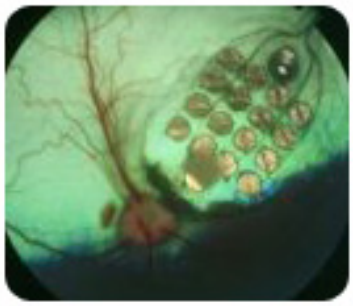
LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Feb. 11-15, 2013.

EYE ON THE PRIZE



A retinal prosthesis contains a small implantable chip with electrodes. These electrodes stimulate the retina and help people regain limited vision.

The retinal prosthesis Lawrence Livermore helped develop has been approved by the FDA.

The U.S. Department of Energy announced Thursday that its support for a decade of revolutionary research has contributed to the creation of the first ever retinal prosthesis -- or bionic eye -- to be approved in the United States by the U.S. Food and Drug Administration for blind individuals with end-stage *retinitis pigmentosa*.

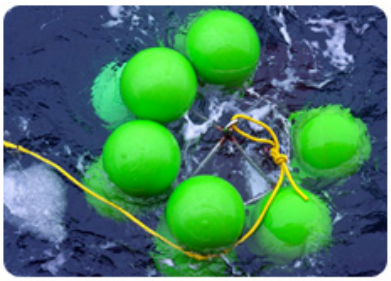
LLNL engineers played a key role in the project by developing the microelectrode array for the epiretinal prosthesis. For more on Lawrence Livermore role in the project, see the July 2009 edition of *Newsline*.

The artificial retina, dubbed the Argus II Retinal Prosthesis System (developed and manufactured by Second Sight Medical Products Inc, Sylmar, California), may prove to be an aid to those blinded by the disease *retinitis pigmentosa*, which can run in families and is estimated by the National Institutes of Health to affect about 1 in 4,000 people in the United States. Over the 10-year lifetime of the project, DOE provided $75.2 million for the development of technologies aimed at advancing artificial retinas like the Argus II, which was based on work by a consortium of scientists using advanced technologies developed by several of the department's national laboratories.

To read more, go to the Web.

physicstoday

OCEAN RESEARCH IS WORTH ITS SALT



Monitoring of the Southern Ocean using arrays of anchored and drifting instruments reveals freshening of deep waters around Antarctica.

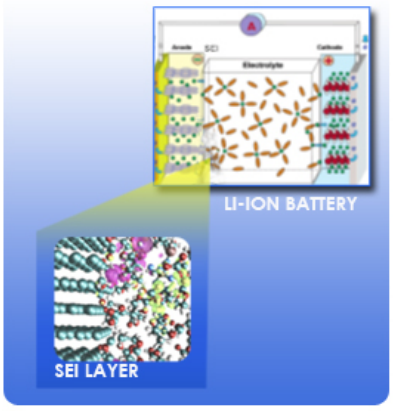
In a warming world, increased temperature means that the atmosphere can hold and transport more water vapor, according to findings at Lawrence Livermore.

This affinity for moisture affects the entire water cycle, throughout the global climate system. Change is especially reflected in increased patterns of evaporation and precipitation, and a corresponding increase in ocean surface salinity.

In the past 50 years, salinity differences -- the marker of the oceanic water cycle -- have intensified in the upper 700 meters of the ocean.

The atmosphere responds to temperature changes at a faster rate than the ocean, so ocean circulation levels vary in temperature and salinity. "As a consequence of the longer ocean timescale, and the fact that ocean salinity captures and averages all the longer timescale variability, there are coherent changes to ocean salinity patterns clearly present in the data," explains Paul Durack of the Program for Climate Model Diagnosis and Intercomparison at the Laboratory.

To read more, go to *Physics Today*.



A Lawrence Livermore team of researchers is working to improve lithium-ion battery performance, lifetime and safety.

Working with Lawrence Berkeley National Laboratory, the scientists are developing a new methodology for performing quantum molecular dynamics simulations at an unprecedented scale to understand key aspects of the chemistry and dynamics in lithium-ion (Li-ion) batteries, particularly at interfaces.

