PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

In this issue . . .

"The fear of the Lord is the beginning of Wisdom."
Psalm 111:10

VOLUME 44, NUMBER 2

JUNE 1992

Perspectives on Science and Christian Faith

MEMBER epa EVANGELICAL PRESS ASSOCIATION

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PERSPECTIVES ON SCIENCE AND CHRISTIAN FAITH
(ISSN 0892-2675) is published quarterly for $25 per year by the American Scientific Affiliation, 55 Market Street, Ipswich, MA 01938. Telephone (508) 356-5656. Second class postage paid at Ipswich, MA and at additional mailing offices.
POSTMASTER: Send address changes to: *Perspectives on Science and Christian Faith*, THE AMERICAN SCIENTIFIC AFFILIATION, P.O. Box 668, Ipswich, MA 01938.

Putting Things Into Perspective

In our lead paper Swiss Biologist Peter Rüst offers a fine-grained evolutionary account for the diversity of life. Rust suggests a complementarian approach which takes into account both the "all-embracing providential activity of the Creator and the personal dignity of the human creature." We welcome your response to his thoughts.

Readers interested in the origins of Christian Science, the Church of Religious Science and Divine Science, and their modern analogues (such as the Unification Church and New Age mysticism) will be interested in Craig Hazen's account of the role of Yankee self-taught healer Phineas Quimby's role in these metaphysical movements. Quimby took the early 18th century American harmony between science and religion to the extreme by fusing God and nature. Hazen's account suggests that a peaceful relationship between science and religion carries its own possible hazards.

Jerry Bergman's "Eugenics and the Development of Nazi Race Theory," discusses a more modern example of science taken out of context. The "final solution" for Jews and other so-called inferior peoples and the need for war were justified by appropriating Darwin's notion of "survival of the fittest."

This issue offers an number of Communications. One of the signal events of ASA's 50th Anniversary meeting at Wheaton College was Physicist John A. McIntyre's ringing challenge for evangelicals to "... Rejoin the Scientific Establishment." Readers are encouraged to build on Jack's suggestions. Geneticists Peter Ritchie and Brian Martin offer a critique of "biological design arguments," finding them inadequate as explanations for nature or (as commonly viewed) as a picture of God.

Daniel E. Wonderly is concerned with the widespread use of pseudo-scientific accounts of biological and geological history in popular Christian literature. He offers ten illustrations of these "creationist myths." Who will counter this literature with material which reflects the best in our understanding of scripture and nature?

Stanford undergraduate Erica Don takes a different look at the scientific enterprise in our concluding Communication.

Californians Richard Dickerson and Walter Hearn lock horns on a basic question in this edition of Dialogue.

The book review section in this issue leads off with Owen Gingerich's and Duane Thurman's reviews of *Darwin on Trial,* and includes reviews of a variety of other books. The issue concludes with two Letters to the Editor — we welcome your comments!

— J. W. Haas, Jr.

How Has Life and Its Diversity Been Produced?

PETER RÜST **CH-3148 Lanzenhäusern, Switzerland**

With complementarity, a fully harmonic interpretation of Bible and nature is, in principle, possible. Both atheistic evolutionism and young-earth anti-evolutionism are unrealistic. Macroevolution is still fully speculative: evolutionary mechanisms are inadequate, evolutionary evidences ambiguous. There are fundamental limits to empirical investigation in the transastronomical size of the combinatorial space of genomes and in the contingency of elementary events. But biblical evidence allows for evolution. The all-embracing providential activity of the Creator and the personal dignity of the human creature are tentatively presented as theological arguments in favor of evolution as God's method of creation.

World Views and Axioms

The question of the origin of life may be approached from various different viewpoints. Much confusion in this area results because presuppositions are not stated, concepts are used without a clear definition, or different categories are confused.

I believe that there is an objective reality or truth, and that we can, partially and in various ways, get to know truth. According to the Old and New Testaments, God is the Creator, and everything else that exists ultimately owes its existence to Him. This is the *theistic* view of creation. In contrast to the *deistic* view, it includes the belief in God's continuing creative activity in sustaining and governing the created realm. In contrast to the *pantheistic* view, it implies that the Creator and the creation are absolutely distinct — without, of course, denying any contact he might choose to have with his creation. *Atheism* (and, in practice, agnosticism) seems to have a close affinity to some forms of pantheism. Its god may be matter-energy itself. Religion appears to be an innate tendency of all humans.

Most Christians believe the Bible to represent a special revelation from God, but do not claim it to be the product of any kind of mechanical dictation by his Spirit. The Bible's subject is clearly theological: God's dealings with mankind. Anyone trying to deduce non-theological matters from its statements has to keep in mind this primary focus. Nevertheless, the fact of its inspiration implies that treating it merely like any other book would be inadequate. It is God's Word in human words. As such it absolutely transcends human minds, and we are not in a position to judge this "input from above."

This far, all Christians would probably agree, but many do not seem to appreciate that, as a consequence, we do not dispose of the criteria necessary to sort out what is human from what is divine in the biblical texts. Might God be willing to tolerate human errors to be introduced into these writings, as long as this would not thwart his intentions? Being absolutely truthful and kind, he would not want to let any sincere readers of his Word be confused by untruths. His revelation in the Word may be compared with his natural revelation in creation. Natural scientists would not expect to find any genuine inconsistencies in nature. If they do find apparent contradictions, they will be convinced of the inadequacy of their understanding instead. Therefore,

This paper is a revised version of a presentation at the ASA Annual Meeting at Messiah College, Grantham, PA in August 1990. The detailed and very helpful comments of two anonymous referees are gratefully acknowledged.

I believe the Bible (in its originals) to be free from errors, just as nature is consistent.

Although the Bible's main thrust is clearly theological, not scientific, it does occasionally touch on aspects of nature. I am not advocating the use of such statements as the basis for investigations in the realm of natural science, but I expect that once we have understood them properly, we will not find any errors. Certainly the authors were not infallible, but I believe God kept them from committing any errors to the biblical texts.

Life and Complementarity

Occasional biblical statements seem to contradict what we know from nature. There are two inadequate responses: a philosophical warfare mentality, which considers scientists blind or the Bible out of date; or isolationism, which believes biblical texts are wholly uncorrelated with any non-theological reality. Exponents of these views tend to lack patience with the "biblicism" of those who try to harmonize biblical remarks about nature with the models of natural science.

If the Bible's focus of interest is theological, then why should we want to consider it at all when asking questions about nature? One motivation is apologetic. It is important to show that the alleged conflicts between empirical reality and the Bible are based on faulty interpretations on either side, and that, therefore, there is no excuse for not taking the Bible seriously. It *has* to become clear that one can accept every biblical statement as true, without falling into the trap of subverting science. On the other hand, I expect that a thorough understanding of the real biblical teaching about creation and nature will give us important epistemological guidelines governing our scientific inquiries. As God charged us with cultivating the earth and caring for it, we may trust his Word to support us in this task. Today's debate about the ethics of gene technology is a case in point. And it will clearly be influenced by our beliefs about creation and evolution.

As our comprehension of both nature and the Bible is partial, the models of both natural science and theology remain approximations to the truth, and occasional inconsistencies between different parts of our view of reality are probably unavoidable. But such difficulties often contain the seed of a deeper understanding if dealt with properly. If they persist after careful scrutiny of the facts on both sides, they may represent complementary aspects of the truth.[1]

Physicists have invoked complementarity to describe the apparent contradiction between the wave and particle aspects of light. This unexpected realization has been of help in understanding quantum mechanics, which has proved to provide a deeper insight into physical reality. The tension between the apparently contradictory concepts of God's holiness and mercy lead theologians to a deeper appreciation of the implications of Christ's substitutionary sacrifice on the cross.

The concept of complementarity may also be applicable to questions like the origin of life or the nature of man, where complementary aspects of reality from different disciplines, like natural science and theology, overlap. Here, care has to be taken to respect the different domains of discourse. For instance, *Homo sapiens* fossils may not always represent humans in the theological sense. But such different aspects of the same reality must be fully compatible with each other.[2] Complementarity *between* nature and the Bible implies the following principles:

(1) As God is the author of creation and of revelation, there must be an ultimate *harmony* between the data from both domains, even though we may not always be able to *conceptualize* it. Truth cannot contradict truth.

Peter Rüst holds a diploma in Chemistry and a doctorate in Biochemistry from the Swiss Federal Institute of Technology in Zurich. He did post-doctoral research in DNA chemistry at Columbia University in New York (with E. Chargaff) and in molecular biology at Hawaii University and at the California Institute of Technology (with R. L. Sinsheimer), and in virology at the Swiss Institute for Cancer Research in Lausanne. At present, he heads the Computer Group at the Swiss Dairy Research Institute in Bern. The creation/evolution question has been his special interest for many years.

(2) The *data* of natural science and of theology have to be distinguished carefully from their *interpretations*, which always remain provisional, subject to revision.

The concept of complementarity may also be applicable to questions like the origin of life or the nature of man, where complementary aspects of reality from different disciplines, like natural science and theology, overlap.

(3) No observation of science and no biblical statement (the data) may be taken out of its *context* when interpreting it, lest we risk producing an apparent conflict. There are no context-free data. There is no absolute objectivity of interpretation.

(4) *Open questions* are not necessarily inconsistencies. Where we are not able to harmonize all observations, our interpretation must be either faulty or incomplete.

Although life is a phenomenon open to scientific investigation, it remains a largely unfathomed mystery. The simplest autonomously viable entities, bacteria, are so complex that they have not even been analyzed completely — let alone synthesized. Conceiving of how they could have been produced by the interplay of random events on an initially lifeless earth is an even more demanding task. Multicellular organisms represent enormously more complicated structures, occurring in many fundamentally different forms. How were they produced?

The model of a recent creation is incompatible with the empirical evidence available today.[3] It is no longer an acceptable option. Various old-earth creation models do not share this problem, but they do not propose any specific, detailed creation mechanisms. At present, evolution is the only creation model available for scrutiny by the methods of natural science. As the possibility of an extraneous causation and governance cannot be ruled out, life must not be tacitly presumed to have emerged and evolved autonomously. With the model of biological evolution, two main problem areas have to be considered:

(1) Are there, apart from specific divine guidance, *adequate mechanisms* for evolution? Does it work? Is the probability for life of any conceivable kind to emerge and evolve high enough to make it not too implausible at least once in our universe?

(2) Is there *unambiguous evidence* for evolution? Atheists, of course, are dependent on evolution at least somewhere in the universe. For them, there is just no way around it, no matter where the facts point. Theists, on the other hand, are free to rationally weigh the evidence.

In biology, the question of the origin of meaningful information is of crucial importance. In general, this is a very hard problem, which in most contexts and with today's limited knowledge is too difficult to deal with. Therefore, I want to concentrate on a few aspects which I feel might be amenable to some investigation. The issues touched upon will be selected accordingly, while some others will be mentioned in passing.

Microevolutionary Mechanisms

For a realistic evaluation of the adequacy of proposed mechanisms, a clear distinction has to be made between *microevolution* and *macroevolution*. I define a macroevolutionary step or development as any transition producing a fundamentally novel structure and function, based upon a sequence of deoxyribonucleic acid (DNA) which is not derivable from a previous one by means of a series of individually selected mutational steps, but only through a random-walk process involving a series of *nonselected* intermediates. This definition may not be conventional, but it points out a crucial distinction. The assumption that any macroevolutionary event consists of a series of microevolutionary ones is usually treated as axiomatic. If it holds, any distinction between the two modes of evolution is basically irrelevant. An argument that it does *not* hold [4] will be summarized below.

The mechanism of *microevolution* consists of three distinct steps:

(1) Genomes can *mutate*, producing genotypic variants.

(2) If expressed, these may produce phenotypic *variants*.

(3) Natural (or artificial) *selection* favors the reproduction of individuals better adapted to their environment. In this way, relative fitness

values of phenotypic variants with respect to their current environment are defined.

Selection works on those variants which are in fact produced. Can we always count on some variant able to cope with a given environment to be available within a reasonable amount of time?

Thus, population gene pools, including their individual constituent gene components, may possibly change with time. The three observations are necessary conditions for evolution to happen. But are they *sufficient*? Selection works on those variants which are in fact produced. Can we always count on some variant able to cope with a given environment to be available within a reasonable amount of time? Could all existing functions arise by these processes?

The feasibility of *macroevolution* implies three more requirements:

(4) Occasionally, *new functions* must emerge.

(5) Functions must be *improved.*

(6) There must be *progressive chains* of improvements.

These additional requirements will be discussed. But first, microevolution needs some further comments.

Apart from point mutations, there are other mechanisms producing variants, but they usually do not create any new *functional information.* A definition of functional (constructive, or semantic) biological information will be given below. Deletions and most insertions destroy such information: sequence shufflings by genetic recombination, transposition, duplication and other mechanisms move preexisting information. These other genome modifications may, of course, have profound functional consequences, often on a regulatory level, but possible constructive effects they might have on their target genes or larger contexts are likely to occur very much less frequently than constructive effects of point mutations.

One has to distinguish between new features produced by shuffling or recombining *preexisting* functionalities, on the one hand, and new functional features which *never existed* before, but arose in sequences having no function, or a different one, on the other hand. Although it might in some cases be difficult to distinguish between these two kinds of novelty, it is clear that many fundamentally new features must have been produced in the biosphere as a whole. Unfortunately, the term "evolutionary novelty" is sometimes indiscriminately applied to both of these possibilities. The first kind is certainly relevant for the origin of biological information. A recent investigation led to the (still disputed) estimate of 1000 to 7000 basically different protein exon or domain subunit families.[5]

Considerations of *population genetics* are very important in an evaluation of evolutionary mechanisms. A mutation conferring a selective advantage benefits its carrier immediately, but it will take some time to penetrate an entire species. Its fixation, by elimination of the previous wild-type allele, will take even longer. Penetration and fixation times increase not only with decreasing selective advantage, but also with the size of the population. Because individual selective advantages are typically quite small, this implies that large populations are genetically very stable: in these, natural selection inhibits change and promotes stability.[6] A mutation conferring a disadvantage will usually be eliminated quickly. The frequency of a selectively neutral one will drift, increasing and decreasing randomly. In a large population, it will often be lost. On the average, the general effect of these and other complications (interdependencies between different genes, variability of the environment, etc.) will probably be to make harnessing advantageous, or adaptive, mutations *more difficult.* Thus, considering individual neutral and adaptive point mutations only will tend to overestimate the chances for success of progressive evolution.

One has to distinguish between new features produced by shuffling or recombining* preexisting *functionalities and new functional features which never existed before...

Semantic Information

The set of all possible DNA sequences of a given length N defines a *combinatorial space* of 4^N configurations. For N=133, hardly enough for a small functional domain of a protein, this number exceeds the estimated number of nucleons in the universe! But *semantic*, meaningful, functional, or constructive biological information is not defined by this combinatorial space of all possible sequences, since there may be sequence stretches which are meaningless, variable, redundant, or synonymous with others.

The "meaning" of a genome or a gene is defined by its biological function. Human symbolic *languages* provide an instructive metaphor for the DNA "language." Only a limited fraction of the set of all possible symbol sequences has any meaning at all, and the meaning is determined by various factors, such as the context of a given human language, as expressed by its speakers and literature. How large is the semantic information content of a given sentence? It depends on the conventions governing the particular language, on the intention of the speaker, and possibly on the situation of the message recipient. It is probably not too difficult to estimate an average amount of synonymity between words. But how about "synonymous" sentences, abstracts, personal messages, discussions, etc.? It is probably impossible to measure these intensely personal specifications. Similarly, we can hardly hope to do more than arrive at approximate estimates of lower or upper bounds for the amount of semantic information contained in specific biological messages, such as protein domains or genes.

Can biological semantic information be spontaneously generated? Can it originate without an information source of at least equal semantic content? It is claimed that it is gradually produced by *"self-organization"* in a long series of microevolutionary events. Environments are certainly capable of modifying gene pools. In a sense, a gene pool "asks questions" concerning its variant genomes, and the environment "answers" them. In this way, some *information* is generated by matching environment and gene pool. Such events constitute a mutational random-walk exploration of the genomic configurational space available by a species.

But the amount of information that can be collected in this way is basically limited by the scope of the set of variants which can be produced. Certainly there is no limit to the mutations possible, but the detrimental ones are eliminated and do not contribute to the functional information eventually stored. In a conceivable extreme case of a genome optimally adapted to its environment, all mutations may be detrimental, and no further information can be gleaned from the actual environment.

But even when far from the optimum, the evolutionary progress will often be frustrated. The macroevolutionary path leading to a selectable better adaptation may contain configurations of lower adaptive value or too many equivalent ones. Most non-detrimental mutations are believed to be selectively neutral. Alternative nonlethal branches leading to dead ends may exist, increasing the number of nonselected steps required — parallel and sequential — for the "wave-front" of exploratory mutants to finally reach a selectable point. With too many dead end branches too many trials are lost on them. With a mutation rate of 10^{-8} per nucleotide replicated, two-step mutations are already too rare to be observable with bacteria in large chemostats. Non-selected paths have to be very short in order to retain a reasonable chance of realization, before the next uninteresting equilibrium stage with a large stabilized population lacking a genuine novelty is reached. This unfavorable situation does not represent an extreme case, but is characteristic for macroevolutionary paths.

In a conceivable extreme case of a genome optimally adapted to its environment, all mutations may be detrimental, and no further information can be gleaned from the actual environment.

Natural selection of a new function presupposes a *minimal functionality*: where nothing is selectable, nothing can be selected. This minimal functionality, therefore, must be produced by random processes. The probability of its spontaneous emergence depends on its semantic information content, or the size of the minimal specification required to define it,[7] but not on the possible pathways leading to it. It is, however, difficult to estimate the size of such minimal specifications.

One approach might be to consider the invariant configuration of a set of known sequences performing a given function in different organisms. Certain sequence positions are observed to be occupied by the same amino acids in all known versions of a protein of a given specificity. It is then assumed that functionality requires these specific occupations.

An analogous argument applies to positions permitting a certain restricted variability. For good measure, all amino acids chemically similar to the ones actually observed at a given position might be added to the set of permissible ones (Yockey[8]). The totality of these restricted occupations found for a given protein type constitutes its invariant configuration. This is a lower-bound estimate for minimal functionality, since positional interdependencies and species-specific requirements are ignored. It may be compared with an upper-bound estimate of the longest feasible non-selected path.

Natural selection of a new function presupposes a* minimal functionality: *where nothing is selectable, nothing can be selected.

The result is that reaching a given invariant by a mutational random walk within 300 million years is already too improbable for three specific amino acids.[9] This estimate, presupposing 3.05 codons per amino acid, 2.16 mutations per specific amino acid change (geometric average), and a mutation rate of 10^{-8} per nucleotide replicated, is based on very optimistic assumptions: 10^{16} moles C per year metabolized in the earth's biosphere (today's total biomass production) consisting entirely of bacteria (5×10^6 nucleotide pairs and 10^{-14} moles C per bacterium), and all of this DNA continuously participating in this particular random walk. Yet *known invariants* comprise not 3, but about *30 amino acids* for basic enzyme functions, such as cytochrome c or ribonuclease[10], or at least 5 amino acids for additional adaptations differing between groups of organisms.[11] These requirements are even below the real lower bounds for functionality, as they reflect unique occupations only. At present, it is unknown whether any smaller invariants might provide some minimal functions. The restrictions on functional structures, such as enzymes, are such that all mutations we observe today are detrimental or at best neutral. To suppose otherwise for earlier organisms is speculative.

Thus, the acquisition of the huge amounts of functional information in the biosphere by random processes incurs preposterous improbabilities.[12] It is out of the question that a known invariant could have been found by random processes — unless there are many other, unknown configurations providing the same functionality. In this case, the exclusive occurrence of a single one of all possible configurations would amount to a "frozen accident." It would provide a strong argument for evolution happening, in fact, because in this case common functional selection pressure would not explain the invariance. But it would also show that it is rather difficult to accidentally hit a new functionality, which in turn would make it hard to understand why so many different functions have been found at all. The number of functional sequences would have to be transastronomically large, or else no lucky hits could be expected. Yet the frequency of a given function among all possible sequences would have to be very small, or else many different solutions to each problem should have been found in different lines of descent.

Are the functional invariants found in the biosphere *frozen accidents* or evidence of *design*? Does each of them represent just one of a myriad of possible configurational sets or the only functional one? Is functionality in configurational space rather frequent or extremely rare? I know of no indications that it might be frequent; the few relevant observations available point the other way.[13] Unfortunately, there does not seem to be any way of finding answers to these questions. The configurational space of all possible genomes is by far transastronomical in extent.

To invoke an extraterrestrial origin of biological information may expand the probabilities by at most a few orders of magnitude. Even providing every star in the universe with a life-supporting planet — an assumption which is certainly too optimistic[14] — would be insufficient.

Thus, the acquisition of the huge amounts of functional information in the biosphere by random processes incurs preposterous improbabilities.

Even for a single protein domain of 100 amino acids, there are 10^{130} different sequences, coded by 10^{180} possible sequences of 300 nucleotides. In analogy to Yockey's[15] estimate, at most one among 10^{64} polypeptides of this length might be expected to display a given enzymatic activity of the rather small complexity of cytochrome c. If there are 10^5 different enzymes, only one among 10^{59} polypeptides of length 100 may have any enzymatic activity at all. To provide just one molecule of DNA coding for each of 10^{59} polypeptides would require 10^{19} earth-

sized planets, each containing an ocean 1 km deep, covering the planet's surface, of a concentrated solution (10 mmolar in nucleotides) of single-stranded polynucleotides of length 300. As no "primitive" enzyme activities are known, there is at present no conceivable way to reasonably reduce this estimate. Yet, on the other hand, the smallest viral genome is 10 times larger, the smallest genome of an autonomous organism 10,000 times. This means that it is in principle impossible to cover an appreciable sample of the configurational genome space by any conceivable method of investigation — experimental, computational, or otherwise. Science cannot answer the information problem.

Is Macroevolution Feasible?

I have postulated three requirements for macroevolution, in addition to those necessary for the microevolutionary mechanism: emergence of new functionalities, improvement by positive mutations, and a reasonable prevalence of such constructive mutations to form progressive chains of improvements.

When a *new function* is to emerge, its minimal functionality must arise accidentally, before it can be selected. The possible emergence of a new functionality in a hidden state (in a temporary pseudogene or under cover of a different function) does not change this requirement, since the development of a function which is not expressed must proceed by means of a random walk. Once a minimal function is present, its further improvement by single-step mutations, under the influence of natural selection, is conceivable. But at least the original emergence of this new function must correspond to a macroevolutionary step, which is much more difficult, as has been shown. Every one of the many different biological functions in the biosphere had to arise at least once.

In order to explain how new functional information could arise, the concept of a hierarchy of complexity has been proposed. According to this view, a fundamentally new level of functionality might emerge, once the complexity of the lower level structures has reached a certain degree. These ideas pertain mainly to higher levels of biological complexity than the ones I am discussing here. They certainly describe a biological reality,[16] but do not provide an explanation for the emergence of information in the individual hierarchical steps. The lowest and simplest of these steps, describing the mutational random walk in a DNA sequence, might be the most promising for investigating the origin of information, as much too little is known regarding the higher hierarchical levels. Therefore, I refrain from discussing hierarchy theory any further.

Each of the newly emerged minimal functions must be capable of *improvement* by random mutations — up to the near-perfection usually found in present organisms. This *seems* to be more easily accomplished than the emergence of a new functionality, but it is not self-evident that it is possible. Not even a single "positive" or adaptive mutation, in the sense of an improved function previously unavailable, has been documented in any organism. Takeover of functions from other organisms, by means of episomes, transduction, genetic recombination, allele assortment and the like, cannot be counted as an emergence of a new or improved function in the biosphere, nor can regaining a function lost previously, or the display, under stress, of a temporarily unused function. A function which is available in principle, but not used under normal conditions, may be induced under stress; but it is lost again upon return to a natural-like environment, presumably because it represents an additional burden on the organism. Observed alleles with slightly different functionalities may indeed be related across a few mutations. But as they exist side by side, we have no indication that either of them represents an evolutionary advance. Both of them may be needed for full flexibility in different environmental, anatomical, or developmental contexts. In any case, their relatedness by descent is an inference, not a documented evolutionary improvement.

Not even a single "positive" or adaptive mutation, in the sense of an improved function previously unavailable, has been documented in any organism.

There must be *progressive chains* of improvements. This implies that improvements are common, rather than exceptional occurrences. Each of the macroevolutionary mutational paths *between* positively selectable configurations must be very short and proceed by random processes composed of neutral mutations only. A huge number of mutations must have caused successful functional improvements, in order to produce today's biosphere. Furthermore, all parts of the configurational space used by any species must be interconnected, as the biosphere is believed to be monophyletic.

Useful configurations have to be found rapidly, at least by *some* species on earth. There has not been much opportunity for search processes. Four billion years is a very short time and the amount of earthly biomass very small if compared to the immense number of possible DNA sequences! If the *inhabitable* area within the configurational space is an infinitesimally small part of the total, by far the largest part of the possible mutations in any given organism will be detrimental. In all but very small populations, by far the largest part of the remaining ones will be effectively neutral, and only the minute rest may have any potential interest for evolution. The vast bulk of the exploratory trials will be lost — in accordance with relevant observations.[17] The huge amount of sophisticated functional information known to exist in the biosphere would then appear to be sort of a mystery. In order for evolution to be plausible, on the other hand, an appreciable fraction of the combinatorial space would have to contain viable genomes. This certainly applies for the region of the combinatorial space explored by life. But is there a reason to believe this minute corner to be in principle different from any other region? Many *random* DNA sequences would have to contain functionally meaningful stretches! Is this a reasonable expectation? Huxley's typing monkey thought experiment suggests otherwise if actually computed.

Although, as a rule, texts about evolution do not even bother to mention such problems, *none* of these processes required for macroevolution have been documented to occur. Furthermore, requirement (4), the origin of new functions — which is an absolute prerequisite for (5) and (6) — has been shown to be likely to involve enormous improbabilities. As long as no hard facts to the contrary are available, this fundamental difficulty must not be ignored!

Although, as a rule, texts about evolution do not even bother to mention such problems, none of these processes required for macroevolution have been documented to occur.

Thus, the known evolutionary mechanisms account for microevolution only, while macroevolution at present looks implausible. (Denton[18] forcefully raises the same issue, but does not offer a solution.) Are these mechanisms, therefore, true evolutionary mechanisms at all? If macroevolution does not occur, "microevolution" should not be called evolution at all. It would then merely represent a mechanism for maintaining stability with some variability, possibly some limited change and diversification, including speciation, within a restricted character space, making such a species, genus, or family capable of better coping with changing environments.

Evolutionary Evidences

The second approach to the question of the reality of evolution is to consider the evidences adduced to support it. There is a host of solid observations which can be interpreted in the evolutionary framework. Some of these observations can be subjected to statistical tests and are sometimes shown to be *highly significant*. But the crucial point is that each one of these observations is *ambiguous* as far as its evidence for evolution is concerned. Occasionally, it has been claimed that evolutionary theory has indeed passed critical tests, according to Popper's[19] strong criterion of falsifiability for scientific theories. But in most cases, microevolution alone has been tested.[20] In others, tests were done against the implausible null-hypothesis of randomness.[21] As is shown below, all of these observations are ambiguous because plausible alternative explanations exist, which would make the evidence irrelevant for evolution. It may be difficult to conclusively show which one of these alternative interpretations applies — or possibly both. But as the proposition that there is no Creator is not demonstrable, the possibility that evolution is an illusion has to be taken seriously.

