

Suggested research questions on evolution for Biology 11/12.
by David Buckna

Michigan State physiology professor Robert S. Root-Bernstein wrote regarding his introductory course on evolution: "I encourage [students] to be skeptical, as long as their skepticism is based on logic and evidence. . . . Questions are what drives science, not answers. . . . Take nothing for granted, I counsel my students: that is what makes a scientist" ("Darwin's Rib," in *Discover*, September 1995, pp. 38-41).

Taking a cue from professor Root-Bernstein that "questions are what drives science, not answers," what follows is a partial list of questions that could be used to critically examine and evaluate evolutionary theory. These questions would make good classroom discussions, initiated by either teacher or student, or good student research assignments.

1. On page one of "The Blind Watchmaker" Richard Dawkins states: "Biology is the study of complicated things that give the appearance of having been designed for a purpose". If living things look designed--if the empirical evidence suggests purpose--then how does Dawkins know they weren't designed? What is Dawkins' criteria for "apparent" design?
2. Are scientists able to determine the specific evolutionary process that accounted for the complex arrangement of inanimate matter into a life form that grows, metabolizes, reacts to stimuli, and reproduces? (the four criteria for biological life)
3. Give one example of an evolutionary process or mechanism which can be seen to create new functional information at the genetic level. Give one reference for any study that has shown that duplicated genes acquired different functions during an experiment or series of experiments.
4. Computer programmers utilize complex codes to create software. The genetic code, which is more sophisticated, controls the physical processes of life and is accompanied by elaborate transmission and duplication systems. How does evolution, using natural processes and chance, solve the problem of complex information sequencing without intelligence?
5. Evolutionists believe the Cambrian explosion of new life began about 525-550 million years ago. Stephen Jay Gould writes: ". . . an elegant study, published in 1993, clearly restricts this period of phyletic flowering to a mere five million years." (*Scientific American*, October 1994, p. 89.) What is the approximate number of beneficial mutations which must have occurred per year during this 5-million-year period, given that billions x billions of information bits would have to be encoded? What percentage of mutations in multicellular organisms have been recognized as beneficial? List any you find.
6. Within the field of biogenesis studies, there are a number of models which posit that the early, prebiotic earth must have had a reducing atmosphere (without oxygen or ozone). How could life begin to evolve without ozone to protect the earliest life forms from harmful UV radiation?
7. Both "left-handed" and "right-handed" amino acids occur naturally. Life forms contain proteins consisting principally of "left-handed" amino acids. Assuming a simple protein molecule of 172 amino acids, what is the mathematical probability that all 172 amino acids would be "left-handed"?
8. Megatons of amino acids would be required to reach the necessary concentrations for protein synthesis in a vast primordial ocean. Puddles and ponds have a limited duration. Does evolution address this problem?
9. Molecular biologist Michael Denton (Senior Research Fellow, University of Otago in New Zealand) in his book, *Evolution: A Theory in Crisis*, states there is not a trace of evidence on the molecular level for the traditional evolutionary series. Other molecular biologists agree/disagree with his conclusion. Why?
10. How does evolution explain the emergence and development of sexual reproduction given that both male and female physiology would have to mutate simultaneously?
11. True or False? Life appears abruptly and in complex forms in the fossil record and gaps appear systematically between various living kinds.
12. Document from the fossil record the transitional forms leading up to the first fish, from their assumed invertebrate ancestors.
13. Jellyfish consist entirely of soft body tissues. How do evolutionists explain the existence of jellyfish fossils, in view of their argument that soft body tissues of missing intermediate forms did not fossilize?
14. The coelacanth fish was thought to be extinct for 70 million years, until one was caught off the coast of Madagascar in 1938. How do evolutionary biologists evaluate the discovery?
15. Describe one undisputed example of a creature that was transitional between fish and amphibian.
16. There are innumerable evolutionary enigmas, such as eyes, bat radar, and pterodactyl wings. In each case, all the component parts would have to evolve simultaneously in order to function properly. Discuss three other structures which defy evolutionary explanation.

