

## PRESIDENTIAL ADDRESS

### Evolution and Faith: Complementary or Conflicting Visions?

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When I was considering what I should talk about this afternoon, I wanted to choose a topic where I could make a small, but hopefully significant, contribution. As a Christian, geneticist, and professor of biology, I have thought a lot about this topic, "Evolution and Faith". After settling on this title, I thought to myself, "Why pick such a controversial topic?" But then I remembered the recent article in *Science* magazine reporting that significantly less than half of adults in the United States accept the idea of evolution, and that the number is declining. And this is in the face of amazingly compelling evidence for evolution, coming from multiple directions, including the Human Genome Project. While South Dakota is too far north to be considered part of the "Bible belt", if you have ever taught evolution to a class of South Dakota college students, or read the *Argus Leader* recently, you know that we fit the trend of rejecting the Theory of Evolution pretty well. In fact, we are probably close to the leading edge. I would say that South Dakota is the "Bible necklace". So, what better place to have this conversation than the South Dakota Academy of Science?

Less than a year ago, Jon Miller, Eugenie Scott, and Shinji Okamoto published their study of the public acceptance of evolution in *Science* magazine. They compared surveys taken in 34 countries over several years. American adults were asked whether the statement, "Human beings, as we know them, developed from earlier species of animals", is true, false, or whether the respondent is not sure or does not know. In 1985, 45% of Americans considered this statement true, 7% weren't sure, and 48% considered the statement false. In 2005, the responses were 40% true, 21% not sure, and 39% false. So, over 20 years, those accepting human evolution declined from 45 to 40%, those rejecting the idea declined from 48 to 39%, and those not sure increased from 7 to 21%. Americans accepting and rejecting human evolution are now about evenly split, with 21% unsure. Digging deeper, Miller *et al.*, reported that in 1993 and 2003, Americans were asked a similar question, but were given more response choices: "definitely true, probably true, probably false, definitely false", or not sure or don't know. About a third thought human evolution was definitely false, 14% thought human evolution was definitely true, and combining the other responses, about 55% had varying levels of uncertainty about evolution.

It is interesting to speculate on why the numbers sure of their answers have declined on both sides, while those unsure have increased dramatically. In the last 20 years, proponents of creationism, and more recently Intelligent Design, have been very actively fighting the idea of evolution. Concurrently, the evidence for evolution has improved, with key transitional forms in the fossil record being described, and DNA sequence analysis providing compelling evidence for common descent. So, maybe Americans are just confused by the conflicting stories? A more sobering possibility is that Americans don't have the science background to form an educated opinion (as was well documented by Bob Tatina in his presidential address two years ago), or in our frantic and entertainment-saturated culture, we don't take the time to think about such an important issue, or don't care.

Looking at the simpler question about human evolution with just three answers, they also found that among people surveyed in 34 countries, including Europe, Japan, and the United States, the U.S. had the lowest level of public acceptance of evolution except for Turkey. They gave this explanation:

“the structure and beliefs of American fundamentalism historically differ from those of mainstream Protestantism in both the United States and Europe. The biblical literalist focus of fundamentalism in the United States sees Genesis as a true and accurate account of the creation of human life that supersedes any scientific finding or interpretation. In contrast, mainstream Protestant faiths in Europe (and their U.S. counterparts) have viewed Genesis as metaphorical and—like the Catholic Church—have not seen a major contradiction between their faith and the work of Darwin and other scientists.”

To test their hypothesis that religion was having an effect on Americans' view of evolution, they created a model to predict attitude toward evolution utilizing 10 independent variables, including religious belief. They found that the effect of fundamentalist religious belief was nearly twice as high in Americans as in Europeans, and that those holding “a strong belief in a personal God and who pray frequently” were significantly less likely to believe in evolution.

So, is it possible for someone who holds a strong belief in a personal God to also believe in evolution? This is an important question for the community of faith, as well as the scientific community. I would hope that all people of faith would want to possess as complete a worldview as possible, one that accurately reflects what we know about the world. I would also hope that those charged with educating students about evolution would want to understand how to most effectively communicate this concept, even if they are not themselves believers in God. As a member of both communities, I would like to address both in the hope of increasing understanding, as well as encouraging productive dialogue on the topic of evolution and faith.

For the community of faith, I would like to summarize why I believe evolution to be the best explanation for our observations of life on this planet, both past and present. There are a number of independent lines of evidence, which

converge to form a very compelling case for evolution. First, let us consider the power of selection on organisms. Natural selection is the selection, or survival and reproduction, of adapted individuals in nature. But there are examples of human selection that we see every day. The cole crops cauliflower, cabbage, Brussels sprouts, broccoli, kale, and kohlrabi are all the same species of plant, which have been selected by humans to emphasize different traits. The numerous breeds of dogs are another example of how selection (by humans) can push organisms in very different directions in the short span of a few hundred years.

Second, biogeography points to evolution. An example of this is life on islands, where species have been found to radiate into different types to exploit different niches. When these very different looking species are closely examined, they are found to be related to one mainland species. The greatest example of this is perhaps seen in Australia, where numerous marsupial forms of mammals are found.