(1) The evidence for highly significant *similarities* between the features of different organisms is impressive. Some of these similarities encompass the entire biosphere, and it is not surprising that for Dobzhansky "nothing in biology makes sense apart from evolution."[22] Yet, in each single case, these similarities may be due to similar *functional requirements*. Strictly speaking, the features concerned would then have to be called analogous, rather than homologous. It is in practice impossible to prove that a given feature is absolutely functionless in its total organismal and ecological environment. But if it has any useful function, it is under selective pressure, and the feature just might *have* to be similar in different organisms in order to be functional. Why are there so many occasions where "convergent" or "parallel" evolution has to be invoked?[23] Evidently, there are many similarities which, even in an evolutionary framework, are not indicative of a common descent. Such functionalist considerations may apply even to weak similarities, whose functio-

nal significance might be hard to detect. Very little is known, as yet, about context- or species-specific functionalities, or about functional interdependencies among different features. Again and again, DNA sequences once believed to be functionless are discovered to have some function; usually the first indications are nonrandom features. After codon synonymity, 5'- and 3'-noncoding gene sequences and introns, propositions for third codon positions and at least some pseudogenes[24] have joined the list.

Plausible population dynamics models explain why usually no fossils representing the transitions should be found. But in order to find out whether evolution is real, we need positive evidence, not explanations for its lack.

(2) The similarities with respect to a given feature between different organisms can be used to compute a similarity tree (or cladistic tree) if the feature has measurable aspects. Significantly *similar cladistic trees* of different features, but referring to the same group of organisms, are often found. Does this prove evolution, as has been claimed? The null-hypothesis of a merely accidental similarity between the trees[25] is unreasonable, even within an evolutionary framework, because it ignores possible *functional interdependencies* between the features considered. If there is a dependency between different functions, their cladistic trees are bound to be similar. Such dependencies are not the exception, but the rule! It is astonishing that the possibility of complete independence between different features of a functional organism is even considered.[26] Of course, the correlations between functional interdependencies and tree similarities need not be absolute, since the same problem is sometimes solved in different ways — possibly due to other functional correlations.

(3) In the history of life, there appears to be a tendency of an *increasing complexity* of the organisms. Even if it is hard or impossible to objectively define progress in life forms, may not this tendential complexity increase indicate evolution? Not necessarily. It may just as well reflect the requirements of a functioning ecology in the presence of an increasing *diversity* of life forms. Such an increasing diversity, however, may fit a non-evolutionary paradigm just as well.

(4) *Fossils* are *very old*, up to almost one billion years for multicellular organisms, and possibly three billion for single cells. This cannot be reasonably disputed.[27] The occurrence of life and death long before the advent of man has to be accepted. Yet this does not rule out *old-earth* non-evolutionary models, such as the one of "progressive creationism." Evidence for a long history of life is not evidence for evolution.

(5) The fossil record displays many obvious *lines of descent*, usually on the taxonomic level of the family or genus. Some of them span millions of generations. It is an outstanding feature of the fossil record that the origin of virtually none of these lines is known.[28] We do not see a "tree of life," but something like a "bamboo thicket." For a long time, this fact has been neglected by evolutionary biologists, and only relatively recently the model of "punctuated equilibria" has been proposed.[29] The lines of descent *observed* in the fossil record represent the periods of *equilibrium* or stasis, while the transitions corresponding to the *punctuations* of this model remain *invisible* (apart from some reasonable but uninteresting transitions on lower taxonomic levels). Plausible population dynamics models explain why usually no fossils representing the transitions should be found. But in order to find out whether evolution is real, we need positive evidence, not explanations for its lack. Is there evolution, or are there equilibria without transitions?

Thus, we have to conclude that the scientific evidence for evolution is ambiguous,[30] in spite of the many contrary claims.

Creation and Chance

Chance describes an observation made regularly in connection with natural occurrences. The scientific concept of randomness implies that it is not feasible or not possible to trace the cause of a given individual event in the ensemble of an effect under consideration. The cumulative outcome of many such events can often be described by stochastic theory, but the outcome of individual events is unknown; it cannot be measured. The ultimate individual event, an elementary event, involves a single elementary particle, such as an electron.

The cause of such an event is, as far as science is concerned, in the invisible world. It may or may not be individually willed by the Creator. Conceptually, there are different possibilities. Either he determines the outcome of each elementary event individually, or he manages them collectively, e.g. by specifying Gaussian normality, mean and stand-

ard deviation, or higher level principles, not caring about individual events as such. Or he might imperceptibly guide chaotic dynamic systems by means of a few disturbances. Chance is not an alternative to God's action: it may be the usual way his creative activity "manifests" itself to us.

It is important to note that theism does not present a "God of the gaps." God's activity is not restricted to events not explainable by science, such as the cause of the Big Bang or of elementary events. How can natural occurrences, which are usually believed to be deterministic, be said to be a consequence of God's activity? The assumption of absolute determinism is erroneous. There is no way of finding out what causes individual elementary events. But each macroscopic event is ultimately composed of and influenced by elementary events not susceptible to scientific investigation.

To call the specific mutations leading to the selectable variant a chance occurrence is equivalent to pleading ignorance of causation: the evolutionary step has not been explained.

It has traditionally been believed that creation necessarily implies a miracle. But what is a miracle? God is continually active in his created universe. His being the Creator cannot easily be separated from his being the Sustainer. Anything happening according to *"natural law"* is just as much God's doing as those of his *"miracles"* lacking ordinary causation. Natural scientists recognize his normal activity as "natural law," because it is normal, reproducible, and understandable. Apart from his ordinary acts, his "extraordinary" ones would not be recognizable as such. Furthermore, God may do "miracles" entirely within "natural law." A biblical miracle is a theological concept: its essence is not lack of conformity to any laws, but the spiritual message to be conveyed to the observers. Thus, the concept of a miracle does not necessarily help understanding creation. It may cause confusion.

As far as God's methods in creation are concerned, it may be worth while to briefly mention the widespread tendency to mix up three issues which are quite distinct:

(1) divine authorship versus material autonomy;

(2) an old versus a young earth;

(3) evolution versus no macroevolution.

I consider the first issue to be resolved for a theist, and similarly the second one for a natural scientist, while the third one remains open. Belief in the autonomy of matter-energy makes belief in evolution inevitable, belief in a young earth makes it impossible, but belief in creation does not prejudge the issue.

Mutations in individual genetic molecules are the crucial point in evolution, as any conceivable evolutionary development is ultimately based on them. A natural mutation in a DNA molecule is a consequence of an elementary event, such as a C^{14} decay or a cosmic ray impact. Yet it may have consequences for an entire organism growing out of a germ cell containing this DNA, and possibly for a species. Therefore, the physical cause for a given evolutionary step can never be investigated, and there is in principle no way to get around this ignorance.

It is customary to consider some selective pressure the cause of a given evolutionary development. In doing so, one tacitly assumes that any structure needed will automatically be produced by mutations sooner or later. But the crucial link in the chain of causation is not natural selection, but the specific mutations leading to the selectable variant. To call it a chance occurrence is equivalent to pleading ignorance of causation: the evolutionary step has not been explained.

The demonstration of stochastic distributions characterizing chance events cannot eliminate the possibility of a precise providential predetermination by the Creator, should he choose to do so. In any case, science has no way of finding out what causes individual elementary events. The claim that there is "nothing but chance" behind mutations is non-scientific. It is a matter of personal belief. Such a use of the concept of chance masquerading as science is an abuse of the popular respect for science.

Warfare Paradigm

The "warfare" model, the belief that creation and evolution are mutually exclusive, is shared by the two extreme positions of dogmatic atheism and "recent-creationism." But is it true? Both views have serious flaws. While the crucial difficulties the *atheists* face are with *natural science*, the ones of the *recent-creationists* are with *biblical theology*. The denial of a Creator makes the origin of information, and therefore evolution, definitely implausible. On the

other hand, a short-term, immediate creation, excluding all developments, dissociates creation from natural science.

The* evidence for creation, *although logically* ambiguous, *is* persuasive *to an upright seeker; it pervades all of creation.

There are serious *scientific* arguments against evolution. They basically boil down to the insufficiency of natural information sources. However, they only apply in an atheistic, not in a theistic, framework of axioms. In nature, there is a tremendous amount of evidence for God's marvelous activity, but none of it is of the kind of a mathematical proof. Probability estimates yield remarkable results, but the inevitable uncertainty of the parameters required leaves a loophole to those who do not choose to believe. God wants to be loved out of a free decision, rather than a forced one. The *evidence for creation*, although logically *ambiguous*, is *persuasive* to an upright seeker; it pervades all of creation:

(1) The Anthropic Principle of *cosmology* has been formulated by scientists who were surprised by the number of cosmological constants which are "just exactly right" for life on earth to be possible at all.[31] Just a small increase or decrease in the value of any one of over a dozen constants would have prevented galaxies, stars, the Earth, or the elements required for life to be produced. This principle has been called "Anthropic" to indicate that humans would not exist to observe the fact if any of these conditions were not what they are to within small tolerances.

(2) Similarly, the environmental conditions on *Earth* throughout its history display a remarkable collection of "coincidences" conducive to life.[32] Very small changes in any of them could have made the Earth uninhabitable, like Venus or Mars.

(3) The origin and further development of *life* imply such an unbelievable series of specific molecular events that the probability of their occurrence is vanishingly small. This is true for the simplest protein domain functions, let alone for whole enzymes, cells, organs, and organisms, or even realities like soul and spirit.

These facts have been recognized by many scientists, and even agnostics and atheists marvel. In order to appease their statistical consciences, some resort to metaphysical speculations like a "many-worlds" hypothesis: there might exist an infinity of universes besides our own, such that even the production of life and of man is deemed "certain to occur somewhere," although in any single universe the probabilities are infinitesimally small. Of course, these ideas are irrelevant if there is a Creator.

On the other hand, the usual *theological* arguments against evolution are based on questionable interpretations of both nature and the Bible, and often a deistic philosophy. They falsely assume that creation and evolution are *alternative* explanations within the *same*, scientific category. A model consistent with both biblical theology and natural science may view them as *complementary* explanations from *different* categories, instead.

God has given Adam the "cultural mandate" of obtaining dominion over the earth, in order to keep it and care for it. It is reasonable to claim that this implies the application of science. The natural order is comprehensible because God made man's mind congruent to his design of the universe. It is no accident that the rise of modern observational and experimental science and technology followed in the wake of the Reformation and the invention of printing, when a careful study of the Scriptures became widespread.[33] It is therefore proper to expect consistent, reliable, truthful results of scientific investigations. But it is not proper to expect misleading appearances in nature, such as an apparent age, which would have to be corrected by scriptural revelation. God does not expect scientists to deal with miracles violating natural law.

What is the theological implication of the concordant evidences for high ages of the universe, the earth, and the fossils? God would certainly be capable of producing an appearance of such ages in a miraculous fashion. But since he is truthful — not only in revelation, but also in creation — we should not expect him to do so. As many independent pieces of evidence point to concordant high ages,[34] their cumulative nature has a force we dare not ignore. It would represent an offense to God's character of veracity to postulate that he produced an appearance of something false.

Harmony Paradigm

Is theistic, or creative, evolution a contradiction in terms, as recent-creationists claim? If the *biblical* evidence is critically examined, the case *against* evolution is rather weak.[35] This may come as a surprise to many Christians desiring to be faithful to the

Bible — and to atheists desiring to get rid of its claim. But particular translations and some traditional interpretations of the biblical texts have definitely mislead many.[36] Of course, this has not been a problem as far as any central tenets of the Christian faith are concerned. These are clarified abundantly throughout the Bible. It is obvious that God is proclaimed as the Creator. But his creational procedures are not so obvious — they are spiritual non-essentials.

If the* biblical *evidence is critically examined, the case* against *evolution is rather weak.

A question of great importance which is often raised in this context is the inerrancy of the Scriptures. Some argue that if the Bible could be shown to be in error when it speaks about creation — even about creational procedures — it could not be trusted when it speaks about salvation, either. This is true, since the Christian faith depends on the reality of God's revelation — and therefore the reliability of its expression in the Bible. However, this still does not answer the question of whether creation is compatible with evolution. An evaluation of contradictory claims in this area has to consider the biblical contexts, the original languages, and all sciences involved in the topics touched upon. To respect science does not mean to put fallible human activities on the same footing with God's infallible revelation. Disputing the validity of certain interpretations like young-earth creationism need not imply questioning God's Word. The creation is just as much a product of God's doing as is the Bible. An evaluation of models of natural science and biblical interpretations leads me to postulate the following compatibilities between concepts of the two different categories:

(1) *Creation* may very well be compatible with *evolution*. The claim that creation necessarily implies sudden creation, using neither source material nor mediate processes, is contradicted by various scriptural examples. God is persistently active in all so-called "natural" occurrences, which are even occasionally described by the Hebrew term "bara'" (or Greek "ktizo") specifically denoting God's creating. The miracle-only concept of creation restricts God's realm of activity to production out of nothing. It is therefore deistic, rather than theistic.

(2) The creation *"days"* of Genesis 1 may very well represent *ages* of unspecified duration, possibly overlapping. This can be accepted without taking the text any less "literally."[37] Considering Gen. 2:4 (of the same immediate context!) and other passages, the "one-week short-day" interpretation is theologically arbitrary and requires the rejection of empirical evidences.[38]

(3) Divine *providence* may very well be compatible with the occurrence of *chance* or random events. Chance, in the scientific rather than a philosophical sense, is a description of the natural functionings of creation, as the Creator has given them. God as Sustainer or Provider definitely does use chance.

(4) God's *goodness* may very well be compatible with *natural selection*. On the one hand, creaturely suffering is inseparably intertwined with the normal day-to-day functioning of the biosphere. In itself, it has nothing to do with evolution. We may consider it incompatible with God's goodness — thereby attributing it to the fall of a spiritual, free creature. But we must not deny his providential care in what is happening in nature. On the other hand, the popular concept of natural selection is coined more by 19th century atheistic philosophy than by science.[39] We have to replace the metaphor of "struggle for existence" with the scientific concept of differential reproduction. Furthermore, computer program tournaments have shown that "blind" natural selection can even favor what we would label as nice and fair behavior.[40]

If the Bible does not tell us directly how God creates, perhaps it gives some indirect indications regarding his "normal ways of acting."

(5) God's *creation* activity may even be compatible with the presence of biological *death*. We certainly must not give plant death and cell death connected with development and continuous bodily renewal in animals and man a negative theological connotation. Individual death in animals is logically unavoidable, as there has been animal life for hundreds of millions of years. Do we really know whether animal death is bad in God's sight? We certainly cannot claim that the biological preparation of man's earthly environment was not planned by God, although it took a few billion years. Whatever negative aspects of death are left, after these caveats, could

be theologically attributable to either the fall of Satan or possibly a time-transcending aspect of the human fall — just as the redemptive effect of Christ's death transcends time, having "consequences backwards in time." And some of the providential dealings of God with believers seem to indicate that, even when human life is concerned, the negative aspects of biological suffering and death must not be stressed out of proportion. God is very much more concerned with *spiritual* death and life.

Creation Revealed

If the Bible does not tell us directly how God creates, perhaps it gives some indirect indications regarding his "normal ways of acting." Are there possible parallels between God's modes of creation and of revelation? Jesus appeared in completely human form, affected with human frailty (though not with sin). God's written revelation has been given through human authors, with their cultures and thought-forms, in human languages. The manuscripts have been copied, sometimes with a few copying errors, and all of the originals have been lost. The canon has been determined by fallible humans. I believe that God has kept his hand over the process, but he has done it in a hidden form. Giving mankind a miraculously written book in finished and incorruptible form would not be in conformity with God's way of doing things, as manifest in Scripture. His revealing himself through his Son and through Scripture leaves man the freedom to believe or not to believe. There is no evidence which logically proves his authorship. It remains a matter of a faith commitment.

Does the Bible provide any more specific indications of the divine methods of creation, which might be compared with the empirical evidence? Of what nature is the declaration of God's authorship in creation?

> Whatever can be known regarding God is evident to them, for God has shown it to them. From the creation of the world onward his invisible qualities, such as his eternal power and divine nature, have been discerned mentally through his handiwork. (Romans 1:19-20, Berkeley translation)

> But faith forms ... a conviction of unseen realities .... By faith we understand that the worlds were put in order at God's command, so that what we now see did not come from visible things. (Hebrews 11:3)

> Thou openest Thy hand, and they [the sea mammals] are satisfied with good things .... When Thou cuttest off their breath, in death they return to their dust. Thou sendest Thy Spirit, and more are created [bara'!], and Thou dost replenish the surface of the earth. (Psalm 104:28-30)

These statements are strangely ambiguous about *how* God creates! Are these visible or invisible realities — natural or supernatural ones? It is a genuine case of complementary aspects of the same truth. Everyone can clearly see the reality of creation — yet it is by faith only that one perceives this evidence as compelling. The biological processes mentioned in the Psalm passage occur "naturally" — yet they are said to reflect God's creating.

These statements are strangely ambiguous about* how *God creates!

God reveals himself to his human creatures through Scripture and through the created order. But he does not use force of any kind in this revelation, not even the force of a logical proof. Why this restraint? A proof of the impossibility of evolution, e.g. by demonstrating that the earth is only a few thousand years old, would amount to a simple, uncontrovertible proof for the existence of a Creator. This in itself makes the feasibility of such a proof at least very doubtful. There is a venerable tradition of "proofs of God," but these may have been conceived as philosophical or moral arguments, such as Paul's in Rom. 1:19-20, rather than scientific proofs. God has created human beings as persons, and he respects this dignity he has chosen to give them. He uses loving moral persuasion and leaves them the freedom of choice. It appears that, in order to guard human freedom, evidence for creation has to be hidden in logical ambiguity. God has thrown the veil of stochastics over his footsteps. In this life, we "walk by faith, not by sight."

As no other scientific hypothesis has been formulated, there is, at present, no alternative to evolution as God's creation method. And evolution is even a very attractive option for Christians who believe in the full inspiration of Scripture![41] There seems to be an inner congruence between developmental processes in nature and the way God deals with his creation according to Scripture. ✧

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"Natural selection can act
only by the preservation and accumulation of
infinitesimally small inherited modifications,
each profitable to the preserved being;
and as modern geology has almost
banished such views as the excavation of a great valley
by a single diluvial wave,
so will natural selection, if it be a true principle,
banish the belief
of the continued creation of new organic beings,
or of any great or sudden modification in their structure."

Charles Darwin, as quoted in *Darwin on Trial* (Phillip E. Johnson, 1991)

"Science Never Fails:" Popular Science and the Emergence of American Metaphysical Religion

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The "Science" in the names of metaphysical groups such as Christian Science, Divine Science, and Religious Science goes back to a time in the nineteenth century when the new republic was riding a wave of enthusiasm for the Baconian philosophy and for science made popular. Phineas Quimby, father of the metaphysical movement, found the science of the day to be an authoritative and infallible foundation for his practice of mental healing and his new religious ideas. Quimby ultimately claimed science and God to be one and the same. His concept of science as an infallible theological absolute provided the budding metaphysical movement with an authoritative foundation on which to stand.

In 1873 John W. Draper declared in *The History of the Conflict between Religion and Science* that

> the time approaches when men must make their choice between quiescent, immobile faith and ever-advancing Science — faith, with its mediæval consolations, Science, which is incessantly scattering its material blessings in the pathway of life, elevating the lot of man in this world, and unifying the human race.[1]

The title of his book begets the imagery of science and religion as Old West gunslingers in a showdown on Main Street, and his comment indicates that science clearly wears the white hat. Similarly, but with greater influence, Andrew Dixon White in *A History of the Warfare of Science with Theology in Christendom* uses a military metaphor of "warfare" to describe the history of what he sees as a long and destructive dispute in which science again is set forth as the good and true hero in an almost melodramatic fashion. In an 1869 lecture, which inaugurated his twenty-seven year study, White concluded that

> *in all modern history, interference with science in the supposed interest of religion, no matter how conscientious such interference may have been, has resulted in the direst evils both to religion and to science — and invariably. And, on the other hand, all untrammeled scientific investigation, no matter how dangerous to religion some of its stages may have seemed, for the time, to be, has invariably resulted in the highest good of religion and of science.*[2]

Although over a century later there still remains an affinity for the *conflict* and *warfare* approaches to the interaction of science and religion on a popular level, the academic world has recently taken some significant steps toward discrediting these positions that have set the "terms of the debate" for decades. Historians of science Ronald L. Numbers, David C. Lindberg, and James R. Moore have attempted to

disarm the military metaphor by showing that it is "a gross distortion," "entirely misleading if not utterly false," and is "neither useful nor tenable in describing the relationship between religion and science."[3] Lindberg and Numbers conclude that the relationship between science and religion is much too complex to be wrapped up neatly by the simplistic *conflict* approach.

Not only is the conflict approach inadequate to make sense of the complex relationship between religion and science, but it *invariably* overlooks periods of remarkable harmony that have done as much to influence our current perceptions of both religion and science as have periods of pronounced discord. The popular and paradigmatic example of the interaction of religion and science in America still remains the Scopes trial of 1925, in which a *conflict* interpretation is, to a large degree, very appropriate. However, little attention is given to antebellum, pre-Darwinian America, where religion and science not only coexisted in peace but were profoundly and shamelessly symbiotic. Herbert Hovenkamp calls this a "honeymoon" period,[4] which is a descriptive term light-years removed from military metaphors. In the same vein, Theodore Dwight Bozeman concludes that "antebellum America, marked by a lively and growing interest in natural science *and* evangelical Protestantism, widely nurtured the comfortable assumption that science *and* religion ... were harmonious enterprises cooperating toward the same ultimate ends."[5]

With the dogmatic conflict theses of White and Draper setting the terms of the debate over the interaction of religion and science this century, it is no wonder that little attention has been paid to the antebellum honeymoon period. It is only in the last twelve years that significant work has been done on the interaction of religion and science concentrating on this period, with Hovenkamp and Bozeman being the only full-length studies, and these dealing only with Protestant orthodoxy.

We suffer today from the drought of interest in this period. According to historian of fundamentalism George M. Marsden, the resurgence of creationism in the last twenty years and modern fundamentalist views of science in general cannot be well understood without an examination of the interaction of religion and science during the early nineteenth-century, which was the formative period for the fundamentalist attitudes toward science that are active today.[6] In addition, a number of modern alternative religious movements such as New Age (including channeling), Scientology, Transcendental Meditation, and the Unification Church, have relationships with science similar to the relationships that nineteenth-century movements such as spiritualism, phrenology, mesmerism, and various medical sects developed with the science of their day.[7]

Still another religious movement that survives today cannot be fully understood in its modern manifestation without reference to the honeymoon period of religion and science in antebellum America. This is the metaphysical religious movement. Springing to life just before the Civil War, and thriving at the time White and Draper were writing, this movement is another significant counter-example to any notion of a universally valid *warfare* thesis. It is a living testimony to the honeymoon that science and religion experienced even beyond Protestant orthodoxy. In fact, at the same time theologian Charles Hodge of Princeton was developing a scientific approach to theology, Phineas Parkhurst Quimby of Maine, the father of the metaphysical movement, was taking the relationship between science and religion far beyond the mere application of the "inductive method" to things sacred. Instead, he was establishing no less than "the Science of Truth" in which "Science [was] the one living and true God to worship."[8]

Today, a century and a half after the advent of the movement in New England, the church section of the telephone directory in almost all of the major

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cities in the United States reveals the remnant of practical metaphysics in listings for churches with names such as Church of Religious Science, Divine Science, Christian Science, and Unity. The existence of these churches reflects an aspect of the movement which at first glance seems especially peculiar to those who may be preoccupied with the *warfare* mentality; that is, the copious and confident use of the term *science* by religious groups that are in an alleged state of war with it. The pervasive use of the term *science* throughout metaphysical literature, as well as its multifarious use in book titles and key concepts (Science of Mind, Science of Being, Spiritual Science, Science of Health, and Mental Science) suggests much more than a movement in a peaceful state of coexistence with science. Rather, here is a movement with a history infused with the concept and with organizational titles that boldly proclaim that allegiance.

This study is an attempt to examine the origins of the relationship that developed between the metaphysical religious movement and science in antebellum America. It is also an attempt to explore popular philosophies and attitudes toward science that made the relationship possible. I offer this study as another significant counter-example to the *warfare* thesis broadly conceived and as another positive example of how religious movements, both traditional and nontraditional, have, since the scientific revolution, used science as an authoritative foundation for their belief systems.

In order to get at the roots of the relationship between the metaphysical movement and antebellum science, I will first focus on the scientific culture of the day by examining its foundation in the "Baconian philosophy" and by pointing to the presence of this philosophy and the concept of science it helped to create in the popular mind. Secondly, I will investigate the origins of the metaphysical movement through the thought and practice of its founder, Phineas P. Quimby, and show how Quimby's religious thought and practice are bound to the scientific fervor of the period. Lastly, I will discuss how Quimby's concept of science, aided by the philosophy of Bacon and the rising tide of scientific enthusiasm, ultimately took on the character of a theological absolute and thus provided his system of thought with an authoritative foundation.

American Baconianism as Popular Philosophy of Science

Historian of New Thought Charles S. Braden, in his *Spirits in Rebellion: The Rise and Development of New Thought*, lists a number of important intellectual currents in New England in Quimby's day that may have influenced the culture in which the metaphysical movement was to arise. Although in his list Braden mentions the philosophical and religious influence of John Locke, the Transcendentalists, the Unitarians, and the Calvinists, he leaves out the influence of what is called the "Baconian Philosophy" which, given Quimby's exaltation of science, is at least as important as the currents of Transcendentalist idealism upon which Braden chooses to focus.[9] Braden, writing in 1963, did not have the advantage of calling upon the more recent work of George H. Daniels and Theodore Dwight Bozeman, who identify the Baconians as representing "the broad foreground of Anglo-American intellectual leadership" in the antebellum period.[10]

It was not just the scientists of the day who were "almost to a man Baconians," but "most of the intellectual community" as well.

At a time when science was coming of age in the new republic, Baconianism, or the "inductive method," provided a tried and true foundation and framework for the blossoming fields not only of natural science but also of all fields of inquiry where "facts" could be gathered. It was not just the scientists of the day who were "almost to a man Baconians," but "most of the intellectual community" as well.[11] Indeed, the physical scientists and naturalists shared their rapture with Bacon's inductive method with a variety of disciplines, not the least of which was religious scholarship. C. Leonard Allen points out that American Protestant theologians found Baconianism a "deft and flexible tool that could be employed in the services of numerous antebellum theologies."[12]

Moreover, Christian theologians, most likely to their chagrin, shared the Baconian bandwagon with others who occupied themselves with more heterodox spiritual concerns. Practitioners of spiritualism, mesmerism, phrenology, psychography, and other phenomena which touched on things metaphysical also tried to hitch their claims to this powerful mental tool that was thought to be able to settle all disputes through proof by demonstration.[13]

The pervasiveness of Baconianism in antebellum thought is by no means proportionate to the minimal attention it has received from modern scholars.[14]

Daniels, who has done one of the most important studies of Baconianism to date, attempts to illustrate the significance of this philosophy by citing nineteenth-century bellwether Edward Everett.

> Edward Everett, editor of the *North American Review*, Unitarian minister, and Massachusetts politician, began a review in 1823 with a remark that might very well characterize the intellectual temper of the period in which he lived. "At the present day, as is well known," he observed, "the Baconian philosophy has become synonymous with the *true* philosophy." Everett's choice of the adjective "true" was not a matter of accident — it was not merely that Francis Bacon's philosophy was the most adequate or the most useful, but that it was thought to be *true*, and any other philosophy was correspondingly false ....
>
> The Baconian philosophy so dominated that whole generation of American scientists that it was difficult to find any writer during the early part of the nineteenth-century who did not assume, with Everett, that his readers knew all about it. Dugald Stewart in his history of philosophy, also disclaimed any need to speak of Bacon's *experimental* philosophy on the grounds that this was so well known as to be obvious.[15]

American Baconianism was, however, at least two steps removed from anything Sir Francis himself had to say.

