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MEDIA REVIEW

Paleontology and Evolution in the News

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Abstract This paper is a review of recent media publications and journal articles about evolution and paleontology.

Keywords African lung fish · Trackways · Movement on land · Bacteria · Migration to land · North American mammals · Climate change · Cenozoic · Species diversity · Biggest dinosaur · *Alamosaurus* · Darwin specimens found · *Archaeopteryx* · Black feathers · Baby dinosaurs · Fossil crabs · Evolutionary rates

Lung Fish Walked Size-change Rates

An article in the MailOnLine (http://www.dailymail.co.uk/sciencetech/article-2073661/Could-lungfish-walk-land.html) for December 13, 2011 asks, "Could lungfish have been the first to walk on land?" Researches by University of Chicago scientists say that a tiny step for the humble lungfish could represent a major leap in the evolution of life. They have confirmed that the strange fish, which has lungs and breathes air, can use its scrawny limbs to "walk." They say that there has been anecdotal evidence about the walking ability of lungfish, although it has never been scrutinized closely before. They show that lungfish demonstrate both "bounding" motion, where both limbs moved at once, and "walking," marked by alternating limbs. Such abilities were previously thought to have originated in early tetrapods, the first limbed land dwellers. The study also raises the possibility that fish, not land animals, left some of the fossil tracks long believed to have been produced by early tetrapods. "In a number of these trackways, the animals alternate their limbs, which suggested that they must have been made by tetrapods walking on a solid substrate," said lead scientist Dr. Melina Hale, from the University of Chicago. "We've found that aquatic animals with fundamentally different morphologies and that aren't tetrapods could potentially make very similar track patterns." The above article and those like it are based on a more extensive press release from the University of Chicago Medical Center (http://www.uchospitals.edu/news/2011/20111212-lungfish.html), "A small step for lungfish, a big step for the evolution of walking." The scientists used extensive videos to reveal their findings: that Africa lungfish could indeed walk. Lungfish are a popular pet in the paleontological community, treasured for their unique evolutionary heritage. An African lungfish (*Protopterus annectens*) kept in the laboratory of study co-author Michael Coates inspired King to study the species' ability to walk on its unusually thin limbs. Heather King, the lead author, and her colleagues designed a special tank in which the motions of lungfish could be videotaped from the side and below for in-depth analysis. The videos revealed that lungfish commonly use their hind, or pelvic, limbs to elevate their body off the surface and propel themselves forward. Though the forelimbs look similar to the hind limbs, they were not involved in locomotion, the authors found. "This is all information we can only get from a living animal," King said. "Because if you were just to look at the bones, like you would with a fossil, you might not ever know these motions could occur." Lungfish can also fully rotate the limb and place each subsequent footfall in front of the joint, suggesting that similar creatures

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would have been capable of producing some of the fossil tracks credited to tetrapods. “It's tempting to attribute alternating impressions to something like the footfalls of an early tetrapod with digits, and yet here we've got good evidence that living lungfish can leave similar sequences of similar gait,” said Dr. Coates, professor of Organismal Biology and Anatomy. “The fin or limb use thought to be unique to tetrapods is actually more general.” “If you showed me the skeleton of this creature and asked me to make a bet on whether it walks or not, I would have bet it couldn't,” said co-author Neil Shubin, PhD, Robert R. Bensley Professor of Organismal Biology and Anatomy. “Their fins seem like the furthest thing from walking appendages possible. But it shows what's possible in an aquatic medium where you don't have to support yourself with gravity.” The paper, “Behavioral evidence for the evolution of walking and bounding before terrestriality in sarcopterygian fishes,” by H. M. King, N. H. Shubin, M. I. Coates, M. E. Hale is published in the Proceedings of National Academy of Sciences, 2011; DOI: 10.1073/pnas.1118669109. The website “Why Evolution is True” (http://whyevolutionistrue.wordpress.com/) by Jeffrey Coyne, Professor in the Department of ecology and Evolution at the University of Chicago, contains an image of a lungfish and describes some of the conclusions of the paper as well as the videos filmed for the research. The lungfish were filmed from various angles as they moved about in water tanks, which helped the researchers conclude that some of the trackways attributed to early tetrapods may have been made by lungfish. For readers who cannot access the scientific paper, the site posts four of the movies that were made available in the supplementary material of the scientific paper showing the movement of the lungfish (http://whyevolutionistrue.wordpress.com/2011/12/13/lungfish-nearly-walk-shed-light-on-the-invasion-of-land/). While you are at the site, a reading of some of the comments is instructive, as well as actually reading some of the other posts.

