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OTHER MEDIA REVIEW

Paleontology and Evolution in the News

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Abstract A review of recent media publications and journals containing articles about evolution and paleontology.

Keywords Therapsid · Herbivore · Fangs · Survival of the fittest · Dinosaurs · Lice · Snail evolution · Darwin's illnesses · Giant fossil ants · Children study dinosaurs · Anomalocaridids · Mammoths · Fossil spiders · Early life's beginnings · Birch mouse · *Tarbosaurus*

Plant-Eating Theraspid with Fangs

The discovery of an ancient theraspid (mammal-like reptile) in Brazil which is closely allied with a species discovered in South Cape, South Africa in 1999 is the oldest evidence that similar faunas of terrestrial vertebrates lived in South America and Africa during the Middle Permian, some 360 million years ago. These animals, the most abundant tetrapods during the Permian, moved between continents that are now separate, but were attached at the time, a part of the supercontinent Gondwana. In addition, the Brazilian animal possesses long saber-like fangs, the oldest known for herbivorous reptiles. Numerous news outlets and blogs reported on the discovery which is based on a press release from the University of Witwatersrand (Wits) (http://www.link2media.co.za/index.php?option=com_content&task=view&id=11626&Itemid=12). For example, see "Brazilian fossil linked to South Africa," by Melody Brandon in the English Edition of *Xinhua News* (http://big5.xinhuanet.com/gate/big5/news.xinhuanet.com/english2010/indepth/2011-03/28/c_13802108.htm). A former Wits student, Dr. Juan Cisneros, discovered and named the Brazilian species, *Tiarajudenseccentricus*, which has close links to the South African species discovered by a team of scientists from the Bernard Price Institute for Paleontology (BPI) at the University of Witwatersrand. The fangs in the wild pig-sized animal were more than half the length of the animal's 22.5-centimeter-long (10 inch) skull. The function of the animal's fangs in this herbivorous animal is unknown, but possible interpretations are that they may have been used in combat behavior, to scare off predators, or for showing off to potential mates. In any case, it is the oldest such example. In addition, it also possesses the oldest example of contact between teeth (dental occlusion). The following is based on an article in the journal *Science*, "Dental Occlusion in a 260-Million-Year-Old Therapsid with Saber Canines from the Permian of Brazil," March 25, 2011, volume 331, pages 1603–1605 (doi:10.1126/science.1200305) by Juan Carlos Cisneros et al. Bruce S. Rubidge, the Director of the BPI of Witwatersrand and one of the coauthors of the paper said, "This provides additional evidence of the contact between terrestrial faunas from these now separate continents, but, more importantly, it also established a temporal bridge, in other words, the faunas having these animals represent nearly similar ages on both continents." Fernando Abdala, another coauthor said, "The new Brazilian species presents some unexpected dental features: it is the oldest herbivore that shows saber canines. This indicates that they used this large tooth for display against predators and also intraspecifically. This new species also shows a battery of teeth following the canine that are places in bones of the palate, ectopterygoid and pterygoid, and shows evidence of dental occlusion with teeth of the lower jaw." The authors say that "critical modifications in terrestrial communities occurred during the Permian period as an increasing variety of herbivorous tetrapods and their predators evolved. This

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process resulted in the establishment of a modern trophic pyramid by the end of the period. A key faunal element in this ecological transformation was the appearance of therapsid 'mammal-like reptiles' during the Middle Permian and the development of heterodont dentition and diverse feeding adaptations within the group, which facilitated their exploitation of different ecological niches." The same issue of *Science* includes an article by Jörg Fröbisch, "On Dental Occlusion and Saber Tooth," pages 1525–1528 (doi:10.1126/science.1204206) which reviews the position of the new fossil in the evolutionary history of these reptiles and subsequent mammals. "The theraspids, one major group of nonmammaliansynapsids, (historically, but erroneously, known as 'mammal-like reptiles') have been particularly important to understanding the acquisition of mammalian characteristics." And this has to do with the differentiation of their teeth over time. In addition, "these findings raise a question: When is a saber tooth a saber tooth, and when is it a tusk or simply an enlarged canine? The existing literature is quite imprecise…the distinction of saber teeth and tusks from ordinary large canines appears to be vague and primarily based on length."

Survival of the Fittest?

