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The World As We Find It

by Ron Gutberlet, Jr.

One of the most pervasive features of our world is change. The wood lot on the corner has been replaced with a Wal-Mart. The driveway that you swept last week is covered with leaves again. Yesterday was sunny and warm, but today a cold rain falls. Although we don't really feel it, we know that the Earth rotates on its axis, giving us day and night. And the Earth orbits the sun, causing seasonal changes. The moon orbits Earth, influencing tides. Dynamic Earth processes create oceanic islands, and volcanic eruptions create new landscapes, scoured of life. Earthquakes rearrange cities; huge mountains are formed and then eroded away; glaciers advance and retreat. Our continents, the very ground that we stand on, are in motion. Our entire galaxy is moving through space.

When a single human sperm fertilizes an egg cell, a complex chain of events is set in motion that can result in the formation of a person. That fertilized egg has no head, no heart, no hands, but the information for making these parts is enclosed within the egg. These parts develop as the pregnancy progresses. To ponder these changes is to experience wonder, yet these changes are not rare or closed off from human understanding.

During our lives, some of the people we know and love will die, and new people will be born. Some unhappy people transform their lives through religious experiences, while others find meaning elsewhere. Some people seem to go through many changes without ever knowing true happiness. Each human life is a series of paths chosen or not, and change accompanies each step. The very atoms that make up our bodies are coming and going as we transform energy and matter through the chemistry and physics of life. Even the body of observations, ideas, and opinions that we call human knowledge continues to change: the Earth is flat, no it's not; the Earth is the center of the universe, no it's not; evil spirits cause epilepsy, no they don't... It's difficult to find much in the universe that does not change.

If change is so common, why does the word evolution evoke powerful emotions in many people? Within mainstream science, there is absolutely no debate about whether biological evolution occurs. Why then is evolution viewed as controversial in large segments of society? As an individual making up my own mind about what I think is true, I find no problem with biological evolution: I can find nothing in it that is inconsistent with available evidence, and I find nothing in it that would empty my life of meaning. I like the world just as I find it. In fact, the beauty of our world—sunlight in blowing leaves; rain on my windshield; a kind act from one person to another; the feeling of connection to my wife, family, friends, and to all things ultimately—fills me with such joy and gratitude that I am awed and humbled.

As a teacher and student of biology, I am fascinated by our society's response to biological evolution. I write this essay not to argue or to criticize, but in an attempt to facilitate communication among people who view the world differently. While I summarize a few points here, those who seek more thorough treatments of biological evolution and its implications for society ought to read books by D. Dennett, D. J. Futuyma, U. Goodenough, S. J. Gould, E. J. Larson, M. Pigliucci, M. Ruse, and E. O. Wilson. Many failures of communication derive from the variety of associations that people make with particular words, including especially "evolution" and "creationism". Other impediments to productive communication seem to arise from misconceptions about the role of science in the development of human knowledge.

A productive discussion of evolution often requires an initial exploration of the meanings that the participants ascribe to particular words. When scientists speak of biological evolution, they are referring to genetically based change in populations (and consequently more inclusive lineages) over time. Thus, evolution includes some types of biological change that we can observe and measure during our lives, and some of these changes—pesticide resistance, antibiotic resistance, HIV evolution, modification of plants and animals for our use—have profound implications for decisions

that we make as a society. My experience has been that many people who claim to reject evolution actually have no problem with genetic change within populations and within species. Their disagreement is usually with more pronounced evolutionary changes like speciation—the process through which new species are formed from previously existing species—and the implications of this process for our place in the world.

Not only is the word evolution taken to mean different things by different people, but inaccurate generalizations are sometimes made as well. Some assume that acknowledgment of biological evolution requires an atheistic world-view and leaves humanity with no moral system. Although knowledge acquired through scientific inquiry might be used to justify particular acts or opinions, a biological process itself—natural selection for example—is not good or bad, right or wrong; it just is. Making an argument about how we ought to act given this information is a philosophical rather than a scientific process.

