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University of Arkansas, Fayetteville

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Researchers Investigate Pathway to Cell Death

Fruit fly specimens in Michael Lehmann's laboratory.

Michael Lehmann, an associate professor of biological sciences at the University of Arkansas, is using fruit fly genetics to study a glutamate receptor that triggers programmed cell death in the nervous system. This receptor controls cell death in both humans and fruit flies.

When larvae of Drosophila melanogaster, a common fruit fly, grow from the larval stage into adults, they shed most of their former organs and grow new ones. The study of the mechanism of cell death may be crucial to fighting neurodegenerative diseases such as Alzheimer's and Parkinson's, Lehmann said.

"Those patients lose brain cells and that is usually brought about by overstimulation of the N-methyl-D-aspartate receptor, known as the NMDA receptor," Lehmann said. "Almost all cell death that takes place in the brain depends on this receptor. So it's very important to understand how it functions and how it may be possible to influence it."

Working with Brandy Ree, a doctoral student in the interdisciplinary graduate program in cell and molecular biology, Lehmann is using a combination of biochemistry and fruit fly genetics in an attempt to define the pathway that leads from activation of the receptor to the cell's eventual death.

"We developed a new system to study the receptor outside the nervous system in a normal developmental context," he said. "Many of the different components involved in cell death are known in this system. We just have to connect the dots and fit the receptor into the pathway to find out how exactly it contributes to the cell's death."

The National Institutes of Health has awarded Lehmann a three-year, $260,530 grant to support the study.

Stahle Presents Tree-Ring Data at AAAS

David Stahle, University of Arkansas

A research team, including University of Arkansas Distinguished Professor and dendrochronologist David Stahle, used more than 1,400 climate-sensitive tree-ring chronologies from multiple tree species across North America to reconstruct the Palmer drought severity index (PDSI), a widely used soil moisture index.

Stahle presented his research Feb. 15, in a symposium on "U.S. Climate and Weather Extremes: Past, Present, and Future," during the American Association for the Advancement of Science annual meeting in Boston. He also participated in a panel discussion with other climate experts.

The Palmer drought severity index is based on instrumental temperature and precipitation data dating back to 1895. Stahle and his colleagues inserted the index between fixed points on a grid covering most of North America. Their tree-ring reconstructions cover the same geographic area but extend back to 800 A.D.

Stahle wanted to examine the reconstructed indices to test the accuracy of the records and to see if there were any patterns related to drought and other climate changes. The findings were dramatic.

"Comparisons of reconstructed PDSI with instrumentally measured PDSI during the 20th century document the remarkable accuracy with which the tree-ring data reproduce the spatial pattern and intensity of observed drought at annual and decadal time scales, including the Dust Bowl drought of the 1930s," Stahle said.

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AWARD WINNERS

The following is a sampling of faculty awards in March, with the principal investigator, the award amount and the sponsor. An asterisk (*) indicates the continuation of a previous award.

— Brent L. Smith, $271,070, University of Maryland
— Marcia Shobe, $250,000, Ford Foundation

Silicon Solar Files for Patent

Douglas Hutchings, Silicon Solar Solutions

Silicon Solar Solutions Inc., a Genesis Technology Incubator client at the University of Arkansas, has developed a new technology that could improve the efficiency of solar cells by 15 percent, thereby potentially saving manufacturers millions of dollars in production costs.

The start-up company at the Arkansas Research and Technology Park has submitted an application for a full patent on a self-aligned hydrogenated selective emitter for N-type solar cells, moving the patent from "provisional" to "pending," said Douglas Hutchings, chief executive officer of Silicon Solar Solutions.

Seth Shumate, a graduate student at the U of A and senior scientist at Silicon Solar Solutions, invented the emitter. In December, the National Science Foundation awarded the company a $150,000 small-business grant to continue its development.

The technology is at the heart of a joint venture being developed by Silicon Solar Solutions and Picasolar, a graduate business competition team at the university that includes Shumate as a member.

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Study Shows Rise in Teachers' Health Insurance Costs

A new study by a University of Arkansas professor and doctoral student found that school district costs for teachers' health insurance in 2012 were, on average, 26 percent higher than those for private-sector professional employees.

The information was published online in Education Next. Robert Costrell, holder of the Twenty-First Century Chair in Accountability, and Jeffery Dean, a Distinguished Doctoral Fellow in education policy, are co-authors.

— Matthew Ganio, $144,535, The Coca-Cola Co.
— Pat Parkerson, $125,452, University of Maryland, Baltimore County
— Douglas Osborne, $50,206, Arkansas Game and Fish Commission

The study, which used data from the Bureau of Labor Statistics, found the average annual health insurance cost for teachers was $8,559 compared to $6,803 in the private sector. When adjusted for higher participation rates in health-care plans among teachers versus private-sector professionals, the costs are 16 percent higher for teachers ($9,838 versus $8,490 in the private sector). School district costs for teachers' insurance rose at an average annual rate of 4 percent above inflation from 2004 to 2012.