After reading Charles Darwin's *Origin of Species*, Herbert Spencer (1820–1903) in his *Principles of Biology* (1864) used the phrase "survival of the fittest," in which he drew parallels between his economic principles and Darwin's evolutionary ones. In Darwin's first four editions of *Origin of Species*, he uses the term "natural selection." In his 5th edition (1869), in Chapter 4, pages 91–92, he writes "this preservation of favourable varieties, and the destruction of injurious variations, I call Natural Selection, or the Survival of the Fittest." A press release headline from the University of Exeter, "Research shows not only the fittest survive," was released on March 28, 2011 (http://www.exeter.ac.uk/news/featurednews/title_132304_en.html). Present understanding has it that for any given niche, there should be a best species, the fittest, that will eventually dominate to exclude all others. Robert Beardmore, University of Exeter, said "Microbiologists have tested this principle by constructing very simple environments in the lab to see what happens after hundreds of generations of bacterial evolution, about 3000 years in human terms. It has been believed that the genome of only the fittest bacteria would be left, but that wasn't their finding. The experiment generated lots of genetic diversity." Laurence Hurst, University of Bath, said: "Key to the new understanding in the realization that the amount of energy organisms squeeze out of their food depends on how much food they have. Give them abundant food and they use it inefficiently. When we combine this with the notion that organisms with different food-utilizing strategies are also affected in different ways by genetic mutations, then we discover a new principle, one in which both the fit and the unfit coexist indefinitely." David Lipson, San Diego State University, said that "Earlier work showed that opposing food utilization strategies could coexist in complex environments, but this is the first explanation of how trade-off, like the one we studied between growth rate and efficiency, can lead to stable diversity in the simplest possible of environments." The three researchers mentioned above and Ivana Gudelj, University of Exeter, published the paper that the press release is based on in *Nature*, "Metabolic trade-offs and the maintenance of the fittest and flattest," March 27, 2011, volume 471, 5 pages, (doi:10.1038/nature09905). They say that "Here we demonstrate the possibility of a new general mechanism of stable diversity maintenance, one that stems from metabolic and physiological trade-offs. The model requires that such trade-offs translate into a fitness landscape in which most fit has unfit near-mutational neighbors, and a lower fitness peak also exists that is more mutationally robust. The 'survival of the fittest' applies at low mutational rates, giving way to 'survival of the flattest' at high mutational rates." The press release states that their work represents a new approach to studying evolution that may eventually lead to a better understanding of the diversity of bacteria that cause human disease. Surprisingly, although their work was mentioned in several blogs posted on Google (www.google.com), little mention of the work was reported in the print media. The reader may want to refer to an article published in *Nature*, volume 412, July 19, 2001 (www.nature.com), "Evolution of digital organisms at high mutation rates leads to survival of the flattest," where Claus Wilke and collaborators used the power of computers to construct an artificial living system that behaves in a remarkably lifelike way. The researchers found that at high mutation rates, genotypes with slower replication rates can displace faster replicators if the former has a higher "robustness"—or fitness—against mutations; that is, if a mutation is, on average, less harmful to the slower replicator than to the faster one. In a takeoff of a common Darwinian phrase, they coin their work "survival of the flattest" rather than of the fittest. The idea is this: if a group of similar genotypes with a faster replication rate occupies a "high and narrow peak" in the landscape of evolutionary fitness, while a different group of genotypes that replicates more slowly occupies a lower flatter, or broader, peak, then when mutation rates are high, the broadness of the lower peak can offset the height of the highest peak. That means the slower replicator wins.

Dinosaurs and Lice

"Dinosaurs May Have Been Tormented by Lice" in the *Wired UK* (http://www.wired.co.uk/news/archive/2011-04/6/