Li-ion batteries have revolutionized personal electronics and have the potential to do the same for transportation and electrical distribution. In transportation, a significant advance in battery performance and lifetime will allow the transition from current gasoline- and diesel-based vehicles to plug-in hybrids and all-electrics with comparable or better power, range and cost. This, in turn, would greatly reduce the nation's dependence on fossil fuels and carbon emissions associated with them. An advance in safety will have significant implications for aviation as well, as the grounding of Boeing 787s worldwide due to Li-ion battery fires has made all too clear.

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

Europium, a rare earth element that has the same relative hardness of lead, is used to create fluorescent lightbulbs.

The Department of Energy has launched a research hub that focuses on solutions to the domestic shortages of rare earth metals and other materials critical for U.S. energy security. Lawrence Livermore has been involved in establishing this Energy Innovation Hub since its conception more than two years ago. In 2010, on behalf of DOE, LLNL hosted the first U.S.-Japan workshop on rare earths elements. LLNL's Ed Jones and Adam Schwartz have been closely tied to the initiative.

The initial team, made up of Ames, LLNL, Colorado School of Mines and Molycorp Inc., established a 'national network' that eventually resulted in the proposal team; helped DOE on its critical materials strategy; and continued interactions on behalf of DOE at the international level.

The rare earths comprise 17 elements in the periodic table. Despite their name, the rare earths (with the exception of promethium) are not all that rare, but are actually found in relatively high concentrations across the globe. However, because of their geochemical properties, they seldom occur in easily exploitable deposits. Several of the rare earths are used in clean energy technologies.

To read more, go to *New Materials International*.

FEDTECH CHECK THIS OFF YOUR LIST

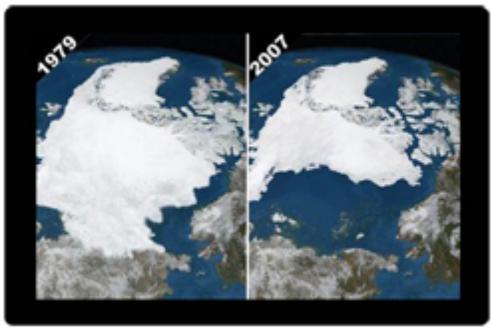
Information technology officials who have experience with virtual desktop infrastructure (VDI) warn that while VDI is ideal for some uses, it does have limitations.

But for those who are considering it, Lawrence Livermore senior cybersecurity analyst Lee Neely has a tip for your checklist.

Transitioning to VDI, even on a small scale, is complex, so seek out vendors who know what's involved in defining, building and implementing the architecture and talk to other agencies about their experience and lessons, Neely recommends. "Don't go it alone," Neely says. "There are a lot of people looking at this and a lot of information out there, so leverage what others know and have done. You don't have to try and invent this wheel by yourself."

To read more, go to *Fed Tech*.

mydigitalfc.com **A DANGEROUS CLIMATE CHANGE GAME**



These pictures show the extent of the September Artic ice cover for 1979 and 2007.

When it comes to mitigating climate change, geoengineering may be an option.

Geogengineering comes in two flavors: One uses carbon-dioxide removal techniques that address the root cause of climate change by removing greenhouse gases from the atmosphere. The other uses solar radiation management techniques that attempt to offset effects of increased greenhouse gas concentrations by causing the earth to absorb less solar radiation.

The eruption of Mt. Pinatubo, a volcano on the Philippine island of Luzon, on April 2, 1991, might be the first evidence on the effectiveness of the geoengineering approach. Three weeks after its eruption, an aerosol cloud had encircled the Earth, and for nearly two years 20 million metric tons of sulfur dioxide mixed with droplets of water to create a kind of gaseous mirror that reflected solar rays back into the sky. Throughout 1992 and 1993, the amount of sunlight that reached the surface of the Earth was reduced by more than 10 percent.

But as climate change becomes more and more evident, the world may have to turn to man-made geoengineering. Melting the polar ice would release enormous stores of methane, a greenhouse gas nearly 30 times more potent than carbon dioxide. If that happens, according to retired hydrologist Jane Long of Lawrence Livermore National Laboratory, "it's game over."

To read more, go to mydigitalfc.com.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance. To send input to the *Livermore Lab Report*, send e-mail.