NATURE | NEWS

Nano-suit shields bugs in the void

Coating enables electron-microscope imaging of live organisms.

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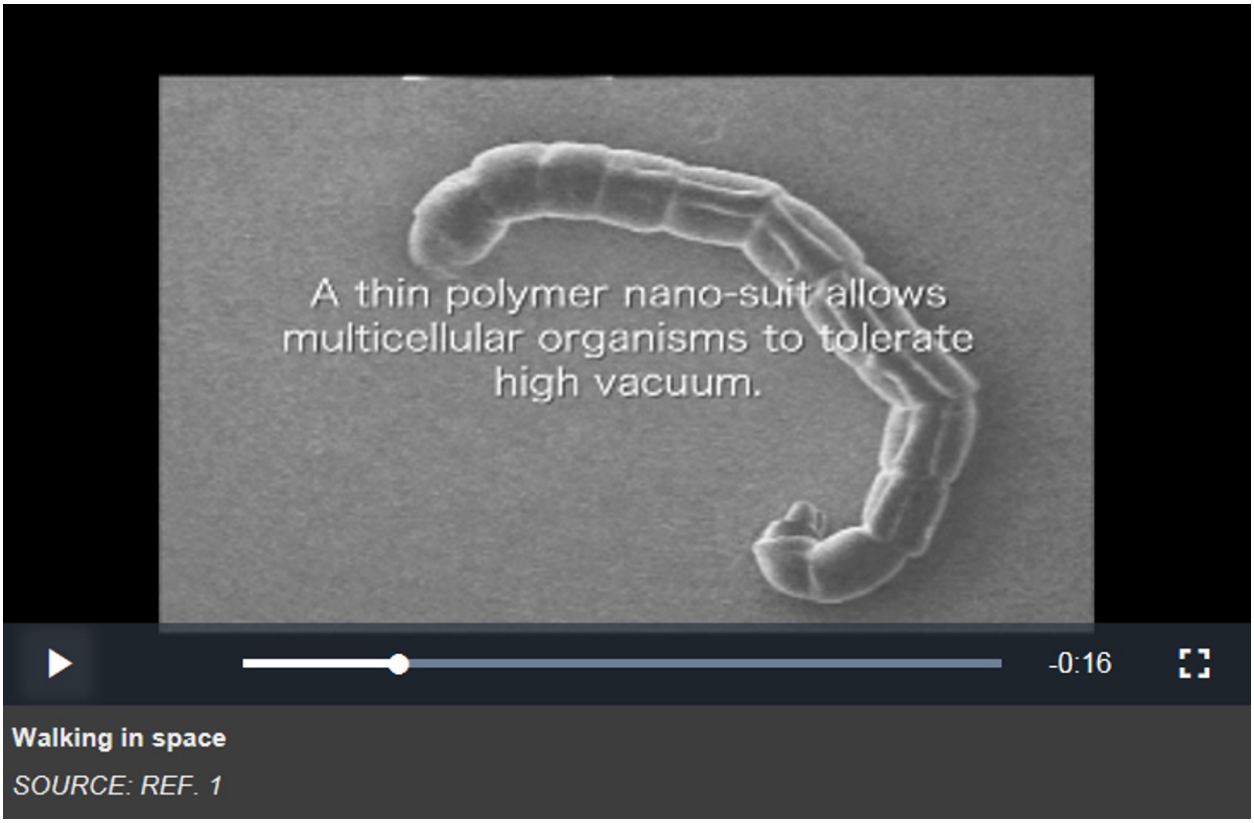

Imaging specimens with electron microscopy imposes conditions that are typically deadly for living things, such as a high vacuum. But the electrons used to create the images might actually have a protective effect. Researchers have found that the beam of a scanning electron microscope can turn a thin coating that occurs naturally on the larvae of some insects into a sort of miniature spacesuit that can keep the animals alive in a vacuum for up to an hour.

Takahiko Hariyama, a biologist at the Hamamatsu University School of Medicine in Japan, and his collaborators describe the results in the *Proceedings of the National Academy of Sciences*[1]. The discovery builds on previous findings[2] that some organisms, including beetle larvae and ticks, can survive short stints in the extremely low-pressure environment of scanning electron microscopes — and even, in the case of dormant tardigrades, or 'water bears', in outer space.

The researchers made their discovery while testing how long various animals could survive in a high vacuum while being imaged inside a scanning electron microscope. Most organisms to lose water rapidly in these conditions, leading to death by dehydration and physical distortion, but the larvae of the fruitfly *Drosophila* survived for 60 minutes and went on to develop normally after being returned to normal pressure.

The cuticles of fruitfly larvae are naturally coated in a substance made of biological molecules such as proteins, and the researchers suspected that exposure to the electron beam caused molecules in the substance to lock together in long chains, or polymers. That would create a flexible, protective layer just 50–100 nanometres thick. Other organisms that have similar coatings, such as Japanese honeybees (*Apis cerana japonica*) and larvae of blue-bottle flies (*Protophormia terraenovae*), survived in the high vacuum after being irradiated with plasma beams, which can generate a polymerization effect similar to that of an electron beam. Plasma beams are already used for that purpose in some industrial applications[3].

To further test their hypothesis, the team tried applying an artificial version of the coating — a detergent solution made from a surfactant — on organisms that did not have one, including a flatworm (*Dugesia japonica*) and the larvae of the Asian tiger mosquito (*Aedes albopictus*). Under plasma irradiation, the coating formed a similarly effective nano-suit.

Structure saviour

The researchers also found that many structural details of the surviving larvae were “completely different from that of untreated specimens and traditionally prepared specimens”, suggesting that the nano-suit was preserving the 'real-life appearance' of the specimens.

However, materials scientist Robert Sinclair of Stanford University in California notes that the process might introduce additional changes — and that the magnifications used in the study are relatively low for electron microscopes.

If it proves sound, however, the technique "could change the way in which some living organisms could be studied using present-day electron microscopes", says Harry Horner, a developmental biologist at Iowa State University in Ames. "Not only with organisms that exist on Earth, but with organisms sent into space or retrieved from space explorations."

Hariyama already has an eye on the skies: he and his team hope to send small animals wearing nano-suits to space, and he says that they have already had some success in nano-suiting small fish.

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References

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