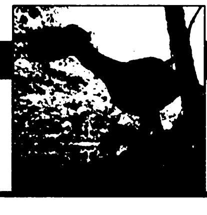

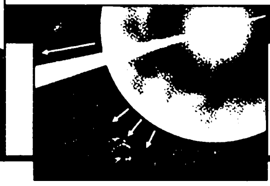

and Germany issued a joint statement calling for an international ban on human reproductive cloning, while their legislatures are debating whether to allow work on embryonic stem cells. In the U.K., which has the most tolerant rules in Europe on the use of human embryos in research, legislators approved research on nuclear transfer to derive stem cells early this year. The House of Commons is planning to debate a bill that would explicitly outlaw the implantation of such an embryo. Lawmakers say ACT's announcement adds urgency to the debate.

The U.S. Senate, which is divided on the subject, has not yet voted on human cloning, although the House passed a bill in July that would make it illegal. If the House bill were in effect today, ACT might be prosecuted. The main effect of ACT's announcement, stem cell researcher John Gearhart of Johns Hopkins University told Reuters, was to scuttle backstage talks among congressional staffers on how to reach a compromise on the use of embryos in research. ACT's announcement, one House aide says, "has made everyone a little queasy."

–ELIOT MARSHALL AND GRETCHEN VOGEL

MOLECULAR IMAGING

Virus Infects Cell: Live and Uncut

Reality TV has never been this good: After several brief kisses for its unwitting victim, a dazzling virus pushes inside the recumbent cell, while another radiant virus, unsuccessful in its flirtation, floats out of view. The camera pans to the cell interior, where glowing viruses glide along protein rails to the nucleus. There, some slip through nuclear pores, and others cruise through tunnels within the cell center.

Cut to laboratory: For the first time, researchers have viewed live scenes of viral infection. Their lens is an imaging technique that may open up gene therapy and antiviral research to highly detailed, blow-by-blow analysis.

On page 1929, a cadre of researchers led by physical chemist Christoph Bräuchle of Ludwig Maximilian University in Munich, Germany, reports having imaged—in real time—single adeno-associated virus (AAV) particles entering cells and moving into the nucleus. The closeup view was provided by a technique called single-molecule fluorescence spectroscopy, which until now had been used to view chemical reactions such as the enzymatic breakdown of adenosine triphosphate.

Although single-molecule imaging techniques have advanced significantly in the last few years (*Science*, 1 June, p. 1671), the technique had never before been used to watch a viral infection, says molecular virologist R. Jude Samulski, director of the University of North Carolina Gene Therapy Center in Chapel Hill. "This technique will be significant for helping us understand how the virus enters the cell," he says. "We're usually taking a picture after the event happened, but this is real time, the live story."

Caught in the act. Three viruses (yellow, green, and pink lines) infect one cell (outlined in yellow) and head straight to the nucleus (outlined in red).

CREDIT: G. SEISENBERGER *ET AL.*

The documentary approach revealed new information about the small virus, which gene therapy researchers are hotly pursuing as a gene delivery vector. Among their findings: AAV poked through the cell membrane in about 64 milliseconds, much faster than expected, and reached the nucleus in about 15 minutes. That's about an eighth of the time in which conventional cell culture methods, which rely on viral gene expression, can detect infection. Also, the researchers were surprised to see that some particles, after floating toward the nucleus, hopped aboard microtubule-based "tracks" on the nuclear surface and began to move in a straight line. Other viruses followed along the same tracks. Bräuchle suggests that the tracks are tube-shaped invaginations of the nuclear membrane, recently discovered structures never before known to ferry viruses.

Bräuchle's team pieced together its imaging system from commercially available equipment and customized it to circumvent obstacles such as a cell's inconvenient habit of autofluorescing, which would outshine the virus's signal. Bräuchle says conventional methods of measuring and imaging viral entry average the properties of a population and may introduce artifacts that affect infection in unpredictable ways. For example, to see where viruses are concentrated, scientists have had to coat each particle with more than 300 fluorescent molecules, which may get in the way of the virus's activities.

To minimize such interference, the researchers tagged individual viruses with one or two fluorescent molecules, each of which is about 1/25 the size of the virus. After using light microscopy to get a good picture of the mammalian cells lying on a microscope slide, the researchers infected each cell with 10 to 1000 viral particles, which Bräuchle says is much closer than typical cell cultures to normal conditions in the body. The molecules' glow lasted 1 to 10 seconds before it bleached out. This gave the researchers ample time to capture the movement of individual viral particles with snapshots every 40 milliseconds. "Because they're carrying little flashlights around, we can see where the virus is," says physical chemist Anne Myers Kelley of Kansas State University in Manhattan, an expert in single-molecule imaging who was not part of Bräuchle's team.

Bräuchle expects the technique to illuminate virus-host cell interactions for other types of viruses, as well as help screen antiviral drugs. "We can really see how drugs affect the uptake of virus into the living cell, at what stage of the infection pathway the drugs work, and to what extent [they interfere with infection]," Bräuchle says. The ability to view viral infection close up will ratchet up efforts to understand viral processes, says Samulski. "If we can understand processes at this level of detail, then we have to. When somebody breaks the mile record, it challenges everybody to run faster."

–MARY BECKMAN

Mary Beckman is a writer based in southeast Idaho.

RESEARCH COLLABORATIONS

Asian Astronomers Build Closer Ties

TOKYO—The vastness of space is bringing Asian astronomers a little closer together. Meeting earlier this month in Taipei, astronomers from China, Japan, Korea, and Taiwan moved ahead with cooperative plans on both regional and international projects.