17. Describe one insect that was transitional between a non-flying insect and a flying insect.
18. During the Industrial Revolution, dark-colored peppered moths appeared in larger numbers during environmental changes. Did a new species emerge, or did it already preexist? Is this macroevolution?
19. "Bird-like" dinosaurs such as *Struthiomimus* were "lizard-hipped," while dinosaurs such as the low-slung, four-legged *Ankylosaurus* were "bird-hipped." How do paleontologists who believe dinosaurs evolved into birds, account for these characteristics?
20. Is it possible to document from the fossil record the series of transitional forms that led up to any dinosaur species?
21. (a) Were the feathers of *Archaeopteryx* identical to modern flying birds? (b) Are there any undisputed true birds in the fossil record that had teeth? (c) *Archaeopteryx* had claws on its wings. Name three modern birds that have claws on their wings (either in the juvenile stage or as an adult).
22. Evolution teaches that mammals evolved from reptiles. All mammals have three bones in the ear (and the Organ of Corti) and a single bone on each side of the lower jaw. All reptiles have a single bone in the ear and on average six bones on each side of the lower jaw. Speculate how intermediate forms could have managed to hear and chew, while the necessary restructuring was taking place and the Organ of Corti was being developed.
23. Has any creature been identified as a direct ancestor of primates? Has any creature been identified as the common ancestor of man and apes? Explain your answers.
24. Evolutionist Dr. Charles Oxnard (Professor of Anatomy and Human Biology, University of Western Australia) completed the most sophisticated computer analysis of australopithecine fossils ever undertaken, and concluded that they have nothing to do with the ancestry of man whatsoever and are simply an extinct form of ape (see Oxnard's *The Order of Man*, Yale University Press, 1984). How have paleoanthropologists responded to his conclusions?
25. Stern and Susman write in the *American Journal of Physical Anthropology* 60:279-313 (1983) that the hands and feet of *Australopithecus afarensis* are not at all like human hands and feet; rather, they have the long, curved fingers and toes typical of arboreal primates. How, then, do some insist that the footprints Mary Leakey uncovered in strata (dated at 3.5 million years old) in Laetoli were made by *Australopithecus afarensis*, though these prints are indistinguishable from modern man? (Tuttle, *Natural History*, 64)
26. Nebraska Man (based solely on a fossil tooth) became a significant image in America during the time of the Scopes trial (1925); later, scientists discovered the tooth came from a pig. A report in *Nature* (August 17, 1995) states that analysis of an incomplete shin bone from a creature dubbed *Australopithecus anamensis* suggests it walked upright "between 3.9 and 4.2 million years ago." How should we treat discoveries which have not yet faced the rigors of scientific validation?
27. In 1982, Dr. Lyall Watson stated: "The fossils that decorate our family tree are so scarce that there are still more scientists than specimens. The remarkable fact is that all the physical evidence we have for human evolution can still be placed, with room to spare, inside a single coffin!" (*Science Digest*, vol. 90, May '82, p. 44.) Is Watson's statement still valid today?
28. In his book, *Darwin's Black Box: The Biochemical Challenge to Evolution*, Dr. Michael Behe defines an "irreducibly complex" system as a single system composed of several interacting parts that contribute to the basic function, and where removal of any one part causes the system to effectively cease functioning. Give an example of a system (living or non-living) that could be considered "irreducibly complex," and explain why.
29. In his 1981 address to the geology staff at the Field Museum of Natural History in Chicago, Dr. Colin Patterson (Senior Paleontologist, British Museum of Natural History) asked: "Can you tell me anything you *know* about evolution? Any one thing? Any one thing that is true?" The answer he got was silence. Can you state any one thing about evolution you know to be true?
30. If "yes", How do you know it's true?