dinosaurs-and-lice) was published on April 6, 2011 by Mark Brown. He reports that Kevin Johnson and his team worked out a family tree of lice by comparing the DNA sequences of genes from 69 present-day lineages. He says the conclusion of the study shows that the blood-sucking parasites lived long before the dinosaurs were killed 65 million years ago, about as far back as the early- to mid-Cretaceous Period, 115 to 130 million years ago. Perhaps they lived on feathered theropod dinosaurs which lived around 125 million years ago. The article includes images of a 44-million-year-old fossil louse and a modern louse for comparison. The article is based on a press release from the University of Illinois News Bureau, "Did Dinosaurs have lice? Researchers say it's possible," written by Diane Yates and released in April 5, 2011 (http://news.illinois.edu/news/11/0405louse_KevinJohnson.html). She describes the researcher's use of fossils and molecular data to track the evolution of lice and their hosts. The results "offer strong evidence that the ancestors of lice that today feed on birds and mammals began to diversify before a mass extinction event killed off the dinosaurs about 65 million years ago." One of the authors of the scientific article, Kevin Johnson, an ornithologist with the Illinois Natural History Survey at the University of Illinois said that "If the lice were around, we know their hosts were probably around." One of the theories concerning the diversity of birds and mammals is that the extinction of the dinosaurs led to the earliest stages of mammal diversification and expansion by occupying habitats that were vacated by the dinosaurs. "But based on the evidence from lice, the radiation of birds and mammals were already under way before the dinosaurs went extinct." Another investigator and the lead author of the study Vincent S. Smith, *Natural History*, London, said "Lice are like living fossils. The record of our past is written in these parasites, and by reconstructing their evolutionary history we can use lice as markers to investigate the evolutionary history of their hosts." Even the editorial page editors of *The New York Times* found the research of interest with the headline "What Stories These Lice Can Tell" (http://www.nytimes.com/2011/04/19/opinion/19tue4.html?_r=1&scp=1&sq=lice&st=cse). "We may now have to reimagine the age of dinosaurs, picturing a wider array of birds and mammals moving among them. We may also have to picture feathered dinosaurs pestered by lice just the way modern birds are. These could be ancestors of the postextinction lice that specialize in mammals, including the three species that specialize on us." The scientific article, which also included the work of Tom Ford, Paul C.D. Johnson, Kazunori Yoshizawa, and Jessica E. Light was published in *Biological Letters*, April 6, 2011 (http://rsbl.royalsocietypublishing.org/content/early/2011/04/01/rsbl.2011.0105.abstract) "Multiple lineages of lice pass through the K-Pg boundary." They say that the Cretaceous-Palaeogene (K-Pg) "boundary is associated with mass extinctions resulting from an extraterrestrial impact and periods of flood-basalt volcanism, the biological consequences of which are still poorly understood and controversial." Some have argued that Cretaceous mammals and birds also suffered a mass extinction and that they rapidly diversified in the Tertiary from a few surviving lineages. Others suggest that most modern orders "survived the mass extinction" or "that several lineages survived, perhaps on different continents. Studies of biogeography, the fossil record and molecular clocks have each been applied to this question, but the results remain contentious." One potential source of evidence to perhaps resolve the problem has been overlooked: the parasite fauna living on modern birds and mammals. The authors used data from multiple genetic markers to establish the age of the major lineages of parasitic lice. "These data lend support to a Cretaceous diversification of many modern bird and mammal lineages." Recent studies show that parasitic and nonparasitic louse lineages diverged from each other early in the Cretaceous, approximately 100–145 million years ago.

Snail Evolution

"Snail Watchers Track Evolution" is the headline in the Friday, April 29, 2011 issue of the *Times of Malta* (http://www.timesofmalta.com/articles/view/20110429/world/Snail-watchers-track-evolution.362764) by John von Radowitz. "Evolution in action has been observed in snails by European members of the public taking part in an online science project." In April 2009, the Open University's Evolution MegaLab created a study in which participants were asked to report observations of banded snails online. The results of the individuals' studies were then forwarded to the project through its web site. "More than 7,600 new observations were made in 2009 which were added to historical data collected between 1950 and 1990. Open University professor of ecology, Jonathan Silvertown, who devised the Evolution Megalab, said 'this is one of the largest evolutionary studies ever undertaken.' Here was an opportunity to give the general public, families and school children, the opportunity to do real science" and to experience the fun and excitement of discovery themselves. Teachers are encouraged to look at Evolution Megalab website to use it as a model to create other studies (http://www.evolutionmegalab.org) that would involve their students. Unlike the present study which involved the general public and included thousands of people, a teacher can utilize the format for classes. Perhaps, the most widespread and readily available subjects are birds and plants. The original project was launched to mark the 200th anniversary of Charles Darwin's birth. Professor Jonathan Silvertown is also the lead author of the article which reports on the results of the data collected on the snail, the brown-lipped

