PALEONTOLOGY

400-Million-Year-Old Wounds Reveal a Time When Predators Romped

Just as swords inspired the invention of chain mail, the history of life hints at many arms races between predators and prey. But with the remnants of the carnage long turned to stone, it can be difficult to prove that the evolution of bigger teeth, for instance, actually did encourage the evolution of defenses like thicker armor.

On page 1453, two paleontologists establish a key part of the argument in a new way. Forest Gahn of the Smithsonian Institution's National Museum of Natural History in Washington, D.C., and Tomasz Baumiller of the University of Michigan, Ann Arbor, show that stalked filter-feeders called crinoids suffered ever fiercer attacks during a period when fish and other major predators were diversifying. Paleontologist Christopher Maples of the Desert Research Institute in Reno and Las Vegas, Nevada, says the case study is "really cool" and could help explain a subsequent explosion in crinoid diversity.

Most studies of predation intensity have focused either on holes that marine snails, which drill into bivalves and brachiopods or on broken fossil shells that show signs of repair. Regrowth indicates the prey survived an attack and could have passed on genes for a thicker shell or other defense, thus ratcheting up the arms race.

Gahn and Baumiller looked at another set of predators and prey during what's called the Middle Paleozoic Marine Revolution. At that time—about 380 million years ago—sharks and fishes were diversifying wildly. Invertebrates in shallow waters were changing, too; crinoids, for example, were evolving thicker armor and spines.



Life and limb. Crinoids fossilized while regrowing damaged arms (arrow) bear witness to ancient dangers.

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Like their starfish cousins, crinoids excel at regenerating lost body parts. So when a fish chomps off several of the tentacle-like appendages, crinoids grow new ones. Looking at slabs with beautifully preserved crinoids, primarily from eastern North America, Gahn and Baumiller could spot new arms growing from stumps. By counting the stumps, they calculated the rate of predation.

For approximately 100 million years before the Middle Paleozoic Marine Revolution, the researchers found that fewer than 5% of crinoids sported regenerating arms. By the time the predator revolution was in full swing, however, more than 10% were growing replacement arms. The evidence increasing predation is "straightforward and convincing," says paleobiologist Geerat Vermeij of the University of California, Davis, who showed that a later burst of predator evolution called the Mesozoic Marine Revolution spurred prey to respond.

Crinoid arm regeneration could be a useful way to look at predation intensity in other time periods as well, says paleontologist Tatsuo Oji of the University of Tokyo, although he and Vermeij caution that comparing regeneration rates between species and environments can be tricky. Baumiller and Gahn are planning to measure predation intensity throughout the fossil record, including Vermeij's Mesozoic revolution, when a group of crinoids called comatulids hit on a particularly effective defense tactic: the ability to flee.

—ERIK STOKSTAD

SCIENTIFIC PUBLISHING

Zerhouni Plans a Nudge Toward Open Access

Hoping to resolve an escalating debate about public access to biomedical research reports, National Institutes of Health (NIH) Director Elias Zerhouni consulted with scientists this week and said that he is leaning toward a delay of 6 months after publication before posting grantees' papers on NIH's free Web archive. This plan won't satisfy everyone, he acknowledged, but it is "reasonable."

A war of words broke out this summer after Zerhouni responded to a House report urging NIH to come up with a plan to give free access to published papers. In a stern seven-page letter last week, the Association of American Publishers and other groups called NIH's plans a "radical new policy" and an "inappropriate intrusion" on free enterprise; they contend that it could force journals to adopt an "unproven" model in which authors pay publication costs. Lobbying for the plan, 25 Nobel laureates—led by Richard Roberts and including former NIH director Harold Varmus and James Watson—wrote Congress on 26 August expressing "strong support" for posting NIH grantees' papers in PubMedCentral—NIH's free, full-text archive—as soon as they are published. A new coalition of patient and library groups called the Alliance for Taxpayer Access, meanwhile, is backing a 6-month release plan.

On Monday, Zerhouni invited about two dozen grantees and intramural scientists to describe "rank-and-file" views. Some expressed concern about pushing journals toward an author-pays model, saying they feared that young scientists might not be able to pay the charges of journals, which could run to $6000 per paper or more. A major shakeup of journals could also harm the peer-review system, others noted. "One of the losers could easily be the scientists," said Gary Westbrook of Oregon Health & Science University, editor-in-chief of the *Journal of Neuroscience*.

Participants seemed comfortable, however, with a 6-month delay; many of journals already meet that standard, said Zerhouni, who also planned to meet with patient advocacy groups this week. Meanwhile, a staffer for Representative Ernest Istook (R–OK), who inserted the open-access language in the House report, said he plans to hold a colloquy to clarify that NIH should take all views into account.

—JOCELYN KAISER

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