

## Paleontology and Evolution in the News

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Olivia Judson, in her guest column in the August 13, 2008 issue of the *New York Times* (<http://www.nytimes.com>), “Optimism on Evolution,” writes “When the dog days of summer come to an end, one thing we can be sure of is that the school year that follows will see more fights over teaching of evolution and whether intelligent design, or even Biblical accounts of creation, have a place in America.” She says the way evolution is taught is a travesty. It is treated as an abstract subject that deals with, for example, when “fish flopped on land,” something that was quaint or, worse, optional and largely “an irrelevant part of biology.” She claims that this is also dangerous and that evolution should be central to beginning biology classes for three reasons. “First, it provides a powerful framework for investigating the world we live in.” The astonishing variety of nature is well known by all, provided not only by one’s own “backyard” experience but also through so much on film, either in outdoor adventures or as “nature” films on a number of cable channels. But these often portray the world of animals and plants as merely a collection of facts. Add evolution and a framework is provided that allows one to see “patterns emerge everywhere, and apparently trivial details become interesting.”

“The second reason for teaching evolution is that the subject is immediately relevant here and now.” She sees that the “impact we are having on the planet is causing other organisms to evolve—and fast.” Some are obvious, such as hunting and fishing. Over-fishing of North Atlantic Cod has caused them to mature smaller and younger than

they did 40 years ago and similarly the grayling in Norwegian lakes. “Human trophy hunting for bighorn rams has caused the population to evolve into one of the smaller-horn rams.” But there are also some not-so-obvious changes, such as the widespread resistance to pesticides among insects and the “evolution of drug resistance in the agents of diseases, from malaria to tuberculosis.” Evolution may also occur in animals that were formerly hunted. Guppies, for example, seem to grow more brightly colored scales and mature later when their predators are eliminated. She claims that, “a failure to consider the evolution of other species may result in a failure of our efforts to preserve them.” In short, evolution is far from being a remote and abstract subject. A failure to teach it may leave us unprepared for the challenges ahead. “The third reason to teach evolution is more philosophical. It concerns the development of an attitude toward evidence.” A dismissal of evolution is a symptom of contempt of scientific evidence, or any kind of evidence. So in the classroom where the rejection of evolution is taught and ideology is substituted, the results can have adverse effects on society. “But for me,” the author explains, “the most important thing about studying evolution is something less tangible. It’s that the endeavor contains a profound optimism. It means that when we encounter something in nature that is complicated or mysterious...we don’t have to shrug our shoulders in bewilderment. Instead, we can ask how it got that way.”

On August 16, 2008, the *New York Times* published letters from people who commented on the article above, the overall reaction of which was “finally, a voice of reason.”

Olivia Judson is an evolutionary biologist and writes a blog that sometimes receives hundreds of comments, found in the *New York Times* website.

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Less than two weeks later, another story appeared in the *New York Times* (August 24, 2008), “A Teacher on the Front Line as Faith and Science Clash” by Amy Harmon (<http://www.nytimes.com>). This is a story about David Campbell, who teaches Biology 1 to sophomores in Orange Park, FL, USA. He knew that many of his students were raised to take the biblical creation story as fact and that the students often arrive at the school fearing that evolution, and perhaps science itself, is hostile to their faith. “However, in February, the Florida Department of Education modified its standards to explicitly require, for the first time, the state’s public schools to teach evolution, calling it ‘the organizing principle of life science.’” Here was an opportunity for schools to teach “what has long been the scientific consensus: that all of the diverse life forms on Earth descended from a common ancestor, through a process of mutation and natural selection, over billions of years,” instead of religious versions of natural history. This came about, in part, because of legal rulings against school districts and votes by citizens in favor of evolution. Ms. Harmon, in her article, reported that many of the students tune out, others come with a document downloaded from the internet, “Ten Questions to ask your biology teacher about evolution,” that supposedly highlights the weaknesses in evolutionary theory.