What was referred to as "Bacon's philosophy," however, had less to do with the seventeenth-century nobleman than the prolific application of his name might imply. American Baconianism was at least two steps removed from anything Sir Francis himself had to say. It was first the distinctive interpretation of Bacon by Thomas Reid, Dugald Stewart, and the school of Scottish common-sense realism, whose writings were popular among America's intellectuals in the early nineteenth century. American intellectuals themselves, such as Samuel Tyler, then added some of their own distinctive interpretations before Bacon's scientific thought blossomed into America's "true philosophy."[16]

Although one of the central characteristics of this *true* philosophy which was "engrafted wholesale into the main structure of nineteenth-century American ideas"[17] was "vagueness," Bozeman, building on the work of Daniels, nonetheless finds a pattern with four general elements: (1) a "spirited enthusiasm for natural science"; (2) a "scrupulous empiricism," with a corresponding trust in the senses and a real outer world; (3) an intense distrust of speculation and of concepts not derived directly from observed data; and (4) a celebration of "Lord Bacon" as founder and the work of Newton as paradigm example of Bacon's inductive method.[18] Elaborating on the importance of the empirical nature of Baconianism and on the priority of the senses, Daniels observes:

> First, and most evidently, "Baconianism" meant "empiricism," in the sense that all science must somehow rest on observation and that it must begin with individual facts and pass gradually to broader and broader generalizations .... The impressions of the mind were considered direct, immediate perceptions of a real objective order. The testimony of the senses had to be admitted as true, and its validity depended upon no outside, additional evidence. The truthfulness of the testimony of the senses could not even be questioned, as one spokesperson said, "without questioning the truthfulness of our constitution, nay, the veracity of God himself — without questioning everything, through whatever channel derived."[19]

Daniels also points out that the method of Bacon meant avoiding "hypotheses" (a term to which Baconians attached a degree of contempt) by not going beyond what could be directly observed. Going beyond observation and entering the realm of hypothesis meant moving away from indisputable fact into the world of what Phineas Quimby often referred to as opinion, prejudice, error, ignorance, and superstition. The average scientist of the day, assured that this philosophy was grounded in the firm foundation of common sense, knew that if one had carefully observed facts and avoided hypotheses one could confidently deduce laws of nature from the comparison of these facts with one another. As Bozeman writes, "In other words, nineteenth-century Baconianism, as most American scientists used the term, implied a kind of naive rationalistic empiricism — a belief that the method of pure empiricism consistently pursued would lead to a rational understanding of the universe."[20]

Science and the Common Person in the Nineteenth-Century

The important studies of Daniels and Bozeman on the reign of Bacon in antebellum America deal very effectively with the veneration of the "inductive method" by the intellectual community. However, for the purposes of examining the origins of a movement that began well outside of academic circles and whose founder, Quimby, had but a "meager

education,"[21] we must look to the popular mind of the common farmer, smith, and shopkeeper to see how the Baconian philosophy and the scientific advances of the day were "playing in *antebellum* Peoria."

The period from 1820 to 1860 in the United States was a time when science was moving out of the hands of aristocratic amateurs into the laboratories and studies of professional "scientific men," or "scientists."

In the early nineteenth-century for an uneducated person such as Quimby to have what seemed, at least in his own mind, to be a firm grasp of experimental science was not unusual. The period from 1820 to 1860 in the United States was a time when science was moving out of the hands of aristocratic amateurs into the laboratories and studies of professional "scientific men," or "scientists," terms that were rapidly replacing "natural philosopher" by the late 1840s.[22] During the transition, what was once considered an esoteric body of knowledge was diffusing out to the population at large. Two fashionable methods of dissemination were most responsible for this spread of information: the local newspaper and the expanding lyceum lecture circuit.

Although there were an average of fifty-five scientific journals in publication in a given year during this period, their circulation was still very limited, and it would be very unlikely that the common person would have much access to these for his scientific information. The local newspaper, on the other hand, provided amateur scientists like Quimby a wealthy source of science education. A study by Donald Zochert surveyed more than 1,500 issues of newspapers between 1837 and 1846 and found a wealth of material in all scientific disciplines in both quantity and substance, indicating a very vigorous and sustained interest in science among the common people and wide dissemination of the latest scientific information of all types.[23] William Ellery Channing wrote in 1841, "Through the press, discoveries and theories, once the monopoly of philosophers, have become the property of the multitudes .... Science, once the greatest of distinctions, is becoming popular." Channing thought that the characteristic of the age was "not the improvement of science, rapid as this is, so much as its extension to all men."[24]

During this same period, when scientific information was regularly making it into newspapers around the country, science was also finding a particularly successful path to the public through the burgeoning lyceum system which, at its peak in 1850, entertained an estimated 400,000 people a week.[25] The scientific content of the information disseminated by lyceum lecturers ranged from the widely respected natural history of Swiss scientist Louis Agassiz, who packed 5,000 into Tremont Temple in Boston in 1846,[26] to the "scientific practices" of itinerant phrenologists, spiritualists, and mesmerists such as Quimby, who at times found "reputable" lyceums closed to them. Due in great part to the successful dissemination of popular scientific information through the lyceum systems and the press of the day, Joseph Henry could say with conviction that there were "more interested in popular science among us than in any other part of the world."[27]

In the early nineteenth-century people everywhere had learned that to invoke the name of "science" was to appeal to utility, certainty, optimism, and progress. One newspaper proclaimed in 1837 that "the world is on the threshold of discoveries in science and the arts, which must change the whole face and fabric of society .... Discovery after discovery, and improvement after improvement, follow each other in such rapid succession, that we are prepared to believe almost everything that may be asserted."[28] Prominent professional scientists were not immune to this unbridled homage to their own occupation, as James Dwight Dana reveals in an 1856 address to Yale alumni: "Science is an unfailing source of human good .... Every new development is destined to bestow some universal blessing on mankind."[29]

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The diffusion of the scientific enterprise to the general public began increasing geometrically in the

United States during the 1830s, and along with the diffusion came the notion that "the common man — no less than the philosopher — could fasten upon it [science] to his advantage."[30] From 1820 to the time of the firing on Fort Sumter in 1861, the character of American science was undergoing rapid change from an activity once thought of as a gentlemanly leisure-time pursuit to one for the trained professional "who had a single-minded dedication to the interests of science."[31] This period of rapid change saw not only the professionalization of science, but its democratization as well; what Channing referred to as its "extension to all men." The layperson, not just the professional scientist, was riding the wave of growth, fascination, and optimism generated by the science of the day; and it was often the layperson who, in little danger of being criticized by "professional" colleagues, saw in science almost limitless possibilities for health, wealth, and entertainment.

It is at this point that I turn to Phineas P. Quimby of Belfast, Maine, who was able to capitalize on some of the limitless possibilities that the science of the day seemed to make available. In the midst of this period in which the population at large was clearly enamored of science and immersed in a popularized Baconian philosophy, Quimby began a journey from clockmaker and amateur scientist to mesmerist and mental healer. Along the way he established a unique relationship between religion and science that defies any dogmatic *warfare* thesis. In doing so, he provided much of the metaphysical movement an authoritative base on which to build.

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Phineas Parkhurst Quimby

P. P. Quimby: Clockmaker, Mesmerist, and Mental Healer

Phineas Parkhurst Quimby (1802-1866) was born in Lebanon, New Hampshire, but moved with his family to Belfast, Maine, at the age of two years and remained there most of his life. Because of his family's poverty he spent no more than six weeks in school, but was taken in as a clockmaker's apprentice while still a boy. New Thought philosopher Horatio Dresser described the young Quimby as a man with meager education who would, if given the chance, have sought training in the special sciences as "that was the tendency of his mind."[32] Quimby's son George wrote of his father,

> He had a very inventive mind, and was always interested in mechanics, philosophy and scientific subjects .... He was very argumentative, and always wanted proof of anything, rather than an accepted opinion. Anything which could be demonstrated he was ready to accept; but he would combat what could not be proved with all his energy, rather than admit it as truth.[33]

Although Quimby never did receive any formal training in the sciences, his apprenticeship in the art of clockmaking gave him the ability to become a sort of first cousin to the natural philosopher who often found that the local clockmaker possessed the best skills for making precise scientific instruments. Quimby's inventiveness (four of his inventions received patents) and his inquisitiveness concerning

new phenomena (he was one of the first makers of daguerreotypes) strongly hint at his personal identification with the tradition of clockmaker as applied scientist. Quimby faithfully carried out his work as mechanic of the clock until he was thirty-six years old. It was at that age that his fortunes began to change.

Through Charles Poyen's performances in Belfast, Maine, the recently imported science of animal magnetism encountered the spirit of American Baconianism in the person of Phineas P. Quimby.

Enter at this point the Frenchman Charles Poyen. In a small lyceum lecture hall in Belfast, Maine, in 1838, the self-proclaimed professor of animal magnetism lectured and performed demonstrations in the new science of mesmerism, which at the time was virtually unknown in the new republic. True to the reputation of many of the controversial "sciences" materializing on the lecture circuit during this time, Poyen was not simply claiming animal magnetism to be an interesting, curious, and entertaining phenomenon. He was, rather, as Robert C. Fuller explains, proclaiming with evangelical zeal the revelation of "lawful principles long hidden beneath the appearances of the outer world," and he thought himself "to be unveiling the hidden secret of human happiness and well-being."[34] As Poyen's reputation spread throughout New England, many people came to the lectures to volunteer as subjects in hopes of obtaining medical cures. Magnetic treatments were a regular part of the act, and reports of success were not uncommon.

Through Poyen's performances in Belfast, Maine, the recently imported science of animal magnetism encountered the spirit of American Baconianism in the person of Phineas P. Quimby.[35] Quimby was so enthralled with this remarkable new science that he dropped everything to chase Poyen from town to town, learning both mesmerism and show business at the same time. Through observation, inquiry, and experimentation Quimby soon became adept at wielding the mysterious power. He teamed up with Lucius Burkmar, a young man particularly susceptible to mesmeric trance, and took his own show on the road. Before small-town audiences Quimby would demonstrate his new science by putting Burkmar into a trance in which the young man would take clairvoyant journeys, read minds, and diagnose and prescribe treatment for illnesses. Cures abounded, including one for Quimby himself, who claimed to be healed of a serious kidney ailment with Burkmar's clairvoyant assistance. "Newspapers began to take note, and soon the magnetic doctor from Belfast was being touted as the world's leading mesmerist."[36]

At some point during his stint as an itinerant lyceum performer, Quimby began to doubt that animal magnetism could account for the success in curing the sick. Through extensive experimentation with the phenomenon on Burkmar and others, he decided that clairvoyant diagnosis and prescribed treatment had little to do with the patient's recovery. Burkmar was not detecting the actual disorder, nor was his prescribed treatment the cause of the cure. He was, instead, reading the patient's belief about his or her own physical condition. Quimby reasoned that the patient, being amazed at Burkmar's accurate diagnosis, would then put full trust in the suggested remedy. The actual cure would come by *believing* that the remedy would cure, not by the remedy itself. Drawing out this insight, Quimby soon concluded that not only were the patients cured by correcting the errors in their beliefs or ideas, but that the errors in belief were the *cause* of the illness in the first place. In an answer to the question "Is disease a belief?" Quimby wrote:

> I answer it is, for an individual is to himself just what he thinks he is, and he is in his belief sick. If I am sick, I am sick for my feelings are my sickness, and my sickness is my belief, and my belief is my mind; therefore all disease is in the mind or belief. Now as our belief or disease is made up of ideas which are matter, it is necessary to know what ideas we are in; for to cure the disease is to correct the error; and as disease is what follows the error, destroy the cause, and the effect will cease.[37]

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It was from this basic observation that Quimby began to develop a system of idealistic thought and practice that, although suffering from a lack of depth and cohesion, was the foundation of his new "Sci-

ence of Health and Happiness." After his personal discoveries about the nature of illness, the mind, and the cosmos, Quimby eventually abandoned the lyceum circuit when people began regularly seeking him out for therapy. He set up a practice in Belfast but soon moved to Portland, where he performed his mental healing techniques for nearly seven years and treated, according to one estimate, over 12,000 people.[38] Among his patients were some of the pillars of the soon-to-burgeon metaphysical movement — Mary Baker Eddy, Warren Felt Evans, and Julius and Annetta Dresser, all of whom were restored by Quimby's techniques, became students of his ideas, and eventually helped to carry them to wider circles of disciples.

Quimby's Healing: Practice and Theory

Looking back from twentieth-century intimacy with ideas such as psychosomatic disorders and the like, Quimby's therapeutic foundation that "disease is in the mind or belief" is one not unfamiliar to us. However, unlike most modern physicians, Quimby did not consider the mental roots of disease as just one among many possible sources. For Quimby, *all* physical maladies were the result of wrong belief, and there were no exceptions. In carrying this idea to what he considered its proper logical end, Quimby dogmatically spurned all of medical science, calling it "a theory based on the lowest grade of ignorance and superstition."[39] And going a step further, not only were the physicians wrong and unable to help the sick (except by the occasional unwitting application of a form of Quimby's treatment), but they (along with the "priests") were the very *source* of almost all human misery. Quimby estimated that "nine-tenths of the sick at this time would be well and hearty if the medical faculty were annihilated."[40]

Quimby's disdain for medical science and the popularity of his unusual methods of treatment make much more sense when one takes into consideration the dismal state of mid-nineteenth-century medicine. When a person fell seriously ill the courses of action were few and frightful. According to William G. Rothstein, although other choices were available, trained physicians were still almost exclusively using the heroic treatments of bloodletting, calomel, blisters, and crude surgery.[41] By turning to Dr. Quimby the patient was at least assured of coming out of the treatment no worse off than when he or she entered. The worst aftereffects of Quimby's treatment were dashed hopes and the charge from skeptics that the patient had fallen prey to humbuggery, a far cry from a gangrenous infection or mercury poisoning. Although conventional medical practice may not have deserved the degree of scorn issuing from Quimby, surrogate therapies with their grand claims must have been exceedingly attractive, given the established alternative.

Quimby's method of healing the sick was, obviously, vastly different from that of the orthodox physician. Stewart W. Holmes describes how with no instruments, no medications, and no formal training, Dr. Quimby would treat the patient:

> Sitting down quietly beside the patient, without exchanging a word with him, he divined clairvoyantly what was wrong and what had been the origin of the disease. His findings he then revealed to the sufferer, pointing out how the belief in the disease had originated, perhaps in some fright, perhaps in a remark made by someone whose opinion was valued, and then how the abnormality operated, — or was manifested. He explained that the reality of the symptoms was conditional on the patient's belief in them. Then he formed a mental image of the patient in "normal," healthy condition and concentrated on this so strongly that the patient's mind, prepared by his explanation of the principles involved, accepted the image. Finally, with varying degrees of speed and permanence, the sick person's organism manifested this healthy belief. In other words, he was restored to health.[42]

"Sitting down quietly beside the patient, without exchanging a word with him, he divined clairvoyantly what was wrong and what had been the origin of the disease..."

Quimby's method of treatment, although unorthodox, appears to have been straight-forward enough. However, below the level of application lies a rather tangled body of homespun theory developed by Quimby to undergird, explain, and defend his practice. Untangling and explaining the details of his metaphysical ideas is an awkward task since, as Braden writes, he "seems to have been groping for a consistent theory, but never quite to have achieved it," probably because "he himself was not clear in his own thought."[43] Quimby leaves no doubt, however, concerning the basic premise of his thought, which is repeated continually in one

form or another throughout his collected writings. Quimby argued that

> there is no intelligence, no power or action in matter itself, that the spiritual world to which our eyes are closed by ignorance or unbelief is the real world, that in it lie all the causes for every effect visible in the natural world, and that if this spiritual life can be revealed to us, in other words, if we can understand ourselves, we shall then have our happiness or misery in our own hands; and of course much of the suffering of the world will be done away with.[44]

For Quimby the matter that we bump into everyday in the physical world is simply the manifestation (or "condensation") of mind. Mind is the cause; matter is the recognizable effect in the physical realm. However, what appears on the surface in the above passage to be a distinct mind/matter dualism is quickly confused by Quimby in his notion that mind is something called "spiritual matter." Quimby reasoned that

> "mind was something that could be changed, so ... I came to the conclusion that mind was something and I called it matter, because I found it could be condensed into a solid. ... and by the same power under a different direction it might be dissolved and disappear."[45]

Using a model based on a common chemistry demonstration performed on the lyceum circuit, the precipitation of a solid from a solution and back again, Quimby concluded that mind is a sort of solution, in which is contained invisible or "spiritual" matter.[46] "Belief" then comes into play as that which has the power to cause the spiritual matter (or mind) to condense in one of two ways. Right belief will bring about the precipitation of life, health, and happiness, including, of course, the cure for the particular illness being treated. Wrong belief (or error), on the other hand, precipitates misery, sickness, and death.

For Quimby the matter that we bump into everyday in the physical world is simply the manifestation (or "condensation") of mind.

In practice, therefore, Quimby's treatment focused on one thing — changing the patient's belief. To accomplish this he used two methods. Sometimes he would simply talk to the patient, reason away false ideas about his or her own physical condition, and the cure would naturally follow. At other times he would use a more direct mind-on-mind operation during which he would not speak at all. He would sit silently and read the patient's feelings, which were "daguerrotyped" on his mind, correct the belief, and send it back to the patient. He continued this until, "the patient's feelings sympathized with his, the shadows [grew] dim and finally the light [took] its place and there [was] nothing left of the disease."[47] The details of this silent method of treatment indicate that although Quimby renounced his earlier practice of mesmerism as "one of the greatest humbugs of the age," his methods and theory still retained, as Catherine L. Albanese argues, "something of the mesmeric model."[48] Mesmeric notions such as magnetic fluid, clairvoyance, and action at a distance all remained entrenched in the system in one form or another.

Quimby: "I make war with what comes in contact with health and happiness, believing that God made everything good, and if there is anything wrong it is the effect of ourselves..."

From the description of Quimby's thought thus far, one might not regard it as necessarily religious. In fact, the whole system herein reported could be categorized as a sort of curious but practical homespun idealism. In addition, given Quimby's copious and consistent rhetoric against the "priests" and their "doctrines" that "humbug the people and keep them in their misery," one might come to the conclusion, as some latter-day disciples have, that he was overtly antireligious. However, this does not stand up in the face of some of Quimby's more perspicuous passages. Consider, for example, this statement:

> My object is to correct the false ideas and strengthen the truth. I make war with what comes in contact with health and happiness, believing that God made everything good, and if there is anything wrong it is the effect of ourselves, and that man is responsible for his acts and even his thoughts. Therefore, it is necessary that man should know himself so that he shall not communicate sin and error.[49]

Charles Braden, convinced that much of Quimby's thought is religious in nature, writes that his ideas "were not orthodox ideas according to the

theological standards of his day, but that he held profound religious convictions none can deny who has read the *Manuscripts*."[50] His collected writings are rife with scriptural quotations and allusions and filled with reflections on Jesus Christ, God, Wisdom, and other religious themes. The first person to edit Quimby's writings, Horatio Dresser, estimated that at least half of the manuscripts are filled with references to religious problems and the Bible.[51]

For our purposes in this essay, the most important point concerning Quimby and religion is that his concept of *science* was clearly religious. While his religious ideas regarding science came as a later outgrowth of his discoveries and theories concerning healing, the seeds were germinating early on in his work with clocks, in his inventions, and in his apparent obsession with all things scientific. For Quimby, science was there from the beginning, lending authority, credence, and proof to the developing system. It is to Quimby's concept of science that I now turn.

P. P. Quimby and Science

Of all the studies that have been done which bear on the early history of New Thought and Christian Science, only one has touched on the importance of the scientific reckoning in the emerging metaphysical movement, and even that was indirectly. Stewart Holmes, writing in 1944, awarded Quimby the title "Scientist of Transcendentalism" because he "demonstrated visibly, on human organisms, the operational validity of Emerson's hypotheses." Holmes did not intend to trumpet the "truth" of the ideas of either Quimby or Emerson. But he was expressing his view that "while Emerson arrived at his theories deductively and never submitted them to anything approaching laboratory proof, Quimby forged his theories — and thence his metaphysic — from years of patient experiment with individual persons; something lawful and orderly occurred when he applied his technique."[52] Quimby's use of science, however, goes far beyond the picture of the noble enterprise painted by Holmes. Indeed, Quimby appears to have been obsessed with the concept of science. It emerges from his writings as a theological absolute with universal authority in all matters, natural and spiritual, and with enough force of meaning to be carried to the present day by Quimby's spiritual offspring.

To say that science saturates Quimby's writings is not an overstatement. In fact, the term is used so often and in so many ways that the prospects for extracting a precise or comprehensive definition are problematic at best. Quimby uses the term interchangeably with charity, love, freedom, revelation from God, God, Christ, the Son, kingdom of God, kingdom, power, law, and Truth (most often equating the terms directly with an inclusive disjunction such as "Science or God"). Indeed, the confusion of Quimby's usage lends credence to the statement by Horatio Dresser that Quimby was not a regular reader of philosophy or theology.[53] Take, for example, the following rambling passage:

> When He [Jesus] was accused of curing disease through Beelzebub or ignorance, He said "If I cast out devils (or diseases) through Beelzebub or ignorance, my kingdom (or science) cannot stand; but if I cast out devils (or disease) through a science or law, then my kingdom or law will stand for it is not of this world" .... He [Jesus] must have known what that power or science is and the difference between His science and their ignorance. His science was His kingdom; therefore it was not of this world, and theirs being of this world, He called it the kingdom of darkness.[54]

Quimby uses the term "science" interchangeably with charity, love, freedom, revelation from God, God, Christ, the Son, kingdom of God, kingdom, power, law, and Truth.

Yet in spite of the definitional difficulties inherent in working with his beclouded texts, Quimby uses the term *science* so often that certain patterns do emerge. The most obvious is that Quimby uses the term "Science" as the name for his system of metaphysical thought and practice. Although names such as the Science of Health, Science of Happiness, Science of Life, Science of Jesus, and Christian Science pepper his writings, the simple designation "Science" appears most frequently. This practice of using science-soaked titles is one of the more conspicuous legacies he unwittingly bequeathed to those who followed in his metaphysical footsteps. The other attributes of the term *science*, although a bit more slippery than the first, likewise do not completely defy description. An examination of the term in context yields characteristics that I describe as *monistic*, *divine*, *living*, *certain*, and *pragmatic*. I take these each in order.

The *monism* inherent in Quimby's use of science is almost completely unqualified. Science is "wisdom

reduced to self-evident propositions"[55] and is therefore the same throughout the world of matter, mind, or spirit.[56] I do not intend here to suggest that Quimby was a monist in terms of rejecting categorically any distinction between matter and mind, or matter and spirit. I think it is safe to say that Quimby was ambiguous enough concerning the concepts of matter, mind, and spirit to keep that question alive for some time. What I am claiming is that for Quimby science is methodologically monistic and therefore holds true in all domains whether physical or metaphysical.

The only qualification apparent in Quimby's monistic approach to science is that his Science of Happiness, although built on the same foundation as other true sciences, requires senses beyond the five we usually recognize.

In contrast, his student Mary Baker Eddy and her Christian Science departed from Quimby and other metaphysical movements on this point by categorically rejecting all science of the physical world. Eddy saw no place for physical science in her system, claiming that her own "divine science wars with so-called physical science, even as truth wars with error."[57] In a system like Quimby's, where mind is primary and causative and matter is secondary and resultant, one would expect the same distinction as that drawn by Eddy; not so with Quimby. His dedication to the legitimacy of the physical sciences never wavers. His writings are replete with illustrations drawn from physics, chemistry, astronomy, geology, physiology, and mathematics which are used to support his spiritual insights. To him, all these sciences rest on the same foundation as his own Science of Health and Happiness because all of them have the key to truth — proof by demonstration. The sciences that he ultimately rejects, such as medicine, phrenology, spiritism, and mesmerism, he negates on the basis that they are not really sciences at all. They are filled with error and opinions, and, like orthodox religion, "cannot stand the test of investigation."[58]

The only qualification apparent in Quimby's monistic approach to science is that his Science of Happiness, although built on the same foundation as other true sciences, requires senses beyond the five we usually recognize. Says Quimby:

> A man may be scientific in many sciences — chemistry, mathematics, astronomy, botany — all that are acknowledged and admitted by even the natural man, though not understood. But the Science of Happiness is not acknowledged by the wisdom of the five senses, so it requires more senses to put man in possession of this Science that will teach him happiness.[59]

In a remarkable adherence to Baconian directives, Quimby does not abandon the all important "senses" when investigating a world that is beyond our natural abilities to detect. Rather, he introduces a new set of senses which can be "detached" from, and exist outside of, the body.[60] These extrasensory senses, along with all the mesmeric baggage they can carry, become Quimby's instruments for exploring the unseen world of mind.

Nowhere is Quimby's obsession with science more evident than when he pays it the ultimate tribute by raising it to a *divine* level. In some passages he equates science directly with God, using the two as interchangeable terms: "God or Science." In others he makes the connection even more unequivocally. On a single page of his collected works he does this four times, writing "God is Science"; "there is but one living and true God or Science"; "Science is the one living and true God to worship"; and "Science is the God or Christ."[61] At other times, rather than making science out to be God, he makes science one of God's attributes such as "the voice of God," or "God's religion."[62] Despite the theological confusion, it is clear that for Quimby science is divine, for if it does not occupy the very throne of God, it surely issues forth from that location.

Nowhere is Quimby's obsession with science more evident than when he pays it the ultimate tribute by raising it to a* divine *level.

Once it is established that Quimby considers science and God to be in some sense one and the same, the fact that science is *living* and *certain* should follow in step. And this they do. Consider the personality of science in Quimby's rendition of I Corinthians 13:

> Science suffers long before it becomes a fact. It envieth not other science, it praiseth not self, is not puffed up, doth not behave unseemly, is not easily provoked, thinketh no evil, rejoiceth not over trouble

> but rejoiceth in the truth. Science never fails but prophesies. The knowledge of this world fails but science never fails.[63]

This passage is representative of many that speak of science as if it were some sort of animate entity. It also points to the absolute certainty wrapped up in Quimby's concept of science in that "science never fails." "Men never dispute about a fact that can be demonstrated by scientific reasoning," claims Quimby; and in his reckoning, "science holds no doubt."[64] Science is therefore demonstrable to everyone and perfectly predictable. Unlike the God of Calvinism, Quimby's God of Science is in no way capricious. Science is certain, acts in accord with the orderly laws of Wisdom, and is available to every person.

Lastly, Quimby's science is *pragmatic*. It is "wisdom reduced to practice" and the healing of sick bodies is its most important demonstration. It is applicable in any situation and is always able to help people "get the most happiness out of the least labor."[65] True to the popular fascination with the utilitarian aspects of the science of the day, Quimby used the daguerreotype, steam engine, telegraph, and various machines as important illustrations of his metaphysical insights. However, the practical nature of Quimby's program did not stop there. In a manner not unlike the millennialist movements of his day, Quimby sees his science as one that has the practical benefit of being able to heal society at large, as surely as it can heal the body. He declares, "Science is the axe in the hands of Wisdom to hew down this wilderness and destroy its inhabitants and introduce a better state of society."[66]

Unlike the God of Calvinism, Quimby's God of Science is in no way capricious. Science is certain, acts in accord with the orderly laws of Wisdom, and is available to every person.

Although Quimby's "Kingdom of Science" has not yet arrived in the way that he dreamed, his concept of science nonetheless had a significant impact on the mind-cure movements that followed. Horatio Dresser, a leader in New England's New Thought movement well into the twentieth century, continued to trumpet Quimby's idea of science in its purest form. Writing almost sixty years after the mental doctor's demise, Dresser reaffirms that Quimby's science is the fundamental knowledge of this our real nature, with its inner states and possibilities. It is light in contrast with the wisdom of the world. It is harmony in contrast with disease or discord. It corrects all errors, holds no doubts, proves all things, explains all causes and effects. It is Divine wisdom "reduced to self-evident propositions." It is the basis of all special branches of knowledge — when those other sciences are rightly founded. It is Christ, the wisdom of Jesus. It is in all, accessible to all. We all become parts of it in so far as we discern real truth. In fact, Quimby often says the real man "is" Science.[67]

Conclusion

Certainly few practitioners of mainstream antebellum science would recognize Quimby's concept of science as anything relevant to what was going on in their investigations. By the time Quimby was codifying his ideas and practices in the mid-nineteenth-century, the emerging professional scientific community in America had already established unofficial canons of scientific orthodoxy and heresy. If Quimby had published his "scientific" works soon after writing them, they would certainly have been anathematized as vigorously by the mainstream scientists as the other bizarre "sciences" that were floating across the young republic.[68]

But strange as it may seem, some of the scientific rules by which Quimby and the mainstream scientists played were the same. In many respects Quimby was a paradigmatic Baconian. In so far as he understood, Quimby showed a spirited enthusiasm for natural science, propounded a scrupulous empiricism, and had an intense distrust of speculation. However, he unwittingly fell into the gaping hole that existed in the common sense philosophy upon which American Baconianism was based: the fact that that which is common sense to one person is not necessarily common sense to another. Those ideas which Quimby considered "self-evident propositions" and demonstrable truths, were, to his critics in conventional medical practice, colossal humbugs. Yet, on the other hand, his critics too were victims of the common-sense dilemma. Holding tenaciously to their own common-sensical self-evident notions, Quimby's critics may have missed a golden opportunity to harness the curative power of suggestion decades ahead of the now recognized pioneers in psychosomatic medicine.[69]

In retrospect it is clear that Quimby was on to something with his practical connection between

state of mind and state of body. However, the theoretical extrapolations which he derived from his experiences with healing were grounded in something far less than epistemological *terra firma*. He was clearly guilty of the same offense of which many spiritualists, phrenologists, and various medical sectarians (not to mention a number of "orthodox" scientists) of his day were guilty: making grand inductive leaps from a few observed phenomena to all encompassing laws of nature and supernature.