Bacteria’s Move from Sea to Land Later than Thought

Igor Jouline, University of Tennessee–Oak Ridge National Laboratory joint faculty professor of microbiology and researcher at Oak Ridge National Laboratory’s (ORNL) Joint Institute for Computational Sciences, performed a genome sequence analysis of the soil bacteria *Azospirillum*, a species whose forebearers made the sea-to-land move. The analysis indicates the shift may have occurred only 400 millon years ago, rather than approximately two billion years earlier, as originally thought, says a University of Tennessee press release, “Bacteria’s Move from Sea to Land May Have Occurred Much Later Than Thought” (http://www.utk.edu/tntoday/2011/12/22/ut-research-reveals-aquatic-bacteria-move-land/). Jouline conducted his research with Kristin Wuichet and Leonid Sukharnikov of the Department of Microbiology, Gladys Alexandre of Department of Biochemistry, Cellular, and Molecular Biology, and Kirill Borziak, a graduate student in the ORNL-UT Genome Science and Technology program. “In the absence of fossil records for bacteria, it is hard to estimate when and how bacteria transitioned from sea to land,” said Jouline. “Using genome sequencing and analysis of bacteria of the genus *Azospirillum*, which colonizes roots of important cereals and grasses, we show that these organisms transitioned from aquatic environments to land approximately at the same time that plants appeared on land—400 million years ago.” Jouline said the *Azospirillum* lineage the team studied has obtained nearly half of its genome from terrestrial organisms, which suggests the much later water–land transition, which coincides with the first appearance of plants on land. The study is of interest to researchers beyond its evolutionary significance. *Azospirillum* is currently used as a biofertilizer for grasses and some other plants. Commercial fertilizers containing the bacteria are available worldwide. The lead author Florence Wisniewski-Dyé and 25 other co-authors of the study published “Azospirillum Genomes Reveal Transition of Bacteria from Aquatic to Terrestrial Environments” in *PLoS Genetics*, 2011; 7 (12): e1002430. DOI: 10.1371/juornal.pgen.1002430doi:dx.doi.org. Here are some of the results contained in the authors’ abstract and summary: Fossil records indicate that life appeared in marine environments ~3.5 billion years ago (Gyr) and transitioned to terrestrial ecosystems nearly 2.5 Gyr ago. Sequence analysis suggests that “hydrobacteria” and “terrabacteria” might have diverged as early as 3 Gyr ago. Bacteria of the genus *Azospirillum* are associated with roots of terrestrial plants; however, virtually all their close relatives are aquatic. We obtained genome sequences of two *Azospirillum* species and analyzed their gene origins. While most *Azospirillum* housekeeping genes have orthologs in its close aquatic relatives, this lineage has obtained nearly half of its genome from terrestrial organisms. The majority of genes encoding functions critical for association with plants are among horizontally transferred genes. Our results show that transition of some aquatic bacteria to terrestrial habitats occurred much later than the suggested initial divergence of hydro- and terrabacterial clades. The birth of the genus *Azospirillum* approximately coincided with the emergence of vascular plants on land. The majority of horizontally acquired genes encode functions that are critical for adaptation to the rhizosphere and interaction with host plants.