Now, they have to teach evolution, but how to do it? Mr. Campbell who is passionate about evolution also helped to devise the state’s new evolution standards. So, how do you teach students who mistrust evolution and, as a result, “jeopardized their belief in the basic power of science to explain the natural world—and their ability to make sense of it themselves?” He decided to use cartoons of Mickey Mouse, one the skinny type drawn in 1928, one from the 1940, and one more recent. He asked his students how Mickey has changed. The students responded with, “his tail got shorter,” “his eyes got bigger,” “he looks happier.” “Mickey evolved” he said. “And Mickey gets cuter because Walt Disney makes more money that way. That is ‘selection.’” Here, he had the opportunity to state some basic ideas—“that minute changes in organisms drive biological change spontaneously, without direction, and how the struggle for existence among naturally varying individuals has helped generate every species, living or extinct, on the planet.”

Studies show that evolution gets poor treatment in some state education standards, which may reflect widely held creationists’ beliefs. Ms. Harmon reviews some of the problems in various states that have arisen from court decisions. In 2000, Florida was among 12 states that received a grade of F. She also mentions that not only do teachers hear complaints from parents but that in Mr. Campbell’s school, a teacher down the hall teaches a unit called “Evolution or NOT.” That teacher tells her students

that evolution alone “can hardly account for the appearance of wholly different life forms.” She leaves it up to them to draw their own conclusions. But when pressed, she tells them, “I think God did it.” The article describes how Florida came to include evolution in the curriculum. One of the complaints was that alternative explanations for life’s diversity were not included, explanations such as “intelligent design.” Mr. Campbell replied that “we also failed to include astrology, alchemy, and the concept of the moon being made of green cheese, because those aren’t science either.” Back in the classroom Mr. Campbell told his students that he did not expect them to “believe the scientific explanation of evolution....But I do expect you to understand it.” The article continues with descriptions of how he taught various aspects of evolution and how students reacted to it.

The article elicited 342 comments. Associated with the article are graphics: Fading Resistance to Evolution and Evolution and How the States Teach Evolution. There is also a video—Sifting Through Faith and Science and 10 Questions, and Answers about Evolution.

As in several other states, teaching evolution in Georgia has been disputed over many years, a debate over science and religion in public schools. To many, it is incompatible with their religious views about how God created the universe and human beings. “Educators and scientists, however, say it is the basis of biology, which is a gateway course to future studies of life sciences.” Teachers from about 60 Atlanta area high schools attended a two-day workshop at Emory University. A state school superintendent proposed in 2004 that evolution should be removed from state science teaching standards but later changed her position as a result of public pressure. “In 2002, Cobb County school officials put stickers in science textbooks warning that evolution was a “theory, not a fact.” In 2005, a judge ordered them removed because they endorsed a particular religious belief. Laura Diamond wrote about these events in *The Atlanta Journal-Constitution*, October 27, 2008 (<http://www.ajc.com/services/content/metro/stories/2008/10/27/evolution.html>). She described some of the experiences teachers had with students in their school classes. Some students burst into tears when they were told they were going to study evolution. Another teacher said students screamed “no” when the subject was being taught. And others questioned why they had to learn something that was just a theory. Parents fear teachers will tell kids that they cannot have their religious beliefs.

In a provocative article, Nancy Shute, *US News and World Report*, July 24, 2008, asks “Where is Human Evolution Heading?” (<http://www.usnews.com/articles/science/2008/07/24/>) She states that the race’s DNA is changing faster than ever. What does this mean for our descendants? She says, scientists say that “Humans are evolving faster than

ever before, picking up new genetic traits and talents that may help us survive a turbulent future....People who lived 10,000 years ago were much more like Neanderthals than we are like those people.” She reports that scientists are using modern technologies to zero in on just how we have changed. For example, using whole-genome sequencing, their research is helping to illuminate not only how humans became what we are but also where we might be headed. She says that some scientists speculate that changes in human mating patterns may be contributing to the increase in autism and that some people now have enhanced abilities to metabolize sugar and fight disease such as HIV because they are genetically more resistant to HIV virus.

