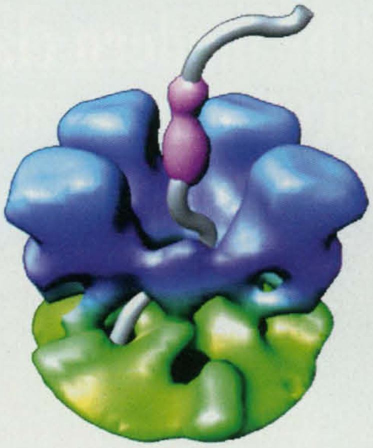
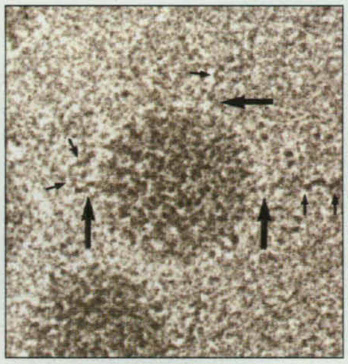
Going it alone. Most viruses depend heavily on the host cell machinery to get their genomes replicated. Retroviruses can use cellular replication enzymes once they have created DNA copies of their genomes via reverse transcriptase, and DNA-containing viruses such as herpesviruses can use the cellular machine directly. But one group of viruses, those containing double-stranded RNA molecules, have to be more self-sufficient, bringing most of their own replication enzymes into the cell with them. The reason is simple: Host cells do not have the enzymes necessary to replicate double-stranded RNA.





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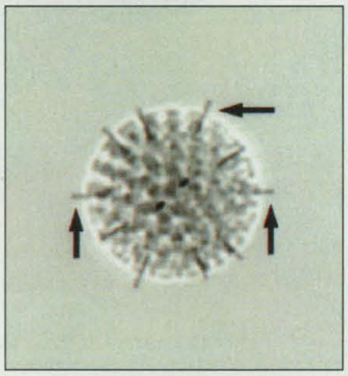

Self-sufficiency. A rotavirus particle *(top right)* produces its own messenger RNA strands, visible in a computer-enhanced image *(bottom)*. A computer model of part of the virus shell shows a possible path for the strand.

A talk by B. V. Venkataram Prasad of Baylor College of Medicine in Houston illustrated the lengths to which these viruses must go to reproduce. Over the past few years, Prasad's group has been exploring the replication machinery of the rotavirus, one of the most important causes of severe diarrhea in children, causing more than a million deaths around the world each year. Earlier work by Prasad's team and other researchers had shown that rotaviruses wear three protein coats: an outer garment that is shed when they enter their target cells in the intestinal lining, and two inner layers that shelter 11 separate segments of double-stranded RNA.

Last year, using a technique called electron cryomicroscopy, which gives a high-resolution picture of frozen, well-preserved viral particles, Prasad and his co-workers demonstrated that the RNA segments are actually embedded in the innermost protein layer, which also contains the enzymes necessary for replication. Unlike most viruses, which come apart after infecting a cell and then go in search of molecular building blocks, double-stranded RNA viruses "stay intact and suck in the nutrients they need to replicate their RNA," says David Bishop of the Pasteur Institute in Paris. And remarkably, once rotavirus has replicated its double-stranded RNA, Prasad saw single-stranded messenger RNA molecules exiting from the virus via narrow channels through the protein layers. They were presumably on their way to the cell's protein-making machinery, where they would direct the production of proteins needed by new virus particles.

Given the wide range of strategies viruses have evolved to adapt to life within their hosts, it is no wonder researchers have faced such daunting challenges in coming up with therapies against these unwelcome guests. Says Bishop: "The meeting gave lots of illustrations that, as far as our health and welfare are concerned, viruses are a moving target."

–Michael Balter

ASTRONOMY

Einstein's Theory Rings True

The ancients knew that glass could bend light, but it took the genius of Albert Einstein centuries later to realize that gravity can perform the same trick. In much the same way as a glass lens can focus light, a sufficiently huge mass—say a galaxy—can focus the light from some source far beyond it. "Gravitational lensing" usually takes the form of multiple images of a single distant source. But a team of U.S. and European astronomers has now used three telescopes to pin down an "Einstein ring," the complete circular image formed when source, gravitational lens, and telescope are in perfect alignment.

The finding, announced at the U.K. National Astronomy Meeting in St. Andrews last week and published in the 1 April *Monthly Notices of the Royal Astronomical Society*, "is a clear, textbook example of gravitational lensing at work," says team member Roger Blandford of the California Institute of Technology in Pasadena. Although Einstein rings have been seen in radio observations, this is "the first time a really complete, unambiguous Einstein ring has been seen in the optical and infrared wavebands," says team member Neal Jackson, of Britain's Jodrell Bank radio telescope, near Manchester.

MERLIN/HST

Full circle. Gravity bends radio waves from a distant galaxy into an arc, infrared light into a complete ring.

The group, which also includes Dutch and French astronomers, has been finding and counting gravitational lenses as a way of gauging the "geometry" of space, which depends on its density of mass and background energy (*Science*, 21 November 1997, p. 1402, and 13 February 1998, p. 981). As a first pass in their lens survey, the team uses the Very Large Array in New Mexico, a system of linked radio telescopes, to spot distant radio-emitting objects that seem to be more than simple bright spots. MERLIN, a six-telescope network centered on Jodrell Bank and spanning 250 kilometers across England to Cambridge, then zooms in for a closer look.

At radio wavelengths, the new system, dubbed B1938+666, looked like an arc rather than a complete ring, because the radio emissions come from two off-center regions in the source galaxy. But when the researchers took another look with an infrared camera aboard the Hubble Space Telescope, the complete ring was revealed—a dazzling demonstration of Einstein's theory at work.

–Andrew Watson

Andrew Watson is a science writer in Norwich, U.K.