QUESTIONS AND ANSWERS ON EVOLUTION

FROM THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS)

Q: **What is evolution?**

A: Evolution is a broad, well-tested description of how Earth's present-day life forms arose from common ancestors reaching back to the simplest one-celled organisms almost 4 billion years ago. It helps explain both the similarities and the differences in the enormous number of living organisms we see around us.

Evolution occurs in populations when heritable changes are passed from one generation to the next. Genetic variation, whether through random mutations or the gene shuffling that occurs during sexual reproduction, sets the stage for evolutionary change. That change is driven by forces such as natural selection, in which organisms with advantageous traits, such as color variations in insects that cloak some of them from predators, are better enabled to survive and pass their genes on to future generations.

Ultimately, evolution explains both small-scale changes within populations and large-scale changes in which new species diverge from a common ancestor over many generations.

Q: **What is intelligent design (ID)?**

A: Intelligent design consists of two hypothetical claims about the history of the universe and of life: first, that some structures or processes in nature are "irreducibly complex" and could not have originated through small changes over long periods of time; and second, that some structures or processes in nature are expressions of "complex specified information" that can only be the product of an intelligent agent.

Q: **Does intelligent design have a scientific basis?**

A: No. In December 2005, Judge John E. Jones III ruled, in Kitzmiller versus the Dover School District, that intelligent design (ID) is based on religion and not science. "The evidence at trial demonstrates that ID is nothing less than the progeny of creationism," he concluded. Moreover, many scientists have noted that the concept necessarily presupposes that there is an "intelligent designer" outside of nature who, from the beginning or from time to time, inserts design into the world around us. But whether there is an intelligent designer is a matter of religious faith. It is not a scientifically testable question.

Q: **Why not "teach both sides" in science class?**

A: First, presenting non-scientific views in the science classroom is bound to confuse students about what is and isn't science. At a time when U.S. students are expressing reduced enthusiasm for science; Baby Boomer scientists are retiring in growing numbers; and international students are returning home to work, America can ill afford to risk compromising the integrity of its science education. Second, it would be unfair to present students with only one religious viewpoint and not all others. And, it would be unreasonable to ask teachers of science to try to teach religion in science classes.

Q: **Are science and religion in opposition?**

A: No. Science does not take a position on an intelligent designer, which is a matter of religious faith and is not testable from the scientific standpoint. Science and religion ask different questions about the world. Many individual scientists — from Rev. George Coyne, Director of The Vatican Observatory, to Dr. Francis Collins, director of the National Human Genome Research Institute of the U.S. National Institutes of Health — are deeply religious and see no conflict between believing in God and accepting the contemporary theory of evolution. In fact, many religious leaders and scientists alike view scientific investigation and religious faith as complementary components of a well-rounded life.

Q: **Are there "gaps" in our understanding of evolution?**

A: No, not in the sense that ID advocates have suggested. Certainly, there are still many puzzles in biology about the particular pathways of the evolutionary process and how various species are related to one another. But, these puzzles neither invalidate nor challenge Charles Darwin's basic theory of "descent with modification," nor the theory's present form that incorporates and is supported by the genetic sciences. Contemporary evolutionary theory provides the conceptual framework in which these puzzles can be addressed and points toward ways to solve them. As scientists are constantly solving nature's mysteries, today's "irreducible complexity" can quickly becomes tomorrow's clear scientific explanation.

Q: **Don't students have a right to learn about intelligent design?**

A: Absolutely. AAAS and others have proposed that discussions of such concepts as intelligent design might be perfectly appropriate in courses examining world views, philosophy, religion, or current affairs — but not in science classrooms. Presenting non-scientific views together with science could confuse students about the nature of science.

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