She also reports that until recently, anthropologists thought that human evolution slowed down, but others believe that it has actually accelerated a hundredfold in the past 5,000 to 10,000 years. Much of the increase has been fueled by the growth of the world’s population, which has expanded by a factor of 1,000 over the past 10,000 years. Having more people increases the odds of mutations. John Hawks, a professor of anthropology at the University of Wisconsin is one of the scientists researching these changes. As the population increases, the human genome has been scrambling to adapt to a rapidly changing world—11,000 years ago, nobody farmed or milked domestic animals, and nobody lived in cities. Right now, our genes are playing catch-up against modern scourges—like diabetes. Native Americans and Polynesians, whose cultures only recently adopted European-style diets of refined grains, have the world’s highest rates of diabetes. At the present time there are 46 online comments about the article, some of which are well worth reading.

One of the aspects falsely brought up by individuals who cannot accept evolution is the phony view that the fossil record has not yielded transitional forms showing how one species gave rise to another. An article by John Noble Wilford on October 16, 2008 (<http://www.nytimes.com>) discusses a new study of a 375-million-year-old fish which displays striking evidence of the intermediate steps by which some marine vertebrates evolved into animals that walked on land. The article, “Fish Fossil Yields Anatomical Clues on How Animals of the Sea Made it to Land,” describes the complex changes that had to occur for the transition—in the head and braincase, a mobile neck, “and a bone associated with underwater feeding and gill respiration was diminishing in size, a beginning of the bone’s adaptation for an eventual role in hearing for land animals.” Examination of the fish specimen revealed delicate details of the creature’s head and neck, confirming and elaborating on its evolutionary position as “an important stage in the origin of terrestrial vertebrates.” The fossil species was named scientifically *Tiktaalik roseae*, but it was given a nickname “fishapod” for its

fishlike features combined with limbs similar to those of tetrapods. “Several skeletons of the fish were excavated four years ago on Ellesmere Island, in the Nunavut Territory of Canada, 700 miles above the Arctic Circle. The Devonian rocks containing the fossils indicate that the animal lived in shallow waters of a warm climate. One of the features found in *Tiktaalik* is that it has the beginnings of a mobile neck, a feature that does not exist in fish. Fish do not have necks. Wilford’s article is based on a study published in the journal *Nature*. This discovery received attention in many newspapers including *Canwest News Service* (<http://www.canada.com>), which emphasized how the fossils revealed “how the first creatures managed to walk out of the sea on to land.”

The discovery of the world’s oldest flying insect fossil behind a strip mall in North Attleborough, Massachusetts is described by Colin Nickerson in the October 18, 2008 copy of *The Boston Globe* ([http://boston.com/news/local/breaking\\_news/2008/10/worlds\\_oldest\\_f.html](http://boston.com/news/local/breaking_news/2008/10/worlds_oldest_f.html)). The 310-million-year-old Carboniferous fossil is described as an “exquisitely detailed” specimen that lived in a steamy flood plain. “The fleeting moment in the life of a creature that probably lived no longer than 24 hours was captured for eternity” in mud that hardened into rock. “What has been captured is a moment in time when a flying insect landed with just the perfect amount of pressure in mud possessing just the perfect amount of moisture to capture the imprint....” It is hoped that the specimen will yield critical information not only about the three-inch-long insect’s anatomy but about how it moved and behaved. “The site, whose exact location remains secret, proved to be extraordinarily rich in fossils, including tracks left by amphibians and reptiles that wandered present-day New England tens of millions of years before the emergence of dinosaurs.” One hopes that not too much information of the whereabouts of the locality was given in the article.

Yahoo! News posted a story about paleontologists sifting Utah soil for plant fossils ([http://news.yahoo.com/s/as/20081029/ap\\_on\\_sc/sci\\_plant\\_fossils](http://news.yahoo.com/s/as/20081029/ap_on_sc/sci_plant_fossils)) on October 29, 2008. The material comes from a lot excavated for retail stores. The ancient lower Jurassic flora (about 198 million years old) represents the only plants of this age found in western North America, so far. The specimens include conifers, ferns, and horsetails living near an early Jurassic lake known as Lake Dixie, which once covered part of what is now Southwestern Utah. Every plant identified is new. “Researchers are still trying to understand what happened there after cataclysmic extinctions wiped out scores of plants, reptiles, insects, and amphibians” at the end of the Triassic. Species that returned in the early Jurassic had to have something to eat. The newly discovered plants somehow fit into that puzzle. A number of institutions around the country have requested specimens, including the Smithsonian and the American Museum of natural History.