Meeting of minds. Japan's Norio Kaifu (front row, second from right), Taiwan's K. Y. (Fred) Lo (front row, fourth from right), China's Chen Jian-Sheng (front row, at left), and Korea's Se-Hyung Cho (second row, second from right) lead an effort to foster Asian cooperation in astronomy.

Since 1990, astronomers from the region have gotten together every 3 years or so to present recent results from their own instruments. But on 11 to 16 November, during the fifth East Asia Meeting of Astronomy (EAMA), participants broadened the scope of their discussion to include concrete ways to foster collaborations. "There is a sense of excitement about future prospects for more collaboration and exchanges and access to each other's facilities," says K. Y. (Fred) Lo, director of Academia Sinica's Institute of Astronomy and Astrophysics in Taipei.

The first actual collaboration is likely to be an East Asian very long baseline interferometry network of radio antennas. Japan and Korea are near an agreement for joint observations beginning in 2005 on radio interferometry networks now under construction in each country (*Science*, 2 November, p. 977). Chinese astronomers are eager to add two more radio telescopes to the network, making a total of 12 antennas. Adding the two antennas, now used primarily for charting star positions, would allow Chinese astronomers to investigate star formation and other phenomena. "Radio astronomy is one area where collaboration among neighboring regions would be very natural," says Se-Hyung Cho, vice president of the Korean Astronomy Observatory in Taejon.

Japanese scientists are hoping to make an even bigger splash by bringing their regional neighbors into the fold on the $650 million Atacama Large Millimeter/Submillimeter Array (ALMA), a network of 64 dishes to be built and operated by European, Japanese, Canadian, and U.S. scientists at a site high in the Atacama Desert in northern Chile. Norio Kaifu, director general of Japan's National Astronomical Observatory in Mitaka, hopes to bring other Asian scientists into the project under Japan's umbrella. "That would make it a true world telescope," he says.

Lo says that talk of greater cooperation has been a staple at the EAMA meetings. But it wasn't until recently, he says, that each of the four neighbors achieved a critical mass of scientists, funding, and observational activities to make such joint efforts worthwhile. Yoshihisa Nemoto, senior specialist for space in the space policy division of Japan's Ministry of Education, Culture, Sports, Science, and Technology, calls the move "a natural and good thing" to do, adding that the ministry would be happy at some point to review any proposals for joint projects.

The scientists who met at Taipei (some of whom are pictured at left) have set up a coordination committee to plan exchanges and the sharing of observation and computing facilities as well as additional conferences. Because of the tenuous political relations between Taiwan and mainland China, the group plans to establish smooth working relationships among scientists before approaching any government for support.

–DENNIS NORMILE

CREDIT: (RIGHT) GEORGE NIKITIN/AP

ULTRAFAST LASERS

Photoelectrons Show How Quick a Flash Is

For more than a decade, scientists have captured the breaking of chemical bonds between atoms with the world's fastest strobe lights: flashes of laser light lasting a few femtoseconds. (A femtosecond is 1 millionth of a billionth of a second.) But bond breaking is a languid process compared with the lightning-fast activity of electrons inside atoms, which zip around the nucleus and hop between energy shells in less than a fifth of a femtosecond. To track such quicksilver movements, researchers have longed to generate and measure individual pulses of radiation as short as a few hundred attoseconds. (A femtosecond equals 1000 attoseconds.) Now they've got their wish.

In this week's issue of *Nature*, researchers from the Vienna University of Technology in Austria, the National Research Council Canada, and Bielefeld University in Germany report that they have produced isolated x-ray pulses 650 attoseconds long. Using these pulses like flashbulbs, the researchers have traced the energy-level transitions of electrons in an atomic gas with a resolution of 150 attoseconds. "This is an important experiment," says Anne L'Huillier, a physicist at the Lund Institute of Technology in Sweden. "It opens the door to the study of extremely fast electronic processes occurring inside atoms and molecules."

Generating the attosecond pulse was fairly straightforward, says Ferenc Krausz

ScienceScope

Research Relief U.S. university scientists have complained in vain for 2 years that stricter arms-trafficking regulations force them to get time-consuming State Department approval for work on research satellites involving foreign graduate students and overseas partners (*Science*, 24 March 2000, p. 2138). But relief may be in sight. Condoleezza Rice (below), President George W. Bush's national security adviser and a former provost of Stanford University, has voiced her support for "open and collaborative basic research."

In a 1 November letter to Harold Brown, co-chair of the Center for Strategic and International Studies in Washington, D.C., Rice says that the Administration will review the impact of the regulations on researchers. In the meantime, she notes, a 1985 order by then-President Ronald Reagan exempting basic research from the arms regulations remains in effect—a critical point that until now has been unclear. The clarification could help "ease the universities' problems," says Eugene Skolnikoff, a political science professor at the Massachusetts Institute of Technology who has followed the issue.

Culture Clash at HHS A plan by the Department of Health and Human Services (HHS) to streamline its bureaucracy has raised concerns at the National Institutes of Health (NIH), where 27 centers and institutes now operate with relative independence.

The "workforce restructuring plan"—which carries the motto "One HHS"—has been under way for months, and NIH has already agreed to form a single personnel office. But two 8 and 9 November memos, one from Ed Sontag, HHS assistant secretary for administration and management, calling for management cuts appear to have hit some tender spots. For example, HHS wants to trim management layers and consolidate grants management and public affairs, now housed at each institute, into central offices. After seeing the memos, one NIH official, referring to the highway outside the Bethesda, Maryland, campus, joked: "Should we all go lie down in Rockville Pike [in protest]?"

NIH acting director Ruth Kirschstein led a delegation of institute directors who met with Sontag on 19 November to discuss the effort, but the group isn't commenting. NIH spokesperson Anne Thomas says only that her agency is "working collaboratively" with HHS, which wants an "action plan" by 30 November.