banded snail (*Capaea nemoralis*) in *PLoS One*, April 27, 2011, volume 6 issue 4, pages 1–8, (http://www.plosone.org/article/info:doi/10.1371/journal.pone.0018927),"Citizen Science Reveals Unexpected Continent-Scale Evolution Change in a Model Organism." Here is part of the abstract: "Organisms provide some of the most sensitive indications of climate change and evolution responses are becoming apparent in species with short generational times." The brown-lipped banded snail "is sensitive to its thermal environment and exhibits several polymorphisms of shell colour and banding pattern affecting shell albedo in the majority of populations within its native range in Europe." By compiling a historical dataset for 6,515 native populations with new data in nearly 3,000 populations, the authors tested for evolutionary changes in shell albedo. "The data collected allowed us to test an evolutionary hypothesis linking climate change with polymorphism in the banded snail. That hypothesis was clearly rejected, but to our surprise, the study also produced another unequivocal result, showing that banded morphs in general and Mid-banded morphs in particular increased. These evolutionary trends do not appear to be related to climate warming and may be related to changing pressure by birds."

Solving Darwin's Medical Mystery

Charles Darwin (1809–1882) suffered from severe abdominal pain for much of his life, vomiting after every meal when it was at its worst, yet couldn't figure out what ailed him. Melinda Beck in the *Wall Street Journal*, Tuesday, May 10, 2011, "Solving Darwin's Medical Mystery" (http://online.wsj.com/article/SB10001424052748704681904576313043723708936.html) reports on a new interpretation that may reveal his condition. Past diagnoses included lactose intolerance, lead poisoning, hypochondria, gout, schizophrenia, and suppressed anger toward his physician father. Beck said that research presented the preceding week suggests that Darwin suffered from three distinct ailments: cyclic vomiting syndrome, which generally starts in childhood; Chagas disease, a parasitic illness contracted during his five-year voyage on HMS Beagle, and *Helicobacter pylori*, the bacteria known to cause peptic ulcers. This analysis was part of an ongoing yearly conference held by the University of Maryland School of Medicine where the illnesses of historical figures are diagnosed using modern medical knowledge. Gastroenterologist Sidney Cohen of the Medical College of Thomas Jefferson University in Philadelphia said that he thought Darwin had multiple illnesses over his lifetime, and his disorder did not fit into one particular disease. "Darwin's medical records were more modern," unlike previous historical persons so analyzed, such as Ivan the Terrible, Jane Austin, and Vincent van Gogh, yet "we had no MRI's, no CT scans, no biopsies." Dr. Cohen and his colleagues had other clues to work with—photos, young and old, showed him well nourished; prolific writings suggesting no cognitive damage; and ten children show that he was not sterile; and several family members had similar symptoms which began before his voyage. Dr. Cohen said, "now we know that cyclic vomiting syndrome is a real thing. It accounts for his multiple symptoms over the years." As for his death at the age of 73 as a result of a heart ailment, "Dr. Cohen believes that Darwin also contracted what is now known as Chagas' disease from a bug bite he described receiving in the South American Andes range in 1835. The pathogen causes an acute illness and can then lie dormant for years before re-emerging as heart arrhythmias and congestive heart failure."

Giant Ant in Wyoming

Tehran Times (http://www.tehrantimes.com/NCms/2007.asp?code=240057) reports that "almost 50 million years ago, ants the size of hummingbirds roamed what is now Wyoming, a new fossil discovery reveals. These giant bugs may have crossed an Arctic land bridge between Europe and North America during a particularly warm period in Earth's history." The specimen is about two inches long and was studied by Bruce Archibald, a paleonentomologist at Simon Fraser University. This specimen is unique because loose giant ant wings have been found before in the United States, but this is the first specimen with a body. The specimen comes from the Green River formation (Eocene, about 49.5 million years old) well known for its large numbers of fish and other fossils trapped in lake sediments. When shown the specimen that was stored in a drawer at the Denver Museum of Nature and Science, Archibald said: "I immediately recognized it and said, 'Oh my god, this is a giant ant and it looks like it's related to giant ants that are known from about the same time in Germany.'" Thus, he named it *Titanomyrmalubei*, "titan" for its size and "myrma" for the Greek, "myrmex," or ant and "lubei" for the fossil collector who discovered the specimen. The question that Archibald and his colleagues now had to answer is how this ant found in Germany is also found in Wyoming. Among the numerous media reports about the discovery is the one by Susan Milius in *Science News* for Wednesday, May 4th, 2011, "Giants ants once roamed Wyoming" (http://www.sciencenews.org/view/generic/id/73880/title/Giant_ants_once_roamed_Wyoming). She writes that "these long-distance relatives bolster the notion that the climate of the time had hot blips that allowed warmth-loving giant insects to spread from continent to continent." Although ants, in general, tend to be larger in cool environments, this species was judged to be a tropic dweller, leading the researchers to seek climate reconstructions that showed tropical places where the large ants lived.

