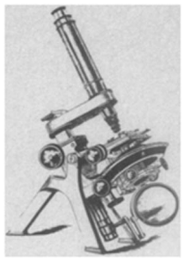
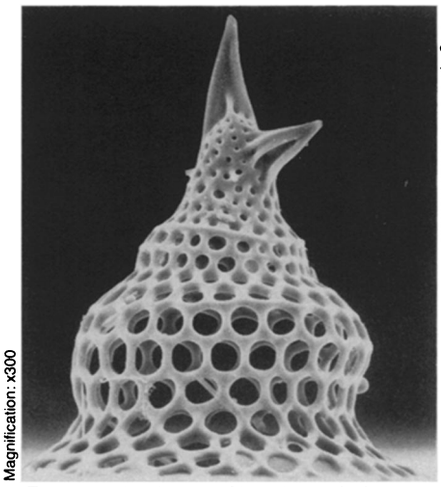


# Life Through the Microscope



Micrographs: Smithsonian Institution

Magnification: x300

*The cupola shape of its glass skeleton identifies the species of a tiny marine animal called a radiolarian.*

*Where the telescope ends, the microscope begins. Who is to say of the two, which is the grander view?*
—Victor Hugo *Les Misérables*, 1862

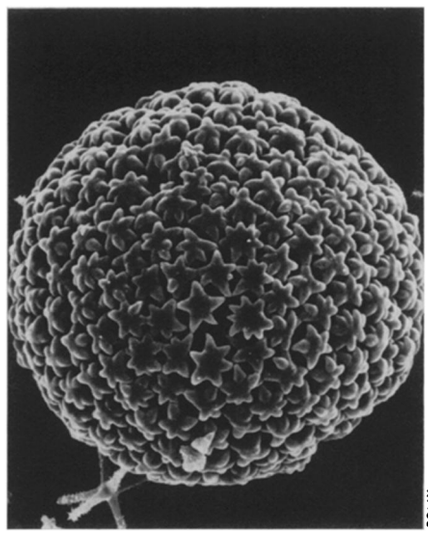
By JULIE ANN MILLER

The face of an ant. The hairs on a housefly's foot. The glass skeleton of a tiny marine organism. As some scientists have been looking at a larger and larger universe, others have been exploring biological structures more and more minute.

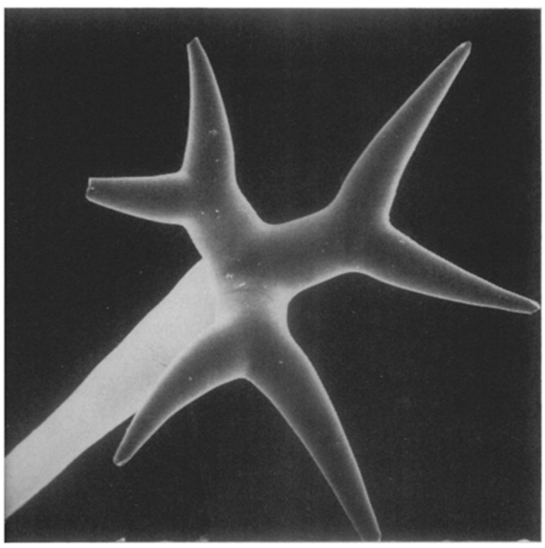
Such images — intriguing, appealing, comic or repulsive — of the world photographed through microscopes, old and new, are displayed in a traveling exhibit just opened at the Smithsonian National Museum of Natural History in Washington, D.C.

"This is the realm of the invisible world, which few people have been able to see," says Richard Benson, curator of paleobiology at the museum. "First it opened to the aristocracy [who bought early microscopes to provide home amusement], then to scientists. The difference now is in making photographs that can be displayed."