Although Quimby was leaping to conclusions alongside of the spiritualists and others, his notion of science was significantly different. Today, as in Quimby's day, the term "science" has two root meanings. The term can emphasize the *method* by which knowledge is obtained or the *knowledge* which is obtained by the method. While Quimby had no problem using the term in both senses, it was his uncommon and unbridled emphasis on science as *knowledge* that most set him apart from the antebellum scientific culture. Even those religious people who found science to be a useful tool for investigating the trappings of spiritual realities, such as Protestant theologians and spiritualists, used the term in its methodological sense almost exclusively.[70]

For Quimby, however, science was equivalent with infallible knowledge, or what he referred to with reverence as "Wisdom." It was a theological absolute that grounded his radically different view of the world. Without the authority of something comparable to the *scriptura* or *traditio* that grounded the denominational churches, Quimby's ideas would likely carry no more weight than the simple musings of an uneducated craftsman. Science, popular and trustworthy in the public mind, infallible in Quimby's, provided the perfect foundation. In the antebellum Protestant culture, it was the only thing that approached scriptural revelation in authoritative stature.

In this light it is not hard to understand how Quimby could elevate science to the level of God; in Quimby's mind they shared so many of the same attributes. As was mentioned earlier, Stewart W. Holmes in 1944 gave Quimby the title of "Scientist of Transcendentalism." It appears that he also deserves the title "Transcendentalist of Scientism" for making science equal with God and declaring science to be as effective in the metaphysical sphere as in the physical.

Contrary to White's and Draper's warfare theses, Quimby saw science and religion as altogether compatible. Indeed, he saw them as one and the same. In the midst of the nineteenth-century American love affair with science and the Baconian philosophy, Quimby journeyed from his background as an amateur scientist and inventor to experimentation with mesmerism and mental healing and ultimately found a spiritual science that was "the greatest of the sciences or the kingdom of God."[71] When one takes into consideration the tremendous influence of Baconianism and popular science on many aspects of life in antebellum America, it seems far less puzzling that it was incorporated into Quimby's brand of Christian Science and that it still remains today in the teachings of the religious movements that can be traced back to this metaphysical healer. ✧

NOTES

[1]John William Draper, *History of the Conflict between Religion and Science* (New York: D. Appleton and Co., 1898), 364.

[2]Andrew Dixon White, *The Warfare of Science* (New York: D. Appleton and Co., 1876), 7, quoted in David C. Lindberg and Ronald L. Numbers, *God and Nature: Historical Essays on the Encounter between Christianity and Science* (Berkeley: University of California Press, 1986), 3. The italics are White's.

[3]David C. Lindberg and Ronald L. Numbers, "Beyond War and Peace: A Reappraisal of the Encounter between Christianity and Science," *Perspectives on Science and Christian Faith* 39 (September 1987): 140; James R. Moore, *The Post-Darwinian Controversies: A Study of the Protestant Struggle to Come to Terms with Darwin in Great Britain and America, 1870-1900* (Cambridge: Cambridge University Press, 1979), 89, quoted in Lindberg & Numbers, *God and Nature*, 7; Lindberg and Numbers, "Beyond War and Peace," 141.

[4]Herbert Hovenkamp, *Science and Religion in America, 1800-1860* (Philadelphia: University of Pennsylvania Press, 1978), 49.

[5]Theodore Dwight Bozeman, *Protestants in an Age of Science: The Baconian Ideal and Antebellum American Religious Thought* (Chapel Hill: University of North Carolina Press, 1977), xv. The italics are Bozeman's. See also Robert V. Bruce, *The Launching of Modern American Science, 1846-1876* Ithaca, New York: Cornell University Press, 1987), 126.

[6]George M. Marsden, "Understanding Fundamentalist Views of Science," in *Science and Creationism*, ed. Ashley Montague (New York: Oxford University Press, 1984), 98.

[7]For an overview of the relationship between these nineteenth-century movements and science see Arthur Wrobel, *Pseudo-Science and Society in Nineteenth-Century America* (Lexington: University Press of Kentucky, 1987).

[8]Phineas Parkhurst Quimby, *Phineas Parkhurst Quimby: The Complete Writings*, ed. Ervin Seale, 3 vols. (Marina Del Rey, California: DeVorss & Co., 1988), 1:193, 354. Most of Quimby's writings were penned between the years 1859 and 1865.

[9]Charles S. Braden, *Spirits in Rebellion: The Rise and Development of New Thought* (Dallas: Southern Methodist University Press, 1963), 28-40.

[10]Bozeman, *Protestants in an Age of Science*, p. xii; and George H. Daniels, *American Science in the Age of Jackson* (New York: Columbia University Press, 1968), 63-85.

[11]Marsden, "Fundamentalist Science," 98.

[12]C. Leonard Allen, "Baconianism and the Bible in the Disciples of Christ: James S. Lamar and *The Organon of Scripture*," *Church History* 55 (March 1986): 66. The best study to date on the topic of the influence of American Baconianism and Protestant theology is Bozeman, *Protestants*.

[13]Wrobel, *Pseudo-Science*, 8, 17.

[14]Bozeman, *Protestants*, 30.

[15]Daniels, *American Science*, 63.

[16]Ibid., 69-85.
[17]Bozeman, *Protestants*, 21.
[18]Ibid.
[19]Ibid., 66-67.
[20]Ibid., 66.
[21]Horatio W. Dresser, ed., *The Quimby Manuscripts* (New Hyde Park, New York: University Books, 1969; repr., New York: Thomas Y. Crowell Co., 1921), 8.
[22]George H. Daniels, "The Process of Professionalization in American Science: The Emergent Period, 1820-1860," in *Science in America Since 1820*, ed. Nathan Reingold (New York: Science History Publications, 1976), 66.
[23]Donald Zochert, "Science and the Common Man in Antebellum America," in *Science in America*, ed. Reingold, 7-32.
[24]William Ellery Channing, *Milwaukee Sentinel*, 17 August 1841, quoted in Zochert, "Science and the Common Man," 7.
[25]Donald M. Scott, "The Popular Lecture and the Creation of a Public in Mid-Nineteenth-Century America," *Journal of American History* 66 (March 1980): 800.
[26]Bruce, *Launching of Science*, 116.
[27]Ibid., 80.
[28]Zochert, "Science and the Common Man," 29.
[29]James Dwight Dana, quoted in Bruce, *Launching of Science*, 131.
[30]Zochert, "Science and the Common Man," 7.
[31]Daniels, "The Process of Professionalization," 63.
[32]Dresser, *Quimby Manuscripts*, 8.
[33]Quimby, *Complete Writings*, 1:20.
[34]Robert C. Fuller, *Mesmerism and the American Cure of Souls* (Philadelphia: University of Pennsylvania Press, 1982), 17-18.
[35]There is some dispute concerning whether it was Charles Poyen or another mesmerist, Robert H. Collyer, with whom Quimby first had contact. Some light has been shed on this question with the publication of all of Quimby's extant writings in 1988. Quimby's own writings seem to indicate that he had personal contact with Poyen only. However, a number of years after his initial contact with Poyen, Quimby dismissed Poyen's demonstrations as humbug. Although it does not appear that Quimby had personal contact with Collyer, the writings clearly indicate that Quimby was familiar with his thought and had read some of his publications. See Quimby, *Complete Writings*, 1:103-4.
[36]Fuller, *Mesmerism*, 120.
[37]Quimby, *Complete Writings*, 3:197.
[38]Fuller, *Mesmerism*, 121.
[39]Quimby, *Complete Writings*, 1:191.
[40]Ibid., 2:301.
[41]William G. Rothstein, *American Physicians in the Nineteenth Century: From Sects to Science* (Baltimore: Johns Hopkins University Press, 1972), 61, 249.
[42]Stewart W. Holmes, "Phineas Parkhurst Quimby: Scientist of Transcendentalism," *The New England Quarterly* 17 (1944): 360-61.
[43]Braden, *New Thought*, 81.
[44]Quimby as quoted in Dresser, *Quimby Manuscripts*, 319.
[45]Quimby, *Complete Writings*, 3:337.
[46]Ibid., 3:183
[47]Quimby, quoted in Braden, *New Thought*, 65.
[48]Quimby as quoted in Dresser, *Quimby Manuscripts*, 58; Catherine L. Albanese, "Physic and Metaphysic in Nineteenth-Century America: Medical Sectarians and Religious Healing," *Church History* 55 (December 1986): 498.
[49]Braden, *New Thought*, 68.
[50]Ibid., 66.
[51]Ibid., 69.
[52]Holmes, "Transcendentalism," 357.
[53]Dresser, *Quimby Manuscripts*, 18.
[54]Quimby, *Complete Writings*, 3:203.
[55]Ibid., 1:343.
[56]For a discussion of monism, dualism, and pluralism in the relationship between science and metaphysical concerns see Erwin N. Hiebert, "Modern Physics and Christian Faith," in Lindberg and Numbers, *God and Nature*, 434-44.
[57]Mary Baker Eddy, *Science and Health with Key to the Scriptures* (Boston: Trustees under the will of Mary Baker G. Eddy, 1906), 144.
[58]Quimby, *Complete Writings*, 2:297.
[59]Ibid., 3:92.
[60]Ibid., 1:185.
[61]Ibid., 1:354.
[62]Ibid., 1:401; 2:297.
[63]Ibid., 3:87.
[64]Ibid., 3:174; 1:370.
[65]Ibid., 2:296.
[66]Ibid., 3:179.
[67]Dresser, *Quimby Manuscripts*, 422.
[68]One of the best examples of these canons of scientific orthodoxy in action involved the reaction of the scientific community to one of its most prominent members, chemist Robert Hare. In 1855, Hare wanted to present the findings of his investigations into the phenomena of spiritualism, investigations that he considered scrupulously scientific. The American Association for the Advancement of Science refused to let him present his work because they considered it outside of the "scientific" concerns of the Association. See Robert Hare, *Experimental Investigation of the Spirit Manifestations* (New York: Partridge and Brittan, 1855), 430-31.
[69]For an introduction to the history of psychosomatic medicine see Franz G. Alexander and Sheldon T. Selesnick, *The History of Psychiatry: An Evaluation of Psychiatric Thought and Practice from Prehistoric Times to the Present* (New York: Harper and Row, 1966), 388-401.
[70]See R. Laurence Moore, "Spiritualism and Science: Reflections on the First Decade of the Spirit Rappings," *American Quarterly* 24 (October 1972): 486-7; and Allen, "Baconianism and the Bible, 66-7.
[71]Quimby as quoted in Dresser, *Quimby Manuscripts*, 385.

Eugenics and the Development of Nazi Race Policy

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A central government policy of the Hitler administration was the breeding of a "superior race." This required, at the very least, preventing the "inferior races" from mixing with "superior" ones in order to reduce contamination of the latter's gene pool. The "superior race" belief is based on the theory of group inequality within each species, a major presumption and requirement of Darwin's original "survival of the fittest" theory. A review of the writings of Hitler and contemporary German biologists finds that Darwin's theory and writings had a major influence upon Nazi policies. Hitler believed that the human gene pool could be improved by selective breeding, using the same techniques that farmers used to breed a superior strain of cattle. In the formulation of his racial policies, he relied heavily upon the Darwinian evolution model, especially the elaborations by Spencer and Haeckel. They culminated in the "final solution," the extermination of approximately six million Jews and four million other people who belonged to what German scientists judged were "inferior races."

The concept that "all men are created equal" and the egalitarian ideal which has dominated American ideology for the past thirty years, and to a lesser degree since the founding of our country, has not been universal among nations and cultures (Tobach et al. 1974). The Germans' belief that they were a superior race had many sources, a major one being the social Darwinian eugenics movement, especially its crude *survival of the fittest* world view (Stein 1988, Clark 1953). As Lappe noted:

> Although the idea of improving the hereditary quality of the race is at least as old as Plato's *Republic*, modern eugenics thought arose only in the nineteenth century. The emergence of interest in eugenics during that century had multiple roots. The most important was the theory of evolution, for Francis Galton's ideas on eugenics — and it was he who created the term "eugenics" — were a direct logical outgrowth of the scientific doctrine elaborated by his cousin, Charles Darwin (1978, 457).

Eugenics' all important impact on Nazi policy can be evaluated accurately by an examination of the extant documents, writings, and artifacts produced by Germany's twentieth century Nazi movement. Historical documents show that Nazi governmental policy was openly influenced by evolution, the zeitgeist of both science and educated society of the time (Stein 1988, Haller 1971, Keith 1946, 230). The Nazi treatment of Jews and the other "races" that their science concluded were "inferior" was largely a result of their belief that the source of biological evolution was a set of proven techniques available to scientists to significantly improve humankind. As Tenenbaum noted:

> the political philosophy of the ... German State, was built on the ideas of struggle, selection, and survival of the fittest, all notions and observations arrived at ... by Darwin ... but already in luxuriant bud in the German social philosophy of the nineteenth century .... Thus developed the doctrine of Germany's inherent right to rule the world on the basis of superior strength ... of a "hammer and anvil" relationship between the Reich and the weaker nations (1956, 211).

Implementation of Nazi Race Theories

The means of evolution are drawn primarily from the process of mutations, which are then selected by natural selection. Favored individuals will be more likely to survive and increase in number, forming new races while the "weaker" ones will die off. This process, once called *raciation* but labeled *speciation* today, is the source of evolution which, in theory, continues forever. If every member of a species were fully equal, there would be nothing to select from, and evolution for that species would stop. Evolution is based on the acquiring of unique traits, whether through mutations or other means, that enable those possessing them to better survive adverse conditions than those who don't.

According to evolution theory, some people (even if it is only *one* person) will inherit a mutation which will be passed on and which will enable them to survive at a higher rate than those without that trait. These differences will always gradually produce new races, some of which have an advantage in terms of survival. These are the superior, i.e., the more evolved, races. When that trait eventually spreads throughout the entire race, because of the survival advantage it confers on those endowed with it, a new and "higher level" of animal will exist. Hitler and the Nazi party claimed that they were trying to apply this accepted science to society. And "the core idea of Darwinism is not evolution, but selection. Evolution ... describes the results of selection" (Stein 1988, 53). Hitler stressed that "we [the Nazis] must understand, and cooperate with science":

> In 1937, while Mengele was still in residence [for his M. D. degree], Otmar von Verschuer published an article in which he said, "Hitler is the first statesman who has come to recognize hereditary biological and race hygiene and make it a leading principle of statesmanship." Two years later von Verschuer announced: "We specialists of race hygiene are happy to have witnessed that the work normally associated with the scientific laboratories or the academic study room has extended into the life of our people" (Astor 1985, 23).

Darwin's evolutionary ideas were exported into Germany almost immediately. The first language into which his writings were translated — only a year after *The Origin of Species* was published — was German. Darwinian evolution was not only championed in Germany more than most other countries, but it was more influential on German state policy. Gasman (1971, xiii) concluded that

> [i]n no other country ... did the ideas of Darwinism develop as ... the total explanation of the world as [it did] in Germany ... [or insist] on the literal transfer of the laws of biology [as interpreted by evolution] to the social realm.

This path was started at the 1863 Congress of German Naturalists. At this meeting, one of evolutions' leading proponents and writers, Ernest Haeckel, "a respected professor of zoology" at the University of Jena, first forcefully presented the views which commenced his four decade long role as "Darwin's chief apostle" (Stein 1988, 54). He was especially active in spreading "social Darwinism," — the application of Darwinian theory to society in order to explain the historical and social development of civilizations, specifically why some were advanced and others remained primitive. But, as Gould (1977, 77-78) concluded,

> ... Haeckel's greatest influence was, ultimately, in another, tragic direction — national socialism [Nazism]. His evolutionary racism; his call to the German people for racial purity and unflinching devotion to ... his belief that harsh, inexorable laws of evolution ruled human civilization and nature alike, conferring upon favored races the right to dominate others .... His brave words about objective science — all contributed to the rise of Nazism. The Monist League that he had founded and led ... made a comfortable transition to active support for Hitler.

Aside from Haeckel, the person most influential in helping the spread of Darwin's ideas in Germany

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was Houston Chamberlain, the son of a British Admiral and a German mother. In 1899 he published *The Foundations of the 19th Century*, which concluded that Darwinism had proved that the Germans were superior to all other races (Weindling 1989). Germans were the "foundation" of our society because they produced the industrial world. Chamberlain quoted extensively from Darwin, noting that the latter stressed that a major difference between apes and humans was brain size. The brain, he stressed, is of far more importance than any other body structure in measuring human evolution progress. The larger the brain capacity, it was then believed, the higher the intelligence. Chamberlain also was interested in phrenology, the now discredited science of determining personality traits by examining and measuring the shape and size of the bumps on one's skull (Jacquerd 1984). Certain traits, the phrenologists reasoned, were located in specific parts of the brain, and if one had developed some trait to an exceptional degree, a "bump" would exist in the appropriate place. Lastly, they concluded that the configuration of the brain and other physical traits can be used to distinguish not only humans from monkeys, but also to rank the races. This idea received wide support from

> ... the German academic and scientific communities ... who helped prepare the way for national socialist biopolicies .... Beginning in the 1890s with the work of Otto Ammon on cephalic indexes and other such scientific proof of Aryan superiority, much German anthropology, especially the most scientific branch, physical anthropology ... [concluded that] If humankind evolved through natural selection ... then it was obvious that the races of humankind must be arranged hierarchically along the ladder of evolution .... there is little doubt that the anthropologists who discovered all the measurable divergent physical, psychological, and mental characteristics of the various races thought they were scientific. And so did the general public (Stein 1988, 57).

Chamberlain concluded that Darwinism had proved that the Germans were superior to all other races.

The inequality doctrine, although an integral part of German philosophy for years, reached its apex under the Hitler regime, and obtained its chief intellectual support from established science (Weiss 1988, Aycoberry 1981). Ernst Haeckel taught that "the morphological differences between two generally recognized species — for example sheep and goats — are much less important than those ... between a Hottentot and a man of the Teutonic race" (1876, 434). And that the Germans have evolved the "furthest from the common form of apelike men [and outstripped] ... all others in the career of civilization" and will be the race to bring humankind up to a "new period of higher mental development" (1876, 332). This was true, not only mentally but physically, because evolution achieves "symmetry of all parts, and equal development which we call the type of perfect human beauty" (1876, 321).

The inequality doctrine, although an integral part of German philosophy for years, reached its apex under the Hitler regime, and obtained its chief intellectual support from established science.

The lesser races were both inferior and worth less: "woolly-haired" peoples, he concluded, are "incapable of a true inner culture or of a higher mental development ... no woolly-haired nation has ever had an important history" (1876, 10). Haeckel even argued that, since "the lower races — such as the Veddahs or Australian Negroes — are psychologically nearer to the mammals — apes and dogs — than to the civilized European, we must, therefore, assign a totally different value to their lives" (1905, 390). And Stein notes that this was not a minority or an extreme view: "Haeckel was the respected scientist; the views of his followers were often more extreme" (Stein 1988, 56).

As a race above all others, the Aryans believed that their evolutionary superiority gave them not only the right, but the duty, to subjugate all others. And race was no minor plank of the Nazi philosophy: Tenenbaum (1956, 211-212) concluded that they

> incorporated the ... theory of evolution in their political system, with nothing left out .... Their political dictionary was replete with words like ... struggle, selection, and extinction (Ausmerzen). The syllogism of their logic was clearly stated: The world is a jungle in which different nations struggle for space. The stronger win, the weaker die or are killed. In the 1933 Nuremberg party rally, Hitler proclaimed that "higher race subjects to itself a lower race ... a right which we see in nature and which can be regarded as the sole conceivable right because [it

was] founded on reason [of evolution]" (Quoted from *The Nuremberg Trials*, Vol. 14, pg. 279).

The Nazis believed that they must "direct evolution" to advance the human race by isolating the "inferior races" to prevent them from further contaminating the "Aryan" gene pool.

The Nazis believed that, instead of permitting natural forces and chance to produce what it may, they must "direct evolution" to advance the human race. To achieve this, their first step was to isolate the "inferior races" to prevent them from further contaminating the "Aryan" gene pool (Poliakov 1974). The widespread public support for this policy was a result of the common belief of the educated classes that it was scientifically proven that certain races were genetically inferior. The government was simply applying, as part of their plan for a better society, what they believed was proven science to produce a superior race of humans: "The business of the corporate state was eugenics or artificial selection — politics applied to biology" (Stein 1988, 56). In Hitler's writings, humankind were biological "animals" to whom the genetics learned from livestock breeding could be applied. As early as 1925, in Chapter 4 of *Mein Kampf*, Hitler outlined his view that science, specifically the Darwinian natural selection struggle, was the *only* basis for a successful German national policy that the very title of his most famous work — in English *My Struggle* — alluded to. As Clark (1953, 115) concluded,

> Adolf Hitler's mind was captivated by evolutionary teaching — probably since the time he was a boy. Evolutionary ideas — quite undisguised — lie at the basis of all that is worst in *Mein Kampf* — and in his public speeches .... Hitler reasoned ... that a higher race would always conquer a lower.

And Hickman (1983, 51-52) adds that:

> It is perhaps no coincidence that Adolph Hitler was a firm believer in and preacher of evolutionism. Whatever the deeper, profound complexities of his psychosis, it is certain that [the concept of struggle was important because] ... his book, *Mein Kampf*, clearly set forth a number of evolutionary ideas, particularly those emphasizing struggle, survival of the fittest and the extermination of the weak to produce a better society.

And the belief that evolution can be directed by scientists to produce a "superior race," as Tenenbaum (1956, vii) noted, was the *central leitmotif* of Nazism:

> There were many other sources from which Nazism drew its ideological fire-water. But in that concatenation of ideas and nightmares which made up the ... social policies of the Nazi state, and to a considerable extent its military policies as well, can be most clearly comprehended in the light of its vast racial program.

The Nazi view on race and Darwinian evolution was a major part of the fatal combination which produced the holocaust and World War II:

> One of the central planks in Nazi theory and doctrine was ... evolutionary theory [and] ... that all biology had evolved ... upward, and that ... less evolved types ... should be actively eradicated [and] ... that natural selection could and should be actively aided. [T]herefore [the Nazis] instituted political measures to eradicate ... Jews, and ... blacks, whom they considered ... [less evolved] (Wilder-Smith 1982, 27).

Hitler's views are rather straightforward German social Darwinism of a type widely known and accepted throughout Germany and which, more importantly, was considered by most Germans, scientists included, to be scientifically true.

Terms such as "superior race," "lower human types," "race contamination," "pollution of the race," and *evolution* itself (*entwicklung*) were often used by Hitler and other Nazis leaders. Hitler's race views were not from fringe science, as often claimed, but rather,

> Hitler's views are rather straightforward German social Darwinism of a type widely known and accepted throughout Germany and which, more importantly, was considered by most Germans, scientists included, to be scientifically true. More recent scholarship on national socialism and Hitler has begun to realize that ... [Darwin's theory] was the specific characteristic of Nazism. National socialist "biopolicy," [was] a policy based on a mystical-biological belief in radical inequality, a monistic, antitranscendent moral nihilism based on

> the eternal struggle for existence and the survival of the fittest as the law of nature, and the consequent use of state power for a public policy of natural selection (Stein 1988, 51).

Hitler: the Nazis "are barbarians! We want to be barbarians. It is an honorable title, [for by it] we shall rejuvenate the world ... "

The philosophy that we can control and even propel evolution to produce a "higher level" of human is repeatedly echoed in the writings and speeches of prominent Nazis (Jackel 1972). Accomplishing this goal required ruthlessly eliminating the less fit by openly barbarian behavior:

> The basic outline of German social Darwinism [was that] ... man was merely a part of nature with no special transcendent qualities or special humanness. On the other hand, the Germans were members of a biologically superior community ... politics was merely the straightforward application of the laws of biology. In essence, Haeckel and his fellow social Darwinists advanced the ideas that were to become the core assumptions of national socialism ... The business of the corporate state was eugenics or artificial selection ... (Stein 1988, 56)

Rauschning (1939) quoted Hitler as stating that the Nazis "are barbarians! We want to be barbarians. It is an honorable title, [for by it] we shall rejuvenate the world ... " By this means, as Keith (1946, 230) concluded, Hitler "consciously sought to make the practice of Germany conform to the theory of evolution." As Humber (1987, ii) notes, Hitler believed that Negroes were

> ... "monstrosities halfway between man and ape" and lamented the fact of Christians going to "Central Africa" to set up "Negro missions," resulting in the turning of "healthy ... human beings into a rotten brood of bastards." In his chapter entitled "Nation and Race," he said, "The stronger must dominate and not blend with the weaker, thus sacrificing his own greatness. Only the born weakling can view this as cruel, but he, after all, is only a weak and limited man; for if this law did not prevail, any conceivable higher development (*Hoherentwicklung*) of organic living beings would be unthinkable." A few pages later, he said, "Those who want to live, let them fight, and those who do not want to fight in this world of eternal struggle do not deserve to live."

Many of Hitler's top aides held similar beliefs. Hoess was "particularly interested in books on 'racial' theories, heredity and ethnological works." His race beliefs guided his management policy in the various concentration camps that he was head of, including Auschwitz. He restructured this former forced labor camp into an evolution laboratory. The inmates in Auschwitz were "no longer persons ... [but] simply goods to be processed in the gigantic death-factory he had organized" (Rudorff 1969, 240).

Caring for the weak, the sick, lame, old, or poor was all directly counter to the chief driving force of evolution — the survival of the fittest, and death of the unfit. This meant that the weak must be eradicated for the benefit of the race as a whole. The Nazi Party did not view these policies as wrong or even inhumane. It openly "prided itself on its scientific ideology and modern view of the world" (Gasman 1971). Given their wholesale acceptance of evolution, their "ideas of class and race ... and determinism, may well [be] ... inescapable" (Barzum 1958, xx).

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The Nazis were not superficial in their application of what became known as "racial hygiene." Prior to 1933, the German scientists published thirteen scientific journals devoted to racial hygiene and there were over thirty institutions, many connected with universities or research centers, devoted to "racial science" (Proctor 1988). When the Nazis were in power, something like 150 scientific journals, many of which are still highly respected, dealt with racial hygiene and allied fields (Weindling 1989). Enormous files of data were kept on the races, much of which was analyzed and used for research papers published in various German and other journals. In 1927, *The Kaiser Wilhelm Institute for Anthropology, Human Genetics, and Eugenics* was established. Although much of the research there was related to the field of eugenics, researchers also studied a wide variety of topics including venereal disease and alcohol.

The German eugenists relied heavily upon the work done in Britain and America. Franz Bumm, the President of the Reich Health Office, "noted that the value of eugenics research had been convincingly demonstrated in the United States, where anthro-

pological statistics had been gathered from two million men recruited for the American Armed Forces" (Proctor 1988, 40). The various institutes began to research the persistence of various "primitive racial traits" in various races in and outside of Germany. They found much evidence of "Cro magnon racial type in certain populations, and presumably also Neanderthal." Like the American and British counterparts, the German Racial Hygiene Institutes and the professors at various universities began to discover genetic evidence for virtually every malady of humankind from criminality to hernias, and even divorce, with researchers adding a few original problems of their own, such as "loving to sail on water." They saw their work as a noble effort to continue "Darwin's attempts to elucidate the origin of species" (Proctor 1988, 291).

