

“Science and Religion: *Vive la Différence*”

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[This document is the text of a talk that was presented October 18, 1998, in East Lansing, Michigan, as part of a forum on "Our Evolving World: Challenge to Mind and Spirit." This document is in the public domain and may be used without charge and without permission, provided the source is acknowledged.]

Preface

Let me begin by thanking Glenn Johnson and Lars Clausen for inviting me to participate in this forum, and Philip Hefner for providing a thoughtful and thought-provoking view of the relation between religion and science in his book, *The Human Factor: Evolution, Culture and Religion* (Fortress Press, Minneapolis, 1993).

Pastor Clausen suggested that I begin by telling you briefly about my own research. I work in evolutionary biology, a field of study that seeks to understand the history and mechanisms by which life on earth has changed during the past several billion years. Most of you probably first associate the study of evolution with dusty fossils, many of which demonstrate the existence of species that are no longer alive today. Certain fossils provide striking evidence for evolution because the fossils have combinations of morphological traits that are no longer present in living organisms, yet were predicted from an evolutionary theory of relationships among modern-day species. For example, scientists have found fossil birds with exquisite feathers and hind-limbs like those of modern birds, but which also have teeth, clawed digits on their fore-limbs, and a long vertebral tail like their reptilian ancestors. Some of you may also know about the evidence for evolution that exists within the genes of all living organisms, including ourselves. The myriad similarities and differences among the genes of different organisms provide a material basis for evaluating the evolutionary relationships among all organisms, from bacteria to humans. These genetic similarities and differences enable scientists to determine which species are more closely related than others, using much the same logic and material that is used to establish paternity in lawsuits. The information in these genes provides independent support for the evolutionary derivation of birds from reptilian ancestors. By digging out fossil bones and sequencing genes, scientists can reconstruct historical events.

But I suspect that few of you think of evolution as an on-going process, one with consequences in our lifetime. And yet, evolution is happening all around us, sometimes with tangible repercussions for human welfare. Consider many disease-causing bacteria that have recently evolved resistance to the antibiotics that we use to treat infections. For example, *Staphylococcus aureus*, which is often acquired in hospitals following surgery, can cause potentially lethal infections; some strains of this species are now resistant to all but one of the antibiotics that were once available for its treatment. By the same token, many agricultural pests have evolved resistance to pesticides that we began using only in our lifetime. Indeed, while much of the public may regard evolutionary biology as abstract and far-removed from our present lives, in fact a substantial component of the costs of medicine and agriculture reflects an arms-race with our biological enemies. While we seek to control or eradicate diseases and pests using chemicals and other methods, these enemies are evolving genetic defenses against our best weapons. The evolution of these defenses by our natural enemies causes illness and economic devastation, and it forces us to spend more money to develop new means of combat.

And because evolution is occurring in the world around us, it is possible to perform experiments on evolution, just as one can in the fields of chemistry and physics. What is required for these experiments are organisms, such as bacteria, that have rapid generations and large populations, so that one can observe — on the time-scale of a student's doctoral dissertation, for example — evolutionary changes that require many generations and that depend on infrequent genetic events. In my laboratory here at MSU, graduate students and I have monitored some 20,000 generations in bacterial populations that have been propagated for about ten years as part of one long-running experiment. This experimental approach enables us to address certain evolutionary questions that would be difficult to resolve using a retrospective (historical) approach, such as studying fossils or comparing genes of living organisms.

For example, on the theoretical side, how repeatable is evolution? That is, what are the relative roles of chance — from random mutation — and necessity — reflecting natural selection — during evolution? To address this question, we measure changes that take place when several initially identical populations of bacteria evolve in parallel in identical laboratory environments. On the applied side, are bacteria that have evolved resistance to antibiotics inferior to sensitive bacteria when they compete for resources, and hence for reproductive success, in the absence of antibiotic? If so, then this suggests that we may prevent, or at least slow, the spread of antibiotic-resistant bacteria by more judicious use of antibiotics.

