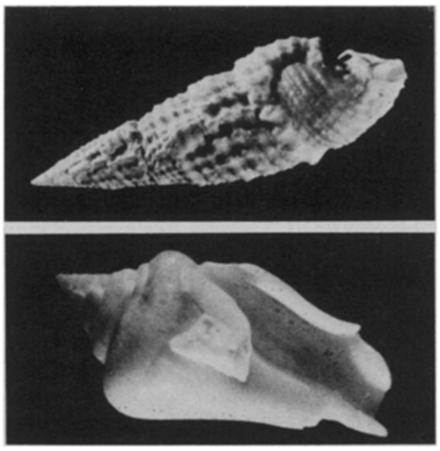
Survival, selection and stronger shells

Life can be treacherous for a gastropod, especially if some creature capable of breaking its shell comes along. The gastropod family ranges from whelks to the "escargot" that graces the plates of gourmets to the slug that cooks and gardeners abhor. But the organisms have been around since the Cambrian period more than 500 million years ago, much longer than there has been anyone to cook or hate them. Their admirable evolutionary success may be due in part to their ability to repair their shells after attack, and to the development of stronger shells.

Geerat J. Vermeij and Edith Zipser of the University of Maryland and David E. Schindel of Yale University report that over geologic time, a marine gastropod's ability to survive shell-breaking attacks in the mud of its warm, shallow-water environment became an important quality for natural selection. The scientists studied samples of gastropods from about 325 million years ago to the present. They found that the frequency of repair rose between the Late Triassic and Late Cretaceous periods, roughly between 200 and 70 million years ago.

Ability to survive shell breakage shows that with more frequent damage, chances are greater that the shell defenses will be maintained or enhanced in future generations. "For every repaired shell, we know that the animal was attacked and that it survived," Vermeij explains. If all breakage were lethal, no shells would bear the scars that record nonlethal injury, and there would be no selection between weak and strong shell variants, the authors write in the Nov. 27 SCIENCE. "We're not claiming that shell-breaking predation became more important as a cause of mortality," Vermeij told SCIENCE NEWS. "We're simply saying that some agents of selection have become more important over geologic time." □

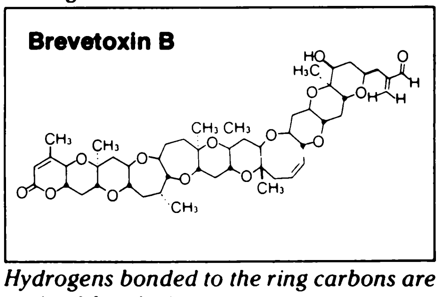


Gastropods from Guam — Rhinoclavis aspera *(top) and* Strombus gibbenilus — *exhibit shell repair after attack.*

Poison of the bloom: Brevetoxin B

When algae bloomed off the Florida coast in 1953, coloring the water a reddish-brown and killing countless fish, it launched what was to become a four-university team attack on a chemical problem: What are the structures of the toxins produced by these particular red-tide algae? Now, 28 years later, the team has part of the answer—they have determined the structure of brevetoxin B, one of the poisons produced by *Ptychodiscus brevis,* also known as *Gymnodinium breve.*

P. brevis is one of the nearly 20 algae species known to release toxins during periodic blooms known as "red tides"— phenomena that have caused massive fish kills, mollusk poisoning and human food poisoning. Determining the structure of such red tide poisons is the prerequisite to finding antidotes or chemicals that can inhibit algal production of the toxins. But isolating those marine poisons is no simple chemical task: Success depends not only on a lot of complicated separating and purifying in the laboratory, but also on being prepared to take advantage of the largely unpredictable blooms. Indeed, prior to the recent unraveling of the brevetoxin B design, only one other family of algae toxins — the three-ringed compounds of the saxitoxin (STX)/gonyautoxin (GTX) group—had been characterized.



Hydrogens bonded to the ring carbons are omitted for clarity.

STX/GTX compounds are water-soluble, so investigators could extract them from the water-soluble tissues of the Alaska butterclam, for example. But the team probing brevetoxin B — whose work is published in the Nov. 4 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY—could not depend on isolating the poison from marine animal tissues, because that toxin is *oil* soluble. Instead, brevetoxin B was extracted from cultures of *P. brevis* isolated during the 1953 red tide.

Sammy M. Ray and colleagues of Texas A&M in Galveston had maintained those cultures in a tank of artificial sea water and eventually were able to extract 90 milligrams of crude poison. Then, Yong-Yeng Lin and co-workers of the University of Texas at Galveston used flash chromatography—an analytical technique that uses gas pressure to push a sample through a filter-like column — to separate the various structures in the substance. Fresh water "zebra" fish were used to test the resulting fractions for toxicity. Next, Koji Kakanishi and colleagues of Columbia University in New York City further purified and crystallized a sample of brevetoxin B. Finally, Jon Clardy and Donna Van Engen of Cornell University in Ithaca, N.Y., used scattered X-ray beams on a photographic plate and computer programs to generate the elusive, 11-ringed structure of brevetoxin B. —*L. Garmon*

Great LEP forward; HERA comes nearer

At a recent meeting of the council of CERN, the multinational European physics laboratory located at Geneva, representatives of all 12 member nations voted for final approval of the construction of the Large Electron-Positron collider (LEP). The representatives of the Netherlands, Sweden and Norway had still to get a final confirmation of their votes from their home governments, but that was being treated as a formality. The representatives of the "host nations," France and Switzerland, were already arranging the necessary permits to begin excavation. A five-year budget "procedure" for the project was voted at the same time.

LEP is designed to provide head-on collisions of electrons and positrons, both moving with energies up to 50 billion electron-volts (50 GeV). Many different particle-physics processes can be studied in the aftermath of such collisions, and important confirmations of current theories are expected. LEP will be built adjacent to the present CERN installation, which straddles the French-Swiss border in the suburbs of Geneva. It will be physically the largest single piece of physics equipment yet built, a ring of 27 kilometers in circumference, almost all underground. LEP will be mostly in France, and French environmental groups had sued to prevent excavation in what is a largely unspoiled region of the Jura Mountains, but their objections have been overridden.

Plans for a companion piece to LEP, called HERA (*Hadron-Elektron-Ring-Anlage* or Hadron-Electron Ring Apparatus), were completed earlier this year. HERA, which would collide protons of up to 820 GeV energy with electrons of up to 30 GeV, is projected for the Deutsches-Elektronen-Synchrotron laboratory (DESY) at Hamburg. HERA has now also gained an important endorsement, that of a committee set up by the West German government to pass on all major scientific research projects. However, the committee recommended that a start on HERA's construction be delayed until 1984 because of budget problems. With that start completion could be expected by 1990. □