The scanning electron microscope (SEM), which the exhibit dubs "an electronic marvel that broke the light barrier," contributes most of the pictures on display. Using electrons instead of light, the SEM can achieve magnifications greater than 100,000-fold as compared to about 1,000-fold for the most powerful light microscopes.



x1100



x75

*This starry orb (above) comes from a common Caribbean sponge. Densely packed, these spherical spicules form a protective armor for the sponge. At left is a another sponge's spicule of quite a different shape.*

Whereas a light microscope can focus on only a thin horizontal plane, the SEM focuses on a slice several hundred times as thick. This ability provides more information and a more realistic image. Unlike the light microscope, however, specimens for SEM cannot be alive. They must be in a vacuum and coated with gold.

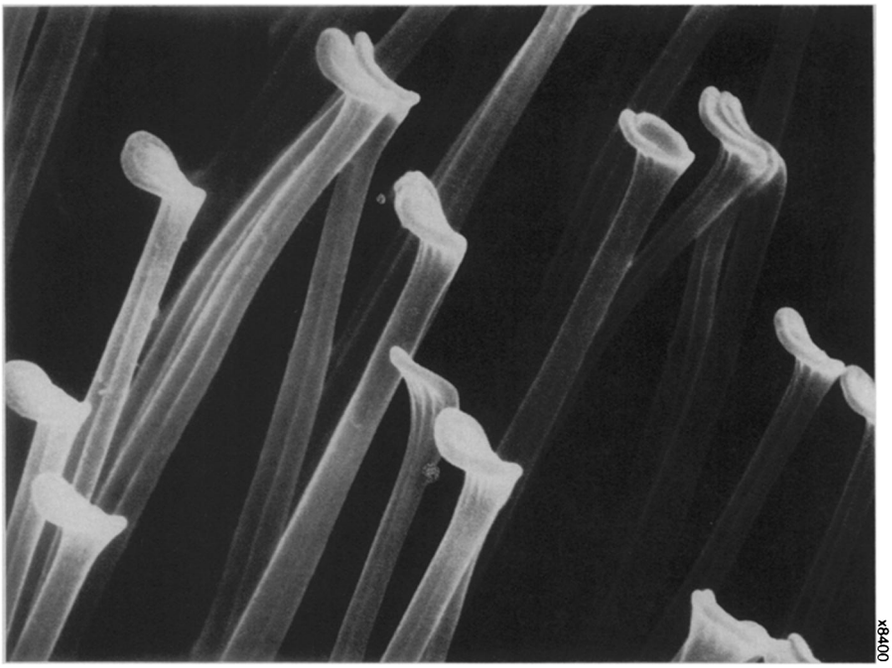
The exhibit includes a modern, fully equipped SEM, donated by Cambridge Instruments Inc. in Cambridge, England. The instrument costs about $100,000. Smithsonian scientists will be at work on the microscope for four-hour shifts while the display is open to the public, so visitors can ask questions and look over the scientists' shoulders or at a monitor mounted behind the work area.

The sheen of brass dominates an exhibit of twenty microscopes of historical interest. Cecil Fox, a cancer researcher at the National Institutes of Health in Bethesda, Md., has been reexamining these and other early microscopes, many from the Billings collection at the Armed Forces Medical Museum in Washington, D.C.

"I use a microscope every day. I wanted to know where it came from," Fox says. "It is important for scientists to understand how they know things."

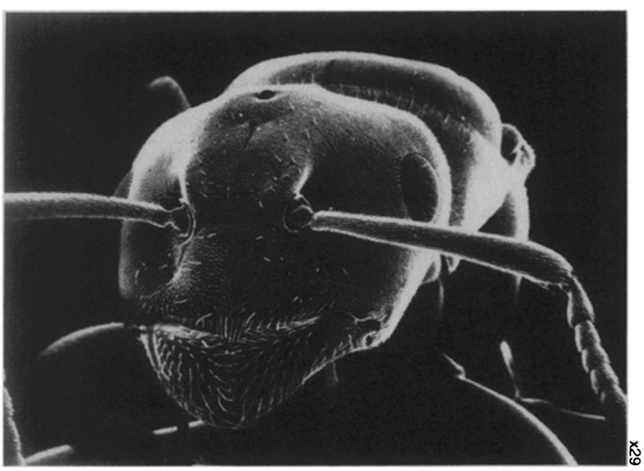
He cleaned the up to 300-year-old microscopes and made photographs of specimens viewed through them. "You can see a lot of neat stuff," he says. In fact, he discovered that it was not the microscopes, but the ways of presenting samples, that limited microscopic vision in the era of bone or ivory "sliders" and mica covers, which preceded today's glass slides and clear cover slips.

