INNER WORKINGS

Inner Workings: Freeing the dinos within

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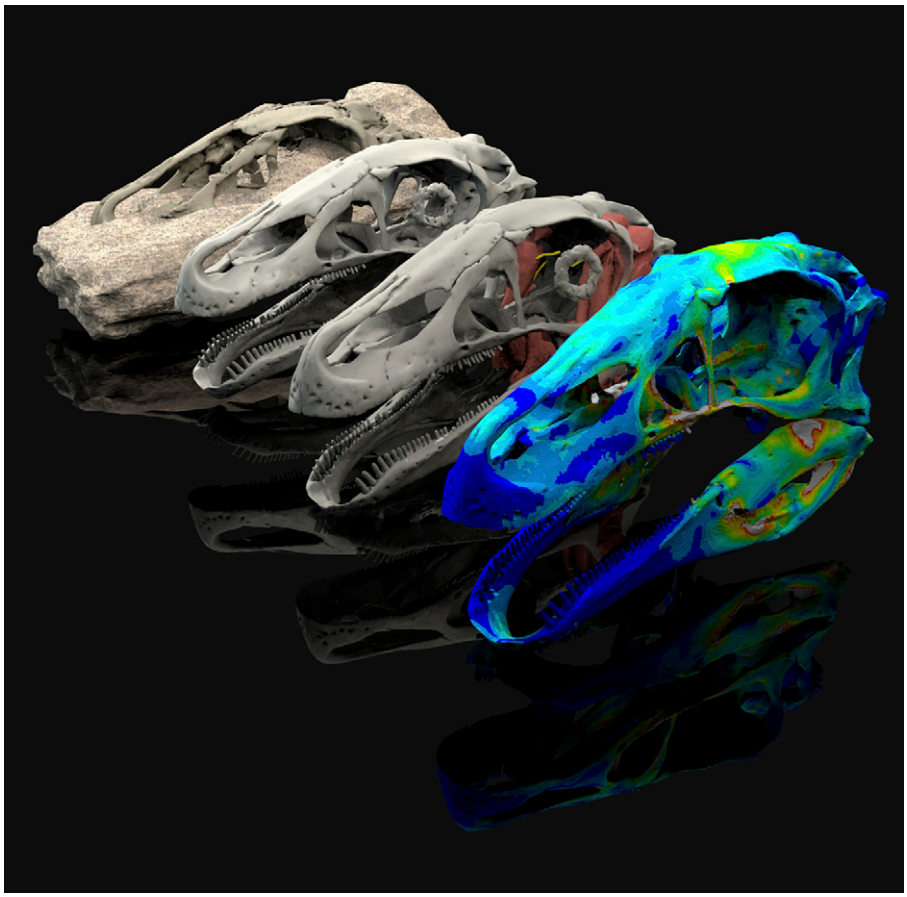
Paleontologists have long faced a daunting obstacle to their research: Fossils are usually embedded in rock. To manually wrench the fossils out, scientists use an array of tools, from needles to dentist's drills to dissolving acids, often with destructive results. Swedish paleozoologist Erik Jarvik, for example, famously took 25 years to create a precise, anatomically correct 3D wax model of the *Eusthenopteron* fish, but by the end the fossil itself had been destroyed.



Digital reconstructions of the skull of the dinosaur Erlikosaurus made from a CT scan. Image courtesy of Stephan Lautenschlager (University of Bristol, Bristol, United Kingdom).

Thanks to rapid advances in X-ray technology, that problem is looking like an artifact of the past, says paleontologist John Cunningham of the University of Bristol in the United Kingdom. Paleontologists can now choose from an arsenal of high-energy imaging tools to peer through the rock and map the fossils inside without destroying the specimen. The highest-energy and highest-resolution versions, called micro-CT and nano-CT, can achieve a resolution on the order of micrometers and digitally remove all traces of the rock.

Digital reconstructions displaying that level of precision are leading scientists to new insights about how ancient creatures lived and evolved. Such reconstructions, Cunningham says, can reveal the exact contours of an organism's anatomy, down to the level of microns, which would have been difficult to map before.

"We can start to answer important questions about how extinct animals functioned in a more rigorous way than we ever could before," he says.

For example: Bristol paleontologist Imran Rahman scanned a fossil echinoderm—an ancestor of modern starfish—to build a virtual 3D model of the creature, which he then fed into a virtual flume. That model has helped him study how the creature might have moved and fed in flowing water.

Cunningham says that as the technology becomes more widely available, and as researchers share data, paleontologists can also move from making inferences about a species from a single specimen to drawing conclusions from multiple specimens of the same species. In addition, the field can expand from looking at individual extinct species to analyzing a range of species that evolved at the same time.

"We can look at a whole load of species within a group and see how things change through time, and within that evolutionary group," Cunningham says.