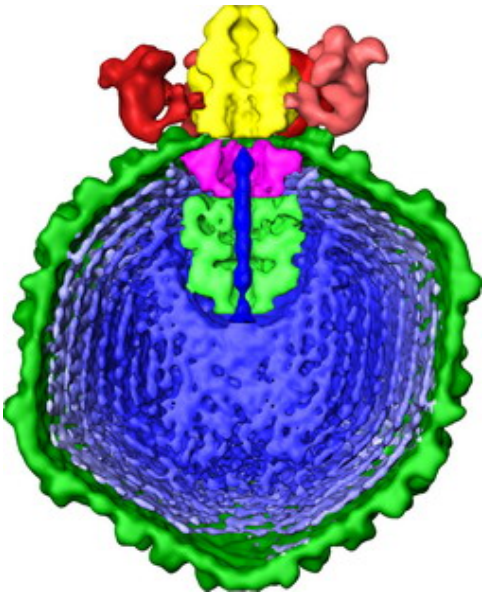
New images capture virus in extraordinary detail



Structure of a virus that infects Salmonella. One end of the DNA genome (blue) is poised for injection into a host cell. Credit: Wah Chiu/Baylor College of Medicine.

Fifty years after MIT researchers pioneered the use of electron microscopy to study viruses, MIT scientists have helped produce the most detailed images yet of the tiny infectious agents.

The images, which show for the first time a virus poised to inject its genetic material into a host cell, grace the cover of the Feb. 2 issue of *Nature*.

Scientists have known for decades that viruses infect cells by injecting their genetic material, either DNA or RNA, into host cells, but even with electron microscopy, "we could never see the details of that aspect of it," said Jonathan King, an MIT professor of biology and one of the authors of the paper.

The researchers, led by Wen Jiang and Wah Chiu of the National Center for Macromolecular Imaging at Baylor College of Medicine, focused on viruses that infect bacteria, known as bacteriophages. Their paper diagrams the structure of a virus that infects Salmonella bacteria.

The photographs clearly show a long coil of DNA dangling inside the viral shell, waiting to be ejected via a protein channel just inside the shell exterior.

"Now you can see the end of the DNA. You can see the cylinder holding it, poised to go into the cell," said King.

To create the detailed images, the researchers photographed about 15,000 virus particles and ran them through a complex computer program that compared the photographs and constructed a 3-D model based on common features shared by the images.

The researchers also improved image quality by rapidly freezing the viruses before photographing them. The amorphous ice that forms as a result of the rapid freezing protects and preserves the virus structure, unlike regular crystallized ice, King said.

This project builds on a long legacy of viral research at MIT, King said. In 1969, MIT Professor Salvador Luria shared the Nobel Prize in physiology or medicine with Max Delbruck and Alfred Hershey for work on the genetic structure and replication mechanisms of viruses.

Luria, who came to MIT in 1959, was the first scientist to show the structure of bacteriophages.

"That really brought these bacterial viruses to the fore, and they've continued to be important for half a century," King said.

Bacteriophages were used in crucial experiments showing that DNA is the genetic material and determining that translation of genetic material into proteins is based on a triplet code.

Luria's legacy at MIT's biology department is carried on today, said King. Shortly after World War II, the Institute got one of the first electron microscopes in the United States, and Luria molded the direction of the department, said King, who arrived at MIT in 1970 after working with Delbruck at Caltech.

"It was (Luria's) appointment that led to the department having its current character, which is a leader in molecular biology," King said.

Source: MIT

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