Third, the fossil record shows a clear progression of increasing complexity in life over time on this planet. The deeper (older) layers of fossils contain simpler organisms, and complexity increases with less deep (younger) fossils. For example, the order of appearance is bacteria, invertebrates, fish, amphibians, reptiles, and finally mammals and birds. While there is not a complete record of all evolutionary transitions in the fossils, the trend is clear. When we consider the conditions necessary for fossil formation, it is not surprising that there should be gaps in what was preserved. In recent years, key transitional forms have been discovered, such as mammal-like reptiles, and whale intermediates. Creationists hold that the radioactive dating methods used to date fossils are not accurate. In fact, the assumptions made are reasonable, and radioactive decay is known to occur at exact and reproducible rates. For example, phosphorus-32 is known to have a half-life of 14.3 days. You can measure this in the lab time after time and you will observe that the rate of decay is constant. The estimated age of the earth is 4.5 billion years. Even if the assumptions of radioactive dating were off, and let's say we got an age of 1 billion years, we would still be talking about orders of magnitude between this age and 6,000-10,000 years, the age held to by creationists. Clearly, these two views are irreconcilable.

Fourth, in the field of comparative anatomy, very different mammals are found to have homologous structures. For example, if you examine the forelimbs of humans, cats, whales, and bats, you will find that although these limbs vary greatly in shape and function, they share a common set of bones. This is most easily explained by common ancestry with the different descendants being molded by different selective pressures to suit different conditions. Vestigial structures also point to modifications of ancestral structures over time. Examples include pelvic bones in snakes and cave animals with blind eyes. These creatures have no use for these structures; rather they appear to be "leftovers" from ancestors, which are no longer used and are in the process of being lost.

Fifth, perhaps the greatest evidence for common ancestry among organisms comes from the comparison of gene sequences between species. When we compare the DNA (or the encoded protein) sequences between different organisms, we find that the more closely related according to evolutionary expectations two

species are, the more similar are their DNA sequences. For example, in comparing the human hemoglobin protein sequence with other animals, the rhesus monkey shows 95% identity, the mouse 87%, the chicken 69%, the frog 54%, and the lamprey 14% identity with the human sequence. This is exactly what would be expected if these species shared a common ancestor with humans, and there had been increasing amounts of time from the point of a shared ancestor. If we look at how the genes are organized in the chromosome, we again see evidence of evolution. Among species in the same taxonomic group, there are long stretches of conserved gene order (colinearity) on chromosomes. This is very striking at the Family level, but is also seen at the Class and Phylum levels. For example, in comparing human and cat chromosomes, cat chromosomes contain very long stretches of genes that line up with the gene order of human chromosomes. In fact, most cat chromosomes are composed of stretches of genes that correspond to only one, two, or three human chromosomes. This is the pattern that would be expected if chromosomes from a common ancestor were slowly rearranged over time as new species evolved. Francis Collins, a Christian, physician, geneticist, and Director of the Human Genome Project, recently published a book, *The Language of God*, which is the best book I have read on the relationship of faith and evolution. In his book, Collins points out that not only is the order of genes conserved between related species, but the non-functional repeated sequences between genes also show a pattern of conservation. For example, ancient repetitive elements (AREs) have built up in many genomes as these "jumping genes" have multiplied and repeatedly re-inserted themselves in genomes over time. Comparing the mouse and human genomes, stretches of conserved AREs are also found between the stretches of gene colinearity. In fact, copies that were damaged during the transposition process can be found in the same relative positions in the mouse and human genomes. It is hard to imagine why a Designer would insert damaged genes in exactly the same positions in the genomes of similar species. Collins also points out that humans and chimpanzees share 96% identity at the DNA level, and that our chromosomes are the same except for two chimp chromosomes that appear to have fused end-to-end to form a single chromosome in humans. The patterns of genes, non-functional DNA, and chromosomes all point strongly to a process starting with common ancestry showing genome rearrangement over time as species diverge from each other.

So, what is a Christian to make of all this evidence? I reject the belief held by some creationists that God put the evidence there to test our faith. This conception of the character of God is not consistent with what I know about him. The most straightforward interpretation is that God used an evolutionary process in his work of creation. As Galileo said, "I do not feel obliged to believe that the same God who endowed us with sense, reason, and intellect, had intended for us to forgo their use." We should be careful about interpreting the Genesis creation account as a scientific document and using this interpretation as our lens to understand the natural world. This is what the Church did with Galileo when it punished him for teaching that the earth revolved around the sun, and not vice versa. I contend that it is quite possible to believe in the Creator and Genesis without being a creationist! We should take into account the literary genre of

the Genesis creation narratives. They do not appear to have been intended as a scientific description of how God created, but rather tell us about who God is as creator, and who we are in relation to him. The majority of conservative biblical scholars agree that there is a significant element of symbolism in the Genesis creation accounts. Roy Clouser, in his excellent article, *Genesis on the Origin of the Human Race*, warns against the danger of using the Bible as an encyclopedia in order to find shortcuts to knowledge about the natural world. He states, "The 'encyclopedic assumption' ignores the Bible's own central theme and purpose, and tries to force the text to yield truths about matters which never crossed the minds of its authors." Many scientists who are also Christians subscribe to the idea going back to St. Augustine that God has given us two books of revelation: the book of scripture and the book of nature. If we ever get to the point where we understand both of these books perfectly, there will be no contradiction between them.