"Climate scientists have already suggested there were several around 50 million years ago; one for example, lasted about 170,000 years." In addition, the fact that the ants were found in Wyoming and Germany means that the continents were attached. Archibald and his colleagues published the results of their study as: "Intercontinental dispersal of giant thermophilic ants across the Arctic during Early Eocene hyperthermals" in the *Proceedings of the Royal Society B*, published online May 4, 2011 (doi:10.1098/rspb.2011.0729).

First Graders Study Dinosaurs

Monte Whaley tells about the experience of first graders studying dinosaurs in the May 25, 2011 *Denver Post*, "Magnet school first-graders take hands-on approach to studying dinosaurs" (http://www.denverpost.com/search/ci_18132956). A group of Northglenn High School educators excavated dinosaur bones, the bones that the first graders were studying. Looking at the bone with a critical eye, a seven-year-old student said that it confused him, and he always wondered what a dinosaur would feel like. As a result, he said "I think it would really be cool to be a paleontologist when I grow up." As a result, his teacher said that he had achieved his goal. "Science is all about getting teachers excited and especially getting kids excited. Maybe we've done that here." The only other dinosaur bones the student had seen were in a museum, well-scrubbed, connected, and intact. The students, 50 first graders "at Adams 12 Five Star Schools' Magnet Lab STEM School will study the 400-pound sauropod fossil, write about it and prepare the piece for display at the Cañon City Dinosaur Depot Museum." Penny Eucker, the principal, said that it's all part of the mission of the school, the first K-8 STEM (science, technology, engineering, math) magnet school in Colorado. She said "They are taking notes, writing about what they find and applying their knowledge of fossils and infusing technology into what they are doing." Sauropods were long-necked plant eaters, 60–70 feet long, and lived in the area that is now Colorado and Wyoming. Kent Hups, the teacher, said "I don't think a group of kids this young had ever worked on something like this, so I thought it would be a fantastic opportunity."

Life Span of Anomalocaridids, Cambrian Predators is Extended

A marine predator, the largest animal species that lived during the Cambrian period, lived much longer and grew larger than previously thought. Sindya N. Bhanoo described them in *The New York Times* on May 25, 2011 "Fossil Extends Life Span of a Marine Predator" (http://www.nytimes.com/2011/05/31/science/31obfossil.html). Anomalocaridids had a long, segmented body and a pair of grasping appendages presumably used to capture worms and other prey. Originally thought to have lived only during the Cambrian period, 540 to 500 million years ago, the new discovery of specimens indicate that they also lived in the Early Ordovician period, adding another 30 million years to their life span. While previous specimens were two feet long, the new specimen from southeastern Morocco is three feet long. Derek Briggs, a paleontologist at Yale, and Peter Van Roy, a paleontologist at Ghent University in Belgium, discovered the specimen. "Along with the anomalocaridid, the pair also discovered more than 1500 fossils of other soft-bodied marine animals, including sponges, horseshoe crabs and tube-dwelling worms, at the site." The animals are thought to have inhabited a muddy sea floor in fairly deep water and were trapped by sediment clouds that buried them and preserved their soft bodies. When these animals were first described in the late 1800s, their scaly appendages had only been found in isolation and were incorrectly thought to be the legs of a shrimp species. The animal's disc-like head was also found in isolation, and some believed it might be a jellyfish. It was not until 1985 that Dr. Briggs described the whole animal for the first time. Roy and Briggs published the results of their discoveries in the journal *Nature*, "A giant Ordovician anomalocaridid," May 26, 2011, volume 473, pages 510–513 (doi:10.1038/nature09920). They say that the first anomalocaridids were from the Burgess Shale found on Mount Stephen in British Columbia and were originally misinterpreted as a number of different animals, but now they are generally accepted as arthropods. Almost all of the Cambrian anomalocaridid localities are located in the palaeotropics. The Fezouata formations, where the specimens were found in Morocco, were deposited at a high polar southern palaeolatitude, confirming a global distribution of the anomalocaridids during the early Palaeozoic, as observed for many other taxa of the Burgess Shale type. "The demise of anomalcaridids may have been associated with the diversification of large predatory eurypterids and stem cephalopods during the Great Ordovician Biodiversification Event." The paper contains images of the actual specimens, while a reconstruction of the animal can be found on the Yale University public affairs site (http://opac.yale.edu/news/article.aspx?id=8601). A video of Derek Briggs discussing the fossils along with a model of the anomalocaridids is available at the Yale site.

