DINOSAURS | OPINION

Paleontology Is Far More Than New Fossil Discoveries

Understanding the ancient past is critical to responding to challenges we face in the future

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The fossilized skeleton of a 230-million-year-old carnivorous dinosaur. Credit: Carl de Souza/AFP via Getty Images

Frozen in time, a 125-million-year-old mammal attacking a dinosaur. A 39-million-year-old whale, the heaviest animal that ever lived. The oldest known jellyfish, from 505 million years ago. Paleontology produces newsworthy discoveries.

Fossils, moreover, provide direct evidence for the long history of life, allowing paleontologists to test hypotheses about evolution with data only they provide. They allow investigation of present and past life on Earth, from single-celled microbes to plants and animals (yes, including dinosaurs). Great ebbs and flows of biological diversity, appearances of new life forms and the extinctions of long existing ones, would go undiscovered without these efforts. At a time when instruction in biology can be increasingly reductive and ahistorical, paleontologists teach us the astonishing breadth of past and present life on Earth and the long history that led to today's biosphere. Learning this long-term historical perspective is as important as studying the gene and the cell.

But the headlines over exciting new fossils, especially new dinosaurs, grossly underestimate the true importance of paleontology. Its real significance lies in how such discoveries illuminate the grand history of life on Earth. From its beginnings, more than three billion years ago, to the present day, fossils record how life adapted or perished in the face of major environmental challenges.

Just like the ones we face today. Knowing this history is critical to our response to just such challenges: climate change, ocean acidification, mass extinctions and other perils, mainly human-made, facing the biosphere and humanity. Alarmingly, the field is declining, just when we need it most.

Paleontologists provide us with a unique vantage on modern climate change. They play an essential role in interpreting ancient environments, in reconstructing ancient oceans, continents and climates. Unraveling long-term variations in climate relies heavily on information embedded in the chemical structure of fossils. Fossils provide key constraints on the climate models that are essential for predicting future climate change. And the fossil record gives crucial insights on how life will respond to predicted future climate conditions—elevated temperatures, high carbon dioxide levels, and ocean acidification—because these have occurred before in Earth's history.

As well, paleontology has provided a fundamental, sobering, contribution to human thought: the reality of species extinction and thus of a world that has dramatically changed over time. In documenting the history of life, paleontologists recognized that many extinction episodes could occur suddenly, such as the event 66 million years ago that ended the dinosaurs (allowing their avian descendants and mammals to diversify). The search for the causes of past mass extinctions sparked pioneering studies from across the scientific spectrum, focusing on potential future threats to the biosphere and humanity. Consideration of the impact of nuclear winter or searching for possible Earth-impacting asteroids would not have occurred if we were ignorant of past biological catastrophes.

Not only do paleontologists know what happens to life when things go bad, they also know how long it takes for ecosystems and biodiversity to recover from these disasters, which can take far longer than modern humans have existed. The extent to which humans have uniquely impacted biological systems would also be largely unknown without the context provided by paleontologists. They thus provide a unique perspective on the nature, scale and future long-term ecological impact of the current human-produced biodiversity crisis, the so-called Sixth Extinction, and therefore the importance of protecting modern biodiversity. The very concept of a Sixth Extinction would not exist without paleontologists documenting the first five.

Focusing solely on new fossil discoveries also badly misrepresents the breadth and depth of paleontological research and how, despite common misconceptions, it remains at the forefront of modern science. Paleontologists use an extensive variety of tools in their research, from traditional hammers and chisels, to sophisticated statistical analyses and numerical models, to laser spectrometers, CT scanners and synchrotrons. They are by necessity multidisciplinary and interdisciplinary scientists. Fossils are found in rocks, so they must know geology. And fossils are the remains of living things, so paleontologists must know biology and chemistry, from anatomy to genetics, to botany, microbiology, biochemistry and zoology. The recent Nobel Prize in Physiology awarded to paleogeneticist Svante Pääbo, who honed his analytical techniques working on extinct cave bears, ground sloths and mammoths, is testament to the breadth of methods paleontologists can employ to bring the past to life.

The focus on fossils, of course, has many potential positive benefits for paleontology. Dinosaurs and other ancient organisms captivate the public, as attested to by films and television shows, such as *Prehistoric Planet*. The *Jurassic Park* and *Meg* franchises would not exist without paleontologists first showing that dinosaurs and megalodon sharks existed. College general-education classes with a paleontological perspective attract high enrollments. Paleontologists use this interest as a springboard to explore the nature of science and to demonstrate what distinguishes science from other ways of knowing. Paleontology is thus a gateway science for STEM, both at the college and the K–12 level.

The public popularity of paleontology, however, masks deeper issues. Although the *Jurassic Park* and *Meg* franchises have earned about $6 billion and nearly $1 billion dollars at the box office, respectively, only a tiny fraction of this has filtered down to support the science that ultimately makes these films possible. Low levels of private and public support of paleontological research have contributed to a reduction in the number of paleontologists in academia, where large grants are valued highly and increasingly difficult to obtain. Another contributing factor is the closing of Earth science departments, a primary employer of paleontologists, at too many small and medium-sized institutions. Many Ivy League and Big Ten schools, once central to the training of paleontologists, have sharply reduced or eliminated paleontologists in geoscience departments.

Paleontologists know that understanding life's past is critical to anticipating and adapting to life's and humanity's future. Paleontology is vital because it brings its unique and critical perspective to current challenges in climate change, biodiversity loss and the environment. Paleontologists are prophets of the future because they know the past.

And they also discover really cool things.

This is an opinion and analysis article, and the views expressed by the author or authors are not necessarily those of Scientific American.

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