Teaching Evolution - Is There a Better Way?

by
Ian Taylor

engravings showing the parallel developments of the fish, the salamander, the tortoise, the chick, the rabbit and the human appears in most biology textbooks to this day. It is sometimes claimed that in its early stages the human has gills like a fish and a heart like a frog and is a popular argument to justify abortion, however, embryologists point out that the pharyngeal arches and clefts found in many developing embryos have nothing whatsoever to do with gills. Embryonic development is said to be evidence for the common ancestor yet even the 15th ed. of the *Encyclopedia Britannica*, 2:221 says: "[it] was influential ...but has been of little significance in elucidating either evolution or embryonic growth." Haeckel had taken liberties in three directions: he selected only those creatures who came closest to fitting his theory i.e. their embryos looked vaguely similar; he distorted his drawings to make them appear more alike than they really are and he completely omitted the earliest embryonic stages that look noticeably different. For example, he had made the eye of the dog twice as large to match that of the human and doubled the length of the lower vertebrae of the human to match the tail of the dog. As bad as this was, a further scandal came to light in 1997. Professor Michael Richardson published a paper containing a series of photographs showing that the early embryonic stages of the fish, the salamander, the tortoise etc. i.e. the top horizontal array of embryos, were not at all the look-alike embryos Haeckel had drawn. *New Scientist* (Sept.6, 1997) declared this news as "Embryonic Fraud Lives On." But, the establishment had clearly been rattled because, incredibly, Richardson issued a letter five months later in *Science* (May, 1998) to say that "the principle underlying Haeckel's drawings does not negate Darwinian evolution ..."

William Ballard. *Bioscience* 1976, 26:36; Michael Richardson(7 authors). *Anatomy & Embryology*. 1997, 196:91; Elizabeth Pennisi. *Science* 1997, 277:1435;

8. A Proposal. Although unstated, traditional teaching assumes a progressive increase of genetic information as molecule becomes man. The evidences offered by textbooks in support of this progression and discussed here can hardly be considered convincing while other evidences such as the origin of life experiments or the evolution of the horse are equally as dubious. Students familiar with the Internet are becoming aware of these deficiencies and, if not confused, are left skeptical. A suggested alternative is to consider a progressive decrease of genetic information. The fossil evidence supports it: Life, much the same as it is today, began suddenly in the Cambrian era and has adapted, degenerated or become extinct. Adaptation can occur quickly permitting considerable variation within the limits of the species but loss of genetic information is a known continuing process (e.g. telemers); this eventually leads to intersterility within the species but it is not speciation. The horse and the donkey, tiger and lion, sheep and goat or camel and llama were likely single species but with domestication or isolation have become intersterile. Alternatively, the wolf, fennec, fox, coyote, colishes, jackal and domestic dog are all interfertile thus have not speciated even though they have been given separate species names. It would be an instructive and insightful exercise to ask students to consider or to list actual evidences that support either progressive acquisition or progressive loss of genetic information.

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1. Today's public school textbooks on Biology, Earth sciences, and Human society generally well-present the facts; it is the interpretation of those facts that is currently under fire and is being openly questioned. Without exception, that interpretation is from the evolutionary perspective and serves to colour the very words that are used in the text. Textbooks on Human anthropology are notoriously bad in this respect. However, this presentation is concerned especially with the slim chapter present in virtually every Biology textbook and usually titled "The Evidences for Evolution." The subtitles in these notes will be recognizable in most Biology textbooks.

