

Utah center. Voth and Alan Frankel, UCSF's principal investigator, each say that improvements to the technology will be especially crucial to his center's goals.

Single-molecule imaging

David Millar, a biophysicist at the Scripps Research Institute who is part of the Utah team, is using single-molecule fluorescence imaging to decipher the mechanism by which HIV's genetic material is transported from the host cell's nucleus back into the cytoplasm, where the cell's protein factories are hijacked to produce more of the virus. By color-labeling each of the numerous proteins involved in that transport, Millar's lab has been able to observe the sequence of events involved in formation of the large protein complex that transports the viral RNA within the cell.

Millar says the fluorescence technology will be useful for studying many other biological processes, including the mechanism by which ribosomes, the protein factories of the cell, are themselves assembled from some 20 individual proteins and RNA.

The centers are also using multi-scale computer simulation, isothermal titration calorimetry, surface plasmon resonance, and fluorescent resonance energy transfer.

The interdisciplinary character of the centers allows the quantitative perspective of the physical scientists to be brought to bear on the biologists, who are more apt to express their findings in descriptive terms, says Gronenborn. "It's very difficult for biologists to put their observations into quantitative terms."

An arranged marriage

"We're bringing together two very different worlds to apply what they know to the problem," says Finzi. The arranged marriage is not without challenges, particularly regarding communication. "We speak different languages, and we don't always understand what the others are doing," says Finzi, who confesses that she has only a basic grasp of the imaging techniques.

The key to interdisciplinary efforts, Voth says, is to focus on one's own area of expertise and let other collaborators do the same. Voth admits that he's not aware of a single "card-carrying physicist" at the Utah-based center.

Frankel says three of the nine principal scientists in his collaboration, including an NMR spectroscopist and a computational expert, have strong physical science backgrounds. Most of the rest are biochemists.

But for all the expertise that's being

drawn into the centers, there's no guarantee of success, Finzi cautions. "We think the centers have tremendous potential," she says. "But it's a little like gambling; sometimes you get something marginal, and sometimes you get a big hit."

David Kramer

DOE, Congress to spur carbon sequestration

Even as the US Department of Energy announced the awarding of a fourth grant for assessing the commercial-scale underground sequestration of carbon dioxide, President Bush's science adviser was expressing doubts that efforts to bottle up the greenhouse gas will mitigate global warming.

"We do not currently have a scalable technology for carbon sequestration, and I do not see one coming soon," John Marburger told a meeting of the American Geophysical Union in December 2007. The world's "stunningly large fossil-fuel consumption numbers" and the roughly 27 billion tons of CO₂ released annually "create barriers for any carbon extraction and sequestration scheme," he said. "Any industrial-scale process has environmental impacts, and there are few greater industrial scales than that of power generation. The sequestration industry would have to be of comparable scale."

But despite his misgivings, Marburger admitted that over the long run, carbon capture and storage from coal-fired plants ranks alongside resolving the nuclear waste problem and minimizing nuclear proliferation risks as the best shots for minimizing climate change.

In December, DOE awarded \$66.7 million to the Midwest Geological Sequestration Consortium for the fourth of seven proposed large-scale sequestration tests. Those tests are to assess the feasibility of storing millions of tons of CO₂ indefinitely in geologic formations deep underground. Three other awards with a combined value of \$318 million were announced in October.

Major energy legislation enacted in 2007 authorized the seven projects and specified that each sequester a minimum of 1 million tons of CO₂ annually. The statute authorizes \$240 million annually for the tests through fiscal year 2012, but appropriators provided just half that amount for the current year. To the extent possible, the law says, DOE should locate the projects in various geologic formations and use CO₂ produced in industrial operations. For the Midwest project, the gas will be supplied from

fossil fuels burned at an ethanol refinery operated by Archer Daniels Midland Co and will be injected into the Mount Simon sandstone formation, which lies underneath four states.

The new law also authorized \$30 million for a peer-reviewed assessment, administered by the Department of the Interior, of the available capacity for geologic sequestration in the US. And the legislation calls for recommendations from the National Academy of Sciences for establishing an interdisciplinary training program to produce specialists in carbon capture and storage.

Separately, \$75 million is appropriated for DOE in FY 2008 for FutureGen, a cost-shared project with utilities to build an emissions- and carbon-free, coal-fired generating plant that will also employ geologic CO₂ sequestration.

At least two large-scale sequestration projects have been declared successes. Each year since 1996, Norway's Statoil has been separating about a million tons of CO₂ from natural gas extracted from the North Sea's Sleipner field and injecting it into a formation beneath the field. In doing so, the company avoids paying a steep tax of about 294 kroner (US\$55) per ton that Norway has imposed on CO₂ emissions.