One of the intriguing and powerful features of bacteria for this evolutionary research is the fact that they can be stored frozen, in a state of suspended animation. These frozen bacteria can be later revived to allow direct comparison, and even competition, with their own evolutionary descendants. Imagine if we could resurrect our own ancestors — from ten-thousand or a million generations ago — and challenge them to a game of chess, or in the struggle for existence.

My students and I perform these experiments because we find them fascinating, and because evolution is a critically important process in the world in which we live. It is a process that has shaped our own being, yet it can also confound our efforts to shape the world for our well-being.

Response to Hefner's Theological Theory of the Created Co-Creator

When Dr. Johnson told me that the focus of this forum would be the dialogue between science and religion, I listened politely but cautiously. I was pleased to hear this would not be another debate about evolution *versus* creation, and therefore would not pit science against religion. But as the magnitude of responding to Dr. Hefner has dawned on me, I've almost come to wish that this were a debate about evolution and creation! At least then it would be easy for me to disagree with another speaker's position, and to feel that I had some expert knowledge to contribute.

Instead, my problem is this: I am a scientist, one with no special knowledge of either theology or philosophy. And yet I must respond to a distinguished theologian who has thought long and hard about the relationship between science and religion, and who has built on subtle philosophical underpinnings. So I begin by admitting that I am in over my head and hoping that I can swim, or at least dog-paddle, across this vast lake. Nonetheless, I do welcome this opportunity to respond, in order to express my admiration for Dr. Hefner's work, but also to convey my own view of the relationship between science and religion. My view is somewhat different from the harmonious and integrated vision put forward by Dr. Hefner.

A good place to begin my reply is with a cartoon featuring *Frank & Ernest*, which appeared a couple of months ago (August 2, 1998). Ernest asks "What do you think of the idea of humans

evolving, Frank?” To which Frank replies “I think it’s worth a try.” Instead of the familiar image about life emerging from the primordial ooze, or our descent from apes, this cartoon strikes us as funny because it depicts evolution in a *forward*-looking fashion, rather than the typical backward view. In fact, it does so at two different levels, at least for me. First, it is forward-looking in the literal sense of suggesting a future course of action. Second, Frank seems to be conveying the progressive view that not all is well with the world as it is, that humans bear some responsibility for the problems, and that therefore a new course of action is necessary.

I think this cartoon captures an important component of Dr. Hefner’s thesis. In his own words, and I quote, “... in the situation to which biocultural evolution has brought us ... the life not only of the human species, but of the entire planetary ecosystem is made to depend on a great wager going well. This wager is that the cultural systems of information that the co-creator fashions will interface with the natural systems and with the global human culture so as to promote survival and a wholesome future.” Dr. Hefner then suggests that “... the wager is not going well. The cultural systems of information are not meshing adequately enough with other systems, and calamity is the prospect.” He therefore proposes “...revitalization of our mythic and ritual systems, in tandem with scientific understandings, so as to reorganize the necessary information. This may help us to put our world together ...”

In a nutshell, I share Dr. Hefner’s profound concern for the future welfare of our species and planet. I agree with him that our species has evolved the unique ability to make decisions that profoundly influence the future of the world in which we live. And I share his view that this decision-making ability imposes on all of us a tremendous responsibility to do what it takes to ensure a wholesome future for our species and planet.

As an academic who values creative synthesis, in a world where narrow specialization has become the norm, I admire Dr. Hefner’s effort to integrate scientific and religious perspectives. But I am also troubled by the idea of integrating two such different ways of knowing. To clarify the reason for my discomfort, I must present my own views of the relationship between science and religion.

