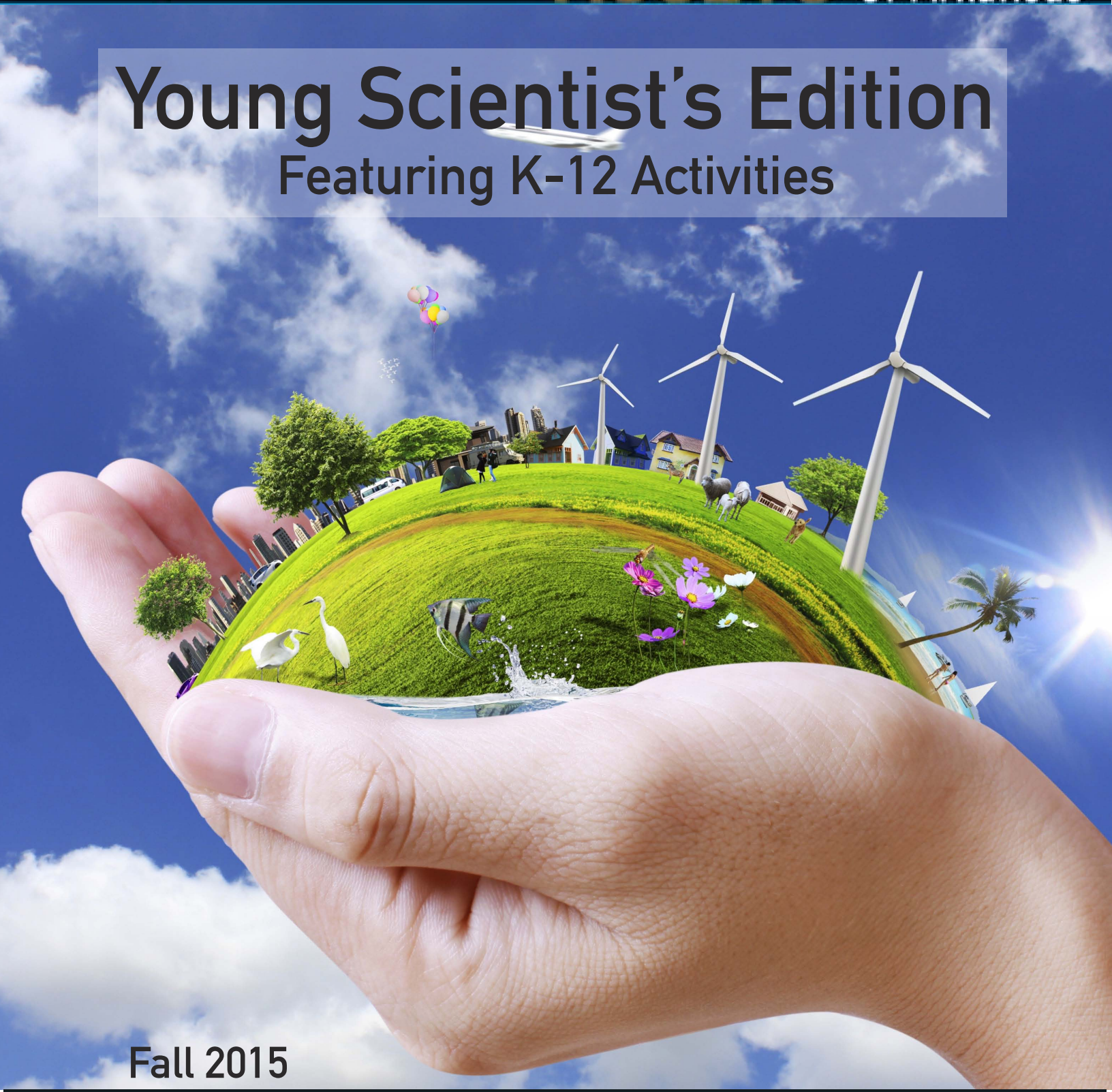
ARKANSAS asset initiative

ASSETS of Arkansas

Young Scientist's Edition

Featuring K-12 Activities



Fall 2015

ASU ARKANSAS STATE UNIVERSITY

UNIVERSITY OF ARKANSAS

UA FORT SMITH

PHILANDER SMITH COLLEGE THINKJUSTICE

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UNIVERSITY OF ARKANSAS PINE BLUFF

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A Message From Dr. Gail McClure, Arkansas EPSCoR Program Director

There have been many changes occurring within Arkansas over the past year. We have a new governor, many new legislators, and most importantly for Arkansas EPSCoR is a new agency home. The Arkansas Science & Technology Authority merged with the Arkansas Economic Development Commission (AEDC) to become a part of a major division within AEDC. This merger contributes to our EPSCoR mission to create economic opportunity in Arkansas through collaborative, multi-university research and development supporting science and engineering innovations which lead to higher paying jobs and expand and diversify state and local economies, increase incomes and investments, and generate positive growth throughout Arkansas.