Education Next is a scholarly journal that is a joint project of Stanford University's Hoover Institution and Harvard University's Kennedy School of Government.

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University of Arkansas Arkansas Newswire

Tree-Ring Data Show History, Pattern to Droughts

Distinguished Professor presents at 2013 AAAS meeting in Boston

Friday, February 15, 2013

FAYETTEVILLE, Ark. – Dendrochronologists have shown that tree-ring data produce a remarkably accurate history of droughts and other climate changes. Combined with reliable drought indices and historical descriptions of climate conditions, dendrochronology – the technique of dating events and environmental change by relying on characteristic patterns of tree-ring growth – can provide a climate perspective on important events such as large-scale human migration and even the rise and fall of entire civilizations.

For more than a decade, Distinguished Professor David Stahle has taken core samples from trees and examined the chronology of their rings to help explain the societal impact of drought and other climate changes.

A research team, including University of Arkansas Distinguished Professor and dendrochronologist David Stahle and Ewing Research Professor Edward Cook of Columbia University, used more than 1,400 climate-sensitive tree-ring chronologies from multiple tree species across North America to reconstruct the Palmer drought severity index (PDSI), a widely used soil moisture index. Stahle presented his research Friday, Feb. 15, in a symposium on "U.S. Climate and

Weather Extremes: Past, Present, and Future," during the American Association for the Advancement of Science annual meeting in Boston. He also participated in a panel discussion with other climate experts.

The Palmer drought severity index is based on instrumental temperature and precipitation data dating back to 1895. Stahle and his colleagues inserted the index between fixed points on a grid covering most of North America. Their tree-ring reconstructions cover the same geographic area but extend back to 800 A.D.

Stahle wanted to examine the reconstructed indices to test the accuracy of the records and to see if there were any patterns related to drought and other climate changes. The findings were dramatic.

"Comparisons of reconstructed PDSI with instrumentally measured PDSI during the 20th century document the remarkable accuracy with which the tree-ring data reproduce the spatial pattern and intensity of observed drought at annual and decadal time scales, including the Dust Bowl drought of the 1930s," Stahle said.

The data also confirmed historical descriptions of climate conditions prior to the modern era of instrumentation for weather and climate measurements. For these comparisons, the researchers relied on accounts from Zebulon Pike's 1806-1807 expedition and from Stephen H. Long's 1820 exploration. Both expeditions described extremely dry conditions across much of the Great Plains and Rocky Mountains.

The researchers analyzed the reconstructions and found a pattern of droughts over the past few centuries similar to the 2011 drought centered over Texas and the Southern Plains as well as the 2012 Corn Belt drought.

"Both of these droughts have precedents in the centuries-long tree-ring reconstructions," Stahle said. "In fact, the tree-ring data document drought anomalies in prehistory with a similar severity and spatial impact that persisted for two to three years. Severe drought over the Corn Belt and southern Great Plains are likely to recur, especially with continued warming over the United States."

The tree-ring reconstructions of the Palmer index indicated that the Great Pueblo Drought, which occurred from 1276 to 1297 and may have contributed to the abandonment of the northern Colorado Plateau by the ancient Pueblo, affected a larger geographic area than originally thought. The findings indicated that this

drought covered the entire southwestern United States and included drought in both the winter and early growing season.

For more than a decade, Stahle has taken core samples from trees and examined the chronology of their rings to help explain the societal impact of drought and other climate changes. Specifically, his research has added rich information to explanations about the migration of North America's indigenous people and the demise of Mesoamerican civilization.

A recently published 1,238-year-long tree-ring chronology, the longest and most accurate of its kind for Mesoamerica, was the first to reconstruct the climate of pre-colonial Mexico on an annual basis for more than a millennium. That study identified four ancient megadroughts and their exact years. Previous research found large and epic droughts over North America during the 8th and 16th centuries.

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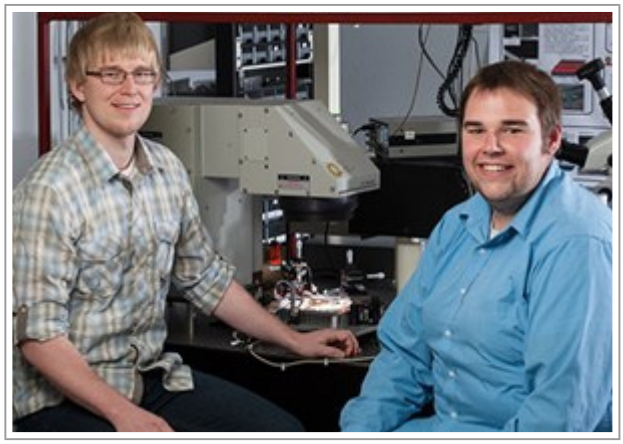
University of Arkansas Arkansas Newswire

University-Affiliated Business Applies for Patent for Solar-Cell Efficiency Technology

Silicon Solar Solutions receives $150,000 grant for invention

Monday, February 18, 2013

FAYETTEVILLE, Ark. – Silicon Solar Solutions Inc., a Genesis Technology Incubator client at the University of Arkansas, has developed a new technology that could improve the efficiency of solar cells by 15 percent, thereby potentially saving manufacturers millions of dollars in production costs.