2. **Fossils & the Geologic Column.** The text tells the student that fossils of simple life forms are found in the lowest strata of sedimentary rock (the Cambrian) then they become more complex as the strata become more recent. Usually, there is a diagram with illustrations of sea-bed life forms at the bottom then in rising order: fishes, amphibians, reptiles, mammals and man at the top. Textbooks may intend this hypothetical diagram, the geologic column, simply to indicate the life forms typical of each era of earth's history but the reader would naturally perceive this to be the evidence that those life forms did indeed develop in this order. This circular projection is then reinforced when the textbooks also claim this fossil order to be the most powerful evidence for evolution. Historically, it was assumed that life evolved from simple to complex, selected fossil evidence seemed to confirm this, but more often than not the fish, the amphibian, reptile etc were out of order or missing. In recognition of this, more than 150 years ago, geologists began using "index fossils," a series of marine arthropods, crustaceans, brachiopods, molluscs etc all of which are very small but their order was more consistent and, again, this was their assumed order of appearance; many of them still exist today. It is the index fossils that are used to identify the strata. The dating of the strata was initially based upon an assumed rate of deposition of sediment resulting in millions of years for massive beds; claims that radiometric methods confirm these ages are regarded as secondary evidence by geologists. It is now openly admitted that naming and dating rocks by fossils and the fossils by the rocks is mere circular reasoning based upon the assumptions that life appeared in the sequence, simple to complex and the assumed of rates of deposition. When index fossils are found out of order, geologists speak of the strata as an "unconformity" i.e. it does not conform to the theory. In the last decade or so it has been admitted that representatives of every phylum are found fully formed at the Cambrian level (the "Cambrian Explosion") followed by degradation and extinction indicating "bottom-up" regression not Darwinian progression.

David. Kitts. *Evolution*, 1974, 28:467; Niles Eldredge. *Time Frames*, 1985, p.52; Tom Kemp. *New Scientist*, 1985, 108:67; R.H.Rastal. *Encyclopedia Britannica 15th ed.* 10:168; R. Dawkins. *The Blind Watchmaker*, 1987, p.229; Mark McMenamin. *Palaeos*, 1990, 5:1

3. **Homology.** The bones of the forelimbs of the bat, the horse, and the human are shown to emphasise their similarity. Darwin called such organs homologous and explained that they had resulted from common ancestry or descent. The definition of homology is given as similar structures that result from common ancestry but first it must be decided that there was a common ancestor. For example, the octopus eye and the human eye are very similar yet these are not regarded as homologous because the octopus and the human are not believed to have a common ancestor. But having decided that two similar-looking limbs are homologous, it is then argued that this similarity proves their common ancestry! This is nothing more than circular reasoning. Darwin lamented that the absence of intermediate fossils was the weakest part of his theory and this is still echoed by senior paleontologists today. The fossil record shows no sign of gradual change as fin changes to leg or limb to wing and in any case such transition creatures would quickly be excluded since, a partially formed wing, would render the creature less fit to survive. Yet, textbooks repeatedly claim that, "more and more missing links have been found" while the *Archaeopteryx* is the example always cited. This is the alleged transition between the dinosaur and the bird. It was controversial when discovered in 1861, is still the subject of controversy and not accepted as a transition by every paleontologist. Claims for more recent discoveries of *Archaeopteryx* are found to be nothing more than existing museum specimens re-classified as *Archaeopteryx*. Every alleged ape-to-man fossil has been wreathed in controversy, nevertheless, they invariably serve as textbook examples for a decade or two until others quietly take their place.

Gail Vines. *New Scientist*, 1985, 105:3; G. P. Wagner. *Annual Review of Ecology & Systematics*, 1989, p.51;

4. **Vestigial Organs.** The so-called vestigial organs are cited as evidence for the "common ancestor," and either the boa constrictor's or the whale's "legs" are given as examples. Two very small bones found half-way along the vertebrate are said to be homologous to the hip bones of other vertebrates. The explanation is actually a tautology based upon the assumption that whales and snakes evolved from four-legged ancestors; this is then offered as evidence that this did in fact occur. In the nineteenth century it was claimed that human beings had 180 vestigial organs but these have quietly disappeared as medical knowledge has advanced. Today, some textbooks will only offer the human "tail," sometimes found in the newly-born as evidence but medical science knows this is a caudal appendage having no relationship whatsoever to the vertebrae.