Evidence and Faith

What is the difference between science and religion? I think it is fair to say that one important difference is that science is based on evidence, whereas religion depends on faith. From some philosophical quarters, this distinction has been criticized as naive, because science (like religion) also depends on certain fundamental beliefs that cannot be tested within the scientific enterprise. For example, science presumes that there is some correspondence between the material universe and our sensory perceptions of it. But science cannot actually prove that the world in which we live is “real” as opposed to a phantasm of our befuddled senses. I will admit, grudgingly, that I cannot prove the material reality of that wall behind me. However, I invite anyone who doubts this assertion to try walking through the wall during the next break. Therefore, I will cling to the common-sense view that this distinction between science and religion — between reliance on evidence and on faith — is an important one. (As a further complication to this distinction, some religious persons also claim evidence for their beliefs, as witnessed in recent days by thousands of pilgrims who visited a farm in Georgia last week to await a message they said was from the Virgin Mary. One of the pilgrims said he had on other occasions seen both Jesus and God, and that they looked similar, except that God has more white hairs in his beard than does Jesus. But this

religious evidence, unlike that required by science, cannot be reproduced or replicated for a skeptic.)

While I hold to this difficult distinction between evidence and faith — indeed because I make this distinction — I would maintain that the existence of a supernatural God lies outside the realm of scientific inquiry. Science can only address natural forces in the material universe. In our work as scientists, we must assume that what we observe obeys natural laws, and that no supernatural force or being plays tricks with our experiments. Otherwise, interpretation of nature becomes arbitrary. This basic assumption applies to all scientific fields, from nuclear physics and inorganic chemistry to molecular genetics and evolutionary biology. Science therefore is unable to prove, or disprove, the existence of a supernatural God. Thus, while science is based on evidence and religion depends on faith, the two can coexist compatibly in our lives precisely because of their essential difference.

Yet despite the compatibility of science and religion at some level, science places constraints on what a religious person can believe about God, if that person also accepts a scientific world view. Let me emphasize that I don't mean that science is infallible. Scientific claims are always liable to revision as new evidence, and even new ideas, emerge. Nonetheless, those of us who accept the validity of the scientific enterprise assume that science tends to converge toward some objective truth, even if convergence sometimes involves taking a step back before seeing the way to move two steps forward. Despite this inherent uncertainty of science, those who accept both science and religion as two sources of truth generally allow their understanding of science to constrain their personal vision of God the Creator.

For example, if a religious person accepts the scientific evidence that the earth is several billion years old, and that all organisms including humans have evolved from a common ancestor, then that person must also accept the view that God the Creator was extremely subtle in his actions, much more so than indicated by a literal interpretation of Genesis or the creation stories of most other religions. Within these scientific bounds, and recognizing the inability of science to answer questions about the supernatural, one might still imagine very different reasons for God's subtle creativity. Perhaps God is playful and has allowed all nature the freedom to follow a path that is unknown even to him; or perhaps God is willful and directed the laws of natural creation so that they would lead to some ultimate purpose. But it would be in striking conflict with the scientific evidence to suggest that God the Creator took such direct actions as the creation stories would have us believe, if we read them as the literal truth.

Thus, one view of the relationship between science and religion is this: Science can say something about what God the Creator has done to bring about creation. This view is certainly not a new one. Over the centuries, and continuing to the present, many scientists have justified their studies on the ground that they are seeking the truth about the universe in which we live, one that God created and gave us the powers to explore. What better way to understand and even worship God than to investigate and understand his creation? The view that science gives insight into God's creation, and by extension into God, seems to me entirely sensible, provided that one believes in the existence of God the Creator.

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I now want to suggest a slightly different view of the relationship between science and religion. It is an evolutionary view of their relationship within our culture that I personally find both plausible

and liberating, in contrast to the scientific constraints that are placed on religious belief according to the previous view. As I explain this view, it should be apparent that there is an important shift in what I mean by religion from the way that I have used it previously, a shift from an emphasis on God the Creator to an emphasis on human morality. Importantly, this shift neither confirms nor denies the existence of God; instead, this view simply accepts the scientific impossibility of settling that issue.

While I am not a historian or a theologian, I think the case can be made that many religions have historically (and probably prehistorically) been conflicted between two distinct functions. On the one hand, religions have often sought to provide explanations about the natural world — how it came into being, and especially our own place in the world. The stories from Genesis of the creation in six days, and of the tower of Babel leading to different languages, are two familiar examples. On the other hand, religions have also sought to direct actions by explaining which behaviors were morally acceptable and which were not, and often prescribing rewards and punishments (in this life or beyond) to encourage moral behavior. The ten commandments and the parables of Jesus are examples in which religion gives moral direction. Thus, many religions, in an intellectual sense, have served two masters — understanding our place in nature and giving moral guidance.