The National Science Foundation recently announced a $20 million award to the AEDC Division of Science & Technology for development of an EPSCoR Center for Advanced Surface Engineering. This is a 5-year statewide program which will also receive a $4 million match from the state. The $24 million will be used to support research and educational activities on eleven campuses and organizations including: University of Arkansas, University of Arkansas for Medical Sciences, University of Arkansas at Little Rock, University of Arkansas at Pine Bluff, University of Arkansas at Monticello, Arkansas State University, University of Central Arkansas, Ouachita Baptist University, Southern Arkansas University, Philander Smith College, and the UA Division of Agriculture. The research and training efforts of this new center are tightly linked to Arkansas industries and will contribute to improving the Arkansas economy.

This issue of our newsletter discusses our past research efforts, including new technologies developed and advancements made in alternative energy research at Arkansas universities. Technology has evolved over the past decade and is embedded in almost every part of our daily lives. Readers will learn about researchers in our state who are creating more durable electronics, improving the world's Internet speeds, and growing plants that are strong enough for outer space.

A large piece of our EPSCoR program is educational outreach, intended to spark interest in STEM topics among the researchers of tomorrow. Read about the outreach activities over the past year like our Summer Research Institute, where undergraduate students learned lab techniques and career development skills prior to their summer research experiences; and the GREEN Mobile, a traveling solar energy laboratory with educational tools. Also, new to our eMagazine are sections that include interactive K12 activities designed for educators (or parents) like Biodiversity Bingo, a fun scavenger hunt that will teach kids about the biodiversity of your yard or playground, or a sound booth activity where kids will learn about physics while building their own sound booth from inexpensive materials. We hope you enjoy reading ASSETs of Arkansas.

These microscope icons represent activities, look for them in this issue!

Environmenally Resistant Electronics: Dr. Mantooth, UAF

Dr. Alan Mantooth (pictured on right), faculty at the University of Arkansas and director of both VICTER and the GREEN Center, is working to improve electronic device performance in extreme environments. The goal is to make electronic components that can thrive in any environment for example Arctic cold, the heat and dryness of the desert, or areas with extreme radiation such as space, and at the same time making the devices more compact. This could have a huge impact on researchers and other indsutries all over the world. He and four other collaborators are creating a more efficient, more compact, and more rugged solar inverter that will hopefully be completed in 2015.

Dr. Mantooth is also working with with Dr. Salamo from the physics department on a gallium nitride current sensor. Typically current sensors are made with silicon and cannot withstand high temperatures, but with the new material they have developed, the sensors can withstand high temperatures and operate faster than sensors that are available now.

Through his collaboration with other researchers, several ideas have been eveloped on how to make different types of renewable energy sources more efficient. According to Dr. Mantooth, VICTER and the GREEN Center have benefited science in Arkansas in many ways, have been nationally recognized for their work, and now have a great sustainable energy program in place that will result in technological advancements.

Chris Farnell, test engineer for the National Center for Reliable Electric Power Transmission, demonstrates how some of the lab equipment works.

Activity: Bioenergy Coloring Book

Kids can learn about bioenergy in this Energy Efficiency & Renewable Energy Coloring Book from the U.S. Department of Energy.
Link: http://tinyurl.com/nzppnp6

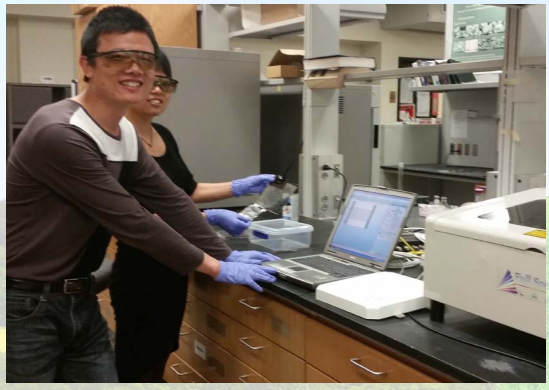
Faster Capacitors, Less Charging Time: Dr. Tian, UAF

Dr. Ryan Tian is a chemistry and biochemistry professor at the University of Arkansas at Fayetteville, and is currently working with the VICTER team and the Joint Center of Artificial Photosyntheses (JCAP) to make renewable energy sources more efficient. JCAP is a California-based organization that is working with Berkeley University and Cal-Tech to make solar panels more efficient, like the GREEN and VICTER Centers in Arkansas. Dr. Tian and his team have joined forces with JCAP to collaborate on this research.