North American Mammal Evolution and Climate Change

Although there are number of scientific articles similar to the following press release from Brown University, "North American mammal evolution tracks with climate change" (http://news.brown.edu/pressreleases/2011/12/mammal), few publications in the print media refer to it (although the usual science blogs do). Borja Figueirido and colleagues from Brown University and elsewhere show that climate changes profoundly influenced the rise and fall of six distinct, successive waves of mammal species diversity in North America over the last 65 million years. These evolutionary biologists use a novel statistical analysis to show that warming and cooling periods, in two cases complicated by species migrations, marked the transition from one dominant grouping to the next. History often seems to happen in waves—fashion and musical tastes turn over every decade and empires give way to new ones over centuries. A similar pattern characterizes the last 65 million years of natural history in North America, where a novel quantitative analysis has identified six distinct, consecutive waves of mammal species diversity or "evolutionary faunas." What force of history determined the destiny of these groupings? The numbers say it was typically climate change. "Although we've always known in a general way that mammals respond to climatic change over time, there has been controversy as to whether this can be demonstrated in a quantitative fashion," said Christine Janis, professor of evolutionary biology at Brown University. "We show that the rise and fall of these faunas is indeed correlated with climatic change—the rise or fall of global paleotemperatures—and also influenced by other more local perturbations such as immigration events." Specifically, of the six waves of species diversity that Janis and her Spanish collaborators describe, four show statistically significant correlations with major changes in temperature. The two transitions that show a weaker but still apparent correlation with the pattern correspond to periods when mammals from other continents happened to invade in large numbers, said Janis, who is the paper's second author. Previous studies of the potential connection between climate change and mammal species evolution have counted total species diversity in the fossil record over similar time periods. But in this analysis, led by postdoctoral scholar Borja Figueirido, the scientists asked whether there were any patterns within the species diversity that might be significant. They were guided by a similar methodology pioneered in a study of "evolutionary faunas" in marine invertebrates by Janis' late husband Jack Sepkoski, who was a paleontologist at the University of Chicago. What the authors found is six distinct and consecutive groupings of mammal species that shared a common rise, peak, and decline in their numbers. For example, the "Paleocene fauna" had largely given way to the "early-middle Eocene fauna" by about 50 million years ago. Moreover, the authors found that these transfers of dominance correlated with temperature shifts, as reflected in data on past levels of atmospheric oxygen (determined from the isotopes in the fossilized remains of deep sea microorganisms). By the numbers, the research showed correlations between species diversity and temperature change, but qualitatively, it also provided a narrative of how the traits of typical species within each wave made sense given the changes in vegetation that followed changes in climate. For example, after a warming episode of about 20 million years in the early Miocene epoch, the dominant vegetation transitioned from woodland to savannah-like grassland. It is no surprise, therefore, that many of the herbivores that comprised the accompanying "Miocene fauna" had high-crowned teeth that allowed them to eat the foods from those savannah sources. To the extent that the study helps clarify scientists' understanding of evolution amid climate changes, it does not do so to the extent that they can make specific predictions about the future, Janis said. But it seems all the clearer that climate change has repeatedly had meaningful effects over millions of years. "Such perturbations, related to anthropogenic climatic change, are currently challenging the fauna of the world today, emphasizing the importance of the fossil record for our understanding of how past events affected the history of faunal diversification and extinction, and hence how future climactic changes may continue to influence life on earth," the authors wrote in the paper. In addition to Janis and Figueirido at Brown, the other authors are Juan Perez-Claros and Paul Palmqvist at the University of Malaga and Miguel De Renzi at the University of Valencia in Spain. Figueirido is also affiliated with Malaga. The research was published in the Proceedings of the National Academy of Sciences as "Cenozoic climate change influences mammalian evolutionary dynamics", PNAS, December 27, 2011, DOI: 10.1073/pnas.1110246108

North America's Biggest Dinosaur

On December 7, 2011, NBCMontana.com posted the story written by Lauren Maschmedt, (http://www.nbcmontana.com/news/29947739/detail.html) telling that a "MSU researcher from Montana State University uncovered fossils from one of America's biggest dinosaurs," one example of numerous stories that made their way into newspapers, blogs, and TV. She says that Denver Fowler uncovered them in New Mexico from 2003 to 2006, but it wasn't until recently that he realized just how big the discovery was. The fossil specimens consisted of two vertebrae and a leg