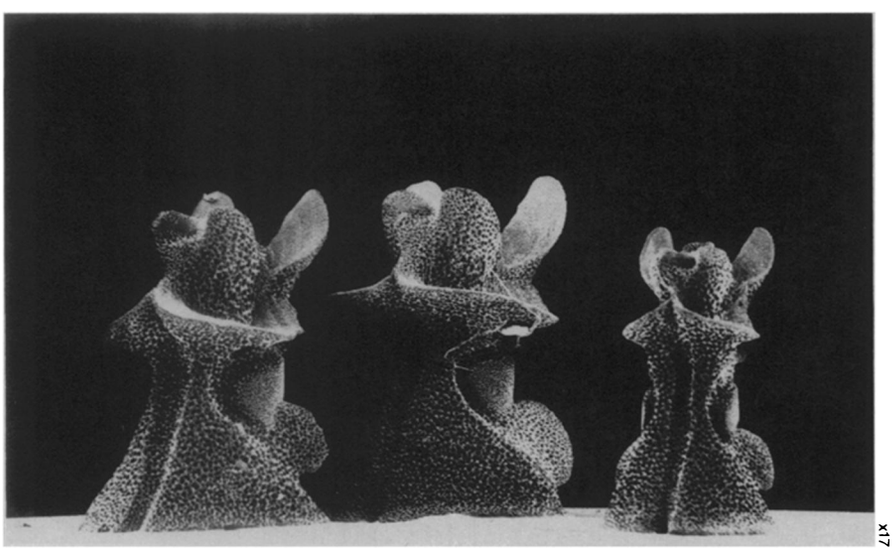
On display is a microscope used by Robert Hooke made in 1678 of wood and gold-tooled leather. There is also a tiny microscope, held up to the eye, the type that Dutch merchant Anton van Leeuwen-




*These hook-shaped hairs, rooted in the pads of a housefly's feet, allow the fly to walk up walls.*

*This is a face unwelcome at any picnic. It belongs to an ant.*




*Forms often invite analogy with familiar objects. These figures are not angels, chessmen or statues of Ginger Rogers waltzing with Fred Astaire. They are calcium carbonate segments of the arms of sea stars, or star fish.*

hoek used to make his observations reported by letter to the British Royal Society every week for 50 years. And there is the microscope George Adams made for the Prince of Wales in the 1750s. After the Prince of Wales became King George III, Adams made him another instrument, now at the Science Museum in London, that Fox says epitomizes the microscope as a status symbol. It is a large silver instrument decorated with cherubs and naked ladies.

"The microscope became the videogame of its time," Fox says. Most people would bring it home, look at the samples provided with it (generally including human hair, thistle down, a fish scale and a fly eye) and then put it away on the shelf. A later version provided more congenial home entertainment. When its mirror was placed outside a window, the microscope projected an image on the wall of a dark room, so that all the guests could view the same fish scale at once, Fox says.

Today at the museum, scientists use microscopic images primarily to describe, distinguish and categorize specimens. But they also gain insight into history. From human bones discovered by archeologists scientists learn about early disease prevalence. From pollen and seeds recovered from the site of an ancient volcanic eruption, they reconstruct the gardens of Pompeii. From tiny fossils they trace the formation of new species millions of years ago.

Presented as part of the exhibit is a description of what modern scientists see when they peer into a microscope: "Like you, they look for the familiar and expected, the beautiful and the absurd—the patterns, forms, structures, sequences, and anomalies in microspace. From these basic features, we — like Aristotle before us — can then begin to discover other properties of living systems: the comparative function of their parts, their behavior, their places in the communities of other living beings, their development from conception to death, and their origins." □