One method Dr. Tian is investigating utilizes a specific structure that increases the surface area of the solar cell by using tall nanowires, and arranging them in a way that optimizes the amount of light that each wire can take in. He is also working with a student on a paper discussing utilization of a magnetic field and spin-tronics to make energy production more efficient.

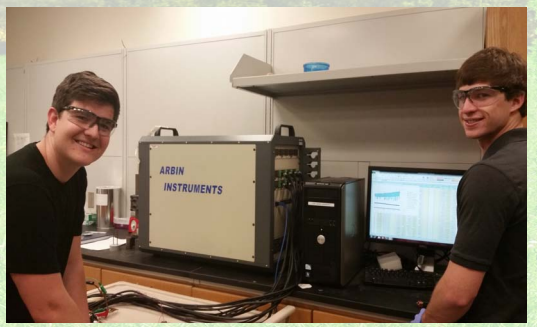
A capacitor is a device that is used to store an electric charge, which consists of one or more pairs of conductors separated by an insulator. Dr. Tian has also created super capacitor graphene sheets that have broken the world record for most energy per weight and most energy per volume. Capacitors are ubiquitous in electronic devices but traditionally take at least 8 hours to charge. Tian's capacitor will also charge at a much faster rate, for example a hybrid car using the capacitor might charge in just a few hours instead of overnight.

Dr. Tian

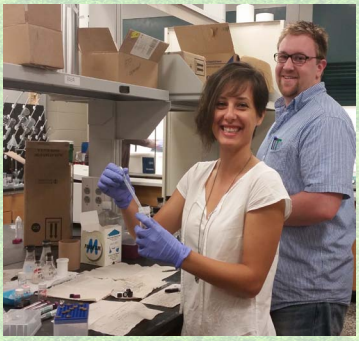


Left: Dr. Shengli Haung and Dr. Chunhua Lin (MD) testing the effciency of a capacitor.

Below: Graduate students Asya Ozkizilcik and Parker Cole working in the lab.



Right: Undergraduate students Braden Henderson and Philip McMeans testing electronics with a computer.



Activity: Biodiversity Bingo

How many different kinds of plants and animals live in your neighborhood? You might be surprised by the answer! In this 1 hour indoor/outdoor scavenger hunt, students explore and document diversity in the area.

Link: http://tinyurl.com/qdexeb3

Opening of the Sustainable Conservation House: Dr. Martini, UAFS

Conservation of energy has become increasingly important, especially since the average electric bill is well over 100 dollars per month. Many old appliances are not efficient, and using them can drastically increase an electric bill. Different types of home insulation and windows can also affect the amount of energy used in a home. Dr. John Martini (pictured on left), professor and the department head of the Department of Electronics at the University of Arkansas at Fort Smith, wants to teach Arkansas residents how to reduce their energy consumption at home with small, easy changes.

