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Evolution is a Fact and a Theory

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When non-biologists talk about biological evolution they often confuse two different aspects of the definition. On the one hand there is the question of whether or not modern organisms have evolved from older ancestral organisms or whether modern species are continuing to change over time. On the other hand there are questions about the mechanism of the observed changes... how did evolution occur? Biologists consider the existence of biological evolution to be a *fact*. It can be demonstrated today and the historical evidence for its occurrence in the past is overwhelming. However, biologists readily admit that they are less certain of the exact *mechanism* of evolution; there are several *theories* of the mechanism of evolution. Stephen J. Gould has put this as well as anyone else:

In the American vernacular, "theory" often means "imperfect fact" - part of a hierarchy of confidence running downhill from fact to theory to hypothesis to guess. Thus the power of the creationist argument: evolution is "only" a theory and intense debate now rages about many aspects of the theory. If evolution is worse than a fact, and scientists can't even make up their minds about the theory, then what confidence can we have in it? Indeed, President Reagan echoed this argument before an evangelical group in Dallas when he said (in what I devoutly hope was campaign rhetoric): "Well, it is a theory. It is a scientific theory only, and it has in recent years been challenged in the world of science - that is, not believed in the scientific community to be as infallible as it once was."

Well evolution is a theory. It is also a fact. And facts and theories are different things, not rungs in a hierarchy of increasing certainty. Facts are the world's data. Theories are structures of ideas that explain and interpret facts. Facts don't go away when scientists debate rival theories to explain them. Einstein's theory of gravitation replaced Newton's in this century, but apples didn't suspend themselves in midair, pending the outcome. And humans evolved from ape-like ancestors whether they did so by Darwin's proposed mechanism or by some other yet to be discovered.

Moreover, "fact" doesn't mean "absolute certainty"; there ain't no such animal in an exciting and complex world. The final proofs of logic and mathematics flow deductively from stated premises and achieve certainty only because they are NOT about the empirical world. Evolutionists make no claim for perpetual truth, though creationists often do (and then attack us falsely for a style of argument that they themselves favor). In science "fact" can only mean "confirmed to such a degree that it would be perverse to withhold provisional consent." I suppose that apples might start to rise tomorrow, but the possibility does not merit equal time in physics classrooms.

Evolutionists have been very clear about this distinction of fact and theory from the very beginning, if only because we have always acknowledged how far we are from completely understanding the mechanisms (theory) by which evolution (fact) occurred. Darwin continually emphasized the difference between his two great and separate accomplishments: establishing the fact of evolution, and proposing a theory - natural selection - to explain the mechanism of evolution.

- Stephen J. Gould, "Evolution as Fact and Theory"; Discover, May 1981

Gould is stating the prevailing view of the scientific community. In other words, the experts on evolution consider it to be a *fact*. This is not an idea that originated with Gould as the following quotations indicate:

Let me try to make crystal clear what is established beyond reasonable doubt, and what needs further study, about evolution. Evolution as a process that has always gone on in the history of the earth can be doubted only by those who are ignorant of the evidence or are resistant to evidence, owing to emotional blocks or to plain bigotry. By contrast, the mechanisms that bring evolution about

certainly need study and clarification. There are no alternatives to evolution as history that can withstand critical examination. Yet we are constantly learning new and important facts about evolutionary mechanisms.

- Theodosius Dobzhansky "Nothing in Biology Makes Sense Except in the Light of Evolution", *American Biology Teacher* vol.35 (March 1973) reprinted in *Evolution versus Creationism*, J. Peter Zetterberg ed., ORYX Press, Phoenix AZ 1983

Also:

It is time for students of the evolutionary process, especially those who have been misquoted and used by the creationists, to state clearly that evolution is a FACT, not theory, and that what is at issue within biology are questions of details of the process and the relative importance of different mechanisms of evolution. It is a FACT that the earth with liquid water, is more than 3.6 billion years old. It is a FACT that cellular life has been around for at least half of that period and that organized multicellular life is at least 800 million years old. It is a FACT that major life forms now on earth were not at all represented in the past. There were no birds or mammals 250 million years ago. It is a FACT that major life forms of the past are no longer living. There used to be dinosaurs and Pithecanthropus, and there are none now. It is a FACT that all living forms come from previous living forms. Therefore, all present forms of life arose from ancestral forms that were different. Birds arose from nonbirds and humans from nonhumans. No person who pretends to any understanding of the natural world can deny these facts any more than she or he can deny that the earth is round, rotates on its axis, and revolves around the sun.

The controversies about evolution lie in the realm of the relative importance of various forces in molding evolution.

- R. C. Lewontin "Evolution/Creation Debate: A Time for Truth" *Bioscience* 31, 559 (1981) reprinted in *Evolution versus Creationism*, op cit.

This concept is also explained in introductory biology books that are used in colleges and universities (and in some of the better high schools). For example, in some of the best such textbooks we find:

Today, nearly all biologists acknowledge that evolution is a fact. The term THEORY is no longer appropriate except when referring to the various models that attempt to explain HOW life evolves... it is important to understand that the current questions about how life evolves in no way implies any disagreement over the fact of evolution.