Wooly and Columbian Mammoths Interbred

I was attracted to the following headline from the *Christian Science Monitor* on June 2, 2011, (http://www.csmonitor.com/Science/2011/0602/Woolly-mammoth-may-have-inter bred-with-elephants), an article written by

Charles Q. Choi, "Woolly mammoth may have interbred with elephants." Upon reading the story, you find that the headline is incorrect. The body of the article is about woolly and Columbian mammoths interbreeding, and it is based on a press release from McMaster University (http://dailynews.mcmaster.ca/story.cfm?id=8022) It appears that the woolly mammoth vanished, with many other Pleistocene animals, about 10,000 years after roaming Europe, Asia, and North America for more than a million years, except for dwarf mammoths that survived on Wrangel Island in the Arctic Ocean until 3,700 years ago. While the woolly mammoth lived in the cold climate of the Arctic tundra, the Columbian mammoth lived in more temperate areas of North America and was about 25% larger than the woolly. Hendrick Poinar, associate professor and Canada Research Chair in the departments of Anthropology and Biology at McMaster University, and his colleagues from France and the United States based their conclusions on a DNA study of two Columbian mammoths, one found in the Huntington Reservoir in Utah and the other found near Rawlins, Wyoming. They meticulously sequenced the complete mitochondrial genome of the two Columbian mammoths and compared these to the first mitochondrial genome of an endemic North American woolly mammoth. It seems that these two different species came into contact when the northern climate deteriorated and the woolly mammoth moved southward to more pleasant conditions, where they came in contact with each other. It is thought that the Columbian mammoth entered North America approximately 1.5 million years ago during an earlier migration and the woolly mammoth later, about 400,000 years ago. Based on their DNA study, they conclude that these species overlapped in time and space and produced hybrids. As an example, they look to living African elephant species that hybridize where their ranges overlap. The *Christian Science Monitor* article contains an image of a model of a woolly mammoth. You'll find a "rogues gallery" of various species of elephants and mammoths on flickr (http://www.flickr.com/photos/a_dangerous_business/4168234731/in/set-72157622959773766/) from the Zoological Museum in St. Petersburg, Russia. However, the labels are in Russian, and the site includes numerous other related images. The scientific article was published in *Genome Biology*, volume 12 (http://genomebiology.com/2011/12/5/R51) on May 31, 2011: "Complete Columbian mammoth mitogenome suggests interbreeding with woolly mammoths." The authors conclude that "Though limited, our data suggest that the two species interbred at some point in their evolutionary histories. One potential explanation is that the woolly mammoth halotypes entered the Columbian mammoth populations via introgression as subglacialecotones, a scenario with compelling parallels in extant elephants and consistent with certain regional paleontological observations…Our results demonstrate that the use of next-generation sequencing technologies holds promise in obtaining such data, even from non-cave, non-permafrost Pleistocene depositional contexts." The article contains a number of helpful illustrations, among which is a map showing the North American ranges of *Mammuthus columbi* (Columbian mammoth) and *Mammuthus primigenius* (woolly mammoth).

