Materials Science

Empty virus acts as crystal container

A virus emptied of its genetic material makes a good mold for synthesizing tiny inorganic crystals, a new study finds.

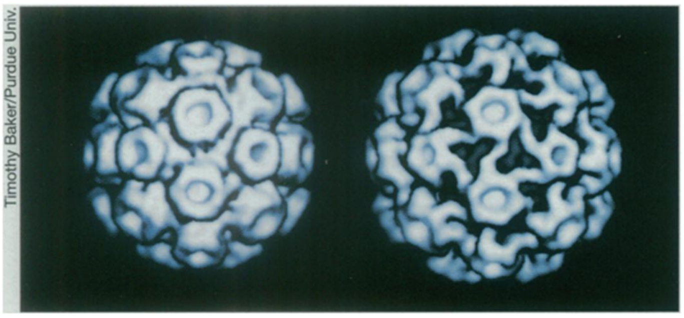
Trevor Douglas of Temple University in Philadelphia and Mark Young of Montana State University in Bozeman made their mold from a cowpea virus. The virus encapsulates its RNA in a protein shell made of 180 identical subunits. The researchers broke the virus apart chemically and extracted the spilled RNA, then allowed the protein subunits to reassemble into a sphere with a cavity 18 nanometers in diameter.

By lowering the acidity of a solution containing the viral coats, the researchers caused the shells to swell, opening up pores. Negatively charged tungstate ions flowed through the pores, attracted by the positively charged amino acids that line the structure. Raising the acidity then closed the pores. Inside, the tungstate ions formed crystals in a narrow range of sizes, Douglas and Young report in the May 14 NATURE.

The size of this virus' coat limits the size of the crystals, says Douglas, but "we can pick a system any size we want." Structural information is available for many viruses.

Douglas and Young are now working on synthesizing polymers inside the empty cowpea viruses.

The researchers haven't yet tried to remove the crystals from their viral molds, but Douglas says that enzymes, which "literally peel off the protein," should do the trick. —C.W.



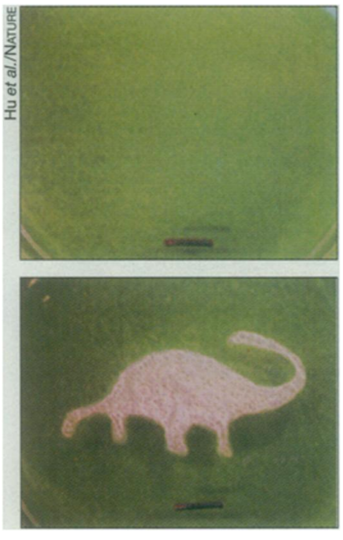
Timothy Baker/Purdue Univ.

A reconstructed electron micrograph shows the shape of the cowpea chlorotic mottle virus (left). At low acidity, the virus swells and 60 pores open up (right).

Heat reveals invisible images in gels

Now you see it, now you don't. Like a magician's prop, an image imprinted on a gel appears and disappears in response to a small change in temperature. Researchers at the University of North Texas in Denton have developed a technique for applying one gel in a precise pattern on top of another. When the system is heated, the top gel becomes cloudy while the bottom one remains transparent, causing the image to stand out. The team can also deposit a gold pattern, which diffracts light differently as the gel shrinks and swells with changing temperatures.

Such gels could be used as sensors or in displays, says Zhibing Hu, who with his colleagues reports the findings in the May 14 NATURE. —C.W.



Hu et al./NATURE

Heating a transparent, patterned gel (top) makes the image of a brontosaurus visible (bottom).

Paleontology

Dinosaurs kept warm in the polar chill

Studies of Australian dinosaurs' bones have added fire to the debate about whether the extinct creatures were warm-blooded or cold-blooded. Unlike almost all other species examined so far, the Australian fossils show evidence of sustained, rapid growth, suggesting that these dinosaurs kept their bodies warm even during frigid winter conditions, according to paleontologists who described their finding last month at the Dinofest symposium in Philadelphia.

Anusuya Chinsamy of the University of Cape Town in South Africa and her colleagues cut through bones of small herbivorous dinosaurs in search of lines of arrested growth, which resemble the growth rings in trees. Such lines, seen in all modern reptiles, indicate that the bones periodically go through episodes of little or no growth, says Chinsamy. The lines do not appear in the bones of endothermic animals, such as mammals and modern birds, which generate their own heat to maintain a constant body temperature.

The group found no growth lines when they examined the bones of these dinosaurs, which lived roughly 100 million years ago along the southern coast of Australia. The animals belonged to the hypsilophodontid family and lived south of the Antarctic circle, where winters were frozen and dark during the Cretaceous period. The average temperature of the coldest month could have ranged between -24°C and -32°C, reports Patricia Vickers-Rich of Monash University in Clayton, Australia.

In past studies, Chinsamy has found lines of growth in the bones of all dinosaurs except other hypsilophodontids from sites in Texas, the Isle of Wight in England, and Africa. Coupled with the evidence of low winter temperatures in Australia, the bone data suggest that hypsilophodontids could maintain an elevated body temperature and that their relatively advanced physiology approached that of modern mammals and birds.

"If any dinosaurs were endothermic, it would be these ones," says Chinsamy, who describes the new study in the June JOURNAL OF VERTEBRATE PALEONTOLOGY. Other dinosaurs had physiologies somewhere between those of modern reptiles and modern mammals, she says.

The Australian hypsilophodontids had much larger optic lobes than did the species living closer to the equator, a possible adaptation that would have helped the polar creatures forage throughout the dark winter. Other Australian dinosaurs from this time had lines of growth in their bones, which suggests they may have hibernated through the cold, suggests Vickers-Rich. —R.M.

A sea turtle's salty tale

The evolutionary origin of sea turtles has been a tough shell for paleontologists to crack, but a fossil discovery in Brazil has penetrated some of their hidden history. The exceptionally well preserved specimen, found in 110-million-year-old rocks, pushes back the record of marine turtles by 10 million years.

Measuring 20 centimeters in length, the specimen has relatively primitive paddles, with moveable fingers and toes that resemble those in freshwater turtles. The limbs in this species, *Santanachelys gaffneyi*, had not yet evolved into the rigid flippers seen in modern marine turtles.

Other adaptations to sea life had developed in this early species, however. *S. gaffneyi* had enlarged eye sockets, indicating that huge lachrymal salt glands surrounded their eyes, according to Ren Hirayama of Teikyo Heisei University in Ichihara, Japan. The lachrymal glands are important for removing salt from the animal's body.

The fossil reveals that, in their invasion of the sea, these forerunners of marine turtles developed the capacity to deal with excess salt before evolving an efficient propulsion system, Hirayama reports in the April 16 NATURE. —R.M.