bone from an *Alamosaurus*, a long-necked plant eater that lived in the southwestern United States and Mexico. Fowler estimates the dinosaur could have been over 80 feet tall and weighed 70 tons. Fowler said "We dug around it and surrounded it in plaster, then we flipped it over to get it out of the ground—that was the point at which we could see what we actually had was not all that much." After uncovering the neck vertebrae piece, Fowler and his research partner had to haul the heavy bone for nearly a mile and a half from the site to their vehicle in 100 degree heat. "It was enormous, it was very large" he said with a laugh. A replica of the full neck vertebrae is housed at the Museum of the Rockies. The original fossil piece Fowler discovered is at the State Museum of Pennsylvania, where his partner does research. This and the following stories were derived from a press release from the University of Montana (http://www.montana.edu/cpa/news/nwview.php?article=10634), "New study reveals North America's biggest dinosaur." New research from Montana State University's Museum of the Rockies and the State Museum of Pennsylvania has unveiled enormous bones from North America's biggest dinosaur. In a paper published Dec. 6 in Acta Palaeontologica Polonica, 2011; DOI: 10.4202/app.2010.0105, "The first giant titanosaurian sauropod from the Upper Cretaceous of North America' MSU researcher Denver W. Fowler and coauthor Robert M. Sullivan from Harrisburg, PA, describe two gigantic vertebrae and a femur that the team collected in New Mexico from 2003 to 2006. The bones belong to the sauropod dinosaur *Alamosaurus sanjuanensis*: a long-necked plant eater related to *Diplodocus*. The *Alamosaurus* roamed what is now the southwestern United States and Mexico about 69 million years ago. "*Alamosaurus* has been known for some time; its remains were first described in 1922 from the Naashoibito beds of New Mexico. Since then, more bones have been discovered in New Mexico, Utah, some really nice material from Texas, and Mexico, including a few partial skeletons," Fowler said. "We used to think that a fully grown *Alamosaurus* measured around 60 feet long and weighed about 30 tons; but a 2009 study by another MSU researcher, Dr. Holly Woodward, found that a femur thought to belong to an adult was still growing," Fowler said. "This told us that *Alamosaurus* got even bigger, but we didn't imagine that it could get quite this big." How big? The enormity of the new bones puts *Alamosaurus* in the same size league as other giant sauropods from South America, including *Argentinosaurus* which weighed about 70 tons, and is widely considered to be the biggest dinosaur of all. "Over the past 20 years, Argentinean and Brazilian paleontologists have been unearthing bigger and bigger dinosaurs, putting the rest of the world in the shade," Fowler said. "However, our new finds not only show that *Alamosaurus* is newly recognized as the biggest dinosaur from North America, but also that it was right up there with the biggest South American species…" Although comparison of the new *Alamosaurus* bones with the South American species gave the researchers an idea of size, giant specimens of sauropods like *Alamosaurus* and *Argentinosaurus* are only known from very fragmentary remains offering only a tantalizing glimpse of what a complete Alamosaurus might look like, Fowler said. The Pennsylvania State Museum field crew is typically just two or three people, so there are limits on how many bones can be collected in one season, Fowler said. Even so, many new and important specimens have been recovered over the past 10–15 years, including new species, and other members of the fauna including the iconic carnivore *Tyrannosaurus*. The *Alamosaurus* discovery goes beyond just "size"-bragging rights, and may have important implications for other dinosaurs, Fowler said. Recent discoveries by paleontologist Jack Horner's paleo lab at the Museum of the Rockies have emphasized the importance of understanding growth and ontogeny in interpreting dinosaur evolution. The press release also contains some useful material for educators.

Darwin Specimens Found After 150 Years

After all these years, you would have expected that all materials (writing, specimens) would have been located, stored, and cataloged. Now a serendipitous discovery has yielded specimens collected by Charles Darwin. The specimens, part of a collection marked "unregistered fossil plants," has been gathering dust in a gloomy corner of the British Geological Survey for more than 150 years. As described, when Howard Falcon-Lang of Royal Holloway University of London happened upon the collection by accident last April, he experienced a moment of disbelief when he examined the specimens. "Almost the first one I pulled out was inscribed with a diamond cut signature of C. Darwin, Esq." The collection of 314 specimens contained 17 that have been verified as Darwin's, samples collected during his voyages on the HMS Beagle from 1831 to 1836. Detailed information can be found in the following blog posted on behalf of Katherine Rowland (http://blogs.nature.com/news/2012/01/darwins-long-forgetten-fossils-unearthed.html) on January 17, 2012, "Darwin's long-forgotten fossils unearthed." Two of the slide specimens bearing Darwin's name were gathered on the island of Chiloe in the Chilean archipelago. In his account of his travels, Darwin described the island as a "miserable hole." However, he found fossils of 40-million-year-old trees, which he shipped back to the British Museum where they were cut and segmented using newly developed techniques. Here is an example of some of the first-ever thin sections, a technique of grinding rock down to a thin sliver and mounted on a slide to be examined under a microscope.

