LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, May 20-25, 2012

WHOLE LOTTA SHAKING GOING ON

Artie Rodgers stands in front of one of the displays at the California Academy of Sciences' 'Earthquake' exhibit.

The Lab's Artie Rodgers knows a thing or two about earthquakes and the shaking that goes along with them.

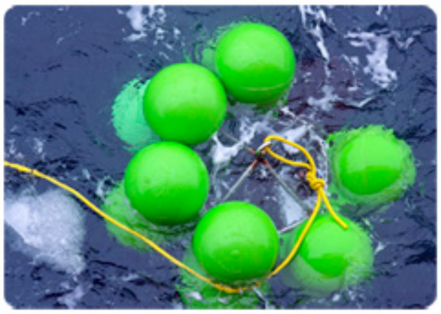
Now, his and his colleagues' -- Christina Morency, Nathan Simmons, Anders Petersson, Bjorn Sjogreen, Michael Loomis and Rich Cook -- work is on display in the full-dome show and exhibit titled "Earthquake" at the California Academy of Sciences (CAS).

"Earthquake" is a new planetarium show and major exhibit that opens to the public May 26. The show launches visitors on a tour through space and time -- flying over the San Andreas fault before diving into the planet's interior, traveling back in time to witness both the 1906 San Francisco earthquake and the breakup of Pangaea (the supercontinent) 200 million years ago.

With an emphasis on scientifically accurate data, the show draws heavily from the expertise of Lawrence Livermore scientists who provided accurate ground motion simulations for the 1906 earthquake, ground motions for a hypothetical earthquake on the Hayward Fault, visualizations of seismic waves traveling through the Earth and a temperature map of Earth's interior based on imaging with seismic waves.

To read more, go to CAS.

ScienceDaily THE DRY GETTING DRIER



Monitoring of the Southern Ocean using arrays of anchored and drifting instruments reveals freshening of deep waters around Antarctica. ***Photo by Steve Rintoul/CSIRO.***

A clear change in salinity has been detected in the world's oceans, signaling shifts and acceleration in the global rainfall and evaporation cycle tied directly to climate change.

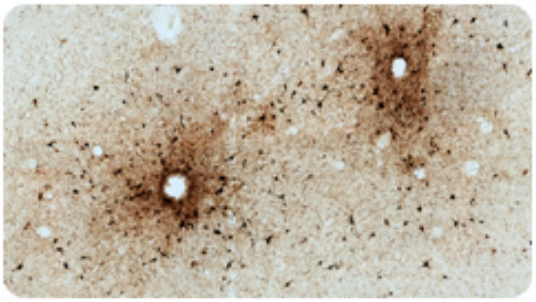
Australian scientists from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Lawrence Livermore have reported changing patterns of salinity in the global ocean during the past 50 years, marking a clear symptom of climate change.

Lead author Paul Durack said that by looking at observed ocean salinity changes and the relationship between salinity, rainfall and evaporation in climate models, they determined the water cycle has become 4 percent stronger from 1950-2000. This is twice the response projected by current generation global climate models.

"These changes suggest that arid regions have become drier and high rainfall regions have become wetter in response to observed global warming," said Durack, a post-doctoral fellow at Lawrence Livermore.

To read more, go to *Science Daily*.

KCBS BRAIN INJURY RESEARCH UNVEILS NEW FINDINGS



The brain of a 45-year-old male U.S. military veteran who was exposed to a single close-range improvised explosive device blast exposure two years before his death.

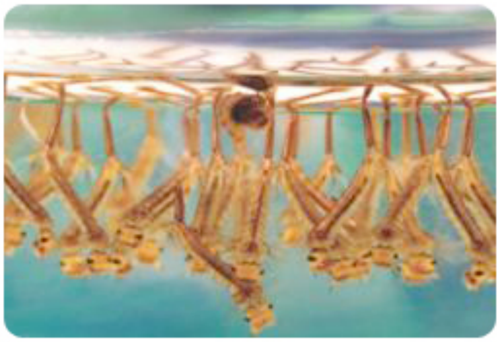
A recent breakthrough shows that soldiers injured from a blast from an improvised explosive device (IED) are similar to the same impact football players endure on the field.

Findings reveal that the brain injuries suffered by soldiers from IEDs are due to the head rotation or motion from the blast wind.

The researchers compared brain tissue samples from four soldiers with known blast exposure and/or concussive injury with brain tissue samples from three amateur American football players and a professional wrestler with histories of repetitive concussive injuries.

The results showed that the brain damage in blast-exposed veterans is similar to the brain injuries observed in football players who have sustained repetitive concussive head injuries. This result is a significant finding because it demonstrates a common link between what has previously been believed to be two disparate injury mechanisms.

To hear more, go to KCBS radio.



Livermore's new molecule is designed to be tethered to a gas-water interface in the same way that these mosquito larvae cling to a water surface.

Carbon dioxide from the flues of coal-fired power plants uses so much energy that no one bothers to use it. So says Roger Aines, principal investigator for a Laboratory team that has developed an entirely new catalyst for separating out and capturing carbon dioxide, one that mimics a naturally occurring catalyst operating in our lungs.

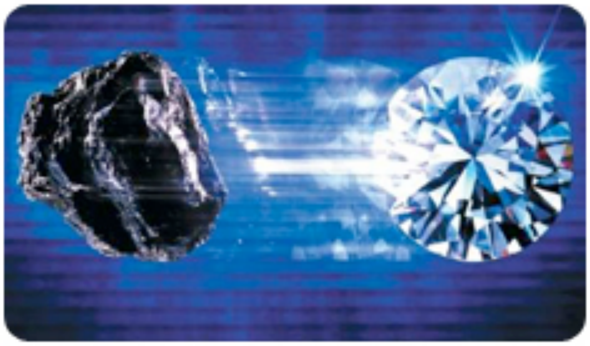
With this success, Lawrence Livermore has become a leader in designing catalysts that mimic the behavior of natural enzymes.

This small-molecule catalyst, dubbed "Cyclen," mimics carbonic anhydrase, which separates, captures, and transports carbon dioxide out of our blood and other tissues as part of the normal respiration process. Carbonic anhydrase is the fastest operating natural enzyme known. For years, researchers have considered adapting it to capture carbon emitted in industrial operations. But carbonic anhydrase cannot take the heat in the intense conditions of industrial processes. Hot, high-pH flue gas quickly degrades it.

The Livermore team's best designer molecule behaves like carbonic anhydrase but has so far indicated that it is one tough cookie. "In fact," Aines said, "it has turned out to be thermodynamically stable. It is far more rugged than we had expected."

To read more, go to *Phys.org*.

R&D DIAMOND IN THE ROUGH



In a series of new experiments, a powerful X-ray laser blasted solid carbon crystals into a liquid and plasma even faster than expected, raising new questions about how these intense beams interact with matter.

The tests took place at the Linac Coherent Light Source, or LCLS, using a pioneering technique to simultaneously blast and probe samples of graphite, a pure form of carbon (diamonds are a pure extremely hard form of carbon).

The team chose graphite partly because it might offer a way to see whether biological molecules, which are also carbon-based, will produce useful data when probed with intense X-ray laser pulses, said Stefan Hau-Riege, a staff physicist at Lawrence Livermore who led the research team. In addition, its fundamental properties, such as its melting behavior, are still not well understood.

Hau-Riege said the results, which show ultrafast changes from solid to liquid and from solid to plasma in the graphite, defied the team's expectations. "The models that we're currently using don't explain it," he said. There are "processes taking place that we don't fully understand."

To read more, go to *R&D Magazine*.

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