Fossil Spider in 3D

"Brush away the cobwebs: 49 million-year-old spider fossilized in amber recreated using 3D imaging technology" is the headline of a story in the *Daily Mail Online* (http://www.dailymail.co.uk/sciencetech/article-1388699/) for May 19, 2011. A fossil spider encased in amber that was dark and cracked could not be identified exactly. That is, up to now. "Using new computer-imaging techniques, researchers from the University of Manchester, working with colleagues in Germany, have discovered the preserved specimen is a huntsman—a variety which still exists today—and has been preserved in 'astounding' detail." J.A. Dunlop of the Museum für Naturkunde and David Penney of the University of Manchester and his scientific collaborators were unsure that the specimen was a huntsman because these spiders are strong and known for speed, so that the likelihood that they would get caught in amber, which oozes slowly, is small—indicating why these large, active free-living spiders are hardly ever trapped in amber. Using x-ray computed tomography, these scientists confirmed that the suspected specimen was a species of *Eusparassus*, a spider currently found in the tropics and in hot, dry regions of southern Europe, but also found 50 million years ago in central Europe. Excellent images and a video which reveals surprising in-depth details also accompany the article. The article is based on a press release from the University of Manchester released in May 2011, "Imaging technology reveals intricate details of 49 million-year-old spider." (http://www.eps.manchester.ac.uk/about-us/news/?archive=sixmonths&id=7048). The movie is also available in http://tiny.cc/HuntsmanSpiderCT and hi-res images (tiff) as well as three versions of the video available to download at http://db.tt/GceCAtE. All of this information is based on the scientific communication that was published in *Naturwissenschaften*, on April 28, 2011 by Jason Dunlop, David Penney, and others (doi:10.1007/s00114-011-0796-x), as "Computed tomography recovers data from historical amber: an example from huntsman spiders." The specimen comes from an old collection of Baltic amber, in which the specimens were darkened by oxidation and cracked and were wrapped in gray-brown paper envelopes. Fossil spiders are common in amber deposits from around the world, "but Baltic amber is by far the most famous and richly endowed fossiliferous amber deposit, with more than 3,000 described arthropod

species." Baltic amber is dated as mid-Eocene (44–49 million years) "and is thought to be produced by an umbrella pine… although the identity of the Baltic amber tree is still somewhat of an enigma…The fossil assemblage is indicative of a tropical–subtropical forest with lightly wooded area and plenty of freshwater habitats. With more than 500 named species described to date it represents the most diverse fossil spider assemblage."

Young Graphite in Old Rocks

Some press releases are never reported on in the traditional press. However, in today's internet world, an institution issuing a press release can be assured that they will be picked up by blogs and scientific and popular science news outlets. Such is the case in the release from Boston University (http://www.bc.edu/) on May 20, 2011, about "Young Graphite in Old Rocks Challenges the Earliest Signs of Life." In the study by Dominic Papineau and his team from several national institutions, they report that carbon in rocks, used to help determine the time when biological life began, may not be correct because the carbon-based minerals tested may be younger than the rocks they are found in. The team says evidence from Canada's Hudson Bay region shows carbonaceous particles are millions of years younger than the rock in which they're found, indicating that the carbon was mixed in with the metamorphic rocks later than the rock's earliest formation, estimated to be 3.8–4.2 billion years ago. The samples they studied come from the Nuvvuagittuq Supracrustal belt, a sedimentary banded iron formation located in the Archean Superior craton. Samples were analyzed by several high-tech tests, including a variety of microscopy and spectroscopy methods, in an effort to more clearly characterize the carbon in the rock. Papineau, the lead author of the paper said "The characteristics of the poorly crystalline graphite within the samples are not consistent with the metamorphic history of the rock." The research was published in *Nature Geoscience*, volume 4, pages 376–37, May 11, 2011 (doi:10.1038/ngeo1155) as "Young poorly crystalline graphite in the >3.8-Gyr-old Nuvvuagittuq bandediron formation." Here's what they say in the paper: "Carbonaceous material present in ancient rocks can be used as an indicator of life during the time the rocks were formed. In particular, evidence for the existence of life more than 3,800 million years ago might have come from mineral associations between apatite and graphite in rocks from southern West Greenland. However, this interpretation is partly based on the assumption that the graphite formed at the same time as the host rocks, an assumption that has been difficult to prove. Here we investigate the origins of poorly crystalline graphite associated with apatite in metamorphic banded iron formation that are 3,750 to 4,280 million years old." The study shows that the graphite experienced much lower temperatures than the host rocks during metamorphism, indicating that the graphite was deposited by fluids after peak metamorphism.

Birch Mouse—A "Living Fossil"