This technique became commonplace and continues to be used today to reveal the fine details of the specimen being examined. Many of the press articles contain at least one image of the specimens including the one listed above as well as, for example, http://www.usatoday.com/tech/science/story/2012-01-17/darwin-fossils-found/52620186/1. Not only does Falcon-Lang find the specimens "exquisitely beautiful," so will the reader who views some of them depicted in the many articles in the media. He also says that following the invention of the thin section and the polarizing microscope in 1829, a cadre of professional slidemakers set up new businesses to satisfy the growing demand from gentleman collectors. It turns out that the history of the specimens is equally interesting because they originally belonged to Joseph Hooker, a renowned botanist and a close friend of Darwin. As a young man in 1846, he was briefly employed at the Geographical Survey to help produce a comprehensive geological map of Britain and its colonies. In addition to the specimens given to him by Darwin, Hooker's collection also includes pieces from the private cabinet of Reverend John Stevens Henslow, who had been Darwin's mentor at Cambridge and whose daughter Hooker would later marry. The Geological Survey implemented a formal registry process for acquisitions in 1848. However, by that time, Hooker had left for an expedition in the Himalayas and the collection eventually was forgotten. This happened because Hooker did not number them in the registry and thus they became "lost." See also "Lost Charles Darwin fossils rediscovered in cabinet" (http://www.bbc.co.uk/news/science-environment-16578330).

Archaeopteryx had Black Feathers

Paleontologists are delighted to find usually monocolored fossils that contain color patterns and better, traces of the original color. Not only are the patterns visually pleasing but they also can say something about the structure of the fossil. In this instance, the fossil is *Archeopteryx* discovered in Germany. Many paleontologists have placed *Archeopteryx* at the base of the bird evolutionary tree, but recent evidence suggests that this animal was a birdlike dinosaur. Writing in LiveScience (http://www.livescience.com/18085-winged-dinosaur-archaeopteryx-black-feathers.html), Charles Choi reports on the discovery which was updated in http://www.msnbc.msn.com/id/46116945/ns/technology_and_science-science/#.TzahmVzOyk8 on January 24, 2012, "Black adorned feathers of winged dinosaurs: Pigment may have helped *Archaeopteryx* fly 150 million years ago in what is now Bavaria." Scientists have now found a feather that shows that this raven-sized animal had black feathers. The structures that held the black pigment may have strengthened wing feathers, perhaps helping *Archaeopteryx* fly, says researcher Ryan Carney, an evolutionary biologist at Brown University. "Being able to reconstruct the colors of feathers can help us gain more knowledge about the organisms and more responsibly reconstruct what they looked like." *Archaeopteryx* lived about 150 million years ago in what is now Bavaria in Germany and was first unearthed 150 years ago. This carnivore, with its blend of avian and reptilian features, seemed an iconic evolutionary link between dinosaurs and birds. To learn more about whether birds and birdlike dinosaurs might have evolved flight, and if so, why, researchers often turn to the animals' feathers. Dr. Carney said that color-generating structures within the animal's feather would have given the feathers additional structural support which would have been an advantageous during this early evolutionary stage of dinosaur flight. The color-generating structures within the feather are known as melansomes. The feather entombed in limestone was discovered in Bavaria, Germany in 1861 (see the article for excellent images of *Archeopteryx* and the feather). The researchers looked especially for melanosomes in the specimen and were unsuccessful during two attempts. Using a more powerful type of scanning electron microscope, the researchers "finally found the keys to unlocking the feather's original color, hidden in the rock for the past 150 million years." Carney said that the research group "located patches of hundreds of melanosomes encased within the fossil. The sausage-shape melanosomes were about 1 millionth of a meter long and 250 billionths of a meter wide—that is, about one-hundredth the diameter of a human hair in length and less than a wavelength of visible light in width. To determine the color of these melanosomes, researchers compared the fossilized structures with those found in 87 species of living birds that represented four classes of feathers—black, gray, brown and ones found in penguins, which have unusually large melanosomes compared with other birds." Melanosomes are important indicators in other dinosaurs, too. See an article published last year "Dinosaurs True Colors Revealed for First Time." (http://news.nationalgeographic.com/news/2010/01/100127-dinosaur-feathers-colors-nature/) The researchers analyzed the barbules in the feather—tiny, riblike appendages that overlap and interlock like zippers to give a feather rigidity and strength. They say that the barbules and the way melanosomes are lined up within them are identical to those found in modern birds. "We can't say it's proof that *Archaeopteryx* was a flier, but what we can say is that in modern bird feathers, these melanosomes provide additional strength and resistance to abrasion from flight, which is why wing feathers and their tips are the most likely areas to be pigmented," Carney said. "With *Archaeopteryx*, as with birds today, the melanosomes we found would have provided similar structural advantages, regardless of whether the pigmentation