Ohio University issued a press release on October 16, 2008 which elaborated on the debate among paleontologists about the function of the strange, horny crests on the heads of the duck-billed dinosaurs also known as lambeosaurs, structures that contain very long, convoluted nasal passages that loop up over the tops of their skulls. Using computed tomography scanning, the researchers have looked inside these mysterious crests and reconstructed the brains and nasal cavities of four species. “The shape of the brain can tell us a lot about what senses were important in a dinosaur’s everyday life.” Over the years, the crests have inspired several suggestions for their function: increased surface area of the sensory tissue heightened the sense of smell; they regulated temperature; and others speculated that they were sound resonators. “When all the available information is put together, including the digital brain and ear casts, the evolutionary relationships, and the growth pattern of the crest and its high degree of variability in different coexisting species, it supports the idea that the elaborate nasal cavity was likely used to produce sounds for communication.”

*ScienceDaily*, October 27, 2008, provides material adapted from the University of Texas about a new ant species discovered in the Amazon, probably the oldest living lineage of ants (<http://www.sciencedaily.com/releases/2008/09/080915174538.htm>). “A new species of blind, subterranean, predatory ant discovered in the Amazon rainforest by University of Texas at Austin evolutionary biologist Christian Rabeling is likely a descendent of the very first ants to evolve. The new ant is named *Martialis heureka*, which translates roughly to ‘ant from Mars,’ because the ant has a combination of characteristics never before recorded.” It is two to three millimeters long, adapted to live in soil, possesses large mandibles, and has no eyes. Ants evolved over 120 million years ago from wasp ancestors, rapidly giving rise to many lineages.

The Pakistani newspaper, *The Nation*, carried the following article on September 9, 2008 (<http://www.nation.com.pk>). “Spectacular fossil forests have been found in coal mines of Illinois by a US–UK team of researchers.... These are the largest forests found anywhere in the world at any point in geological time. It is quite extraordinary to find a fossil landscape preserved over such a vast area, and we are talking about an area the size of (the British city of) Bristol. The forests grew just a few million years apart some 300 million years ago and are now stacked one on top of another. It appears that the ancient land experienced repeated periods of subsidence and flooding which buried the forests in a vertical sequence. They have become visible because of the extensive mining operations in the border area between the states of Illinois, Indiana, and Kentucky.”

EurekaAlert! posted, “Tiny juvenile dinosaur fossil sheds light on evolution of plant eaters” [http://www.eurekaalert.org/pub\\_releases/2008-10/uocm-tjd102008.php](http://www.eurekaalert.org/pub_releases/2008-10/uocm-tjd102008.php).

The article describes one of the smallest dinosaur skulls ever discovered by a team of scientists from London, Cambridge, and Chicago. The skull, which would have been less than two inches (45 millimeters) in length, belonged to a very young *Heterodontosaurus*, which weighed about 200 grams. The researchers described their investigation in the Fall issue of the *Journal Of Vertebrate Paleontology*. “Since heterodontosaurs are among the earliest dinosaurs adapted to eating plants, they may represent a transition phase between meat-eating ancestors and more sophisticated, fully herbivorous descendents.” This group of dinosaurs lived during the Early Jurassic period (about 190 million years ago) in South Africa, where they attained the size of a small turkey, about three feet in length and weighing five to six lbs. They have an unusual combination of teeth, with large fanglike canines at the front of their jaws and worn, molar-like grinding teeth at the back. This unusual combination of teeth led to some speculation about what they ate. Either they were omnivores that ate both plants and meat, or they were plant eaters only, or the sharp teeth were sexually dimorphic and used as weapons against male rivals. The researchers found that their tiny juvenile skull already had a fully developed set of canines, suggesting to them that the teeth were not a sexually dimorphic characteristic.