But these two functions of religion sometimes come into conflict with one another, especially with the emergence of science as another way of explaining the natural world. This conflict has run both ways, with religious groups sometimes challenging scientific findings as heretical, and scientists (or individuals who usurped science) sometimes suggesting that their knowledge gave them special authority over issues of morality. As examples of the former, consider the trial and imprisonment of Galileo by the church for stating that the earth revolved around the sun; and the effort today of some fundamentalist groups to impose their creationist beliefs on the science curriculum in public schools. As examples of the latter, industrialists of the Victorian era sought to use Darwin's principle of natural selection to justify their exploitation of the poor and weak; and Nazis borrowed pseudoscientific theories of racial differences as a supposed rationale for the irrational genocide of the Holocaust.

By viewing science and religion as two descendants of ancient religion, we can take comfort from the fact that these two interwoven realms of ancient religion — explanation of the natural world, and moral direction — continue to be present in our lives today. Moreover, by separating these two realms of understanding, each is freed from the binding constraints of the other. No longer must science be squeezed through the filter of any religious doctrine; and no longer must religion depend on justification in the natural world, which is often ruthless and unforgiving of mistakes.

Let me make it clear that I don't believe these two realms must be kept absolutely separate. For example, we may use scientific data to inform the ethical course of action in medical practice. So, too, we need scientific information about our impact on nature to weigh moral consequences of alternative behaviors with respect to the health of our planet and all its inhabitants. And religious persons may wish to integrate a scientific understanding of the natural world into their religious framework in order to promote morality that is maximally consistent with a wholesome future, as exemplified by Dr. Hefner. By the same token, scientists ought not ignore the moral implications of their work, for example, with regard to methods of warfare or the impact of their discoveries on the environment. Moreover, scientists may investigate the evolutionary origins of certain moral and religious beliefs, such as prohibitions against incest or dietary laws. And scientists may take

spiritual pleasure in expanding our knowledge of the universe, whether to satisfy human curiosity or to promote a wholesome future by informing decisions within a moral framework.

But my important point is this: Our understanding of the material world no longer depends on its agreement with any religious faith. At the same time, our moral dimension has the freedom to develop, perhaps enlightened by — but without fear of contradiction by — the natural world.

Conclusion

My discomfort with Dr. Hefner's theological theory boils down to this: He weaves science and religion together so tightly as to blur the boundary between them, at least in my own reading. In a sense, he uses scientific evidence to support his religious faith; he uses what is known to support the unknowable. But this could be a hazardous enterprise. I think the same facts of evolution — with the perpetual struggle for existence and genetic rewards for selfishness — could just as easily be used to support a religion that both Dr. Hefner and I would find repugnant.

So I respect Dr. Hefner's faith, and I admire his inclusive religious tone, even as he holds fast to the tenets of his faith. And I applaud his use of science and religion together to promote a more wholesome future for our species and our planet. But I cannot endorse his theological theory of the created co-creator, just as I could not endorse any theological theory that seeks scientific support for a matter of religious faith. Science depends on internal consistency, whereas religions span an enormous range of mutually incompatible beliefs. Some believe that God is embodied in nature, whereas others believe that God exists outside the material universe. Some believe that morality evolved from within nature, whereas others believe that morals are transcendent. Some preach tolerance, while others claim divine support for intolerance. Some look forward to life after death, others fear life after death, while still others view this life as the only one we have. Some welcome the idea of an apocalypse, while others hope for generations without end.

Science can never settle these differences in faith. While individual scientists may hold diverse religious beliefs, or none at all, science is a way of knowing about the material universe only. Having evolved into two distinct cultural functions — two different ways of knowing — we can hope that science and religion together promote a wholesome future. Let the dialogue continue between science and religion. *Mais vive la différence.*