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The core concept of the *survival of the fittest* philosophy, the observation that all animals and plants contain a tremendous amount of genetic variety, and that in certain environmental situations some of these differences may have an advantage in survival, and others may be at a disadvantage, has been well documented. The best example is artificial selection, where breeders select the male and the female with the maximum trait that they are concerned with and then, from the offspring, again select the members which maximize that trait. Breeders using these techniques have been able to breed a wide variety of plants and animals. Breeding for certain traits, though, invariably causes the loss of other traits. Consequently, in plant and animal breeding a trade-off occur: some traits are gained, but others are lost. Thus cows are bred either for dairy use or else for meat. The theory that the German eugenists had developed was thus poorly conceived, and inadequately considered enormous amounts of data and the implications of the tremendous amounts of biological diversity which we now know exist.

Some members of the scientific community do not want to share the blame for what happened and try to justify what Nazi Germany did. The most common claim is that the German academics were coerced into accepting racist ideas. Several recent studies, including Weindling (1989) and Proctor (1988), persuasively argue that this was not the case. The limited coercion that occurred was often from the scientific community, rather than the German political force "imposing its will on an apolitical scientific community" (Proctor 1988, 5; see also Wertham 1966). The Nazis forced the dismissal of many German academics from their posts, but many were Jews, and most were dismissed for reasons not related to their opposition to eugenics. Proctor's important study eloquently argued that Nazis are

> commonly portrayed ... as fanatic, half crazed criminals conducting their evil plans with as much reason or sense as 1930s television gangsters. This is a false impression for a number of reasons, but primarily because *it underestimates the degree to which large numbers of intellectuals, often leaders in their field, were willing and eager to serve the Nazi regime.* Evidence presented in the [Nuremberg] trials reveals the involvement of doctors in a massive program for the extermination of "lives not worth living," including, first, infants with inheritable defects, and later, handicapped children and patients of psychiatric institutions, and finally, entire populations of "unwanted races" (1988, 5-6) [Emphasis mine].

"Biological arguments for racism ... increased by order of magnitude following the acceptance of evolutionary theory" by scientists in most nations.

As Gould (1977, 127) concluded, "Biological arguments for racism ... increased by order of magnitude following the acceptance of evolutionary theory" by scientists in most nations. Chamberlain (1899) was one of the first popular German writers to use evolution to argue for the claim that the Germans were innately *biologically* superior to all other races and peoples, including the Persians, Greeks, and especially the "parasitic semites" whom he branded as a "race of inferior peoples." Darwin interpreted evolution of *homo sapiens* as principally due to brain improvements, as shown by the much larger brain case in higher primates, and especially by the apex brain found in humans. Chamberlain picked up on this, concluding that human evolutionary differences were thus reflected in skull differences, primarily its shape and size, but also all of those traits which have historically identified human races (skin color, nose, lip and eye shape among others). He utilized as evidence for his theory not only physical anthropology and Darwinian evo-

lution, but also the then fashionable "science" of phrenology, and

> Chamberlain's racial explanation for human history was only one of the many intellectual syntheses produced in the latter half of the Nineteenth Century. Most of the "isms" which have profoundly influenced the Twentieth Century have their genesis in these decades (Schleunes 1970, 30).

Social Darwinism was thus extremely influential in the development of the racism based on physical traits that flourished in the late 19th century Germany and elsewhere.

Social Darwinism was thus extremely influential in the development of the racism based on physical traits that flourished in the late 19th century Germany and elsewhere. These racist theories closely followed the spread of Darwinian evolution, which had a wide following in Germany almost immediately after the publication of the German edition of *The Origin of Species* (Schleunes 1970, Cohn 1981). Although racists also relied on phrenologists for support, both phrenology and social Darwinism obtained their rational, if not their primary, basis from evolution (Davies 1955). Also used for support were comparisons of various cultures which were assumed to be a product of racial superiority (not the reverse). They concluded that inferior races produced inferior cultures, and only superior races produced superior cultures (Hooton 1941). Hence, Schleunes (1970) notes that racism came into scientific repute through its solid link with the "third great synthesis of the Nineteenth Century," the Darwinian theory of evolution and the *survival of the fittest* world view.

These "scientific" views about race that then existed in the western world, especially Nazi Germany, were clearly evident even in America, as is apparent from surveys of textbooks published from 1880 to 1940. Princeton Professor Edwin Conklin (1921, 34) said in one of his texts that

> Comparison of any modern race with the Neanderthal or Heidelberg types shows that ... Negroid races more closely resemble the original stock than the white or yellow races. Every consideration should lead those who believe in the superiority of the white race to strive to preserve its purity and to establish and maintain the segregation of the races...

Soon after the American Supreme Court ruled that sterilization of minorities was legal, Adolf Hitler's cabinet, using the American work as an example, passed a eugenic sterilization law in 1933. The German law was compulsory to all people,

> ...institutionalized or not, who suffered from allegedly hereditary disabilities including feeblemindedness, schizophrenia, epilepsy, blindness, severe drug or alcohol addiction and physical deformities that seriously interfered with locomotion or were grossly offensive (Kevles 1985, 116).

Ironically, the German laws were used to inspire even harsher laws back in the States — in Virginia, Dr. Joseph DeJarnette argued that Americans who were progressive and scientific minded should be shamed by the "enlightened" progressive German legislation, and that *we* should be taking the lead in this area instead of Germany.

The next step in Germany was for the government to provide "loans" to those couples that it concluded were "racially and biologically desirable" and therefore should have more babies. The birth of each child reduced the "loan" indebtedness by another 25%. Then came sterilization and, in 1939, euthanasia for certain classes of the mentally or physically disabled. Up until this time, many American and British eugenists held up the German program as a model because "it was without nefarious racial content" (Kevles 1985, 188). The German eugenists, on the other hand, repeatedly acknowledged their enormous debt to the American and British researchers and periodically honored eugenists from their universities with various awards.

The Jews in Germany

The German eugenic leadership was originally less anti-semitic than the British. Most German eugenists had originally believed that German Jews were Aryan, and consequently the movement was supported by many Jewish professors and doctors. The Jews were only slowly incorporated into the German eugenic laws which, up to this time, were supported by a large number of persons, both in Germany and abroad.

The Darwinian racists' views also slowly entered into many spheres of German society which they had previously not infected (Beyerchen 1977). The Pan German League, dedicated to "maintaining Ger-

man Racial Purity" and helping Germans throughout the world resist the tendency to assimilate, was at first not overtly anti-Semitic. Jews who were fully assimilated into German culture were allowed full membership. Many German eugenists would have accepted blacks or gypsies as being racially inferior, but their racial theories did not seem to fit Jews, since they had achieved no small level of success in Germany. Schleunes (1970) adds that by 1903 the influence of racists' ideas permeated the League's program to the degree that its policy changed, and by 1912 the League declared itself based upon "racial principles."

German Jews considered themselves Germans first — and were proud of being such — and Jews second. Their assimilation into German life was to the extent that most were convinced that Germany was now a safe harbor for them.

In spite of the scientific prominence of these racial views, until World War II they had a limited effect upon most Jews. German Jews considered themselves Germans first — and were proud of being such — and Jews second. Many modified the German intelligentsia's racial views by including themselves in it. Their assimilation into German life was to the extent that most were convinced that Germany was now a safe harbor for them (Schleunes 1970, 33). Most felt its anti-Semitic actions did not represent a serious threat to their security. Many still firmly held to the Genesis creation model and rejected the views upon which racism was based, including macro-evolution, and thus, did not see these ideas as a real threat. What happened in Germany later was obviously not well received by Jewish geneticists, even Jewish eugenists, and certain other groups:

> The eugenics movement felt a mixture of apprehension and admiration at the progress of eugenics in Germany ... [but] the actual details of the eugenics measures which emerged after Hitler's rise to power were not unequivocally welcomed. Eugenicists pointed to the USA as a place where strict laws controlled marriage but where a strong tradition of political freedom existed (Jones 1980, 168).

While in much American and British eugenic literature the Jewish race was still held up as an *example* of educational and professional achievement, the Germans soon began placing them near the bottom of the list. Further, many American and British eugenists were appalled that the Germans included "many foreign races" as inferior — including many groups such as the Southern and Eastern Europeans, which were respected groups in Britain and America.

Evolution and War in Nazi Germany

Darwinism not only offered the German nation a meaningful interpretation of their recent past, but also a justification for future aggression:

> German military success in the Bismarkian wars fit neatly into Darwin categories in the struggle for survival, the fitness of Germany had been clearly demonstrated. [W]as not this expressive of a *superior spirit or volksgeist?* (Schleunes 1970, 31).

Hitler not only unabashedly intended to produce a superior race, but he openly relied heavily upon Darwinian thought in both his extermination and war policies (Jackel 1972). Nazi Germany thus openly glorified war for the reason that it was an important means of eliminating the less fit of the highest race, a step necessary to "upgrade the race." Clark (1953, 115-116) concludes, quoting extensively from *Mein Kampf*, that

> Hitler's attitude to the League of Nations and to peace and war were based upon the same principles. "A world court ... would be a joke ... the whole world of Nature is a mighty struggle between strength and weakness — an eternal victory of the strong over the weak. There would be nothing but decay in the whole of nature if this were not so. States which [violate] ... this elementary law would fall into decay .... He who would live must fight. He who does not wish to fight in this world where permanent struggle is the law of life, has not the right to exist." To think otherwise is to "insult" nature. "Distress, misery and disease are her rejoinders."

War therefore was a positive force, not only because it eliminated the weaker races, but also because it weeded out the weaker members of the superior races. German greatness, Hitler stressed, came about primarily because they were jingoists, and thereby had been eliminating their weaker members for centuries (Rich 1973). Although Germans were no strangers to war, this new justification was powerful. The view that the process of eradication of the weaker races was a major source of evolution was well expressed by Wiggam (1922, 102):

> At one time man had scarcely more brains than his anthropoid cousins, the apes. But, by kicking,

> biting, fighting ... and outwitting his enemies and by the fact that the ones who had not sense and strength ... to do this were killed off, man's brain became enormous and he waxed both in wisdom and agility if not in size ...

In the long run, war is thus positive, for only by " ... kicking, fighting, biting," etc., can humans evolve.

In the long run war is thus positive, for only by " ... kicking, fighting, biting," etc., can humans evolve. Hitler even claimed as truth the contradiction that human civilization as we know it would not exist if it were not for constant war. And many of the leading scientists of the day openly advocated this view:

> Haeckel was especially fond of praising the ancient Spartans, whom he saw as a successful and superior people as a consequence of their socially approved biological selection. By killing all but the "perfectly healthy and strong children" the Spartans were "continually in excellent strength and vigor" (1876, 170). Germany should follow this Spartan custom, as infanticide of the deformed and sickly was "a practice of advantage to both the infants destroyed and to the community." It was, after all, only "traditional dogma" and hardly scientific truth that all lives were of equal worth or should be preserved (1905, 116) (Stein 1988, 56).

The commonly believed assumption that European civilization evolved far more than others primarily because of its constant warmongering is not true. Historically, many tribes in Africa were continually involved in wars, as were most countries in Asia and America. War is actually typical of virtually all peoples except certain small island groups who have abundant food, or peoples in very cold areas (Posner and Ware 1986).

Nazi policies, therefore, resulted less from a "hatred" toward Jewish or other peoples, than the idealistic goal of preventing "pollution of the race." Hitler (1953, 115-116) elaborated as follows:

> Whose fault is it when a cat devours a mouse? ... the Jews ... cause people to decay ... In the long run nature eliminates the noxious elements. One may be repelled by this law of nature which demands that all living things should mutually devour one another. The fly is snapped up by a dragon-fly, which itself is swallowed by the bird, which itself falls victim to a larger bird ... to know the laws of nature ... enables us to obey them.

We thus must understand and apply the "laws of Nature," such as the *survival of the fittest* law, which originally produced the human races and is the source of their improvement. We as a race, therefore, must aid in the elimination, or at least the quarantine, of the less fit. In Hitler's words, (1953, 116):

> If I can accept a living Commandment, it is this one: "Thou shall preserve the species." The life of the individual must not be set at too high a price. If the individual were important in the eyes of nature, nature would take care to preserve him. Among the millions of eggs a fly lays, very few are hatched out — and yet the race of flies thrives.

Individuals are not only *far less important* than the race, but the Nazis concluded that certain races, as Whitehead (1983, 115) notes, were not humans, but animals:

> The Jews, labeled subhumans, became nonbeings. It was both legal and right to exterminate them in the collectivist and evolutionist viewpoint. They were not considered ... persons in the sight of the German government.

Once the inferior races were exterminated, Hitler believed that future generations would thank him profusely for the improvement that his work brought to the world.

Hitler was especially determined to prevent Aryans from breeding with any and all non-Aryans, a concern eventually resulting in the "final solution." Once the inferior races were exterminated, Hitler believed that future generations would thank him profusely for the improvement that his work brought to the world:

> The Germans were the higher race, destined for a glorious evolutionary future. For this reason it was essential that the Jews should be segregated, otherwise mixed marriages would take place. Were this to happen, all nature's efforts "to establish an evolutionary higher stage of being may thus be rendered futile" (Mein Kampf) (Clark 1953: 115).

Thus, the Darwinist movement was "one of the most powerful forces in the nineteenth-twentieth

centuries' German intellectual history [, and] may be fully understood as a prelude to the doctrine of national socialism [Nazism]" (Gasman 1971, xiv). Why did the concepts of evolution catch hold in Germany faster, and take a firmer hold there than any other place in the world?

Evolution Used to Justify Existing German Racism

Schleunes (1970, 30-32), in his discussion of the Nazi policy towards the Jews, noted rather poignantly that the reason the publication of Darwin's 1859 work had an immediate impact in Germany was because

> Darwin's notion of struggle for survival was quickly appropriated by the racists ... such struggle, legitimized by the latest scientific views, justified the racists' conception of superior and inferior peoples ... and validated the struggle between them.

The Darwinian revolution gave the racists what they thought was powerful verification that their race suspicions were "correct." The works of its chief German spokesman and most eminent scientist Haeckel especially provided support (Poliakov, 1974). The support of the science establishment was such that Schleunes (1970, 30-52) notes:

> The racists' appropriation of these scientific categories won for racist thought a much wider circulation than its ideas warranted. What satisfaction there must have been to find that one's prejudices were actually expressions of scientific truth ...

And what greater authority than science could the racists have for their views? Konrad Lorenz, one of the most eminent animal behavior scientists, often credited with being the founder of the field, stated:

> Just as in cancer the best treatment is to eradicate the parasitic growth as quickly as possible, the eugenic defense against the disgenic social effects of afflicted subpopulations is of necessity limited to equally drastic measures ... When these inferior elements are not effectively eliminated from a [healthy] population, then — just as when the cells of a malignant tumor are allowed to proliferate throughout the human body — they destroy the host body as well as themselves (Chase 1980, 349).

Lorenz's works were important in developing the Nazi program which was designed to eradicate the parasitic growth. The government's programs about the ways that "German Volk" (people) can maintain their superiority made racism almost unassailable. Although King (1981, 156) claimed that "the holocaust of Nazi persecution ... pretended to have a scientific genetic basis," in the minds of those in the government and the universities of the time, its scientific basis was so strong that few contemporary scientists seriously questioned it. The attitudes of the German people were only partly to blame in causing the holocaust — only when Darwinism was added to the preexisting attitudes did a lethal combination result.

Most of the early eugenists, especially in America and Britain, stressed that it was best to rely upon volunteerism to implement their programs. Galton, though, concluded that the situation in his day "was so clear cut and so dire, as to warrant state intervention of a coercive nature in human reproduction" (Kevles 1985, 91). Later, more and more eugenists supported direct government action in applying eugenics laws — if natural selection yielded the Darwinian fit, only artificial selection enforced by the government could insure that only the eugenically superior multiplied. Many social workers and psychiatrists in Britain, the United States, and Germany were convinced of the heredity origin of social deficiencies, and, in more and more countries, they felt compelled to force the government to intervene. In no country was this intervention as successful as in Germany. Discouraged by the lack of effectiveness of their science, and fully convinced that it had adequately been empirically supported with the brilliant work of Charles Darwin, Karl Pearson, Francis Galton and many others, Western scientists felt envy that only Germany was able to implement the programs which many scientists of America and Europe were then strongly advocating (Chase 1980).

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Nazi Germany was certainly not alone in applying science to government. As Kevles (1985, 101) states, "In the United States during the opening decades of the century, it came to be a hallmark of good reform to shape government with the aid of scientific experts ... eugenics experts aplenty were to be found in the biology, psychology, and sociology departments of universities or colleges ... " And the German eugenics programs elicited in little opposition from the United States. The implications of its eugenic immigration acts, especially the American

Johannson act quotas of 1924, a law not repealed in 1941, had enormous consequences for human lives.

> At least nine-million human beings of what Galton and Pearson called degenerative stock, two-thirds of them the Jews ... continued to be denied sanctuary at our gates. They were all ultimately heralded into Nordic Rassenhygiene camps, where the race biologist in charge made certain that they ceased to multiply and ceased to be (Chase 1980, 360).

The first step was to determine which groups were genetically superior, a judgment that was heavily influenced by one's culture. Many Germans believed that the American and British choices for the inferior races were incorrect; thus, they instituted their own program to determine who were the superior races. This meant that they must first determine which are superior, and then specifically what traits would place a person in a superior and/or in an inferior race.

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In trying to group persons into races to select the "best" Germans to serve as "official" child breeders, the Nazis measured a wide variety of physical traits, such as brain case sizes. Although superficial observations enable most people to make a rough classification based on white, black and oriental, when the race question is explored in depth, such divisions are by no means easy, as the Nazis soon found out. It was further made difficult in that, with many of the groups that they felt inferior, such as the Slovaks, Jews, Gypsies, and other groups, it was not easy to distinguish them from the pure "Aryan" race. In general, the Nazis relied heavily upon the work of Hans F.K. Gunther, who was a professor of racial science at the University of Gena. As Mosse (1981:57) acknowledged, although Gunther's "personal relationships with the party were stormy at times, his racial ideas were accepted" and received wide support throughout German government and were an important influence in German policy. Gunther recognized that, while "a race may not be pure, its members share certain dominant characteristics, thus paving the way for stereotyping (Mosse 1981:57). The goal was to find the racial "ideal type."

Gunther concluded that all Aryans share an ideal Nordic type which contrasted with the Jews, who, he concluded, were a mixture of races.

He concluded that all Aryans share an ideal Nordic type which contrasted with the Jews, who, he concluded, were a mixture of races. Gunther stressed both anthropological measurement of skulls, as well as an evaluation of a person's physical appearance. The predominance of such characteristics and a person's genealogical lineage were used as criteria. Even though physical appearance was stressed, the key was that "the body is the showplace of the soul" and "the soul is primary" (Mosse 1981:58). Select females were placed in special homes and kept pregnant as long as they were in the program. Even though the researchers tried to choose persons with the ideal traits, the I.Q.'s of the resulting offspring were generally lower than that of the parents. Research on the offspring of this experiment has concluded, as is now known, that I.Q. regresses toward the population mean.

The evolutionary views not only influenced the Nazi attitude toward Jews, but other cultural and ethnic groups as well. Even mental patients were massacred, in part because it was believed at the time that heredity had a major influence on mental illness. Mental patients were not the products of a sick environment, but a sick gene line (or perhaps they had some Jewish or other non-Aryan blood in them). Consequently, they had to be destroyed. Poliakov (1974, 282) notes that many intellectuals in the early 1900s accepted *telegony*, the idea that bad blood would *contaminate a race line forever*, or that "bad blood drives out good, just as bad money displaces good money." Only extermination would permanently eliminate "weak" and inferior genetic lines and, thereby, further evolution.

Numerous respected biologists supported this position — Darwin even compiled a long list of cases where "bad blood" polluted a whole gene line, causing it to bear impure progeny forever. Ernst Ruedin, of the University of Munich, and many of his colleagues (such as Herbert Spencer, Francis Galton, Calaude Bermand and Eugene Kahn, later a professor of psychiatry at Yale) actively advocated this

"hereditary argument." They were also the chief architects of the compulsory German sterilization laws which were designed to prevent those with defective or "inferior" genes from "contaminating" the Aryan gene pool. Later, when the "genetically inferior" were also judged to be "useless dredges," massive killings became justified. The groups judged "inferior" were gradually expanded to include a wide variety of races and national groups. Later, they even included less healthy older people, epileptics, mental defectives (both severe and mild), deaf-mutes, and those with terminal illnesses (Wertham 1966, Chase 1980).

Mengele's zeal (at Auschwitz) was based on highly accepted mainline science theory, not on alleged sadistic or psychopathic impulsives.

The justification for this killing, repeated over and over again, was that the "leading biologists and medical professors" advocated the program. Dr. Carl Brandt, according to Wertham (1966, 160), felt that since the learned professors were in support of it, the program must be valid, and "who could there be who was better qualified [to judge it] than they?" The scientist who presided over the race program at Auschwitz, Dr. Josef Mengele, was a highly respected and published researcher who held a Ph.D. from the prestigious University of Munich, and an M.D. from the University of Frankfort (Astor 1985). His zeal was based on highly accepted mainline science theory, not on alleged sadistic or psychopathic impulsives (Posner and Ware, 1986). His biographer (Astor 1985, 21) concluded that

> Race purity and the contaminant threat of Jews became gospel in lower and higher education. When Mengele began his college studies at the University of Munich, anti-Semitism had already sprouted in the sciences .... The impressionable young man ... soaked up writings like those of a German oriental scholar, Parl de Lagarde, who despised "those who out of humanity defend these Jews, or who are too cowardly to trample these usurious vermin to death .... With trichinae and bacilli one does not negotiate, nor are trichinae and bacilli to be educated. They are exterminated as quickly and thoroughly as possible."

And Posner and Ware (1986, 23) add:

> In Munich, meanwhile, Joseph was taking courses in anthropology and paleontology as well as medicine ... his real interest in genetics and evolution happened to coincide with the developing concept that some human beings afflicted by disorders were unfit to reproduce, even to live ... *His consummate ambition was to succeed in this fashionable new field of evolutionary research* [Italics added].

The groups included as "inferior" were later expanded to include persons who had only Negroid or mongoloid *features*, gypsies, and those who did not "pass" a set of ingeniously designed overtly racist phrenology tests now known to be worthless (Davies 1955). After Jessie Owen won several gold medals at the 1936 Berlin Olympics, Hitler stated that "the Americans ought to be ashamed of themselves" for even permitting blacks to enter the contests (Stanton 1972). Some even advocated the view that women were evolutionarily inferior to men. Dr. Robert Wartenberg, who later became a prominent neurology professor in California, tried in one monograph to "prove" women's inferiority, stressing that they could not survive unless they were "protected by men," and females evolved "weak" because of historically being protected by males. For this reason, he concluded that natural selection had not been as operative on women to the extent it had been on men. Thus, the weaker women were not eliminated as rapidly, resulting in a slower rate of evolution. How the weak were to be "selected" for elimination was not clear, nor were the criteria used to determine "weak." Women in Nazi Germany were openly prohibited from entering certain professions and were required by law to conform to a traditional female role (Weindling 1989).

After Jessie Owen won several gold medals at the 1936 Berlin Olympics, Hitler stated that "the Americans ought to be ashamed of themselves" for even permitting blacks to enter the contests.

Current writers often gloss over, totally ignore, or even distort the close connection between Darwinian evolution and the Nazi race theory and the policies that it produced, but, as Stein (1988, 50) admonishes,

> There is little doubt that the history of ethnocentrism, racism, nationalism, and xenophobia has also been a history of the use of science and the actions of scientists in support of these ideas and social movements. In many cases it is clear that sci-

> ence was used merely as raw material or evidence by ideologically interested political actors as proof of preconceived notions. Most contemporary sociobiologists and students of biopolitics would argue that all attempts to use science in this manner are, in fact, mere pseudoscience ... On the other hand, there is also little doubt in the historical record that this contemporary self-protecting attitude is based on a somewhat willful misreading of history. The history of ethnocentrism and the like has also been the history of many well-respected scientists of the day being quite active in using their own authority as scientists to advance and support racist and xenophobic political and social doctrines in the name of science. Thus, if the scientists of the day used the science of the day to advance racism, it is simply a form of Kuhnian amnesia or historical whitewash to dismiss concern with a possible contemporary abuse of science by a claim that the past abuse was mere pseudoscience.

The literature contains only a few studies which directly deal with this issue — and many avoid it because evolution is inescapably selectionist. The very heart of the theory of evolution is *survival of the fittest* — and this requires differences among a species which in time will become great enough so that those individuals that possess them — the fittest — are more apt to survive, manifesting differential survival rates. Although the process of raciation may begin with slight differences, evolution in time produces distinct races which results from *speciation*, or the development of a new species.

Nazism and Religion

Much of the opposition to the eugenic movement came from the German Christians. Although Hitler was once an altar boy and then "considered himself a good Roman Catholic," (Zindler 1985, 29), as an adult, he clearly had strong anti-religious feelings, as did many of the Nazi party leaders. As would any good politician, though, he openly tried to exploit the church's influence (Phillips 1981, 164). His feelings on religion were once bluntly stated:

> The organized lie [religion] must be smashed. The State must remain the absolute master. When I was younger, I thought it was necessary to set about [destroying religion] with dynamite. I since then realized there's room for subtlety .... The final state must be, in St. Peter's Chair a senile officiant; facing him a few sinister old women .... The young and healthy are on our side ... It's impossible to eternally hold humanity in bondage and lies ... [It] was only between the sixth and eighth centuries that Christianity was imposed upon our people ... Our people had previously succeeded in living all right without this religion. I have six divisions of SS men absolutely indifferent in matters of religion. It doesn't prevent them from going to their death with serenity in their souls (1953, 17).

"Christianity makes no distinction of race or of color ... In this respect the hand of Christianity is against that of Nature, for are not the races of mankind the evolutionary harvest which Nature has toiled through long ages to produce?"

His beliefs are abundantly clear: the younger people who were the hope of Germany were "absolutely indifferent in the matters of religion." As Keith (1946, 72) noted, the Nazi party viewed evolution and Christianity as polar opposites because

> Christianity makes no distinction of race or of color; it seeks to break down all racial barriers. In this respect the hand of Christianity is against that of Nature, for are not the races of mankind the evolutionary harvest which Nature has toiled through long ages to produce? May we not say, then, that Christianity is anti-evolutionary in its aim?

The opposition to religion was a prominent feature of German science, and thus later German political theory, from its very beginning. As Stein (1988, 54) summarized:

> Ernst Haeckel ... in a lecture entitled "On evolution: Darwin's Theory" ... argued that Darwin was correct ... humankind had unquestionably evolved from the animal kingdom. Thus, and here the fatal step was taken in Haeckel's first major exposition of Darwinism in Germany, humankind's social and political existence is governed by the laws of evolution, natural selection, and biology, as clearly shown by Darwin. To argue otherwise was backward superstition. And, of course, it was organized religion which did this and thus stood in the way of scientific and social progress.

Borman was equally blunt, stressing that the church's opposition to the forces of evolution must be condemned. In his words:

> National Socialist [Nazi] and Christian concepts are incompatible. The Christian Churches build upon the ignorance of men and strive to keep large portions of the people in ignorance ... On the other hand, National Socialism is based on scientific foundations. Christianity's immutable principles, which

> were laid down almost two thousands years ago, have increasingly stiffened into life-alien dogmas. National Socialism, however, if it wants to fulfill its task further, must always guide itself according to the newest data of scientific researches. (Quoted in Mosse 1981, 244.)

Borman also concluded that:

> The Christian Churches have long been aware that exact scientific knowledge poses a threat to their existence. Therefore, by means of such pseudo-sciences as theology, they take great pains to suppress or falsify scientific research. Our National Socialist world view stands on a much higher level than the concepts of Christianity, which in their essentials were taken over from Judaism. For this reason, too, we can do without Christianity (Mosse 1981, 244).