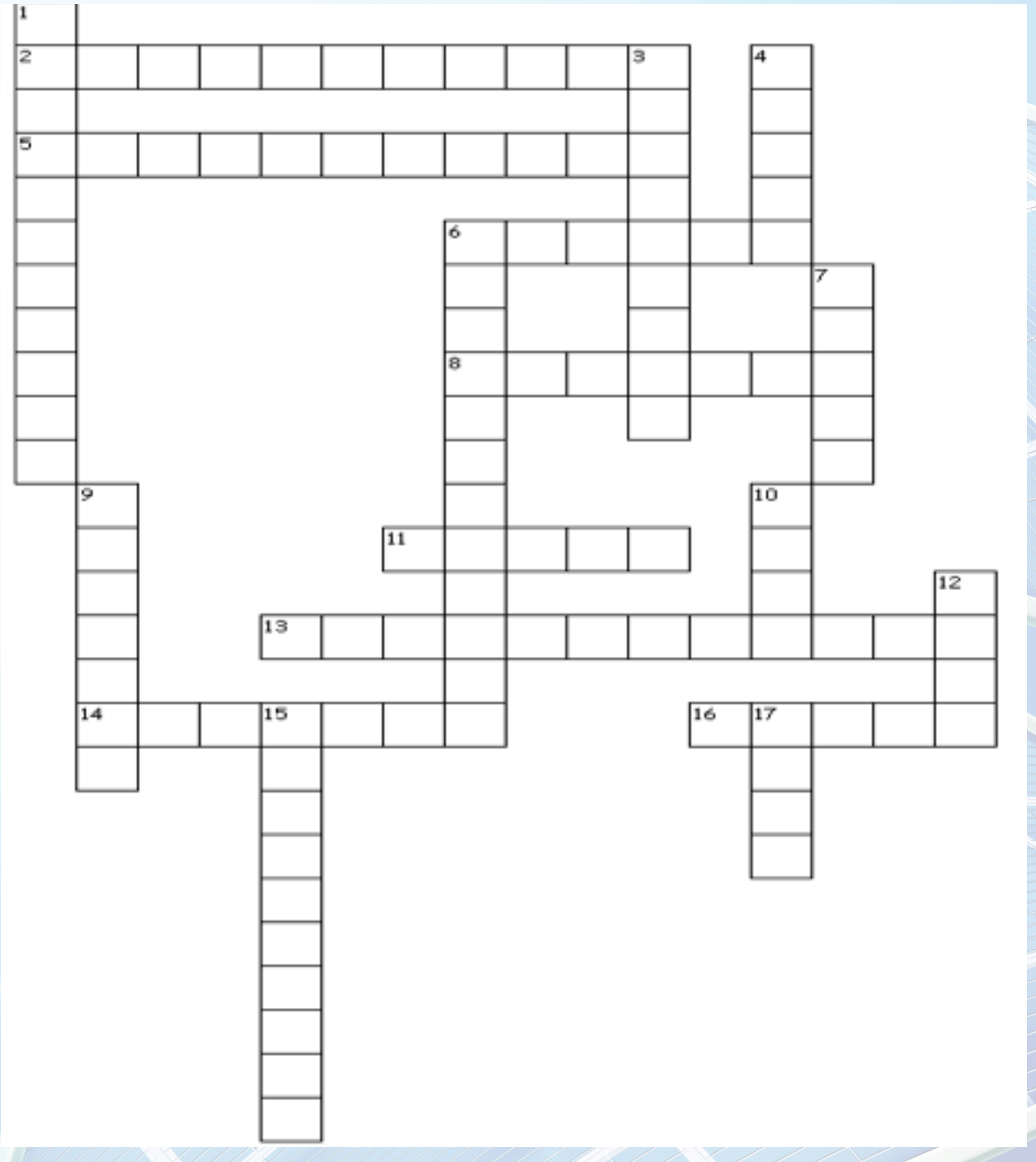
Dr. Martini created the Sustainable Conservation House (pictured on right), which opened to the public in late May 2015. This house has three main sections that are all hooked up to solar panels. The first section is designed to mimic the average home. It includes a living room, kitchen, bathroom, bedroom and the traditionally older appliances that are found in these rooms such as a refrigerator, stove, and hot water heater. The next section of the house has a classroom, bathroom, and office area with state-of-the-art appliances including a tank-less hot water heater, ductless heating and air, premium windows and insulation. The basement of the house contains a classroom and a guitar building shop where students can learn about mathematics, engineering, and physics in a hands-on interactive class.

Jared Dunning with the house's solar panel.

The basement is equipped with meters that show how much energy is being used by the appliances in the home, as well as how much is being generated by the solar panels. Visitors can also view a solar water heater, which works by piping water through special solar panels and then storing the hot water in a tank. The other classroom has several different energy related instruments for students to practice with to help them become certified energy auditors. The house demonstrates which materials are more energy efficient and what precautions to take to conserve energy in your home.

Dr. Martini hopes that the Sustainable Conservation House will benefit Arkansas residents in many ways. This is a public service that teaches residents how to conserve energy in their own home, and students can learn valuable hands on training that will benefit them and properly prepare them for a future career in the energy field.