- Neil A. Campbell, *Biology* 2nd ed., 1990, Benjamin/Cummings, p.434

Also:

Since Darwin's time, massive additional evidence has accumulated supporting the fact of evolution - that all living organisms present on earth today have arisen from earlier forms in the course of earth's long history. Indeed, all of modern biology is an affirmation of this relatedness of the many species of living things and of their gradual divergence from one another over the course of time. Since the publication of *The Origin of Species*, the important question, scientifically speaking, about evolution has not been whether it has taken place. That is no longer an issue among the vast majority of modern biologists. Today, the central and still fascinating questions for biologists concern the mechanisms by which evolution occurs.

- Helena Curtis and N. Sue Barnes, *Biology* 5th ed. 1989, Worth Publishers, p.972

One of the best introductory books on evolution (as opposed to introductory biology) is that by Douglas J. Futuyma, and he makes the following comment:

A few words need to be said about the "theory of evolution," which most people take to mean the proposition that organisms have evolved from common ancestors. In everyday speech, "theory" often means a hypothesis or even a mere speculation. But in science, "theory" means "a statement of what are held to be the general laws, principles, or causes of something known or observed", as the Oxford English Dictionary defines it. The theory of evolution is a body of interconnected statements about natural selection and the other processes that are thought to cause evolution, just as the atomic theory of chemistry and the Newtonian theory of mechanics are bodies of statements that describe causes of chemical and physical phenomena. In contrast, the statement that organisms have descended with modifications from common ancestors - the historical reality of evolution - is not a theory. It is a fact, as fully as the fact of the earth's revolution about the sun. Like the heliocentric solar system, evolution began as a hypothesis, and achieved "facthood" as the evidence in its favor became so

strong that no knowledgeable and unbiased person could deny its reality. No biologist today would think of submitting a paper entitled "New evidence for evolution"; it simply has not been an issue for a century.

- Douglas J. Futuyma, op. cit., p.15

There are readers of these newsgroups who reject evolution for religious reasons. In general these readers oppose both the *fact* of evolution and *theories* of mechanisms, although some anti-evolutionists have come to realize that there is a difference between the two concepts. That is why we see some leading anti-evolutionists admitting to the fact of "microevolution" - they know that evolution can be demonstrated. These readers will not be convinced of the "facthood" of (macro)evolution by any logical argument and it is a waste of time to make the attempt. The best that we can hope for is that they understand the argument that they oppose. Even this simple hope is rarely fulfilled.

There are some readers who are not anti-evolutionist but still claim that evolution is "only" a theory which can't be proven. This group needs to distinguish between the fact that evolution occurs and the theory of the mechanism of evolution.

We also need to distinguish between facts that are easy to demonstrate and those that are more circumstantial. Examples of evolution that are readily apparent include the fact that modern populations are evolving and the fact that two closely related species share a common ancestor. The evidence that *Homo sapiens* and chimpanzees share a recent common ancestor falls into this category. There is so much evidence in support of this aspect of primate evolution that it qualifies as a fact by any common definition of the word "fact".

In other cases the available evidence is less strong. For example, the relationships of some of the major phyla are still being worked out. Also, the statement that all organisms have descended from a single common ancestor is strongly supported by the available evidence, and there is no opposing evidence. However, it is not yet appropriate to call this a "fact" since there are reasonable alternatives.

Finally, there is an epistemological argument against evolution as fact. Some readers of these newsgroups point out that nothing in science can ever be "proven" and this includes evolution. According to this argument, the probability that evolution is the correct explanation of life as we know it may approach 99.9999...9% but it will never be 100%. Thus evolution cannot be a fact. This kind of argument might be appropriate in a philosophy class (it is essentially correct) but it won't do in the real world. A "fact", as Stephen J. Gould pointed out (see above), means something that is so highly probable that it would be silly not to accept it. This point has also been made by others who contest the nit-picking epistemologists.

The honest scientist, like the philosopher, will tell you that nothing whatever can be or has been proved with fully 100% certainty, not even that you or I exist, nor anyone except himself, since he might be dreaming the whole thing. Thus there is no sharp line between speculation, hypothesis, theory, principle, and fact, but only a difference along a sliding scale, in the degree of probability of the idea. When we say a thing is a fact, then, we only mean that its probability is an extremely high one: so high that we are not bothered by doubt about it and are ready to act accordingly. Now in this use of the term fact, the only proper one, evolution is a fact. For the evidence in favor of it is as voluminous, diverse, and convincing as in the case of any other well established fact of science concerning the existence of things that cannot be directly seen, such as atoms, neutrons, or solar gravitation

So enormous, ramifying, and consistent has the evidence for evolution become that if anyone could now disprove it, I should have my conception of the orderliness of the universe so shaken as to lead me to doubt even my own existence. If you like, then, I will grant you that in an absolute sense evolution is not a fact, or rather, that it is no more a fact than that you are hearing or reading these words.

- H. J. Muller, "One Hundred Years Without Darwin Are Enough" School Science and Mathematics 59, 304-305. (1959) reprinted in *Evolution versus Creationism* op cit.

In any meaningful sense evolution is a fact, but there are various theories concerning the mechanism of evolution.

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