Creationism poses several threats to the community of faith. First, it forces young people to choose between faith and scientific evidence. Some, having been told that they have to make this choice, abandon their faith. Thus, those who think they are protecting the faith are actually driving the faithful away. Second, as Paul Rohde, campus pastor of Augustana College shared with me, the converse danger is that "faithful people would abandon their minds, senses, and critical capacity". Another danger of creationism (and Intelligent Design) is to the credibility of faith. A "God of the gaps" theology squeezes God's role in creation into the parts that we do not yet understand. But as scientific knowledge expands, God is relegated to a smaller and smaller place. Collins quotes from St. Augustine in 400 AD, more than a millennium before Darwin:

"In matters that are obscure and far beyond our vision, even in such as we may find treated in Holy Scripture, different interpretations are sometimes possible without prejudice to the faith we have received. In such a case, we should not rush in headlong and so firmly take our stand on one side that, if further progress in the search of truth justly undermines this position, we too fall with it."

Now I would like to turn my attention to the scientific community. It is the zealots on both extremes who are doing the most damage. A prime example is Richard Dawkins, who in his recent bestseller, *The God Delusion*, states "I am not attacking any particular version of God or gods. I am attacking God, all gods, anything and everything supernatural, wherever and whenever they have been or will be invented". In a debate between Dawkins and Collins, published by *Time* magazine in November, 2006, Dawkins stated: "Once you buy into the position of faith, then suddenly you find yourself losing all your natural skepticism and your scientific—really scientific—credibility. I'm sorry to be so blunt." Dawkins extends the *methodological* naturalism that all scientists use in their work to a *philosophical* naturalism that pervades his whole outlook. There is no room for any belief in the supernatural. It is seen as a result of a weak mind, as a delusion, something dangerous to be eradicated from the world.

Scientists who use science or evolution as a weapon in their crusade for atheism not only overstep the boundaries of what science can answer, but also make the dialogue with the public much more difficult. As Lawrence Krauss pointed out recently in *New Scientist*, “Not only is it inappropriate to try to convince people of the validity of scientific theories by first arguing that their deeply held beliefs are silly, it is also clear that the existence of God is a metaphysical question which is, for the most part, outside the domain of science. Now more than ever it is important to understand the limits of science.” Stephen Jay Gould, one of the most articulate explainers of evolution, placed science and religion in what he called “non-overlapping magisteria”. He wrote,

“To say it for all my colleagues and for the umpteenth millionth time... science simply cannot (by its legitimate methods) adjudicate the issue of God’s possible superintendence of nature. We neither affirm nor deny it; we simply can’t comment on it as scientists.”

Gould had little patience for either science or religion infringing on the other’s turf. He continued,

“If some of our crowd have made untoward statements claiming that Darwinism disproves God, then I will find Mrs. McInerney [Gould’s third-grade teacher] and have their knuckles rapped for it (as long as she can equally treat those members of our crowd who have argued that Darwinism must be God’s method of action). Science can work only with naturalistic explanations; it can neither affirm nor deny other types of actors (like God) in other spheres (the moral realm, for example).”

Gould then went on to demonstrate that prominent proponents of evolutionary theory have included both agnostics and devout Christians. He concluded that evolutionary theory is compatible with both conventional religion and atheism. My only difference with Gould here is that I would add that the two spheres are complementary, synergistic, not merely non-overlapping. Returning to the thoughts of Lawrence Krauss, aggressive atheism “pitch[es] misguided evangelicals against the scientific community.... To counter these threats we need to argue compellingly that people of faith are ill served by ignorance, rather than argue that faith and ignorance are synonymous.”

To many observers, the beauty, order, and magnificence of nature point to the Creator. They declare his power and divine nature. As the scriptures say in Psalm 19, “The heavens proclaim the glory of God. The skies display his craftsmanship.” Let’s take the Big Bang as an example. Science can never tell us the Why behind the Big Bang, and so far has not been able to tell us the How. But Genesis 1:3 states “And God said, ‘Let there be light...’ This is the Who, and the rest of the story is the Why. The message of faith is that God’s revelation in scripture provides us with answers to questions that science cannot address, such as “What is our purpose?” “Who is God?” “Who are we?” If nature points us to God’s ordered mind, the scriptures tell us about his heart. The scriptures record

the history of God progressively revealing himself to us over time. This is a type of truth different from what science can provide.

To summarize, if believers could see the two books of God's revelation as complementary rather than conflicting, and if scientists were clearer on the point that science does not, cannot, disprove God, we could start seeing less conflict and confusion and more of an appreciation that these two viewpoints complement each other to give us a more complete picture of the whole of reality. I will conclude with a final thought from Galileo: "scripture teaches us how to go to heaven, [and science] how the heavens go".

## RESOURCES

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