Activity: Science Crossword Puzzle



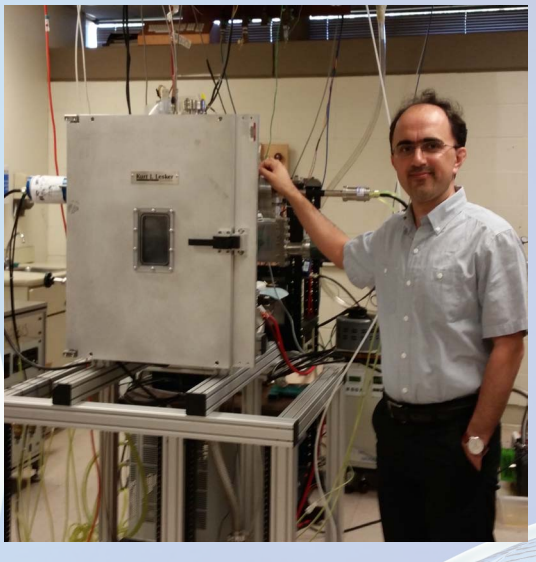
Across

2. scientific name for a butterfly
5. power house of a plant cell
6. transports plant liquids downwards to the root
8. these can be found on the periodic table
11. type of energy derived from the sun
13. power house of an animal cell
14. force that attracts you toward the center of the earth
16. used to weigh products

Down

1. used to power your home
3. branch of science dealing with space
4. transports plant liquids upward from the root
6. branch of science concerned with fossils
7. 1609 of these is a mile
9. the study of animals
10. has a low pH (acid)
12. has a high pH
15. we need to eat these to stay healthy
17. all living things are composed of this

Solar Cell Technology: Dr. Karabacak, UALR



Dr. Karabacak is a professor at the University of Arkansas at Little Rock and faculty member with the GREEN Center. He is currently working to create fuel cells that are less costly to make and less harmful to the environment. Fuel cells can be used as power supplies for processes that normally use coal, oil, or natural gas. Dr. Karabacak and his team hope to reduce the world's dependency on fossil fuels by using chemistry to develop better catalysts for fuel cells. With better catalysts, the chemical reaction that creates electricity can occur faster, resulting in more electricity produced.

Another important component of his research is to find a less expensive method of creating nanoparticles. Currently, nanoparticles are created with platinum, which is one of the most expensive metals in the world. Dr. Karabacak mixes platinum with other metals to create alloys and then studies their qualities.

The Search for Renewable Energy: Dr. Cansizoglu, UALR

Dr. Hilal Cansizoglu, who recently received her doctoral degree with an emphasis in physics from the University of Arkansas at Little Rock, is working with her former mentor Dr. Karabacak to improve solar cell capabilities. Together they are researching CIS solar cells, which are composed of copper and indium sulfide. Dr. Cansizoglu has worked to identify the best optical model for solar cells to make them absorb more light and reflect less, leading to better efficiency.

She is also working with Dr. Karabacak on glancing angle deposition (GLAD), which involves manipulating the film that the solar cell is made of during production. This causes the film to be covered with tiny nanostructures that increase the surface area of the solar cell, resulting in better light absorption. The cells can be tested after the GLAD process to see which combination of factors is more efficient.

Dr. Cansizoglu and her team hope to significantly impact absorption capabilities of solar cells, which would increase the power that can be produced by the solar cell. If solar cell production can be more efficient and cost effective, they could replace other energy production methods that are typically harsh on the environment.

Activity: Build a Sound Booth

In this 3 hour activity, students will explore the sound dampening ability of several materials through experimentation and construction of a sound booth. As a result, the students will learn about how sound is reflected, absorbed and travels through different materials, thus giving the students an overview of sound dampening, energy absorption and sound propagation.

Link: http://tinyurl.com/o4swf9y

Eco-Rich Energy: Dr. Seo, UALR

Due to increased population and energy use, renewable energy has become one of the most important scientific ventures of our time. Efficiency, cost effectiveness, and environmental safety all play a role in the energy industry, which makes thorough research critical.

Dr. Hye-Won Seo (pictured on left) is a professor of astronomy and physics and researcher at the University of Arkansas at Little Rock. Dr. Seo and her team are currently working on many different devices that will assist with more efficient and environmentally friendly energy production. Dr. Seo hopes to introduce new, more capable technologies, and improve the technology that we currently use on a daily basis.

One project that she is currently working on is nitride nanostructure and film fabrication by metal organic vapour deposition, and making more efficient light emitting diodes (LEDs). 80% of the gas in the air in Earth's atmosphere is nitrogen, which makes this element very abundant, cost effective, and ideal in using to extract energy.

Seo and her team are also working to make a more efficient photo-detector. Photo-detectors are used in many types of technology today, from the camera in your phone to the satellites orbiting our planet. Current photo-detectors read red wavelengths of light most efficiently. Her team wants to optimize the photo-detectors at violet and blue wavelengths of light to improve the devices overall.