As in the previous discussion, the following discovery was not reported in the traditional media. A press release from Southern Methodist University on May 25, 2011 (http://blog.smu.edu/research/2011/05/post_1.html) reports on a "Birch Mouse Ancestor Discovered in Inner Mongolia is New Species of Rare 'Living Fossil'" by Yuri Kimura. The new fossil is known by its tiny teeth that were discovered in 17-million-year-old sediments and named *Sicista primus*. A single molar of the animal is about the size of half a grain of rice, and the teeth have distinct morphological features that distinguish it from other genera. Images of the expedition are posted on the SMU Research flickr site (http://www.flickr.com/photos/52146845@N06/72157626764403486/) and on YouTube (http://www.youtube.com/watch?v=khkx11W1Kaw). Birch mice include 13 modern and 7 fossil species, and this species of *Sicasta* is the oldest of the 326 genera in the largest rodent suborder, Myomorph, which includes laboratory mice and rats. Kimura says that rodents, both modern and prehistoric, rank as the most prolific mammals on earth. After the demise of the dinosaurs 65 million years ago, rodents evolved and dispersed worldwide during the Cenozoic. They comprise an astounding 42 percent of all living mammals. Kimura published her research in *Naturwissenschaften*, volume 98, pages 87–95, 2011 (doi:10.1007/s00114-010-00744-1), "The earliest record of birch mice from Early Miocene Nei Mongol, China." The teeth of *S. primus* were discovered in fine sediments gathered from Gashunyinadege, a fossil locality in the central region of Inner Mongolia. Gashunyinadege is one of several fossil localities near Tunggur, a fossil site discovered in the 1920s by the Central Asiatic Expedition, which was led by Roy Chapman Andrews from the American Museum of Natural History. Kimura is a member of an international scientific team sponsored by the Chinese Academy of Sciences Institute of Vertebrate Paleontology and Paleoanthropology and the Natural History Museum of Los Angeles County. Their expeditions retrace important classic localities, as well as prospect new fossil localities. Kimura and other members of the team discovered the birch mouse fossils by first prospecting Gashunyinadege for small mammal fossils visible to the naked eye. Those fossils indicated the possibility of even smaller mammal fossils, so the team gathered 6,000 kilograms, more than 13,000 pounds, of Early Miocene sediment. Using standing water from recent rains, they washed the sediments repeatedly through continually smaller screens to separate out small fossils.

Juvenile *Tarbosaurus*, a Tyrannosaur

A press release from Ohio University (http://www.oucom.ohiou.edu/dbms-witmer/juvenile_tyrannosaur/Juvenile_tyr annosaur_facts_and_graphics.pdf) on May 9, 2011 describes a newly discovered skull of a very young individual of *Tarbosaurus bataar* that helps shed new light on the biology of this closest relative of North America's *Tyrannosaurus rex*. The specimen was found in 2006 in the Upper Cretaceous Nemegt Formation in the western Gobi Desert of Mongolia. It is the youngest, most complete skeleton of a tyrannosaur yet found. Bone microstructure reveals that the animal was just two to three years old when it died. Key findings are that the skull of this young animal was clearly not well adapted for the hard-biting, bone-crunching lifestyle of the adult. Absent are the reinforcing mechanisms, bony buttresses, and large muscle attachment sites that allowed older individuals to deliver and withstand high bite forces and otherwise dangerous twisting movements. Because their skulls were more delicate, juveniles must have fed on different prey types than adults, relying more on speed and agility than power. They would have had to have taken smaller prey that would not have struggled as much because their skulls couldn't handle the stress. The juvenile skull is also important because it's among the very few young tyrannosaur skulls that can unequivocally be identified to species. Lawrence M. Witmer of Ohio State University is one of the coauthors of the paper published in the *Journal of Vertebrate Paleontology*, volume 31, number 3, pages 497–517, May 10, 2011, "Cranial osteology of a juvenile specimen of *T. bataar* from the Nemegt Formation (Upper Cretaceous) of Bugin Tsav, Mongolia" by T.Tsuihiji and others. "It's one of the secrets of success for tyrannosaurs—the different age groups weren't competing with each other for food because their diets shifted as they grew," said Ohio University paleontologist Lawrence Witmer. "We knew that adult *Tarbosaurus* were a lot like *T. rex*," said lead author Takanobu Tsuihiji, a former Ohio University postdoctoral fellow who is now a postdoctoral researcher at the National Museum of Nature and Science in Tokyo. "Adults show features throughout the skull associated with a powerful bite…large muscle attachments, bony buttresses, specialized teeth. The juvenile is so young that it doesn't really have any of these features yet, and so it must have been feeding quite differently from its parents." The different hunting strategies of juveniles and adults may have reduced competition among *Tarbosaurus* and strengthened their role as the dominant predators of their environment. The excellent web site contains a number of illustrations, including a 3D model of the skull, and animations. You can directly access a nine-page pdf file containing additional illustrations and information, "Facts, Images, & Animations for the juvenile tryrannosaur story" that would make valuable addition to courses in paleontology.