D. R. Scadding. *Evolutionary Theory*, 1981, 5:173; Steven Stanley. *Earth & Life Through Time* (Textbook), 1989, p.138; J. K. Rijdsbosch. *The Netherlands Journal of Surgery*, 1960, 12:211;

6. **The Peppered Moths.** In 1959 Bernard Kettlewell published his work on the peppered moth as the "consummation and confirmation" of evolution. His work, and the famous photograph of the black and white forms of this moth on the lichen-covered trunk of a tree, have appeared in virtually every biology textbook as definitive evidence of evolution. The story began in England at the time of the Industrial Revolution where it was noted that as the tree trunks became blacked by industrial soot, the white form of the moth, *Biston betularia*, declined in numbers

while the black form proliferated. Later in this century, when anti-pollution laws were introduced, the tree trunks became white and the moth population shifted back from predominately black to white. Kettlewell believed that the birds ate those moths that could easily be seen as they rested on the tree trunk. This shift in population was real but to this day no one really knows the mechanism. As early as 1975 doubts were expressed in Kettlewell's explanation because it was known that there were major problems but nothing was said in the textbooks. In 1998 Michael Majerus published a scholarly work titled *Melanism: Evolution in Action* in which these problems were spelled out. The birds were not the principal predator since they fly during the day when the moths are well hidden and researchers do not know where they hide. The moths do not rest on tree trunks but the famous photograph of the black and white varieties was produced by gluing dead specimens to a tree trunk. The same population shift has occurred in an identical population of moths in Michigan where there had been no industrial pollution and Kettlewell's work is now highly suspect. Kettlewell and other workers since have simply observed a shift in population. When insecticides such as DDT were developed it was recognized that, say, 99% of the insect population was affected. This was seen to be commercially viable and, although at first successful, like the peppered moths, that resistant 1% has now become dominant. This is simply natural selection but is not speciation.

Theo. Sargent et al. *Evolutionary Biology*, 1998, 30:299ff.;

Larry Witham. *The Washington Times* (National Weekly ed.) Jan. 25, 1999, p.28.

5. **Darwin's finches** (*Geospiza*). There are 13 varieties of this bird found on the Galapagos Islands. Textbooks today still claim these finches were the source of Darwin's inspiration, however this was a legend introduced by Percy Lowe in 1936 and exposed in the 1982. The finches probably did originate from one mating pair blown from the mainland while adaptation to the environment has caused slight changes in the size and shape of the beak. Darwin called this "Natural Selection" and initially (1859) claimed it was the mechanism that produced new species. Later, he conceded that natural selection was only part of the mechanism for evolution. The facts have been established by Peter and Rosemary Grant who observed natural selection produce larger beaks in one drought season but also smaller beaks in one wet season. There is little evidence of speciation since it was observed that most of these finches hybridize with fertile offspring resulting in what is known as oscillating divergence and convergence of the population. Darwin experimented with pigeons and it was evident to him that there is far greater variation among pigeons than among the finches and no one claims that the pigeons have speciated.

Frank Sulloway. *Journal of the History of Biology*, 1982, 15:1-53;

Peter & Rosemary Grant. *Proc. Roy. Soc. of London B*, 1993, 251:111 and *Science*, 1992, 256:193; Charles Darwin. *On the Origin of Species*, 1859, Chap. 1.

7. **Embryology.** Here it is claimed that during embryonic development the embryo passes through many of the prior evolutionary stages thus by circular reasoning this becomes the evidence that evolution has taken place. Promoted by Ernst Haeckel in 1866 as his "Biogenetic Law" or "Recapitulation Theory" and popularised by his phrase "Ontogeny recapitulates Phylogeny," it was condemned in 1874 as fraudulent by Wilhelm His, a noted embryologist. In spite of this, Haeckel's nineteenth century