for all times and places. If I am correct, then science is historically rooted in monotheistic religion. Therefore I am in profound disagreement with anyone who says that science and religion each has its own domain. The world is one, and if we truly believe that, we will seek a way to combine science and religion and live accordingly.

Historically, monotheism was not, however, sufficient to bring about the growth of science. If it were, Jews would have been millennia ahead of all other people. Both Islam and Christianity, outgrowths of Judaism, are monotheistic. In Islam, Abu Hamid Muhammad al-Ghazali declared 100 years before Maimonides that to restrict God to His laws was blasphemous (al-Ghazali, 1095). Science by Jews, Christians and Muslims had flourished under Islam until then (Spencer, 2007). In contrast to Islam, Judaism retains the concept that God is subject to God's rules, similar to the idea that a king is subject to the same rules as his subjects, as in the story of David and Batsheva.

It was left to Christianity, not Judaism, to spark modern science. In fact, it seems to have been a particular sect of Christianity, the Puritanism of the 1600s CE in England, that got things moving. This did not at all involve a separation of science from religion, but rather, to quote:

“Perhaps the most directly effective element of the Protestant ethic for the sanction of natural science was that which held that the study of nature enables a fuller appreciation of His works and thus leads us to admire the Power, Wisdom, and Goodness of God manifested in His creation” (Russell, 1973).

Torah Umadda (Lamm, 1990), the slogan “Torah and secular knowledge”, is a comparable, but small movement in Modern Orthodox Judaism. The current creationist, so-called Intelligent Design movement, rampant in fundamentalist Christianity but rapidly penetrating both Islam and Judaism, has the opposite effect, for it denies science (Perakh, 2004; Seckbach & Gordon, 2008).

These themes, the parallel between the oneness of God and the lawful nature of the whole universe, God subject to God’s rules, science as a way to God, and the knowability of the laws of God through science, suggest a strong and deep bond between science and religion. However, science has achieved something remarkable that religion has barely begun to contemplate. Science has a universality that crosses all cultures, and a means of cooperation and consensus building that transcends all boundaries between nations and peoples. If science and religion are one, because the universe is one, because the Shema is correct, then science may show the way for religion to join it in one universal conception that replaces both.

The Big Bang, the notion that the indeterminacy of quantum mechanics somehow gives us free will, the crude and probably wrong parallels between Genesis and the presumed (Gordon & Hoover, 2007) origin and evolution of life on earth (Schroeder, 1990; Schroeder, 2001), have led to a false sensation that science and religion are now in harmony. On the contrary, I suggest that we have a lot of work ahead. I would like to repeat the oft quoted relationship between modern science and religion, formulated by Robert Jastrow:

“For the scientist who has lived by the faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries” (Jastrow, 1992).

But I add a new ending:

who have been sitting there for centuries... killing each other and their descendents in the name of God. But the scientist and his comrades, who although they had also argued for centuries, formed together a single world effort at understanding the universe. They then convinced the younger theologians to descend the mountain and consider whether science itself might provide a way to bring an end to their mutual

slaughter. In exchange, the scientists had to broaden their view, and start working on some of the tougher problems that they had previously fobbed off on religion.

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Dialogue

Jack A. Tuszynski

I'm not sure I'd agree with your giving credit for the launching of science to the Puritans. First of all, science has been at the service of religion for millennia (e.g. the astronomers of Babylon, Egypt) but not only. Greece has given us non-religious mathematicians (Euclid, Pythagoras — he was also a mystic though) and physicists (Democritus). They did not have universities but small schools of disciples. However, the first university with hundreds if not thousands of students was founded in Alexandria some 2000 years ago. Then you had the method of inquiry that has a lot in common with the Midrash and the organization of Talmudic scholarship in yeshivas. In modern times, the first European universities (late 1100s to early 1200s) were created largely (if not exclusively) by the Catholic Church in places like Bologna, Paris, Oxford or Padova. The first real scientists were closely associated with the Church (Copernicus, Galileo, Giordano Bruno) although they did their work largely against the Church's doctrine. Newton may have been a singular scientific genius of the greatest caliber but he was also a theologian, a mystic and an alchemist. I guess, what I'd like to say is that while religion doesn't directly promote science, it does stimulate scientific thinking. I guess the big divide has to be traced back to Bacon who distinctly separated religion and philosophy but maintained that the two can coexist. The main distinction he drew was that religion is based on "blind" faith while science on a method of inquiry. I think, had he been raised in Judaism, he would not have seen such a sharp difference between science and religion.

Richard Gordon

The hypothesis that modern science started with England's Puritans is not mine, but rather Robert K. Merton's. See:

Merton, R.K. (1936). Puritanism, pietism and science. *Sociological Review* 28(Part 1), 574-606.

Hall, A.R. (1963). Merton revisited, or Science and Society in the Seventeenth Century. *History of Science* 2, 1-16.

Both are reprinted in:

Russell, C.A. (ed.) (1973). *Science and Religious Belief: A Selection of Recent Historical Studies*, London: University of London Press.

Merton himself was Jewish:

Efron, N.J. (2007). *Judaism and Science: A Historical Introduction*. Westport, CT USA, Greenwood Press.

In retrospect, my idealistic, universalistic view of “Science as a Value” above is placed in its American-Jewish historical context by Efron (his p. 201).