initially evolved for another purpose." See: R.M. Carney et al., "New evidence on the colour and nature of the isolated *Archaeopteryx* feather." Nature Communications 2012; DOI: 10.1038/ncomms1642. Another article, written by Carl Zimmer, "Achaeopteryx: The Embargoed Tatoo" (http://blogs.discovermagazine.com/loom/2012/01/24/archaeopteryx-the-embargoed-tattoo/) not only reports on the scientific investigation of the feather including a history of the discovery of *Archaeopteryx* but also adds a personal note when he says that a fair number of scientists like to get a tattoo to celebrate their research. Ryan Carney, a biologist at Brown University has taken the practice one step further. He's gotten a tattoo that shows the key finding of a paper he and his colleagues have published. They conclude it looked just like his tattoo. The article included an excellent image of his tattooed finger.

Baby Dinosaur Hatching

A remarkable find is reported in Adelaide Now, for January 27, 2012, "Baby dinosaurs frozen for eternity by Peter Michael." The image of the fossil as well as the well-executed painting which is an artist's impression of the birthing ground and event tells the story (http://www.adelaidenow.com.au/news/national/hatching-dinosaur-frozen-for-eternity/story-e6frea8c-1226255740862). Geologist Dr. Eric Roberts, of Townsville's James Cook University, a member of the research team, said the find was very rare and exceptional. The newborn's brief life, frozen in time, is among fossilized embryos and tiny footprints at the oldest dinosaur nesting site ever found. Perfectly preserved, the embryonic dinosaurs provide important information of the beginning stirrings of life for these animals. An international research team found more than 10 nests in the Golden Gate Highlands National Park, in South Africa. "In one of the eggs, you can see the baby dinosaur is just hatching. Its head has just broken the shell and the rest of the skeleton is perfectly preserved inside the egg. It is the size of your hand, and was obviously about to hatch, when it was buried in a thin layer of flood mud." One close-up of a *Massospondylus* embryonic skeleton reveals that the head was pushed out of the egg after death. The scientists suspect gasses produced by decay caused this to happen. Each nest had up to 34 round eggs in tightly clustered clutches. Although small to begin with, these herbivorous dinosaurs, *Massospondylus*, grew to be five meters long and about two meters high, while their eggs are only six centimeters in diameter. Dr. Roberts said that the encasing rocks contain traces of ancient ripples and evidence of desiccation cracks suggesting that these animals were nesting in a dynamic shoreline environment along the edge of a river with fluctuating climatic conditions. He said that the fossils were buried during episodic flooding that buried parts of the nesting colony multiple times over unknown generations. Apparently, this find is unique, predating nesting sites of dinosaurs by 100 million years and is the oldest known evidence of nesting behavior among dinosaurs. Dr. Robert R. Reisz, a vertebrate paleontologist at the University of Toronto in Mississauga, the lead researcher for the project wrote that an incomplete egg clutch was collected from road-cut talus, but its exact provenance was uncertain. Then, in 2006, an excavation program at the site was started; eventually, the egg clutch was found in place The presence of numerous clutches of eggs, some of which contain embryonic remains, in at least four distinct horizons within a small area, provides the earliest known evidence of complex reproductive behavior including site fidelity and colonial nesting in a terrestrial vertebrate but also provides additional insights into the initial stages of the evolutionary history of dinosaurs. The scientific paper was published in the Proceedings of the National Academy of Sciences (http://www.pnas.org/content/early/2012/01/23/1109385109.abstract?sid=4f59fa83-53fd-4799-ad7a-3086d416a737) on January 23, 2012, "Oldest known dinosaurian nesting site and reproductive biology of the Early Jurassic sauropodomorph."