Like evolution, the word creationism is associated with a variety of meanings. Different individuals may associate creationism with a young or old Earth, different degrees of biological change, and a literal or more interpretive reading of the Bible or other religious texts. Common misconceptions about creationists are that they are unintelligent and uneducated. I have been fortunate to know several creationists who I like and admire very much, including students in my introductory biology courses. Some wrote beautiful essays about allopatric speciation and natural selection; they conducted phylogenetic analyses; and they were respectful and friendly when expressing their personal beliefs. They had a calm, quiet strength about them that somehow allowed them to learn all about evolution without assimilating any of its most significant elements into their belief systems. They were hardly the one-dimensional antagonists that some might assume them to be. Another problematic assumption is that any religious person is superstitious, naïve, or poorly educated. Views of science as anti-religion or religion as anti-science are grossly oversimplified at best and are often just wrong; a particularly effective discussion of this point can be found in Chapter

5 of Denying Evolution by Massimo Pigliucci.

Common sense and hopeful analysis also seem to confound understanding of biological evolution. A combination of these approaches may cause many people to think of themselves as apart from nature rather than as a part of nature. Although many people are offended by the suggestion that we are related to chimpanzees and bonobos, they think that I'm ridiculous when I point out that we are also related to worms, grass, and mushrooms. Because common sense is most effective on scales of time and space that we can experience personally, it may be unreasonable to rely on it to draw conclusions about events that span billions of years. My common sense does little to help me understand how I might be related to grass, but more effective avenues of investigation are available.

We are all familiar with hopeful analysis in our personal lives. We sometimes make silly little decisions based on what we hope is true rather than on an objective analysis of evidence; this is the kind of thinking that might, for example, cause you to run out of gas or burn your mouth on a piece of pizza. If used to deny a significant problem, this type of thinking can have very serious consequences. I suggest—and I mean to do so respectfully—that some people may reject evolution in part because they hope that it is not true. Additionally, evolutionary history conflicts directly with some specific religious beliefs. If your religion teaches that the Earth is young, perhaps hope is a factor in your rejection of evidence for an old Earth. Given the pitfalls of common sense and hopeful analysis, how can we know if we are being honest with ourselves when we prefer one explanation to another? And even if self-deception is not a problem, how can we be certain that our evaluation of complex alternatives is accurate?

Science provides a powerful suite of analytical tools that address these very problems. The methods of science are designed to maximize objectivity and to provide empirical tests of alternative explanations. In the practice of science, all explanations are subject to testing followed by tentative acceptance, revision, or rejection. Explanations shown through extensive testing to have the most predictive power and that are most consistent with available

evidence are taken as our best explanations, but are subject to revision or replacement to accommodate new findings. A classic example of this type of scientific progress was the replacement of Newton's theory of gravity with the theory of general relativity. Since 1859, no explanation for the diversity of life on Earth has come close to explaining our myriad biological observations better than Darwin's theory of evolution.

How do we treat the various forms of creationism, then? Well, to put it bluntly, in science we don't. Supernatural explanations cannot be evaluated through scientific inquiry, because they are not testable—they are immune to falsification. For example, there is no way to disprove the notion that the universe and all of our memories were created yesterday. Imagination is the only limit to possible explanations once supernatural explanations are permitted. Importantly too, if science were to use miracles as explanations, there would always be an easy solution when a problem resisted a natural explanation. The result would be chaos: all solutions to a problem could be considered equally likely, providing no basis for decisions about practical matters. The exclusion of supernatural explanations is a defining feature of science, but this does not have to be viewed as anti-religious. Although not all scientists agree, most do not consider science to be the sole arbiter of truth. The diverse questions posed by humanity require the efforts of philosophers, theologians, artists, and others.

What then of disagreements about evolution and creationism? If the discussion is going to continue, it must proceed without benefit of the scientific method; but, knowledge gained through science may still be relevant. For instance, an interesting question to consider is this: if we have a sound natural explanation for the diversity of life, what reasons do we have for preferring a supernatural explanation? We have reached the jumping-off point of individual freedom to choose. Science has provided a solid and fascinating explanation of the processes that generated the great variety of life on Earth. Whether you accept or reject that explanation is entirely up to you.

Outside my window the world continues to change, seemingly

unconcerned with my thoughts and questions. The wind is in the sweet gums, oaks, and pines, and light from the early evening sun is there too. The dance of each leaf is beautiful, but the glittering whole is amazing. I think about connections, and I step outside.

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