Douglas Hutchings (left), chief executive officer of Silicon Solar Solutions Inc., and Matthew Young, a member of Picasolar, a graduate business plan competition team at the University of Arkansas, pose in a GREEN Center Laboratory at the Arkansas Research and Technology Park. Photo by Russell Cothren, University of Arkansas

The start-up company at the Arkansas Research and Technology Park has submitted an application for a full patent on a self-aligned hydrogenated selective emitter for N-type solar cells, moving the patent from "provisional" to "pending," said Douglas Hutchings, chief executive officer of Silicon Solar Solutions.

"If successful, this approach represents the single largest technology leap in solar since 1974," Hutchings said. "We have demonstrated it on lab-scale cells already. We're all excited."

Seth Shumate, a graduate student at the U of A and senior scientist at Silicon Solar Solutions, invented the emitter. In December, the National Science Foundation

awarded the company a $150,000 small-business grant to continue its development.

The technology is at the heart of a joint venture being developed by Silicon Solar Solutions and Picasolar, a graduate business competition team at the university that includes Shumate as a member. On Jan. 26, Picasolar took first place at the 2013 IBK Capital-Ivey Business Plan Competition and took home a cash award of $20,000.

Shumate, a doctoral student in the microelectronics-photonics program at the university, uses a vacuum chamber in a laboratory at the Arkansas Research and Technology Park to conduct his experiments. The chamber has a tungsten filament, similar to a light bulb, which heats to 3,452 degrees Fahrenheit. When hydrogen is introduced to the chamber it hits the surface of a tungsten filament, separating the hydrogen atoms.

“Those atoms then go into the solar cell and do their magic,” Shumate said.

Selective emitter technology for solar cells has so far involved complex processes with at least two or more steps. The technology innovation put forward by Silicon Solar Solutions is a single-step method for creating a selective emitter by using atomic hydrogen to deactivate impurities in the emitter. It increases solar power conversion efficiency and reduces the amount of silver needed to produce high-efficiency solar cells, thereby lowering material costs.

The National Science Foundation Phase I grant came through the Small Business Innovation Research Program, which allows federal agencies to stimulate technological innovation in the private sector by strengthening small businesses that meet federal research and development needs. The program also is intended to increase the commercial application of federally supported research results.

Silicon Solar Solutions will raise $60,000 of outside investment for the emitter to secure an additional $30,000 from the National Science Foundation. Hutchings said it hopes to receive a $750,000 Phase II grant in January 2014 to demonstrate the lab results on industrial-quality cells and start implementing the technology in existing solar-cell manufacturing lines.

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University of Arkansas Arkansas Newswire

Study Shows Rise in Teachers' Health Insurance Costs

Wednesday, February 13, 2013

A new study by a University of Arkansas professor and doctoral student found that school district costs for teachers' health insurance in 2012 were, on average, 26 percent higher than those for private-sector professional employees.

The information will be published online (http://educationnext.org/) today, Feb. 13, in *Education Next*. Robert Costrell, holder of the Twenty-First Century Chair in Accountability, and Jeffery Dean, a Distinguished Doctoral Fellow in education policy, are co-authors.

The study, which used data from the Bureau of Labor Statistics, found the average annual health insurance cost for teachers was $8,559 compared to $6,803 in the private sector. When adjusted for higher participation rates in health-care plans among teachers versus private-sector professionals, the costs are 16 percent higher for teachers ($9,838 versus $8,490 in the private sector). School district costs for teachers' insurance rose at an average annual rate of 4 percent above inflation from 2004 to 2012.

"The Rising Cost of Teachers' Health Care" will appear in the spring issue of the magazine. *Education Next* is a scholarly journal that is a joint project of Stanford University's Hoover Institution and Harvard University's Kennedy School of Government.

Recognizing that recent battles over collective bargaining in Wisconsin and other states have focused significantly on health insurance costs, the study also examines new data from Wisconsin to quantify the impact of that state's recent change in collective bargaining law, finding a reduction in district health insurance costs of 13 to 19 percent.

Comparing unionized and non-unionized workers in both the public and private sectors, the authors find that "unionization is associated with higher total premiums, higher employer costs and lower employee contributions in both the

public and private sectors." Widely varying teacher unionization across states helps explain large differences in employer and employee health insurance costs.

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