Fossil Crab Named After Michael Jackson

A Kent State University researcher was part of an international team of paleontologists that recently made a significant discovery in northern Spain. The group discovered a new family, genus and species of fossil hermit crab—one that lived 100 million years ago. Why name it after a celebrity? It turns out that after the team which made the discovery on June 25, 2009 later met at a restaurant in the city of Alsasua, where they learned on TV that the international superstar Michael Jackson had passed away that day. The paleontologists decided to honor the late music icon by naming the specimen, *Mesoparapylocheles michaeljacksoni*. "Michael Jackson's music will no doubt live a very long time and influence many people so I think the name is appropriate," explained co-author Adiël Klompmaker, a Ph.D. candidate in Department of Geology at Kent State. The shield of the new hermit crab was discovered in an abandoned limestone quarry in the foothills of the Pyrenees in the Spanish province of Navarra. "The rocks in the Koskobilo quarry are part of a fossil coral reef with an age of 100 million years," Klompmaker said. "This is right in the middle of the Cretaceous period, when dinosaurs were dominating the continents. In this area in northern Spain, we find many invertebrate fossils, such as corals, algae, sea urchins, but also a wide variety of crabs." The material was provided by Kent State University, "A Thriller of a Discovery: Fossil Hermit Crab Named after Michael Jackson" (http://www.kent.edu/news/newsdetail.cfm?newsitem=f2a74ed6-953d-906a-

fbca7d2758cda010), January 19, 2012. The group's findings were published online this month in the Germany-based journal *Neues Jahrbuch für Geologie und Paläontologie*. A brief description can also be found in http://www.physorg.com/news/2012-01-mesoparapylocheles-michaeljacksoni-fossil-hermit-crab.html, *M. michaeljacksoni*: Fossil hermit crab named after Michael Jackson. *M. michaeljacksoni* has one living relative from the same family. *Parapylocheles scorpio* lives in deep waters of the Indian and Pacific Oceans. "However, the new hermit crab lived in the shallow waters of a coral reef hidden in between the branching corals," said Dr. René Fraaije, the lead author and director of the Dutch Oertijdmuseum. "Still undiscovered species of the same family must have migrated to deeper waters at some point in time." Nowadays, hermit crabs predominantly use a snail shell as a shelter when the shell becomes available after the death of the snail. When the extinct ammonites were still around in the Cretaceous period, they also would use their shell sometimes. "We are not sure what the fossil hermit crabs from Spain used as a protection because snail and ammonite shells are extremely rare in the quarry," Klompmaker said. "They may have relied on the additional protection provided by the branching corals, as hermit crabs are rare in rocks from the same quarry that contain few corals." According to Klompmaker, fossils shields of hermit crabs are much rarer than those of true crabs, which are a separate group within the decapod crustaceans. Today, less than a dozen of these shields are known and a great deal of information concerning the evolution of this group remains undiscovered. Included in the article is an image of the crab as well as the only living species from the same family: *P. scorpio*. The orginal article was published in Neues Jahrbuch für Geologie und Paläontologie–Abhandlungen, Volume 263, Number 1, January 2012, pp. 85–92(8), "New species, genera and a family of hermit crabs (Crustacea, Anomura, Paguroidea) from a mid-Cretaceous reef of Navarra, northern Spain." Although the press release and all of the other articles dwell on the species named for Michael Jackson, other hermit crabs are also described. Fraaije writes that despite intensive collecting the number of gastropod shells in the mid-Cretaceous reefal deposits of Koskobilo quarry is low in comparison to the number of carapaces. Approximately 60 hermit crab carapaces were found, but less than a dozen gastropods were observed. The same observation can be made for the Late Jurassic sponge reefs in Geisingen and the Krakow region, southern Poland. Thus, the Mesozoic radiation of hermit crabs was not driven by a gastropod-inhabiting lifestyle. Alternatively, early hermit crabs may have hidden themselves in crevices, in pieces of rock, dead coral or wood. And finally, this is not the first time that a fossil has been named after a person in the news. When Nikita Khrushchev arrived in Washington, DC in 1959, the traffic jams were considerable. Rousseau Flower, a well-known paleontologist from New Mexico was studying fossils there felt inconvenienced by the situation (and known to be a die-hard anticommunist) named a some fossils after him with specific names *Khruschevia rotundus*. Later, after he was deposed, Flower named a worm *Khruschevia ridicula*. For this and other interesting aspects of the museum world and paleontology see Richard Fortey's "Dry Storeroom No. 1: The Secret Life of the Natural History Museum, 2008. Alfred A. Knopf"