From our modern perspective, WW II and its results ensued from the ideology of an evil madman and his administration. Hitler, though, did not see himself as evil, but as mankind's benefactor. He felt that many years hence the world would be extremely grateful to him and his programs, which lifted the human race to genetically higher levels of evolution by preventing mixed marriages with inferior races. His efforts to put members of these inferior races in concentration camps was not so much an effort to punish but, as his apologists repeatedly stated, was a protective safeguard similar to quarantining sick people to prevent contamination of the community. Or, as Hoess (1960, 110) adds, "such a struggle, legitimized by the latest scientific views, justifies the racists' conceptions of superior and inferior people and nations and validated the conflict between them."

Some Conclusions

Although many factors produced the fatal blend which produced the Nazi movement, Darwin's notion of struggle for survival was appropriated to justify the movement's views, not only on race, but also war. One contributing reason, if not a major reason, that matters reached the *extent* of the holocaust was the acceptance of Social Darwinism by the scientific and academic community (Aycoberry 1981, Beyerchen 1977, Stein 1988). Misuse of Darwin's theory, as modified by Haeckel (1876, 1900, 1903, 1905, 1916), Chamberlain (1911), and others thus contributed to the death of a total of over nine million persons in concentration camps, and approximately forty million other human beings in a war that cost about six trillion dollars. Although it is no easy task to fully assess the conflicting motives of Hitler and his party, eugenics clearly played an important part. If the Nazi party had fully embraced and consistently acted on the belief that all humans are brothers, equal before God, it can be argued that the holocaust probably never would have occurred. Expunging the Judeo-Christian-Moslem doctrine of divine human origins from mainline German theology and its schools openly contributed to the acceptance of Social Darwinian theory, resulting in the tragedy of World War II (Chase 1980). ✧

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It's Time to Rejoin the Scientific Establishment

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"You are invited to a banquet to honor the 48 American Jews who have won the Nobel Prize." As I read the letter I could not recall one evangelical Christian who had won a Nobel Prize. Yet there are some five times as many evangelical Christians as there are Jews. So, the score is: Jews: 240, Evangelicals: 0.

How can we account for this wipeout? I don't think that Jews are that much smarter. The Nobel Prize results are simply evidence that there are 48 times more Jewish scientists than Evangelical scientists.

The Protestant Reformation Betrayed

So, why are there so few Evangelical scientists? I want to propose here that Evangelicals have abandoned science and other forms of scholarship because they have become separated from their roots in the Protestant Reformation.

Before the Protestant Reformation, there were two types of Christians — the clergy and the laity. The clergy were "in full-time Christian service." Their service was performed in leading the parish ministry, teaching the young, caring for the sick, and improving the lot of the poor. And, over all this, was the great missionary enterprise that supported the Crusades and sent the clergy to convert the heathen discovered by the European explorers as they opened up the new world.

The laity, on the other hand, had to earn their living, as well as support the clergy. They carried out the business of the secular world, the farming, the building, the buying and selling. They had little time for "Christian service" and were considered by both themselves and the clergy to be spiritually inferior to the clergy.

This was all changed with Luther's rediscovery of the gospel truth of justification by faith. No longer did man's salvation depend on his works. All works done by Christians were accepted by God if done for his glory. Thus, Luther's shoemaker glorified God by making good shoes.

This new respect for men working with their hands also recaptured the Old Testament attitude toward work. In contrast to the Greek practice of separating the philosophers, who were free men, from the manual laborers, who were slaves, Israel recognized the skill of the manual laborer as a gift from God.

> So it is with the potter, sitting at his work,
> turning the wheel with his feet;
> constantly on the alert over his work,
> each flick of the finger premeditated;
> he pummels the clay with his arm,
> and puddles it with his feet;
> he sets his heart on perfecting the glaze,
> and stays up cleaning the kiln.
> All these put their trust in their hands,
> and each is skilled at his own craft.
> They are not remarkable for culture or sound judgement,
> and are not found among the inventors of maxims.
> But they give solidity to the created world,
> while their prayer is concerned with
> what pertains to their trade.[1]

Science, in particular, benefitted from this new Christian freedom to enter into the material world. Commenting on astronomy, Calvin wrote:

> For astronomy is not only pleasant, but also useful to be known: it cannot be denied that this art unfolds the admirable wisdom of God. Wherefore, as ingenious men are to be honored who have expended useful labor on this subject, so they who have leisure

> and capacity ought not to neglect this kind of exercise.[2]

And so reformed Christians flocked into science. Over half of the founders of the Royal Society of London were Puritans.

Now, let us examine the Evangelical culture of our day. There is an approved list of activities headed by the "full-time Christian service" of ministry in the church or on the mission field. Other approved activities are the teaching of the young, the caring for the sick, and the ministry to the poor. It is almost uncanny how similar this list is to that of the clergy in pre-Reformation society.

Naturally, these priorities have an effect on the people living in the Evangelical culture. There is a steady subconscious pressure on our young people to devote their lives to the approved activities and, of course, to admire others who do so. One hears Christians speak proudly of their sons or daughters who have married seminary students or missionaries.

But where is the encouragement for our young people to enroll into the graduate schools of our great research universities to enter a life of scholarship? I have yet to hear a Christian father speak proudly of his son or daughter marrying a graduate student. No wonder our young people are discouraged from entering the rigorous life of learning and research.

In contrast, for two millennia, the learned Jewish rabbi has occupied the place of honor in the Jewish community. Consequently, Jewish young people strive to enter the most challenging universities to prepare themselves for a life of scholarship.

Evangelicals in the Universities

Consider, for a moment, the effects of having a significant Evangelical presence in the university faculties of this country. One effect of such a presence has been described in a 1980 article in *Time* magazine:

> In a quiet revolution in thought and argument that hardly anybody could have foreseen only two decades ago, God is making a comeback. Most intriguingly, this is happening not among theologians or ordinary believers, but in the crisp intellectual circles of academic philosophers, where the consensus had long banished the Almighty from fruitful discourse.

The article proceeds to credit this change to the fact that "a generation ago the brightest philosophers were atheists, but today, many of the brightest philosophers are theists and they are using a tough-minded intellectualism in defence of that theism."

Evangelicals do have a talent for scholarly work, as was demonstrated earlier in their development of modern science. And, even today, at least one observer has noted that Evangelicals defend their faith in a rational manner and that those who have betrayed reason are the liberals.[3] It is almost a crime that, by their own choice, Evangelicals have disassociated themselves from the scholarly activities of our day.

To re-enter the modern world of scholarship and research, Evangelicals must return to their Reformation roots. This requires a profound change in the Evangelical culture and so will not be accomplished easily. I would like to propose that, during its second 50 years, the American Scientific Affiliation assume the responsibility of bringing Evangelicals back into the community of scholarship and research. I believe that the ASA is possibly the only organization that can achieve this goal, for only *our* members belong to both the evangelical and scientific communities.

Turning It Around

But what should we do to encourage Evangelicals to return to the universities? My purpose here is to invite suggestions from the audience. To stimulate your thinking, I will begin with a few suggestions of my own.

First, I should say clearly that the ASA has long been aware of the need to encourage Evangelicals to participate in the scientific enterprise of our day. One result of this concern is SEARCH, Walt Hearn's series of biographies of Evangelical scientists, published as inserts in *Perspectives*. These articles seek, for the benefit of Evangelicals interested in science, to give a glimpse of the rewarding lives Evangelicals find in their scientific work.

Another ASA project with great potential is *Space, Time, and God*, the six-part TV program on the history of science, now in production. This program will correct the anti-Christian bias of other TV histories. It should also help to encourage Evangelicals to participate in the scientific enterprise when they realize that modern science was initiated and then supported by evangelical Christians for some three centuries.

We should also explore other avenues of entry into the evangelical community. For example, most

church denominations have monthly publications that inform their members about details of the life of their church. The ASA could supply material for these publications so that the activities of the scientists in the denomination could be followed in the same way as those of the missionaries are. Walt Hearn's series of biographies (SEARCH) provides a ready resource of such materials. The ASA could also supply reviews of books such as Templeton and Herrmann's *The God Who Would Be Known,* that emphasize the beauty and mystery of God's creation.

Returning to the Reformation

However, as useful as these suggestions might be, they treat only the symptoms of the disease and not the disease itself. The disease is the pre-Reformation belief that some activities are more "Christian" than others and, in particular, that the study of science is not one of the "Christian" activities.

In addition, I believe that the study of science was rejected as a Christian activity when, at the turn of the century, tensions arose between the discoveries in science and the Evangelical interpretations of the early chapters of Genesis. But, wasn't this Evangelical withdrawal from the scientific community not a huge, irrational error that should be repudiated as soon as possible?

The Vision

Whether an Evangelical believes in evolution or not, is it not a good thing for all Evangelicals to have their fellow believers teaching and working in the laboratories of the great research universities? Like the situation in philosophy, wouldn't the character of science be changed if Evangelicals were participating in its development? No longer would it be necessary for the ASA to produce a textbook to challenge one produced by The National Academy of Science. Evangelicals would be in the National Academy. No longer would it be necessary for Probe Ministries to request permission to present the Christian viewpoint on university campuses. Evangelicals would already be presenting it in their classes. No longer would it be necessary for Christian student groups to make a diligent search to find a Faculty Advisor. Their prospective advisors would be the professors teaching their classes. And, finally, the improper attacks on Christian beliefs would be challenged in the university faculty rooms instead of being left to fester waiting for action in the courts.

Isn't the vision of large numbers of Evangelical faculty members teaching in the secular universities a prospect that can appeal to all Evangelicals? Isn't this a vision to which we can all, without reservation, commit our support? Let us all join together to encourage our young people to prepare themselves to participate as faculty members in our secular universities. Our absence from the universities has been by our own choice and so the restoration of our presence to the universities lies within our own power.

Gathering Our Resources

Since all Evangelicals can agree on this vision, the ASA can expect to find support from the entire Evangelical community in its efforts to pursue the vision. The only problem is to decide what kind of support is needed. To make this decision, it is necessary to locate the place in the Evangelical community where our young people are being diverted from seeking an academic life. I believe that this place is at the heart of the community, in the churches. It is here that the basic values of the Evangelical community are taught and encouraged. The ASA must begin, then, by seeking the commitment of the ministers in these churches.

One line of communication to these ministers is through the ETS, the Evangelical Theological Society. A number of years ago, the ASA had joint meetings with the ETS. However, I do not believe that such a joint meeting would lead to the cooperation that we desire; we would spend all of our time arguing about evolution. No, we want to share our vision with them and ask for their commitment to pursue it with us. Therefore, I would recommend, as a first step, that the ASA send representatives to the next ETS meeting to propose that they join us in our pursuit of the vision.

The ministers are not the only ones who can help us with this task. The Creation Research Society enjoys a credibility with just the part of the Evangelical community with which the ASA has little influence. Again, the vision should be as appealing to them as to us.

Potential Evangelical scholars are also lost further along the educational chain. Here, the Evangelical student groups in the secular universities, such as InterVarsity, Campus Crusade, and the Navigators, can be approached. And, for the Christian colleges, we could share the vision with the Christian College Coalition.

Once a commitment to the vision has been accepted by the various constituencies of the Evan-

gelical community, representatives of these groups should meet together to develop a plan of action. By drawing from such a broad background of experience across the entire Evangelical community, these suggestions should lead to an effective program for proceeding further.

Staying the Course

The vision of a large Evangelical representation in the secular universities is one which all Evangelicals can share with enthusiasm. And, when we recognize that nothing except our own inaction prevents the realization of the vision, we should be optimistic of a successful conclusion for our efforts.

But, we must remember that we are dealing with deeply held Evangelical beliefs about the secular universities. Yet these institutions are no more spiritually daunting than the heathen cultures which our missionaries challenge every day. The only way to transform a culture is for Christians to enter that culture and reside there as Christians.

And so, in pursuing this vision, we will be entering into a long-term commitment. But Christians have shown the staying power to transform societies in the past. I would like to wager that, on its 100th anniversary, a large fraction of those attending the Annual Meeting of the ASA will be scientists from the large research universities.

I noted in the preliminary program for this meeting the topic: "How to Connect ASA with the Third World." I am proposing here that ASA get connected with the First World. It is time for Evangelicals to rejoin the scientific establishment. ✧

NOTES

[1] *The Jerusalem Bible*, Ecclesiasticus 38:32-35, 39.
[2] Calvin, John, *Commentaries on the Book of Genesis* (Grand Rapids, Eerdmans, 1948) p. 86.
[3] Hordern, William E., *A Layman's Guide to Protestant Theology* (New York, Macmillian, 1968) p. 68.

Then the Lord answered Job out of the whirlwind, and said,

"Who is this that darkeneth counsel by words without knowledge?
Gird up now thy loins like a man; for I will demand of thee, and answer thou me.
Where wast thou when I laid the foundations of the earth?
Declare, if thou hast understanding.
Who hath laid the measures thereof, if thou knowest?
or who hath stretched the line upon it?
Whereupon are the foundations thereof fastened?
or who laid the cornerstone thereof;
When the morning stars sang together, and all the sons of God shouted for joy?
Or who shut up the sea with doors,
when it brake forth, as if it had issued out of the womb?
When I made the cloud the garment thereof, and thick darkness a swaddlingband for it,
And brake up for it my decreed place, and set bars and doors,
And said, Hitherto shalt thou come, but no further:
and here shall thy proud waves be stayed?"

Job 38:1-11, KJV

Designer Explanations of Nature

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It is clear in scripture that God is seen as Creator. The metaphor of God as a "Designer," however, has become ubiquitous and dogmatically defended by Christians in their attempts to explain nature. The metaphor of a Designer is distinct from the concept of a Creator, in that the concept of a Creator is the essential explanation of existence, while the concept of a Designer is a metaphor explaining the *particulars* of nature.

We contend that God is the Creator, but we disagree with the description or metaphor of a Designer, which sees the world having been designed in the same way that humans design artifacts. In this article we outline the history of what we call the Paley-Darwin legacy. We suggest that the concept of God, "the Designer," is similar to the concept of natural selection, the apparent "designer." Such similarity is not surprising, since the two concepts are the same metaphors under different guises. Although questioning design is not a central issue in creationism or neo-Darwinism, we believe there is a time and a place to question the so-called non-negotiables.

Where Did Design Come From?

Aristotle, a student of Plato who is sometimes said to be the "father" of modern biology, argued that nature does nothing in vain, that all things have a purpose. He distinguishes four causes which he thought necessary to explain the complexity of living beings. This causal inference rests upon the assumption that human designing is equivalent in kind to design seen in organisms, which is often likened to a builder constructing a house. The wood to build this house is the material cause (*causa materialis*); the force that was invested by the builder into his project is the efficient cause (*causa efficiens*). Before the builder starts his work, he must have some plan or idea for the house: the plan is the formal cause (*causa formalis*); and the intended use of the house is the final cause (*causa finalis*). The 17th century philosopher René Descartes typifies this metaphor in his interpretation of the "designed universe," which has dominated Western thought ever since. Descartes saw the organic plus the inorganic world as a machine, a vast clockwork mechanism set in motion by God (Kenny, 1968). Organisms are cogwheels in this mechanism, each part functioning and designed to fulfil a particular task or purpose.

This perspective was extended in one of the most famous arguments for design, William Paley's watch and watchmaker analogy, from his book *Natural Theology* (1828). Paley saw a beautiful and exquisite design in nature, for which he crafts a detailed and persuasive "proof" for the existence of God, a designer. Paley imagined what his likely reaction would be if one day walking in a field he came across a watch and a stone. The stone would be accounted for as always having been there, but no one, he says, would account for the watch in the same way. An examination of the watch would reveal its precision and intricacy of "design," a mute testimony to the existence of a watchmaker. Paley then argued that the design in the watch is the same that exists in the works of nature, and he often compared biological form (for example, the human eye) with human artifacts, such as the telescope. Today many creationists argue in a similar manner. Wieland (1990), for example, suggests that there is a "clever engineering design in bones"; he likens these to the criss-cross members in the truss of a large bridge. The "braces" in vertebrate bones are placed so that they are exactly coordinated with the lines of stress. Redesign in bone structure to new directions of force that come from age or ability, says Wieland, is programmed in the DNA. To Wieland the mechanistic world of Descartes is probably appealing; the organism becomes the phenomena of the genome, programmed like a computer.

On the other hand, in the middle of the nineteenth century Charles Darwin (who in his youth was influenced by Paley) produced the first widely accepted non-theistic mechanism to account for the apparent design of organisms. Darwin argued that functional adaptations of organisms are not the result of God's hand, nor some mysterious Lamarckian drive, nor are they a simple matter of chance: they are the result of selection (Mayr, 1978). Darwin reinterpreted Paley's prevailing evidence for design, saying that design in nature anticipates the *question* to which natural selection is the *answer*. If artificial selection could supposedly manipulate the character of a given species, then, just as man adapted plants and animals to his needs, so nature has adapted them to *their* needs and environment. Thus, to Darwin, it was logical that those organisms with the most appropriate combination of characteristics for coping with the environment would have the greatest chance of surviving, reproducing, and leaving their traits. Natural selection, to Darwin and his successors, is an extrinsic ordering principle upon variation in populations, explaining the apparent fit of the organism to its environment (ie. design).

Richard Dawkins, a modern proponent of neo-Darwinism, is very explicit about design analysis, even deriving the title of his most recent book, *The Blind Watchmaker* (1986), from Paley's work. In the first chapter of this book Dawkins remarks on how scholarly Paley's writings are, and how he is right about the apparent design in nature. However, Dawkins states, Paley was fundamentally wrong about the designer. It is not God but natural selection that gives nature the appearance of design. Dawkins changes the teleological view of nature to a teleonomic view — that is, an *appearance* of design in nature — hence the "blind" and the "Watchmaker." Dawkins goes on to draw out in great detail this apparent "good design" of natural selection, such as echolocation in bats. These bats, Dawkins argues, are like miniature spy planes, packages of miniaturized electronic wizardry. Natural selection has perfected the system over tens of millions of years; sonar and radar pioneers, who were ignorant of nature's invention, designed similar systems in the Second World War for submarines and aircraft. Dawkins, in awe of nature's complexity, humbles us with the sight of "nature's" engineering feats, which he suggests are much more accomplished than our feeble attempts.

The idea of design in nature that has come from Aristotle, Descartes, Paley, Darwin, and Dawkins is central to many of our contemporary perspectives on nature. For Paley and contemporary creationists, design in the natural world is the evidence for a Creator's existence. To Darwin, and proponents of neo-Darwinism, design in nature is a question; natural selection is invoked as the blind watchmaker, not seeing ahead nor planning, but rather "inventing" to the particular need of the present environment. Neo-Darwinism and creationism are often dichotomised, and in many respects this is justified as these represent two different ways of explaining the world. However, we suggest that these two explanations are fundamentally similar in that they share the same axiom: there is (apparent) design. Therefore, according to these theories, the world can be analyzed using design criteria.

Is Design an Appropriate Metaphor?

Science is one way we explain the world, and often such explanations are achieved through analogies and metaphors from our everyday activities. These help us to make the complexity and order in nature more intelligible. However, if the metaphor that we use is inappropriate, our explanations become problematic. We believe the metaphor of design, to a large extent, dictates how we regard our world. Living organisms are seen as the end-product of a central directing agency, so that a "designer" must be used to explain them. Creationists and neo-Darwinists, having constructed their theories upon this metaphor of design, often merely invoke their answer and imagine some story to support it (Gould and Lewontin, 1979): their argument then becomes irrefutable. The victor of the feud between neo-Darwinism and creationism becomes that which can provide the most plausible reason for its "designer's" existence. All-encompassing designer explanations like these become vacuous by being able to explain everything real or even imaginary. That is, no matter what the subject of our inquiries happens to be, the answer becomes that it was "designed" by a central directing agent, and all that is left is to answer the question — what was it designed for?

By contrast, we *can* see God's creation not as a display of His architectural ability, but, rather, a direct reflection of His character (Psalm 19:1-4; Romans 1:20). God did not have to "design" His creation in the human sense of the word, and nowhere in scripture have we found evidence of this, although there is occasional mention of his "plan" and synonymous phrases. Even then we do not see these latter terms having been meant to be grounds for an anthropocentric interpretation. "Design" in a human sense often implies a time-dependent process of invention or elucidation of the ideal structure of something, given the resources and skill at hand. This is a classic case of the inadequacy of our words

to intellectually describe, let alone comprehend, God's attributes.

Creationism and Neo-Darwinism: Confronting the Metaphor of Design

It is widely recognized that there is a tension between creationism and neo-Darwinism, and many authors have tried to resolve this tension only to end up dissatisfied with both schools of thought. This tension occurs because both creationism and neo-Darwinism shared the same keywords — "design" and "purpose," — yet differ in their central directing agent. We contend that the conflict between creationism and neo-Darwinism will never be resolved because of the very nature of the arguments — God "the Designer" verses natural selection "the apparent designer" — these arguments are diametrically opposed. Therefore, if there is to be progress on this issue, we must trace creationism and neo-Darwinism to the fundamental perspective (way of seeing) that originally generated the theories, and question that. The perspective containing the metaphor of design, which is essentially an intuitive assumption, must be critically assessed.

Taking a step back in history to the sixteenth century, we find there was an Italian astronomer by the name of Galileo who began teaching that the earth moves round the sun. Galileo was eventually imprisoned for such a heresy, because scripture (namely Psalm 93:1) and the "fact" that the earth appeared motionless both contradicted Galileo's conviction. We find this an interesting debate because it was the new and different perspective of Galileo that allowed a fruitful and accurate view of the universe to emerge. We put the question to the reader; what would happen if we took a different perspective of nature, without the Paley-Darwin mentality? Secondly, we ask the question; why is it that biological systems appear to be explained by invoking the concept of a designer? To our amazement, authors such as Pollack (1990) freely admit that students of natural selection are trained as scientists but think like historians. They are not held to any obligation to find laws, but to draw their mission from the simpler hope that a historical record can be recreated, and that we can learn from it. In fact, the case was very different in the 19th century with the rational morphology movement, with influences from Goethe, St. Hilaire, Owen, Driesch, and others (see Webster and Goodwin, 1982, for a discussion of this). The rational morphologists believed that organismal domain could be explained by a lower common denominator, in essence a search for laws of form. However, history shows us that the scientific community decided the Paley-Darwin track was more appropriate, and this is the issue we believe needs challenging.

Concluding Remarks

To conclude, we believe that "designer explanations" literally become *designer* explanations; the fashion of the day, tailor-made for our scientific activities. In these explanations the organism is not important. In fact, one does not need to know anything about organisms in creationism and neo-Darwinism — the answer is merely invoked. We suggest these circular explanations will continue to explain essentially nothing, except maybe to enlighten us with some description of nature. Moreover, the Paley-Darwin legacy has canalized thought about evolution and nature, emphasizing the Aristotelian perspective of design. This brings us to the words of Thomas F. Torrance (1981, p.13) when he said:

> ... it is because our thought is so powerfully influenced by culture that we must bring its latent assumptions out into the open and put them to the test. Cultural assumptions, after all, are most dangerous when we are unaware of them.

The metaphor of design, we believe, is inappropriate to explain nature, though this should not be confused with the suggestion that the universe in not ordered and logical. Rather, our mode of explanation is inadequate or antiquated, resulting in a futile tension between theories of creation and evolution.

Acknowledgements

We wish to extend our thanks to the Creation Science Foundations' magazines, for their many articles in which they rephrase their same argument, and in particular thanks to Carl Wieland for his correspondence to us. Plus a special thanks to Neil Broom, Craig Millar, Richard Newcomb, and Rev. John Haverland for their comments on this manuscript. ✧

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Fanciful Bible-Science Stories' Harm: A Call to Action

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I appreciate the thorough work of Edward B. Davis in tracing down the fallacies of the 19th-century story of James Bartley's supposed experience in the stomach of a whale (December 1991 *Perspectives*, pp. 224-237). I agree that we should expose and warn against the use of such unfounded stories in teaching the relation between the Bible and science. But to me, a much more current and burning question is that of the many totally unsupported stories regarding the supposed means by which our earth's crust was formed. These have been accepted by large numbers of conservative Christian workers as useful in their ministry. The stories or scenarios to which I refer have been created in the minds of the "scientific creationist" leaders in order to argue that God created all the "heavens and the earth" only a few thousand years ago. By now they have confused untold numbers of honest Christians who want the truth and really do not want to pass error on to others. Such erroneous myths — now widespread in the English-speaking world — have disgraced the Bible in the eyes of a high percentage of the educators and scientists in the United States, Canada, and England.

So, I would ask what we of the ASA are doing and can do to expose such stories. What can we do to warn conservative ministers and other Christian leaders who are wanting to be careful regarding the materials they recommend, yet who do not have the scientific background or the study time to identify the erroneous origin and nature of the stories?

Listed below are some of the best-known and most misleading of the "scientific creationist" stories which possess neither the support of scientific data nor an appreciable amount of biblical support. These fallacious explanations of the origin of parts of the earth's crust have been enthusiastically taught to pastors, evangelists, youth workers, Christian day-school teachers, and Bible college teachers as "good science" which is supposedly in agreement with the Bible.

1. *The origin of the great coal deposits of the world.* The story usually says that all these were formed from plant material that was floating on the seas during the Flood. Unknown forces caused the plant material to collect in great, broad mats and then to rapidly sink to the bottom and be covered over with uniform layers of sediment. This story reaches the point of total absurdity when we realize that in most coal fields there is a vertical sequence of beds of coal, one above the other, separated by several thick strata of sedimentary rock of different types, *including limestone.* In some coal fields certain of these limestone strata are of freshwater origin, and others are of marine origin, with marine fossils. Some sequences of coal beds alternating with other types of rock strata possess thirty or more coal beds.

2. *Dinosaurs and mankind.* According to this highly popular story, the Bible is said to teach that the entire great era of the dinosaurs occurred during the life of the human race. Beautiful story books and coloring books portraying the supposed relation of human beings and dinosaurs living in close proximity to each other are now abundant in Christian day schools, church libraries, and Christian homes.

3. *Stories which attempt to explain the vast deposits of marine fossils in the strata of the earth's crust and sea floor.* These fossils are supposedly *not* arranged in an orderly sequence which reveals the extinction of many, many species during successive ages. And the fact that immensely thick sequences of progressively younger, Mesozoic strata of rock yield many totally new species, families, and orders in several geographic areas is ignored.

4. *Stories which make the claim that most plants and many animals, especially marine animals, were able, before the Flood, to grow and reproduce dozens or scores of*

times faster than they can now. Thus, great coral reefs and immense reserves of fossil shells could be produced, awaiting the event of the Flood. The plants allegedly made this rapid growth in violation of many known laws of biological growth, including going far beyond the rate limits of assimilation of food and oxygen, chemical metabolism and excretion — all of which are based on divinely established physical laws such as diffusion and chemical reaction rates.

5. *Stories of how the great, layered formations of limestone and other types of rock seen in roadcuts and in petroleum drilling cores were produced.* The shale layers in these formations are usually said to have been formed by rapid settling and hardening of fine clay particles from the waters of the Flood. The limestone formations are usually said to have arisen by rapid precipitation and lithification of calcium carbonate from the sea water. But there are no known physical laws which would have allowed anything like these amounts of calcium carbonate to be derived from the waters in so short a time. There are of course many other barriers to these hypotheses; e. g., the origin of the fossils and other biogenic components usually found in the limestone, and the great amounts of time required for lithification by cementation. The amounts of time required for the diagenetic changes in the limestone are also immense.

6. *The story of how, in the Grand Canyon region, thousands of layers of different kinds of sediments were laid down rapidly by the waters of the Flood.* While the sediments were still soft, the run-off from the Flood allegedly cut the steep-walled canyon. Strangely, the mile-high stacks of unlithified sediments on each side of the canyon remained intact! The immense weight of the sedimentary column did not even cause the distinct layers to mix or amalgamate with each other! The story is made even more intriguing — and ludicrous — by the fact that the possible sources of some of the types of sediments are completely unknown and difficult to imagine.