The second project, sponsored by DOE, the Canadian government, and several oil companies, met its goal of injecting 5 million tons of CO₂ into the Weyburn oil field in Saskatchewan. The liquefied gas was piped in from a synthetic fuels plant in North Dakota. The project's expenses were offset by revenues from the thousands of barrels of oil that were pushed out of the reservoir each day by the injection. Indeed, CO₂ injection has been employed for years to extract oil that is not recoverable by conventional drilling.

As Marburger pointed out, even if the geological storage proves to be an unqualified success, it will be expensive to adopt. What he didn't say is that in the absence of either a tax on CO₂ emissions or a cap-and-trade regime, industrial emitters will have little or no economic incentive to adopt the technology.

David Kramer

news notes

India's growing science budget. The Indian government has announced a fivefold increase in the education budget between 2007 and 2012 for a series of schemes to increase the number of science and technology researchers. Prime Minister Manmohan Singh announced the news last month at the

95th Indian science congress. "We need a quantum jump in science education and research," he said.

The announcement came days after India launched the first of three new nanotechnology institutes as part of a five-year 9.8 billion rupee (US \$250 million) nanotechnology initiative. The initiative is to stop India from falling further behind China, the US, and the European Union, said Singh. The new institute, based at Bengaluru in the southern state of Karnataka, will open in 2009.

This is not the first time the Indian government has provided funds or a five-year strategy for nanotechnology, but the scale of the endeavor is 10 times larger than previous efforts. The new strategy is being led by a dozen academics and industrialists involved in nanotechnology and headed by C. N. R. Rao, president of the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore and chairman of India's science advisory council. **PKG**

New CERN DG. The CERN Council has appointed Rolf-Dieter Heuer to succeed Robert Aymar as CERN's director general. Since 2004 Heuer has been the research director for particle and astroparticle physics at Germany's Electron Synchrotron (DESY) in Hamburg. He will start his five-year term at CERN on 1 January 2009.

Between 1984 and 1998, Heuer worked for the OPAL experiments on CERN's Large Electron-Positron Collider. He then took a professorship at the University of Hamburg, where he established a group working on preparations for experiments at a possible

future electron-positron collider. He will start at CERN just as the first results from its Large Hadron Collider become available (see *PHYSICS TODAY*, September 2007, page 32, and November 2007, page 26).

"This is a very exciting time for particle physics," says Heuer. "To become CERN's director general for the early years of LHC operation is a great honor, a great challenge, and probably the best job in physics research today. I'm looking forward to working with CERN's community of personnel and researchers from around the world as we embark on this great adventure." **PKG**

CERN



Heuer

AIP awards and prizes. Yu Lu, a theoretical physicist and research fellow in the institute of physics at the Chinese Academy of Sciences, is the recipient of the 2008 Tate Medal for International Leadership in Physics from the American Institute of Physics (AIP). The medal, named for the late John Torrence Tate, a former president of the American Physical Society, recognizes distinguished service to the physics profession by a non-US national. Yu, an APS fellow, is cited for landmark contributions in "bringing together the world's condensed matter physics community, the support of young scientists, the creation of important international conferences, and international statesmanship in theoretical physics." The medal and a check for \$10 000 will be awarded at the APS March Meeting in New Orleans, Louisiana.

Also at the March Meeting, AIP, APS, and the Heineman Foundation will jointly award the 2008 Dannie Heineman Prize for Mathematical Physics to Mitchell Feigenbaum of Rockefeller University for "developing the theory of deterministic chaos . . . and for profound influence of these discoveries on our understanding of nonlinear phenomena." His work in chaos theory has led to the so-called Feigenbaum constants. The prize consists of a certificate and \$7500.

In January, AIP and the American Astronomical Society named Andrew Fabian, professor of astronomy at the University of Cambridge, the recipient of the 2008 Dannie Heineman Prize for

Astrophysics for his "innovative and influential work in the field of x-ray astronomy." His research areas include black holes, neutron stars, and the x-ray background. Fabian is editor-in-chief of *Monthly Notices of the Royal Astronomical Society*. He will receive \$7500 and a certificate.

Also awarded at the AAS meeting was AIP's 2007 Andrew W. Gemant Award for physics in culture. It was given to Andrew Fraknoi, an astrophysicist and physics professor at Foothill College in Los Altos Hills, California. Fraknoi received a \$5000 prize. He also designated an additional grant of \$3000 to be split between Foothill College and the Astronomical Society of the Pacific, where he served as executive director, to further the communication of physics to the public. **JNAM ■**

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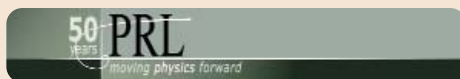
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<http://prl.aps.org/50years>

This July marks the 50th anniversary of the world's premier physics journal, *Physical Review Letters*. To learn about the planned celebrations, and to suggest some yourself, visit the journal's special anniversary website.



<http://mapecos.org/map>

MapEcos displays air-quality information about industrial facilities in the US. The information appears in the form of an interactive map and comes from the Environmental Protection Agency and—voluntarily—from the facilities themselves.

