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Research Highlights . . .

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Potent peptides inhibit HIV entry into cells

Based in part on protein structures determined at the National Synchrotron Light Source (NSLS) at DOE's Brookhaven Lab, scientists at the University of Utah have developed new peptides that appear to be significantly more effective at blocking HIV's entry into cells than other drugs in their class. The researchers say these peptides are sufficiently potent to begin pre-clinical studies as a new class of agents for the prevention and treatment of HIV/AIDS. Since these inhibitors have a unique mechanism, they should work well in combination with existing HIV inhibitors. The NSLS-derived structures also suggest ways to engineer the peptides to reduce the chance of drug resistance arising.

[Karen McNulty Walsh, 631/344-8350, kmcnulty@bnl.gov]

Windy City's top research

Twelve years after its discovery at DOE's Fermi National Accelerator Laboratory, the top quark is back in the spotlight. On October 2, Chicago Mayor Richard Daley announced the discovery of this particle as one of the Top Ten scientific discoveries and innovations in the history of the Chicago area.

For particle physicists, however, the top quark's mysterious properties always have remained at the center of their research efforts. The weight of the top quark provides crucial information on the Higgs boson and the origin of mass. Due to the quantum quirks of nature, the masses of the top quark and the Higgs boson are mathematically linked. With precision top quark measurements, scientists of the CDF and DZero collider experiments at Fermilab are narrowing the window on the Higgs particle.

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Clearing away the clouds

Runoff from melted snowpack provides much of the west's fresh water. While satellite images can be a powerful way of tracking changes in snow cover, clouds often obscure a view of snow extent in mountainous regions. Researchers at DOE's Idaho National Laboratory have developed a method to predict snow cover in these areas using daily images and historical data from NASA's MODIS satellites. The new technique is being field-tested by regional water managers as a way of more accurately predicting day-to-day water flow. The data could be used to identify possible trends to due climate change and serve as an input for more accurate measurements of total water volume.

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NIH Funds New Biomarkers Center at PNNL

Pacific Northwest National Laboratory has been awarded a $5.9 million grant by the National Institutes of Health's Genes and Environment Initiative to establish a Center for Novel Biomarkers of Response. In the center's first effort, researchers at PNNL and the University of Utah will study cigarette smoke and obesity as causes of chronic inflammatory stress. Work will include the use of spectrometers and other instruments at the W.R. Wiley Environmental Molecular Sciences Laboratory, a DOE national scientific user facility located at PNNL, to help researchers create exposure assessment tools to better understand the role of gene-environment interactions in human disease.

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DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***DOE Pulse*** (www.ornl.gov/news/pulse/) is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

Fermilab steering group proposes plan for leadership

The Department of Energy's Fermi National Accelerator Laboratory, the nation's primary laboratory for particle physics, has proposed a plan to maintain leadership for the laboratory and U.S. particle physics in the quest to discover the fundamental nature of the physical universe in the decades ahead.

Discoveries of revolutionary new physics of the universe will come from powerful next-generation particle accelerators. At CERN's LHC, U.S. physicists will join scientists worldwide in exploring the physics of the Terascale, the high-energy region where physicists believe they will find answers to key questions of 21st-century particle physics. To follow the LHC, physicists have proposed the International Linear Collider, a globally funded and operated accelerator to build on LHC results and illuminate Terascale science. With the help of other DOE laboratories, Fermilab is working toward hosting the proposed ILC in the United States, maintaining the nation's leadership of frontier particle physics.

Should events postpone the construction of the ILC, a Steering Group at Fermilab has developed a plan to keep the laboratory and particle physics in the United States on the pathway to discovery. Using ILC technology, and in collaboration with DOE and international laboratories, Fermilab would build an intensity-frontier accelerator at one percent of the ILC's length and combine it with existing Fermilab accelerators to create a new facility called Project X. Project X's intense particle beams would give Fermilab's scientific users a new way into the world of neutrinos and precision physics, where physicists expect to discover answers to compelling questions about the nature and origin of the universe.

With its ILC technology, Project X would spur U.S industrialization and reduce costs of ILC components while advancing accelerator science for future applications in particle physics and beyond. Fermilab's plan would keep the laboratory and U.S. particle physics on the pathway to discovery both at the energy frontier with the ILC and in the domain of neutrinos and precision physics at the intensity frontier, the Steering Group's report said.

Submitted by DOE's Fermi National Accelerator Laboratory

Stanford's Shen cuts broad swath in science

Stanford Professor Zhi-Xun Shen is making a mark across a broad swath of scientific territory. Known by colleagues as "Z.-X.," Shen's interests run a gamut that includes photon science, the physics of quantum matter, spectroscopy and imaging techniques, as well as the physics of the very small and the very fast at the most extreme scales.

Zhi-Xun Shen

Shen was appointed professor of Physics and Applied Physics at Stanford and DOE's Stanford Synchrotron Radiation Laboratory (SSRL) in 2000. He has made a pioneering career probing the secrets of superconductors as well as in the techniques used to study them. He is considered by many to have helped revolutionize the technique of Angle Resolved Photon Emission Spectroscopy, or ARPES, used to investigate the electronic structure of solids.

Besides his Stanford and SSRL professorships, Shen is also director of the X-ray Laboratory for Advanced Materials, or XLAM, which, in addition to being a unit in Stanford Linear Accelerator Center 's Photon Science Directorate, links the intellectual resources in other Stanford schools and SLAC and fosters mutual collaboration in the DOE's Basic Energy Science research enterprise.

Submitted by DOE's Stanford Linear Accelerator Center