One variation of this story has the sediments lithifying suddenly, almost like commercial concrete. This ignores the complement of substances in the rock layers and violates all of the many known processes of lithification of the types of sedimentary rocks which are found in the Grand Canyon.

7. *The beautiful, imaginative story of the deposition of fossil communities by "ecological zoning" during the Flood.* This story is told and taught without regard for the fact that such a process could do no better than explain a deposit of fossil-bearing strata approximately three or four meters thick. It is utterly illogical for explaining the fossil communities buried in the many sequential formations of great areas where the earth's sedimentary rock cover is a few *miles* thick.

8. *The story that the entire geological column of the earth's sedimentary strata, from the Cambrian on up, is merely an imaginative creation of the minds of unbelieving scientists.* This assumes that the many competent field geologists who made careful observations of the different types of strata and compared them worldwide were only imagining that they saw order and reason in the sequences of strata.

9. *The story of how the earth's magnetic field has allegedly undergone a simple, rapid process of decay over a period of approximately 10,000 years.* The large number of magnetic reversals that are permanently recorded in the strata of so many rock formations of the world are said to be meaningless with regard to the age of the rock formations, or of the earth.

10. *The story of how, before the Flood, the carbon-14 content of the atmosphere was supposedly very small.* Just after the Flood, a rapid buildup of atmospheric C-14 is said to have occurred — because the hypothetical "vapor canopy" was gone. This supposed rapid increase of the supply of C-14 is said to invalidate all C-14 dates before 5,000 B.P.

I believe that the biblical flood was a real event. But the fact that many data-rejecting stories like the ones above are told as absolute truth and as obligatory for Christians is troubling. This open disregard for careful scientific research has disgraced the Christian cause, and has produced serious mental conflicts in many students' minds. Fallacious scenarios purporting to describe how the entire earth, with all its fossil-bearing strata, was formed in only a few thousand years have been unwarily accepted by great numbers of honest Christian workers. Likewise, practically the only Bible-science materials recommended in the Christian bookstores of America are those which make these same hypothetical claims.

Consequently the conservative evangelical community is being taught, year after year, that the proper Christian stance is to reject practically all research data which are derived from the work of earth scientists, paleontologists, astronomers, and physicists. But substituting unsupported Bible-science stories for research data is no way to make friends with public educators *or* to help students.

What can ASA members do to help their Christian brethren in this problem? It appears that, to this

point, most of us have thought that there is not much that can be done. I submit that this is a wrong approach. Most extreme creationist leaders are adamant, ignoring practically all earth-science research reports; but a non-belligerent dissemination of scientific information to the conservative evangelical ministers, youth leaders, and teachers of our nation can have a strong impact if we seek God's help in the effort. For example, we have not produced and distributed an appreciable amount of written or visual material presenting standard earth-science research information in the language of laymen. Such information would at least enable high school students and Christian workers to begin to evaluate some of the extremist claims which are presented to them. ✧

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A Dream Journey into Understanding

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The other night I had been up very late studying. I'd intended to finish working through the selections from Locke's *Human Understanding* and Hume's *Human Nature* in the Literature and the Arts course reader, but I could not keep my thoughts from wandering. They got lost in the text, in themselves, in the Beatles poster that hung crookedly on the wall. In my mind, my own thoughts began to fuse with the thoughts of the philosophers. I began to consider myself and how I had come to be the way I was, and how I knew things, and what was truth. Finally concluding that it might be a dangerous thing to consider truth at 3:30 in the morning, I closed the reader, said a distracted little prayer for understanding, and went to sleep.

I dreamed. In my dream I was a little child, a small child looking for something. I did not know what it was, only that I needed to find it. I was in a dark place, a place full of shadows, and I could see neither myself nor where I was going. I did not remember where I had come from.

"Help!" I cried out — I could think of nothing else to say.

I was startled to see a man appear at my left side, carrying a lantern. He was exceedingly tall and austere (he rather resembled my seventh-grade math teacher) and he wore a white wig. He was so great in stature, I believe he had to squint to see me. His strides were long and confident, and if I didn't know where I was going, he certainly did. But before I had a chance to speak to him, another man appeared at my right, also bearing a lantern. This second was equally stern of feature and also physically imposing, but while the first was great in height, he was great in girth. Fists clenched, he walked likewise with grave purpose. I looked at my strange companions in awe and amazement.

"Child," said the one on the left, "what is your name?"

"I don't know," I replied, and realized I had spoken the truth. "I don't know anything. But who are you?"

"I am called Science," he said, and his voice was low and even. "You desire to know? I am an expert on such matters."

"Do you know everything?" I asked.

"Nearly," he replied. "And what I do not know I shall soon find out." He then produced a great stack of books and manuscripts, old and new, and placed them before me. He also took out a small microscope (much like the one in the Junior Scientist kit I got for my tenth birthday) and placed it in my hand. "Read and discover," he said, "and you will know all of life."

Quite pleased and satisfied, I thanked the tall gentleman and began to sort through the volumes, looking, searching. Seeing so many strange and beautiful words, I had almost completely forgotten about the man standing at my right. I jumped a little when he spoke.

"Child," said he, "what are you looking for?"

"I want to know all of life, " I replied.

"For that," he returned, "you need only one book." And with an air of gravity, he handed me a single volume. I read the cover: *The Holy Bible.*

"That's all?" I asked. "That's everything?" I glanced doubtfully at the books Science had given me and wondered how they all could have been compressed into the one.

"That is all."

Originally written as a term paper for Dr. Richard Bube in "Interactions Between Modern Science and Christianity," Freshman/Sophomore Seminar, Stanford University, Winter 1991

"But, sir, who are you?" I asked then.

"I am called Religion," he answered. "But, child, who gave you all those worthless books?"

"Why, Science did," I said. I motioned towards Science, surprised. "Didn't you see?"

"I saw nothing," answered Religion. "I know of no such person."

"But he's standing right there! Don't you see him?"

"I see nothing."

I turned again to Science. "Science," I said, "did you see me talking to Religion?"

Science raised one finely arched eyebrow. "Religion? Is that your little imaginary friend?"

"No," I said. "He's certainly real. And he gave me this." I showed the Bible to Science.

"Ha!" Science laughed. "The Holy Bible?! An interesting historical and sociological document, to be sure, but it really has no relevance to you or me. Besides," (here Science bent down low to speak to me in confidential tones) "it's wrong."

He took the Bible from my hands and began to leaf through it rapidly. "You see? Genesis implies that the world is only about 6000 years old — that's ridiculous: the earth is billions of years old. And a universal flood certainly never happened." Science reached into his own stack of books and tossed me *Geology*. "Job is nothing but an old folktale — almost all cultures have one like it." He gave me *Comparative Mythology*. "Matthew — let's see ... the birth and resurrection of Jesus are physical impossibilities." He threw me *Human Biology*. Science went on like this for quite a while, and it was not long before I had lost most of my respect for Religion and his gift. I tossed the Bible off to one side. I picked up *Physics*.

But Religion shook his large head and said to me, "Child, what are you doing? You are going about this all wrong. You must not assume that those other books contain the truth. They only contain the imperfect guesses of man. In fact, the only truth is in the book you are ignoring. The Bible is the direct Word of a perfect God, and every sentence is the truth, just as it is. So if anything you read disagrees with the Bible in any way, it is false. That's all." I looked at Religion questioningly. He said, "Come closer. Let me tell you what knowing all of life really is."

More confused than ever, I came. I was surprised to find that he, too, had a formidable stack of books. From them, he began to instruct me in the Church doctrines, the Church rules, and the official Church views on every conceivable issue. He assured me that all these things came from the Bible, and were therefore entirely true. I did not agree with everything he said, but I dared not say anything, as I figured Religion knew much more than I.

So I was once again lost, pulled strongly in two different directions. Science on the left! Religion on the right! It occurred to me that the quest I was on had become something like the *Human Quest* of Professor Richard Bube's book. (If I had remembered the contents of that book, it might have helped me.) I wanted to read, to know for myself, but I realized that I had to read by one lantern or the other, for the two would not come together. I tried to read the Bible by Religion's lantern, but as I knew so little, I did not know what to look for. Seeing the microscope still in my hand, I decided to look for microscopes in the Bible. I couldn't find any.

"Religion," said I, "there are no microscopes in the Bible. Does that mean they do not exist?"

"If they are not in the Scriptures," said Religion, "they are meaningless."

I turned to Science. "What has meaning?" I asked.

"I cannot tell you what has meaning," he replied, "but I can tell you what has truth. The things you can see, hear, taste, touch, examine, analyze, and evaluate — these are the only things that have truth; they are the only realities."

I still had the Bible and the microscope. Under Science's lantern, I took a corner of a page of the Bible and placed it on the microscope stage. I set the instrument on low magnification and looked.

"Science," I said, "I see but random lines and grains."

"Yes," he said.

Suddenly, I remembered what I had been looking for. I was looking for myself, for my identity. I realized that I still hadn't found it. Gazing up once again at knowledgeable Science, I queried, "who am I?"

Science cast his eyes down upon me (they really were very cold) and contemplated me for some time. At last, he reached a long, lanky hand behind him and brought forth a mirror. He held it before me, and I looked. I shrank away.

What I had seen in the mirror was a robot, a machine of steel and wire which mimicked my own gestures to perfection. Exceedingly complex, it had many moving parts but was quite devoid of life. Alarmed, I cried out, "Science, Science, is *that* all I am?"

Science shrugged. He did not answer.

I turned to Religion. "Who am I?" I demanded of him. He too produced a mirror. I looked and saw nothing but the reflection of the floor beneath me.

"I see nothing!" I cried. "Where am I?"

"In truth," said Religion, "there is nothing of significance in you but your soul, which is invisible."

"But — "

All at once, there appeared a light that was a thousand times brighter than both lanterns put together. Science and Religion suddenly seemed very small, very human, and just a little foolish. I saw Jesus Christ walking out of the light towards the place where I stood. *"Erica,"* I heard his great voice say. *"I know you. Follow me."*

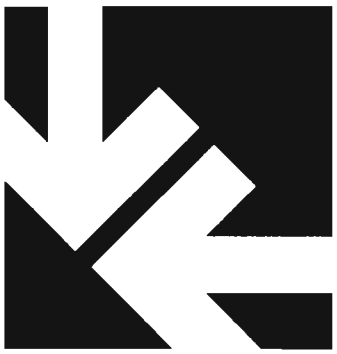
"Lord," I whispered. Suddenly ashamed of the microscope, I dropped it on the ground. To my great surprise, he stooped to pick up the microscope and gave it back to me.

"My child," he said. *"You are free to find out all you can about the world I created for you. But above all things, I want you to know me."* He then opened Religion's Bible to John 14:6 — "I am the Way and the Truth and the Life." The words sprang forward from the page and filled my mind.

I was certain now that I had found what I was seeking. Not books, but a living Person! From him comes all identity, all knowledge, all life. I looked again at my two companions. I could see them so much more clearly in the greater light than I could by their own flickering lanterns. The tall one seemed not so tall and the broad one not so broad, and some of the severity was gone from their faces.

They looked at Christ and then at each other. I believe they were seeing each other for the first time. With great joy, I began to walk into the brightness...

When I awoke to the lesser light of the morning, I had an incredibly powerful sense of answered prayer. ✧



The Game of Science: Reflections After Arguing With Some Rather Overwrought People

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Science, fundamentally, is a game. It is a game with one overriding and defining rule:

> Rule No. 1: Let us see how far and to what extent we can explain the behavior of the physical and material universe in terms of purely physical and material causes, without invoking the supernatural.

Operational science takes no position about the existence or non-existence of the supernatural; only that this factor is not to be invoked in scientific explanations. Calling down special-purpose miracles as explanations constitutes a form of intellectual "cheating." A chess player is perfectly capable of removing his opponent's king physically from the board and smashing it in the midst of a tournament. But this would not make him a chess champion, because the rules had not been followed. A runner may be tempted to take a short-cut across the infield of an oval track in order to cross the finish line ahead of his faster colleague. But he refrains from doing so, as this would not constitute "winning" under the rules of the sport.

Similarly, a scientist also can say to himself, "I believe that *Homo sapiens* was placed on this planet by a special act of divine creation, separate and apart from the rest of living creatures." While this can be a genuinely held private belief, it can never be advanced as a scientific explanation, because once again it violates the rules of the game. If that situation were true, and if *H. sap.* were indeed the result of a special miracle, then, in view of Rule No. 1, above, the only proper scientific assessment would be: "Science has no explanation." The problem with any such statement is that we know from past experience that it probably should have been qualified: "Science has no explanation — yet." As people who have grown up amid the current scientific revolution realize, last year's miracle is this year's technology.

The vital importance of excluding miracles and divine intervention from the game of science is that allowing such factors to be invoked as explanations *discourages the search for other and more systematic causes*. Two centuries ago, if Benjamin Franklin and his contemporaries had been content to regard vitreous and resinous forms of static electricity as only expressions of divine humor, we would be unlikely to have the science of electromagnetism today. A century later, a passive belief that God made all the molecules "after their own kind" would have stunted the infant science of chemistry. And a contemporary who believes devoutly that there are no connections between branches of living organisms is unlikely ever to discover such connections as do exist. *The most insidious evil of supernatural creationism is that it stifles curiosity and therefore blunts the intellect.*

There are those who demand, in a bizarre misapplication of courtroom standards, that the claims of modern science either be proven beyond a shadow of a doubt at this present moment, or else be given up entirely. Such people do not understand the structure of science as a game. We do not say, "Science absolutely and categorically denies the existence and intervention of the supernatural." Instead, as good game players, we say, "So far, so good. We haven't needed special miracles yet." The particular glory of science is that such an attitude has been so successful, over the past four centuries, in explaining so much of the world around us. A

good maxim is: *If it isn't broken, don't fix it.* The game of rational science has been enormously successful. We change the rules of that game at our peril.

To be sure, many areas exist where we as scientists do not yet know all the answers. But these problem areas change from one generation to another, and that which might have seemed miraculous (to some) a generation ago now is seen to be perfectly explicable by natural causes. In hindsight we would have felt foolish had we written off those areas as the result of miracles fifty years ago; and we would be ill-advised to set ourselves up for ridicule by those who will follow us fifty years from now. It is a reasonable prediction that the attitude of future generations toward twentieth-century "scientific creationism" (an inherent oxymoron according to Rule No. 1, above) will be one of ridicule.

Science is not a closed body of dogma; it is a continuing process of enquiry. A dry and querulous legalism that tends to inhibit or close off that process is antithetical to science. The cartoonist Sidney Harris once published a cartoon depicting two scientists in consultation before a blackboard filled with equations — obviously some kind of proof in the making. One scientist points to a particular equation and proclaims confidently, "And at this point a miracle occurs!" Real scientists don't talk that way — not because some of them don't believe in miracles, sometime, somewhere — but *because invoking miracles and special creation violates the rules of the game of science and inhibits its progress.* People who do not understand that concept can never be real scientists, and should not be allowed to misrepresent science to young people from whom the ranks of the next generation of scientists will be drawn. ✧

Scientific Gamesmanship

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"The Game of Science" is a metaphor used by many of us to argue that science isn't the whole meaning of life. Science is a game, we say, though not the only game in town. Not everyone chooses to play, but those who do must abide by the rules of the game.

Richard Dickerson has reminded *Perspectives* readers that Rule No. 1 limits scientific explanations to physical and material causes. Rule No. 1 applies with equal force to every team on the field, from the "Harmless Doves," who believe that God exists and interacts with his creation, to the "Savvy Serpents," who claim that all God-talk is a lie or a delusion.

As though to reinforce the metaphor, those who police research papers submitted to scientific journals are called "referees." They see to it that Rule No. 1 is obeyed. Spectators of the sport seldom appreciate how much leeway this system leaves for Christians to make distinctive contributions to life in the lab, or to hold views of how the world works that differ from currently accepted scientific views.

When metaphors are taken literally, problems arise. Insistence that "Science is, fundamentally, a game," can give the impression of an overrated diversion. After all, not everyone sees the point of grown men battling over possession of a ball. And even avid sports fans suspect that many professional players are grossly overpaid for what they do. Few branches of "the science game" can be played with so little equipment as to resemble a chess game or footrace. Scientific work (or "play") has become an expensive, elitist enterprise, more like professional sports or the winter Olympics—which ordinary citizens might refuse to support with their taxes. Games can get out of hand.

On the other hand, U.S. citizens have been bombarded with dire predictions about what will happen to our country unless science and science education are taken with utmost seriousness. Coach Dickerson warns that we would face "peril" if we changed the rules of "the game of rational science." Does that send citizens a double message? Why should "playing a game" under slightly different rules amount to "insidious evil"?

Pondering divine participation in the world *might* stifle curiosity and blunt the intellect. But a lot of curious people are already asking, "Who made the rules?" and "Who defines what constitutes progress?" In 1992 it seems clear that millions of people suffered great harm through the application of navigational technology 500 years ago. It also seems clear that those who control technology have defined the terms ever since. Was the voyage of Columbus really an amazing discovery of a new world? Or was it the beginning of conquest and exploitation of an old one?

Scientific research depends on the financial support of millions of citizens who will never know the joy of scientific discovery. Hubris about scientific progress can produce a backlash: "If science can't deal with questions that are important to everyone *except* scientists, maybe it's time to redefine science—or shift our support to some other pursuit." "Scientific creationism" might well earn the ridicule of future generations, but (alas) so might "rational science."

Evidence is now coming to light about grave environmental damage done in countries where scientific progress was officially embraced while the validity of religious faith was officially denied. The leaders responsible for that misuse of science were hardly "creationists." While fending off overwrought critics and guarding science against encroachment, we must not let a quasi-religious belief in "salvation through progress" shut down our own curiosity.

I wonder, for example, if adhering strictly to Rule No. 1 to rid the game of a personal deity could, perhaps over many generations, lead to a devaluing of personhood in general. Last year I corresponded with a prominent molecular biologist who had put down ASA's *Teaching Science* booklet as "a work of religious advocacy." In a letter to me he advocated that human beings are "the descendants of defective purple bacteria."

To me that assertion seemed largely underdetermined by empirical evidence, and not very helpful, but he devoutly believed it. To produce a biologist from a bacterium is not technically a divine miracle—if it took three or four billion years—so the concept was allowable under Rule No. 1. It was just one of those points that science has not cleared up—"yet," according to Dickerson. It might even be true, I thought. At least belief in his bacterial ancestry didn't seem to stifle that scientist's curiosity. But of course belief in God's creative activity did not stifle the curiosity of Copernicus, Galileo, or Newton, either.

Cartoonist Bill Watterson began a recent "Calvin and Hobbes" strip with Calvin's teacher saying that the class would move on to the next chapter if there were no questions. Calvin, a precocious six-year-old, did have a question: "What's the point of human existence?" His long-suffering teacher replied that she meant any questions about the subject at hand. Calvin then said that he'd like to have the issue resolved before he expended any more energy on school work.

Perhaps Calvin and others like him will never be "real scientists," but it would be unwise to tell them, in the name of science, to stop asking such unanswerable questions so we can get on with playing the game. ✧

"It is the glory of God to conceal a matter;
to search out a matter is the glory of kings."

Proverbs 25:2

Book Reviews

Two on *Darwin on Trial*...

DARWIN ON TRIAL by Phillip E. Johnson. Washington, DC: Regnery Gateway & InterVarsity Press, 1991. 196 pages, index. Hardcover; $19.95.

Reviewed by L. Duane Thurman, Professor of Biology, Oral Roberts University, Tulsa, OK 74171.

Darwin on Trial is another book on creation and evolution written by a lawyer. Unlike Wendell Bird, who emerged from law school as an advocate for the creation-science version of creation, Phillip Johnson became active in evolution and creation issues as a law professor who had been teaching in the University of California at Berkeley law school for over 20 years. Johnson, whose specialty is the analysis of logical arguments and the identification of hidden assumptions, has written two books on criminal law and procedures.

Darwin on Trial has 154 pages of text followed by 33 pages of research notes and a short index. Except for the occasional footnotes, sources and quotes are referred to in the research notes by sequential paragraphs rather than numbered citations. There are no illustrations, charts, or tables. InterVarsity Press co-published this book by special arrangement with Regnery Gateway, Inc.

The first of 12 chapters is a discussion of the legal battle surrounding Louisiana's 1981 law requiring equal treatment for "creation-science" in public school science classes. After a chapter each on natural selection and mutations, Johnson devotes three chapters to an evaluation of fossil evidence for Darwinism, and a chapter each on molecular evolution and prebiological evolution. The last four chapters address the rules of science, Darwinist religion, Darwinist education, and science and pseudoscience.

The book reads well, with good chapter-to-chapter transitions that keep the reader informed of the path ahead. Johnson deals more with the philosophy of naturalism, hidden assumptions, inconsistencies, and the large picture than with details of evolutionary mechanism and analysis of word meanings in scripture. This broad philosophical perspective can help scientists who are more prone to focus on technical details than to see how well these evidences are used to support assertions. Johnson goes beyond mere objective analysis of evidence and the way it is used. It is easy to see Johnson the lawyer trying to persuade the reader as judge and jury to accept his point of view.

Johnson maintains that Darwinists lack sufficient empirical evidence to support the strength of their statements on evolution and that they exclude the possibility of design

Reviewed by Owen Gingerich, Professor of Astronomy and History, of Science at the Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138.

Phillip E. Johnson's brilliantly argued critique of Darwinian evolution is guaranteed to arouse exasperated irritation from those who accept evolution as an article of faith. Like a clever lawyer for the prosecution, he scores point after point as he demonstrates how little empirical evidence underlies that hypothesis, and as he attempts to link it with a materialistic and atheistic philosophy. His account is deftly organized, articulate, even witty; I enjoyed it as a good read.

Johnson is a professor of law at the University of California in Berkeley. He has an enviable logical gift of mind, and a covetably sharp pen. His book contains such gems as, "Descriptions of fossils from people who yearn to cradle their ancestors in their hands ought to be scrutinized as carefully as a letter of recomendation from a job applicant's mother." Elsewhere, after criticizing a naturalism that "does not explicitly deny the mere existence of God," he remarks that, "A God who can never do anything that makes a difference, and of whom we can have no reliable knowledge, is of no importance to us."

Drawing upon a wide range of scientific literature, Johnson shows the flimsiness of the reasoning that numerous small mutations can really drive evolution. Problems with the fossil record and with the molecular evidence come under his persistent questioning. Finally, he turns to Darwinist religion and Darwinist education. Each step of the logical chain is designed to cast more and more doubt on the efficacy of Darwinian evolution.

And yet, the exercise left me with a highly uneasy feeling. Suppose, just for a moment, that Johnson were reviewing Newtonian physics in 1700. The whole thing, he might point out, was based on an unproven hypothesis that the earth moved. The most obvious prediction, that the stars should show an annual shift owing to the earth's motion, had not been confirmed, despite a concerted effort. The idea that distant planets could be attracted by the sun with no intervening frame to transmit this pull was clearly an unsubstantiated notion. And the geometrical proofs that involved distances or time intervals vanishingly small clearly smacked of division by zero, and anyone versed in mathematics could see how absurd that was. All in all, the *Principia* was a dangerously se-

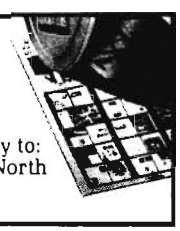
THURMAN, *continued.*

and purpose by God as creator. By automatically ruling out all versions of creation, Darwinism becomes the only reality allowed — because of their rules — not because of the strength of empirical evidence. The problem of insufficient evidence is solved by substituting scientific naturalism, a philosophy which, in some ways, is a religion to the Darwinists. This is also what G. A. Kerkut, a British biochemist and evolutionist whom Johnson did not cite, said in *Implications of Evolution* in 1960. Johnson does not merely imply that the emperor has no clothes; his repeated request for empirical evidences instead of philosophical substitutes is as persistent as the familiar "Where's the beef?"

Johnson also points out that evidence does not speak for itself but has meaning only in the philosophical context of the interpreter. The different ways in which writers such as Richard Dawkins, Niles Eldridge, Stephen Gould, Douglas Futuyma, G. G. Simpson, and Karl Popper interpret science, Darwinism, and the possibility of God as creator are discussed. I was surprised that Thaxton, Bradley, and Olsen's book *The Mystery of Life's Origin* was not mentioned, even in the chapter on prebiotic evolution.

Johnson recognizes the confusion caused by "elastic" definitions of science, evolution, and creation, which to him is not limited to literalistic fundamentalism. Although recognizing the important distinction between microevolution and macroevolution, he most often uses the general term "evolution," which can be given variable meanings by his readers, too. He points out the faulty analogy of artificial selection to natural selection, which he examines as a tautology, deductive argument, scientific hypothesis, and philosophical necessity for Darwinists. There is much more in this book to enlighten or refresh our perspective of origins, evolution, and creation.

Darwin on Trial emphasizes the influence that different philosophies and worldviews have on the way empirical evidence is interpreted — or accommodated for, when lacking. This book should inspire us to be more attentive to logic and to search for hidden assumptions. Before debating how many angels can dance on the head of a pin, perhaps we should ask whether or not angels even dance. The few overly inclusive statements, use of general instead of precise terms, and omissions of some important works on this topic are not serious. I recommend *Darwin on Trial* as a book worth reading. ✧



GINGERICH, *continued.*

ductive attempt to build a mechanical universe in which the need for God was radically diminished.

The point is that science attempts to build up a coherent explanatory scheme, and part of the game plan is to seek mechanistic, automatic methods that do not rely on the supernatural. This coherency is generally achieved by ignoring certain apparent facts of nature because other aspects seem more important. Copernicus was impressed by a group of beautiful linkages and commensurabilities that became obvious only in a sun-centered arrangement. He had to ignore his lack of any explanation of terrestrial physics (why birds didn't get left behind by a rotating earth, for eample) or the failure to observe an annual stellar parallax. Newton was able to pull together many more of the pieces, and while he couldn't prove that the earth moved, his system was so comprehensive that most people had no trouble accepting ideas that Galileo had earlier admitted were "contrary to the evidence of the senses."

While Johnson does a spectacular job of showing what a leap of faith is required to believe that random mutations could, over time, form major genus-building patterns, he almost totally ignores the achievements of evolution in accounting for the temporal and spatial distribution of organisms and in explaining imperfect design such as geese with webbed feet that never go near the water, or flightless birds. Thus Johnson, always the lawyer, never manages to comprehend why so many scientists find evolution so compelling.

What is puzzling about his brief is that he never quite comes to terms with what we or the Supreme Court ought to have done with respect to the Creationists. He makes a good case to show that all of us who accept the activity of God in the universe are necessarily creationists, in that we accept the role of design and purpose. Johnson allows that God might well have used natural selection over billions of years to form life as we observe it on earth, but to him the essential requirement is the designing hand of God in the operation. Johnson is clearly distressed that the orthodoxy exemplified by the National Academy of Sciences and the court decision essentially prevents the mention of design or purpose in the teaching of science.

Evolution has had an uphill battle for acceptance, not just because it places us within a mechanistic, chance-driven animal kingdom, but also (ironically) because it is not mechanistic enough. Unlike Newtonian mechanics, with its rigid predictive outcome, evolution is contingent, chancy, unpredictable; most leading evolutionists take a dim view of intelligent life on other, alien worlds because they feel that the earth's particular life forms are the happenstance of an idiosyncratic history that would never be duplicated again. In their attempt to show how we could come to be via a chance process, these evolutionists are loathe to dilute this astonishingly different mode of explanation with an taint of design. I can understand and sympathize with some of their vehemence, but of course Johnson is correct in pointing out that this all-

GINGERICH, *continued.*

too-easily becomes a philosophic stance of religious proportions, a matter of faith and credo not intrinsic to science itself. Science is not atheistic or anti-God, just neutral with respect to the deity. Not too surprisingly, the evolutionary orthodoxy tends to stray from this guideline rather badly at times, as Johnson is all too willing to notice.

So, what does Johnson want us to do about all this? Abandon teaching evolution in schools? Teach it as a scientific myth? Give creationists equal time? He calls the writers of the ASA *Teaching Science in a Climate of Controversy* "naive," but he seems to offer no obvious prescription. If he understood better how science functions, perhaps he could have proferred some advice, for he is obviously a thoughtful and intelligent author. As it is, he has written a fun, provocative, but ultimately very frustrating book. ✧

THE CREATION SCIENCE CONTROVERSY by Barry Price. Sidney: Millennium Books, 1990. 244 pages, index. Paperback.

