

THE AMERICAN BIOLOGY TEACHER



About Our Cover

In honor of Darwin's birth in February 1809, each year *The American Biology Teacher* produces a special issue featuring a range of articles focused on Darwin and evolution. Of course, these are two topics of enduring importance and interest to biology educators.

This month, our cover features *Brachiosaurus brancai*, the world's tallest mounted dinosaur skeleton at a height of >13 m. This giant stops visitors in their tracks at Berlin's Museum für Naturkunde (Natural History). When alive, this specimen may have weighed ~50 metric tons (~100,000 pounds) and dwarfs another giant dinosaur, the *Diplodocus* standing near it.

Brachiosaurus is representative of the group of dinosaurs known as sauropods, four-legged herbivores in the saurischian (lizard-hipped) group that includes *Diplodocus*, *Apatosaurus*, and the classic *Brontosaurus*. *Brachiosaurus* lived about 100–150 mya in the Late Jurassic and Early Cretaceous but died out before the end of the age of dinosaurs in the Late Cretaceous (66 mya).

Paleontologists from the Berlin museum found this brachiosaur early in the 20th century at Tendaguru Hill in what was then German East Africa or Tanganyika (now Tanzania). The museum reports that >250 tons of bones were recovered during this extraordinarily successful expedition.

The term "dinosaur" was coined in 1842 by anatomist Richard Owen. Owen was a contemporary of Darwin but strongly disagreed with him about the mechanism of evolution. Until the beginning of the 19th century, dinosaurs and other extinct creatures like them were known only from early descriptions of animals such as megalosaurs (1824) and plesiosaurs (1821). The first complete dinosaur skeleton was discovered in Haddonfield, New Jersey, in 1858, just a year before the publication of *Origin of Species*.

Darwin did not use dinosaur evidence to any degree in his arguments for descent with modification; in his time, the actual status of these creatures within the animal kingdom was unclear because remains were so fragmentary and discoveries so recent. For instance, *Archaeopteryx*, a remarkable dinosaur–bird transition fossil, was discovered just 2 years after *Origin*, allowing Darwin to state in the fourth edition that "Hardly any recent discovery shows more forcibly than this how little we as yet know of the former inhabitants of the world." Coincidentally, the best-preserved *Archaeopteryx* specimen is also on display at the Museum für Naturkunde, in the same hall as the giant *Brachiosaurus*.

The photographer is William F. McComas, the Parks Family Professor of Science Education in the College of Education and Health Professions, University of Arkansas (mccomas@uark.edu), and editor of *ABT*.

Contents

Feature Articles

- Can a Biology Course Rooted in the Tree of Life Overcome Student Misconceptions?**
Completely novel courses may be the best strategy in overcoming biological misconceptions
John W. Doudna 93
- Beyond the Adaptationist Legacy: Updating Our Teaching to Include a Diversity of Evolutionary Mechanisms**
Shifting evolutionary biology research away from the focus on natural selection as the default explanation for evolution
Rebecca M. Price, Kathryn E. Perez. 101
Available online at <http://www.nabt.org/websites/institution/index.php?p=762>
- The Scientific Methods of Biology, Starting with Charles Darwin**
Helping students perform both inductive and deductive scientific reasoning in their daily lives
Cristina Sousa 109

Research on Learning

- Extracting DNA to Visualize the Unity & Diversity of Life**
Enabling students to learn that all organisms have DNA in their bodies as a common chemical background
Yoshihito Kinoshita, Takahiro Yamanoi, Masaharu Takemura. 118

Inquiry & Investigation

- Design-o-saurs: Using Inquiry to Reinforce Aspects of the Relationship between Genotype & Phenotype**
Helping students organize the wealth of information covered during units on genetics & protein synthesis
Steven M. Autieri 127
- Picturing Evolution through Geologic Time**
Representation of major evolutionary and geologic events helps students visualize macroevolution
Lloyd H. Barrow 137
- Modeling Macroevolution with Invented Creatures**
Learning how to draw a phylogeny based on shared characters & observe how phenotypic diversity evolves over time
Christopher G. Brown 141
- Population Evolution: The Pollination Game**
Playing the role of either pollinator or flower students work through a set of scenarios to maximize plant fitness
Jennifer J. Weber, Laura B. Vary, Colette E.S. Berg, Beth H. Ansaldi, Steven J. Franks 149
- Integrating Fossils, Natural Selection & Molecular Genetics: A Structured Inquiry-Based Evolution Lab**
Exploring a specific evolutionary event from the combined perspectives of fossil evidence, population genetics & molecular biology
David A. Wollert 155



Tips, Tricks & Techniques

- Using Fossil Teeth to Study the Evolution of Horses in Response to a Changing Climate**
Understanding the change in horse teeth in response to plant evolution due to a changing climate
Julie Bokor, Jennifer Broo, Jessica Mahoney 166

Departments

- Letter from the Editor** • *Biology Education Is Evolution Education* • William F. McComas 91
Book Reviews • Elizabeth Cowles, Department Editor 173
Classroom Materials & Media Reviews • Remy Dou, Department Editor 176