From Mouse to Elephant Size

A team of researchers wanted to determine how long it would take a mouse to become an elephant. The result: For the first time, researchers have measured how fast large-scale evolution can occur in mammals, and to do so have examined the increases and decreases in mammal size following the extinction of the dinosaurs 65 million years ago. The team looked at 28 mammal groups, including elephants, primates, and whales from various continents and ocean basins over the past 70 million years. They found that it takes 24 million generations for a mouse-sized animal to evolve to the size of an elephant. The findings were reported in the press such as *The Scotsman*, "Mouse to elephant in 24m generations," January 31, 2012 (http://www.scotsman.com/the-scotsman/environment/mouse_to_elephant_in_24m_generations_1_2086982). The scientist found that changes in whale size occurred at twice the rate of land mammals, they because think it is easier to grow big in water where it supports their weight. Dr. Alistair Evans, an evolution biologist at Monash University in Melbourne, Australia, the lead author of the study, and part of the international team of 20 biologists and paleontologists, said that the study was unique because most previous work had focused on micro-evolution, the small changes that occur within a species. "Instead we concentrated on large-scale changes in body size. We can now show that it took at least 24 million generations to make the proverbial mouse-to-elephant size change—a massive change, but also a very long time." However, their research shows that a rabbit-sized mammal took only ten million generations to reach an elephant-sized animal. They also found that rates of size decrease are much faster than growth rates. "The huge difference in rates for getting smaller and getting bigger is really astounding—we certainly never expected it could happen so fast." The research furthers understanding of conditions that allow certain mammals to thrive and grow bigger and circumstances that slow the pace of increase and potentially contribute to extinction. Many of the species that have shrunk, such as the dwarf mammoth and dwarf hippo and "hobbit" hominids lived on islands—helping to explain their size reduction—eventually became extinct. "When you do get smaller, you need less food and can reproduce faster, which are real advantages on small islands," Dr. Evans

explained to show why evolution (and size reduction) was faster. The newspaper article and many others are based on the press release from Monash University, "The maximum rate of mammal evolution" (http://www.monash.edu.au/news/show/mouse-to-elephant-just-wait-24-million-generations). The actual scientific paper was published in Proceedings of the National Academy of Sciences, 2012; DOI: 10.1073/pnas.1120774109 by Alistair R. Evans and 19 other researchers and scientists, "The maximum rate of mammal evolution." In part, the authors have written in the abstract of their paper the following: How fast can a mammal evolve from the size of a mouse to the size of an elephant? Achieving such a large transformation calls for major biological reorganization. Thus, the speed at which this occurs has important implications for extensive faunal changes, including adaptive radiations and recovery from mass extinctions. To quantify the pace of large-scale evolution we developed a metric, clade maximum rate, which represents the maximum evolutionary rate of a trait within a clade. We applied this metric to body mass evolution in mammals over the last 70 million years, during which multiple large evolutionary transitions occurred in oceans and on continents and islands. Our computations suggest that it took a minimum of 1.6, 5.1, and 10 million generations for terrestrial mammal mass to increase 100-, and 1,000-, and 5,000-fold, respectively. Values for whales were down to half the length (i.e., 1.1, 3, and 5 million generations), perhaps due to the reduced mechanical constraints of living in an aquatic environment. When differences in generation time are considered, we find an exponential increase in maximum mammal body mass during the 35 million years following the Cretaceous–Paleogene (K–Pg) extinction event. Our results also indicate a basic asymmetry in macroevolution: very large decreases (such as extreme insular dwarfism) can happen at more than 10 times the rate of increases. Our findings allow more rigorous comparisons of microevolutionary and macroevolutionary patterns and processes.