This book was written by an Australian Roman Catholic science teacher, and for this reason has a perspective not commonly found in anti-creationist writings. The author discusses not only "scientific creationism" in the United States, but also the "creation science" movement, as it is called in Australia.

Price deals with the areas typically found in anti-creationist materials such as thermodynamics, the flood, fossils, dinosaurs, Paluxy footprints, and others. He also discusses rather extensively the leaders of the movement, notably Henry Morris, Duane Gish, and others involved in Australia. Gish seems to be his primary target. One chapter ("Gish the Debater") and parts of other chapters contain information on alleged inaccuracies, inconsistencies, and other problems related to statements made by Gish. Much of this is not documented with bibliographic references and may lead the reader to wonder about the accuracy of Price's information.

Other chapters contain various other problems associated with the scientific creationism movement. These include textbook controversies, court cases, and numerous details regarding the movement in Australia.

Price makes numerous valid criticisms of the scientific creationism movement. However, his style of writing is biased and not very objective. He makes some rather personal attacks upon the leaders of the movement and questions their honesty and integrity. There is quite a bit of material related to the Bible in which the author demonstrates little sympathy with traditional biblical in-

terpretation. For example, he states that the creation accounts were totally borrowed from Babylonian materials, and that Genesis was the last Old Testament book to be written (i.e., he dates Genesis at ca. 450 B.C.). He implies that the book was written to reach those who have fallen under the spell of scientific creationism. Such readers, however, would be likely to be turned off by the approach of the author, and probably not read beyond the first few pages.

Reviewed by Phillip Eichman, University of Rio Grande, Rio Grande, OH 45631.

SCIENCE AND REASON by Henry E. Kyburg. New York: Oxford University Press, 1990. 283 pages. Hardcover; $35.00.

Kyburg's most important and most interesting contribution to science is an original approach to probability. The two known interpretations of probability refer to mass phenomena and to uncertainty, the former leading to statistics, the latter to inductive logic. Kyburg attempted to combine these interpretations by defining probability as a function of assigning to sentences not *numbers* but *intervals of numbers*. However, axioms of probability calculus are not satisfied in this interpretation. Since it is not a relation between sentences, as in inductive logic, but between sentences and a body of knowledge, the author calls it an evidential probability. (In 1961 he called it an epistemological interpretation).

Science uses observation to create and to justify its laws and generalizations. However, virtually no observation is free of error. Therefore, a theory of error based on observational experience must be included in the picture. In this respect, Kyburg applies the minimization principle, which states that observations should be attributed a minimum amount of error entailed by a theory. He spells out also the distribution principle according to which errors are as evenly distributed among different kinds of observation as possible. Observation statements are included in the body of knowledge only if their level of error does not exceed the level imposed by a theory with respect to observation.

The concept of error along with the concept of quantity and measurement is central to laws and theories. Because an error is present in measurement, it has to be analyzed in this contest as well. In fact, as the author claims, we should focus on observational errors when analyzing theories rather than, for instance, on the controversy between realism and instrumentalism (p.151). This statement betrays Kyburg's rather unfriendly view of philosophy, which is especially clear in his treatment of causality.

When discussing causality, Kyburg asks a rhetorical (in his view) question: "does classical dynamics require that the fall of the leaf be caused at all? It seems not" (p.191). He finds a belief in causality unnecessary, even superstitious (p.209), since everything can be explained in terms of numbers, ideally in statistical terms. Causality is too weak to be used for explanation and prediction. Thus, it is one of these metaphysical concepts that logical positivists wanted to reject. However, causality seems to have always been one of the strongest motivations for doing science. Causality *per se* is not a scientific concept, in the same sense as mass, velocity, atom, etc. Yet it led to scientific theories, and scientists are more interested in establishing causal relations between events rather than mere correlations. Otherwise the theory is not deemed satisfactory from a cognitive standpoint. Causality is an extra-physical concept but as important to physics as, for example, consistency or sensual perception, and statistical character of quantum physics did not render it obsolete. However, physics itself may create an impression that what is sufficient is the *post hoc ergo propter hoc* (after, that is, because) principle. Satisfaction with this principle would mean that scientists are in what psychologist Harry Sullivan called the parataxic mode of experience — the dominance of temporal sequence as the only conception of causality in the infant's developmental history.

How is the level of including a statement to the body of knowledge chosen? Kyburg starts with an analysis of full belief, or acceptance. Full belief is relative to the risk/reward ratio. The range of such ratios is what "the agent has (implicitly) in mind" (p.250). If the risk/reward ratio characteristic for a certain action is below the level of what the agent knows to be the risk/reward ratio characterizing the situation, then the act is rational. Thus, our acts can be deemed rational even if what we have in mind is not rational. Kyburg cannot accept such a consequence and tries to argue for rationality of assumptions and speculations, stating that "perhaps there are no standards of reasonableness or rationality, but standards of taste" (p.262), and he points to such standards as coherence, simplicity, and beauty. Interestingly, he does not think much about truth as such a standard, since "it is not clear that it serves a useful function in the evaluation of scientific theories" (p.263). Clearly, instrumentalism is the only option.

Kyburg criticizes the claim that science requires assumptions that cannot be scientifically defended as a "speculative hypothesis, or an article of faith". Yet in the same breath he advocates making an attempt "to produce a presupposition- and assumption-free analysis of scientific argument" (p.270). Isn't it an article of faith?

Kyburg equates rationality with computationality (p.256), and the whole tenor of his book, where he generously uses statistical analyses, is to support this generalization. He mentions the existence and some importance of qualitative considerations, but does not make much of it. Understood rationality is therefore a cure for religious and ethical problems. This rationality, and science generated by it is to be a source of values, and since we have science, we have no use for such hypotheses as sin and salvation.

Kyburg made, as indicated, a very important contribution to inductive logic, and uses this logic throughout

his book trying to solve with it each and every problem. But although it lends itself very well to approaching such problems as measurement or observational statement, it is ill-suited for solving traditional philosophical and metaphysical problems, such as causality, truthfulness, sin and salvation. Kyburg apparently disagrees with it by either dismissing them as pseudoproblems or diminishing their importance. This solution is hardly satisfactory.

Reviewed by Adam Drozdek, Duquesne University, Pittsburgh, PA 15282.

BEYOND THE BIG BANG: Quantum Cosmologies and God by Willem B. Drees. La Salle: Open Court Publishing Company, 1990. 323 pages, appendices, index. Paperback.

Does the Big Bang and most modern cosmology support or refute the biblical belief in creation? Is this area of physics perhaps religiously neutral or even irrelevant? These hot topics are rigorously addressed by Willem Drees' doctoral dissertation, *Beyond the Big Bang*. Since the author's previous doctorate was earned in theoretical physics, this examination of theological issues in cosmology is refreshing in its personal examination of the interplay between theology and physics.

The book's six chapters are meticulously subdivided into as many as twenty sections — the table of contents is 6 pages long — to help the reader map out the argument. Drees begins with an examination of the Big Bang and creation. He points out the inadequacies of attempting to use the Big Bang to support or prove theological premises (God of the gaps(!), ambiguity of scientific terms such as beginning, time, contingency) or to use creationism to argue against modern cosmology. In a similar vein he examines some scientists (Hoyle) who dislike the Big Bang theory for its supposed theistic implications. In a later chapter, he examines the claim that modern cosmology (Hawking) has made God redundant; that the Big Bang combined with quantum cosmology marks the "end of the road for metaphysics." His personal conclusion is that the Big Bang theory is religiously neutral, but consonance can/should be constructed between our theological and scientific ideas within an appropriate metaphysic.

He shows how different scientific approaches (Hawking versus Penrose versus Linde) might challenge or influence various theological programs. Furthermore, theology and science do not usually dialogue on equal terms.

> Science leads our understanding of the world. However, the presence of metaphysical influences in the construction of the most abstract theories about the Universe gives an opening for an influence from religious convictions to scientific research.

Thus, a concern for history would correspond more closely to cosmology with time asymmetry (Penrose). Drees also reminds us that all scientific theories are tentative proposals, especially in the frontiers of cosmology, where a successful integration of general relativity and quantum mechanics is still more of a wish than fulfillment.

Drees also outlines and criticizes the various anthropic principles or arguments from design implied within them. While humans are children of the universe, that doesn't clearly point to a world designed for the sake of humans, nor does it imply there is nothing but nature. Drees acknowledges that the mystery of existence, the conceptual boundedness of theories, and the intimations of transcendence are suggestive for theism, but he thinks there is too much ambiguity allow us to either build theology up or make knock-down arguments.

Drees examines the future and both secular/scientific and religious eschatologies. Dyson's open universe envisages an advanced human species living forever by carefully choosing cycles of activity and hibernation. Tipler's Final Anthropic Principle describes/prescribes all events being guided by the future's Omega Point, which is the determining boundary condition for the wave function of the universe. Drees treats these secular visions respectfully but notes glaring difficulties which might cause even the most hopeful optimist to despair. Process theology and Pannenburg's eschatology share some similarities with Tipler's final causation approach, but their congruence require further analysis.

Drees' own "constructive consonance proposal does not demand a strong methodological consistency or even attempt a proof of a religious claim. It merely seeks some sort of mutual consistency and credibility based on an adequate method of relating the scientific and theological enterprises. Drees emphasizes the constructive nature of all knowledge as well as the human desire for integration or consonance. Drees sketches other attempts (Barbour, Peacocke, Gilkey, Torrance) to relate science and theology briefly before outlining his own enterprise. He focuses on the ambiguity in theology; God is both present and absent. Secondly, the limits of the Big Bang theory and the various research programs imply the relevance of metaphysical preferences and a close examination of methods of relating theology(ies) to different cosmologies. Thirdly, he focuses on intelligibility and credibility; to clarify and embed theological ideas in a web with the most credible scientific and philosophical ideas. This difficult and ongoing task is further complicated by some fundamental dissimilarity between theology and science, including the difference between description and prescription. Drees finishes his book by starting his theology, constructing a consonant vision of God and the Universe.

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THE CHURCH AND CONTEMPORARY COSMOLOGY by James B. Miller and Kenneth E. McCall, (eds.). Pittsburgh, PA: Carnegie Mellon University Press, 1990. 400 pages. Paperback; $13.95.

This book consists of the Proceedings of a consultation of the Presbyterian Church (U.S.A) held in December 1987. Both editors are ordained ministers in the Presbyterian Church (U.S.A.). Seventeen other authors each contributed a chapter to the book; among the authors, eight are theologians, three are astronomers, three biologists, two philosophers, one ethicist, and two are professionally undefined. The book is slow reading. It presents overall a wide variety of perspectives (some of which have very little connection with historic Christianity). A few approaches offer wise and valuable suggestions for dealing with the interaction between science and Christianity.

What does cosmology mean in this context? Miller offers an all-inclusive definition in his chapter, "From Organism to Mechanism to History."

> First, by cosmology I will mean the broad worldview which orients a culture .... cosmology also implies epistemology. And with these two in attendance can metaphysics be far behind? (p. 65).

In later chapters authors involved in science offer somewhat different definitions. In a chapter devoted almost strictly to a scientific summary of the theories of the origins of the universe, Joseph Silk of the Astronomy Dept. at the University of California at Berkeley treats cosmology as dealing with scientific questions concerning physical properties of the universe. In another chapter that deals only with science in the areas of quantum physics, James Maher of the Physics and Astronomy Depts. of the University of Pittsburgh, points out the large difference between the common use of the word between physicists and theologians. He says, "When I use the word cosmology below, I mean no more than the implications of our current knowledge of physical law for the way we think about the very long ago and the very far future of our physical world .... (p. 193) It is not surprising, therefore, that the perspective and approach of many authors, even to what "cosmology" means, follows the conventions of their own disciplines.

There are two papers that one might conclude simply do not belong in a book with this one's stated purpose. The very first paper on "Our Cosmic Heritage by astronomer Eric J. Chaisson starts unbelievably with the words, "The subject of cosmic evolution is my religion. The process of change itself ... is my God" (p. 20). Later he states, "Formerly the nearly exclusive purview of philosophy and religion, a viable ethic for today's world is in my view no longer provided by either of these venerable institutions." Garrett Hardin, Prof. of Biology at UCSB, contributes a totally utilitarian analysis titled, "An Ecological View of Ethics." His second paragraph starts, "A scientist cannot accept the orientation of the first sentence of the book of John ... If I were charged with altering Scripture to conform with science I would say, "In the beginning was the *World* ...." (p.345) It is difficult to see how either of these chapters is suitable for a book on *The Church and Contemporary Cosmology,* — unless it is to imply that the Church has nothing to offer. This is not to state that these chapters themselves have nothing to offer, but only that they seem to belong to another conference.

The major chapter, by James B. Miller of the United Campus Ministry of Pittsburgh, consists of 60 pages of text without a single subsection break, and 23 pages of notes. The author provides an overview of some 3000 years of historical and cultural development. His treatment of Wittgenstein's contributions are particularly helpful. He clearly presents the major contribution of Popper, involving the position that "truth is to be understood as correspondence in some sense between statement and reality" (p. 109), but then goes on himself to deny that truth is measured in this way.

There are some excellent insights in this collection that should not be missed. Although his paper is limited to science, the chapter by Maher referred to above, concludes cogently,

> [N]o biological theory can in principle comment on the ultimate questions addressed by theologians, and theologians will only embarrass themselves if they tie their arguments too closely to contemporary biological theory (p. 204).

In a paper entitled, "Genesis, Procreation, or Reproduction: Cosmology and Ethics," Abigail Rian Evans, Director of the National Capitol Presbytery Health Ministries, sounds a similar theme when she writes that, "[s]truggles emerge when science attempts to provide ultimate answers to the questions it raises and when religion attempts to use theology to explain how the physical world functions" (p. 328). In "What Ever Happened to Immanuel Kant," Langdon Gilkey of the University of Chicago Divinity School, argues effectively against all forms of naive realism in science. In "Evolutionary Biology and the Study of Human Nature," Philip T. Spieth of the Dept. of Genetics at the University of California at Berkeley, concludes that, "Introduction of ethics and values — not to mention concepts of morality and sin — into the study of human nature is beyond the competence of biology. The task calls for theology, and not just natural theology .... For the Christian theologian, therefore, the major problem is one of integrating scientific knowledge with Biblical interpretation" (p. 220). A good "Consultation Summation" by Ian Barbour of Carleton College sets forth in helpful form the various options of interaction between science and theology and suggests major areas of promise and problem.

It is somewhat surprising that two authors make the mistake of identifying paradox with contradiction (pp. 241, 264). Some authors get carried away with their own rhetoric in calling for a grand new synthesis of science and theology different from anything we currently know (e.g., pp. 267, 321). Others make much ado about perspectives long since forsaken by those with an understanding of authentic science and theology, as though these perspectives were on the cutting edge of today's interactions (e.g., pp. 288, 289). For some, only process philosophy

offers a framework within which to view the science/theology intersection (e.g., p. 290).

In the next-to-last-paper, "Notes on the Practice of Christian Asceticism in Relation to Contemporary Science and Technology," Carl Mitcham of the Philosophy and Technology Studies Center of the Polytechnic University, Brooklyn, raises the question, "Is there a Christian technological form of life?" (p.361) and suggests that "sometimes 'less is more' " (p. 363). The chapter presents a warning, leaving open the question of how valid it is and how it should be dealt with.

The final chapter of the collection is somewhat curiously written in the style of a cracker-barrel philosopher by Robert Short. Borrowing a phrase from novelist Kurt Vonnegut, he repeatedly describes a principal role of science with respect to theology as "cleaning sh— off practically everything." (p.372) One could argue that the author's style gets in the way of his message.

This book gives a feeling for the unanswered questions that grip at least one denominational group as it tries to face the interactions between science and Christianity. Others involved in similar activities among Christian or scientific groups ought at least to know what *these* authors think are the problems and possible solutions.

Reviewed by Richard H. Bube, Professor of Materials Science and Electrical Engineering, Stanford University, Stanford, CA 94305.

EVOLUTION AND THE MYTH OF CREATIONISM: A Basic Guide to the Facts in the Evolution Debate by Tim M. Berra. Stanford: Stanford University Press, 1990. 198 pages, annotated bibliography, index. Paperback; $7.95.

Tim Berra, a Professor of Zoology at Ohio State, was drawn into the evolution/creation controversy when he reviewed biology curriculum and discovered it was "about 50 percent creationist." To counter the threat to the growth and spread of knowledge, Berra joins the vocal contingent of scientists and philosophers to show that "creationism has no scientific validity," while there is no "genuine scientific controversy about the validity of evolution," even though certain details or nuances remain to be worked out. The book is written for the open-minded non-specialized reader and pulls no punches with regard to the quality or character of creationist claims.

The well-illustrated book is divided into five chapters and two appendices (one on genetics and the other on Darwin). The first chapter introduces the nature of science, creationist tenets, and a brief summary of the mechanisms and evidence for evolution. The second chapter outlines the fossil record and geological time, including radiometric dating. Next Berra details the explanatory power of evolution with reference to drug resistance in bacteria, myxomatosis in rabbits, moth melanism, sickle cell anemia, convergent evolution and stepwise adaptation. Chapter four is the largest chapter and lays out cosmic evolution, abiogenesis, the emergence of the major taxa, and human evolution. Berra focuses on the broad outline of the history of evolution and major evidences that support its occurrence. His final chapter refutes major creationist challenges to evolution and attempts to place the debate within the broader context of twentieth century American society.

Berra carefully distinguishes the fact of evolution (organisms are related by common descent) from the theory of evolution (natural selection) which explains how the fact occurred. The first is supported by evidence too vast and too varied to deny, such as biogeography, morphological homologies, embryology, the fossil record and molecular biology. While the second is still being worked out with greater precision (neutralism, punctualism) it has survived "considerable challenges" and still fruitfully guides research.

The portrayal of the origin of the first cell is painted with a broad optimistic brush, for Berra feels compelled to leave no gaps for creationists to fill with God. On the other hand, Berra spends much more time on human evolution — his field of interest — to detail the argument and evidence that we share descent with all other organisms. While there are "quibbles" about precise pathways (Leakey versus Johanson) the fact of human evolution is "so solid and comprehensive that it cannot be denied by reasonable people." Similarly, he carefully examines certain controversies (Is *Archaeopteryx* transitional?) to marshal support for evolution and show how even respected scientists (Hoyle) can err in areas outside of their expertise.

In attempting to write with "candor and clarity" Berra inevitably overstates his case. For instance, he claims that an engineer could certainly design from scratch a more efficient and pain-free backbone than natural selection was constrained to do (p. 69). He treats abiogenesis as the highly probable result of a real-world process very like the various simulation experiments that scientists have conducted" (p. 80). Berra also takes a few cheap shots at his opponents. He describes the modern features of the Neanderthals, "who could probably pass for television evangelists" if attired in business suits (p.115). The Bible is blamed for its injunction for man to "master the environment ... (which might) yet do us in" (p. 131). In an age of polemic, he neglects to mention the role that scientism has played in spawning creationism. Moreover, he is also silent about the stance and efforts of the ASA. in relation to abuses of science and genuine scientific research and reflection on the question of origins; does he know we exist?

Berra's book achieves its purpose: to explain and defend evolution. He does not spend too much time demolishing flawed creationist arguments — for that see Willard Young's *Fallacies of Creationism* and various ASA members'

publications — to strongly present the positive case for evolution. This book goes a long way to showing the general public why evolution is accepted by the scientific community — for reasons other than a predisposition to naturalism, or worse, some sort of conspiracy theory (*In the Minds of Men*).

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Letters

On Davis' "A Whale of A Tale"

Edward Davis" engaging, informative and well documented detective article ("A Whale of a Tale," December 1991 *Perspectives*) highlighted a common concern in science, but it is by no means a problem only with those who attempt to justify their religious belief structure. It is my experience that this type of error is commonly committed by both religious advocates and scientists. Even the most careful scientists, judging by modern studies of eminent historical scientists, have not uncommonly accepted uncritically reports that latter proved false or questionable. Of course, some scientists make these mistakes far more often, and are as a whole less critical evaluators than others, but it is a common problem which I believe must be addressed.

An excellent example of what has evidently proved to be an enormous hoax is the Tasaday Tribe case, supposedly a "stone age people living in the Philippine rain forest." A book by John Nance, *The Gentle Tasaday*, with a forward by Charles A. Lindbergh (1975, New York: Harcourt Brace Jovanovich) is one of the many extensive "scientific" studies on them, yet subsequent research found the "tribe" to be a publicity hoax.

Another example is many of the major research conclusions by Margaret Mead (which have now also been seriously questioned), on which she based her arguments for permissive sexual behavior and the alleged harm of the Christian value system. Her original "research" has been shown to be both naive and heavily influenced by her presuppositions. Several other anthropologists have reviewed her original data, even re-interviewing those individuals which she interviewed for her original study (see *Margaret and Samoa*, by Derek Freeman, Professor of Anthropology at Australian National University, subtitled, *The Making and Unmaking of an Anthropological Myth*, published by Harvard University Press, Cambridge, MA, 1983). Two excellent summaries of many other similar cases are Alexander Kohn's *False Prophets: Fraud and Error in Science and Medicine* (Basil Blackwell, England, 1986) and *Betrayers of Truth: Fraud and Deceit in the Halls of Science by William Broad and Nicholas Wade* (New York, Simon and Schuster, 1982). Many researchers, attorneys, and university administrators have concluded that fraud and deceit is now epidemic in science and medicine.

The latest case I am aware of is an example that I have seen over and over in textbooks. It concerns an animal behavior called *batesin mimicry*. The example of this that has been used for over a century involves the conclusion that one butterfly evolved the wing pattern of another species which is foul tasting so that birds will avoid it, as well. The researchers (Ritland and Brower, *Nature*, 350:497-498) note that this classic example has evidently never been tested, and when the authors did so, they discovered that the viceroys are just as unpalatable to birds as the monarchs, the butterfly they supposedly mimicked. This research has now caused the whole topic to be reevaluated, and while all of the data is not yet in, it is clear that the butterfly example has been uncritically accepted by hundreds of researchers.

A more recent example is the Whorfian hypothesis of linguistic relativity — the conclusion that the language that one speaks shapes one's world view. Researched by Benjamin Whorf in the 1940s, and widely accepted in the 1950s and 1960s, it was then "seemingly discredited by rigorous tests in the late 1960s" (see Ross, *Scientific American*, Feb. 1992: 24-26). The most common example of linguistic relativity was the assertion that Eskimos use many distinct words — seventeen is the figure often given — in place of the one English word "snow," concluding that this lexical grid causes the Eskimo to see snow in a far more critical and analytical way than English speakers. Then research by anthropologist Laura E. Martin of Cleveland States University replicating the Eskimo studies concluded that Whorf "exaggerated" the number of Eskimo "snow" roots, and also understated the number of English words commonly used to describe snow. Now, in a recent conference this summer on the subject, it was concluded that, although some of the examples were in error, Whorf's idea makes a valid contribution in helping us to understanding language.

Another example closer to Davis' genre is the rumor that Charles Darwin retracted his theory of evolution and became a Christian. For a refutation of this still widely believed and often quoted belief, see Wilbert H. Rusch and John W. Koltz, *Did Charles Darwin Become a Christian?* (Creation Research Society Books).

The example that Davis discusses is probably not fraud or deception, but in his words, a story which no one has likely given "the kind of careful investigation it warrants if it were to be used as evidence for the reliability of Scripture" (Davis, p. 231). Although sloppiness often blends into deceit, I think that the major problem is the tendency for most people to uncritically accept information which fits their belief structure, plus the simple fact that most of us lack time to do the research necessary to directly

verify every story, study, or idea that we come to believe. This problem is well illustrated in the enormous and commendable amount of effort that Davis had to expend in order to track down what seems to be the conclusion of the story. (Actually, I could think of at least two other solutions aside from that which Davis hypothesizes).

My own concern relative to the whale account is that if an event is categorized as a *miracle*, it must be an event which would not *normally* be possible — and demonstrating that such a feat is easily possible removes it from the miracle category and into the "God wanted events to turn out that way" category, somewhat like meeting the right person at the right time on the street. If I found a way to "convert" water to wine, Jesus becomes not a miracle worker but merely a smart man. Secondly, if my sources are correct, the Hebrew word here interpreted *whale* refers only to a *big fish*. Davis gave us our miracle back.

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On Snoke's "Unified View of Science and Theology"

I generally like Dr. Snoke's approach in his "Toward a Unified View of Science and Theology" (September 1991 *Perspectives*). But I feel he confuses the overthrow of theology with the abandonment of a scientific theory. Paul said that evidence that Jesus Christ did not rise from the dead would destroy orthodox Christianity (I Corinthians 15:14-19). Because Christianity has a historical fact as its necessary foundation, this would destroy the basis for evangelical theology. This does not parallel a recalcitrant observation upsetting a scientific theory. The cosmos, the basis of science, cannot be destroyed or rendered irrelevant by any observation of it.

When Snoke writes, "Experimental results, archeological digs, historical documents, my inner feelings, and the words of scripture all function as 'sense experience' data" (p. 169), I fear that he is striving too hard to parallel science and theology. Perhaps he is misled by *Wissenschaft*, which, like *scientia*, even includes theology. He may also be following Roger Bacon, who held that all knowledge comes from divine revelation. This revelation was given to the Hebrews, the Babylonians the Egyptians, the Greeks. The divinely given information has been passed down to us correctly in Scripture and corruptly in secular writings. Hence these latter require testing by means of experience. For Bacon, experience includes several levels of mystical illumination. I put little stock in mysticism as a source for theology, let alone science. The phenomena of "illumination" occur as much among Kabbalistic Jews, Muslim Sufis, Zen monks, Hindu adepts, pagan shamans, etc., as with Christians of various degrees of orthodoxy. I hold that the theologian had better hold to Scripture rather than accepting non-biblical traditions and "revelations." The reformers' *sola scriptura* is a proper standard.

I note also that Snoke's quotation from Roger Bacon (p. 173) expresses Bacon's view that Scripture gives the truth about creation better than philosophy does. The term "philosophy" must be understood broadly as encompassing all human investigations. Centuries later, "natural philosophy" was still the term for empirical science.

Although science, theology, and other areas of study deal with one total universe, we must not push this fact too far. What do I mean? Let me pose a couple of questions. First, is an excited neutral atom angry, happy, harried, joyous, frustrated? What is its emotional state? Second, what is the mass of a white-knuckled clenched-jaw anger? Nonsense questions, you say? Do you mean that emotional terms are nonscientific? That "mass" does not belong in a scientist's vocabulary? In truth, both "mass," "angry," and the other terms are essential to science, but not to all disciplines. "Excited," though important to both physics and psychology, means very different things in the two disciplines. If language may be vital to one scientific discipline and nonsensical within another, why may we not find a similar non-overlap among theology, science, history, philosophy, mathematics, etc.? The methodologies of these various studies are more radically different than those of any two empirical sciences. Consequently, there is some relevance to the "two world" approach that Snoke totally rejects. But it must not be carried too far.

With this we come up against some of the basic problems of being human. These include, first, the tendency to go to extremes rather than to find a balance; second, the tendency to find some parallels and to equate or identify the entities or areas where they appear. The swing of a pendulum rather than an approach to equilibrium marks so many aspects of human history. How often has someone spotted a relevant factor and pushed it much too far, even to the point that MacKay called "nothing-buttery"? The second tendency has long been recognized as false generalization, one of many fallacies. Since we are all human, we need to help each other as much as possible to avoid these and other pitfalls. Even after we have done our united best, though, our fallibility will render our results imperfect. We are neither God incarnate nor divinely inspired prophets and apostles. So humility — more humility than commonly manifested — is appropriate.

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* * * * *

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INDICES to back issues of *Perspectives* are published as follows:

Vol. 1-15	(1949-1963),	Journal ASA	15,	126-132	(1963);
Vol. 16-19	(1964-1967),	Journal ASA	19,	126-128	(1967);
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