On September 3, 2008, *National Geographic’s* (<http://nationalgeographic.com/news/2008/09/080903-gecko-ambder.html>) “Photo in the News” featured the oldest gecko fossil found in amber. The Lower Cretaceous specimen, 100 million years old, was found in Myanmar (Burma) in a piece of fossilized tree sap. A foot, toes, and part of a tail are all that remain, but they are so well preserved that the toe pads covered with microscopic hair-like structures are clearly seen. It is these structures that give modern geckos the ability to stick to walls and ceilings.

The India edition of Zeenews.com (<http://www.zeenews.com/articles.asp?aid=284864&sid=FTP>) described an important new site for fossil bones of ancient elephants discovered near Bida al Mutawa, Abu Dhabi’s western region. The bones are late Miocene, around six to eight million years old. Other fossil bones were identified as well as fossil tree roots up to ten meters long.

An article written by Shaun Smillie, October 3, 2008 in the *Star* (<http://www.iol.co.za/>) describes a 3.2-million-year-old mystery that scientists have been trying to solve for decades—the bones of 13–17 hominids, including children that were only three or four years old found in an Ethiopian riverbed. Donald Johanson, who found the famous hominid Lucy in 1974, said they died a sudden catastrophic death. He said these bones, which belonged to the same species as Lucy, *Australopithecus afarensis*, have been given the name First Family. “They can give a glimpse of how our early ancestors lived with information

on social structures, sexual dimorphism, and size differences within a single species.” The most popular theory about how they were killed is that they were crossing or resting in a dry riverbed and were surprised by a flash flood. Part of the mystery is that only hominid bones were found. Another suggestion is that they might have been killed by predators and their bones then collected in that particular part of the river. So for the time being, the mystery remains unsolved.

In the previous issue of this column, there was a description of a mobile lab in Montana that was configured to analyze dinosaur bone material the same day it was excavated. Fossilized bones may contain some original material that would begin to deteriorate as soon as they are exposed, causing some of the apparent soft material to decompose. It was these researchers who reported discovering soft tissue in 2005 in *T. rex* in Montana.

However, a new report (<http://www.sciencedaily.com/releases/2008/06/080606145623.htm>) indicates that the material interpreted as soft tissue may have been erroneously interpreted. A report published in PloS One (<http://www.plosone.org/article/info:doi/10.1371/journal.pone.0002898>) on research led by Thomas Kaye, a paleontologist at the University of Washington in Seattle demonstrates that slimy bacterial colonies called biofilms mimic the fleshy residue allegedly recovered from fossilized bone material dug up in Montana. A description of this report can be found in 60-

Second Science Blog, written by Adam Hadhazy, on July 30, 2008 (<http://www.sciam.com>). These bacterial films may have faked out researchers by growing into the channels and spaces where the *T. rex*'s blood vessels and bone cells (osteocytes) had once been, mirroring both the shape, and the elasticity of the vanished soft tissue. Mr. Hadhazy says that Mary Schweitzer, the North Carolina State University paleontologist who announced the 2005 discovery, stands by her claims.

*Scientific American* was not the only online website posting a description of this controversy (eFluxmedia, <http://www.efluxmedia.com>) July 30, 2008, expanded on the report written by Dee Chisamera to explain that biofilm is capable of maintaining the original morphology of the substrate, even if the substrate is removed, which explains the quantity and similarity of structures in the fossil bone. An example of this phenomenon described in <http://www.sciencedaily.com>, for July 30, 2008, can be found in a pail of rainwater left for a couple of weeks. Touching the inner walls of the bucket you would be able to feel the slime produced by the bacteria. If you were able to dissolve the bucket away, you would find the slime in the shape of the bucket. The researchers tested a variety of bones including turtles and found similar structures. A press release issued by the University of Washington was also used by Reuters (<http://www.reuters.com>) to disseminate the study to newspapers and other news outlets.