One of Dr. Seo's undergraduate students Vince Loyd working in the lab.

Testing for Quality: Dr. Mortazavi, UAPB

Researchers throughout the world are working to perfect electronic devices and solar panels. One widespread problem is that most labs don't have all of the equipment needed to test every aspect of their devices. For example, a researcher may have equipment to test efficiency of a new solar panel, but not to test durability. The panel could be extremely efficient, but if it is not durable enough to deal with the environment it will encounter, it would be a bad investment.

Dr. Mortazavi (pictured on right) is a physics professor at the University of Arkansas at Pine Bluff, and the UAPB campus lead for VICTER. His major areas of interest are quantum mechanical investigation of non-linear optics, analyzing the behavior of quantum dots, and spectroscopy of biological cells. Dr. Mortazavi works with researchers across the state testing the characteristics of new devices. His lab is equipped with instruments that can measure a variety of characteristics like voltage, current, and durability. If Dr. Mortazavi finds an issue, he will report it to the researcher and they will re-work the device. The testing process is then repeated until the devices are perfected.

Visit:
www.VICTERcenter.com
For more information about VICTER

Mentoring the Masses: Dr. Pereira, UAF

Dr. Pereira is a Plant Molecular Genetics Professor at the University of Arkansas at Fayetteville, a faculty member of P3, and student mentor. His main research areas include plant stressors, bioinformatics, gene regulation, plant physiology, biofuels and bio-based products. Dr. Pereira and his students are researching photosynthesis. Through genetic modification, they have been able to increase photosynthesis in rice plants by increasing the number of chloroplasts in plant cells. Chloroplasts are organelles found in plants that are critical for photosynthesis. Increasing photosynthesis in the plant also results in an increased yield, which is extremely beneficial.

Dr. Pereira's team consists of many student mentees studying a variety of plant biology topics. He assists his students with research that they need to complete their thesis and graduate. Jowaher Arkahtani is a PhD student that is working with salt tolerance in plants. Graduate student Ritii Nahani is working on rice cell wall biosynthesis, and graduate student Anuj Kumar is working with drought stress and tolerance of rice. Ramegowda Venkategowda , Subodh K. Svivaslava, and Supratim Basy are all working on their postdoctoral studies and are all researching different aspects of plant stress due to drought. Finally, Miranti Rahmaningsih, Wedyan Alyamani, and Ipeleng Raudome are all graduate students working in Dr. Pereira's lab in the hopes of becoming expert plant biologists. Mentors like Dr. Pereira are crucial to developing skilled science workers of the future.

From left to right: Some of Dr. Pereira's mentees Anuj Kumar, Chirag Gupta, Ritii Nahani working in the greenhouse.

Plant Throughput Phenotyping Workshop: Dr. Lorence, ASU

Dr. Lorence

A phenotype is the set of observable characteristics of an organism, and is a result of the interaction of the organism's genotype with its environment. An important part of plant research is the ability to thoroughly analyze phenotypes and genotypes of experimental specimens, and compare them to control specimens to see if the experimental modifications had any effect. The P3 'Plant Throughput Phenotyping' Workshop trained attendees in this critical skill. The workshop was held in May 2015 and was lead by Dr. Argelia Lorence, a professor in metabolic engineering at Arkansas State University and Co-leader of the Plant Imaging Consortium.

Some of the workshop topics included Dr. Suxing Liu discussing imaging analysis, Dr. Gregory Phillips spoke about plant tissue culture and the appropriate media to use for a tissue culture. Dr. Steve Grace spoke about plant metabolomics, abiotic stress, and antioxidants. Overall, the workshop was a success. 'Plant Throughput Phenotyping' not only explored how to analyze a plant for further information, but also taught about important culturing procedures and media requirements that will benefit researchers and students in the future.

Activity: Science WordSearch

Science Wordsearch

Z	C	R	R	J	M	Y	Y	N	W	L	R	S	X	H
I	B	U	E	E	G	A	E	C	A	K	S	A	L	F
D	F	S	R	O	S	U	S	G	N	D	G	Q	T	D
Q	A	J	L	R	T	A	U	S	I	A	I	P	K	I
B	F	O	P	R	E	F	L	V	Y	C	Y	T	B	C
N	I	D	O	V	I	N	E	Y	S	H	V	O	J	A
B	H	N	E	R	B	R	T	Z	Q	E	C	N	U	Q
W	H	T	T	F	G	V	Z	J	V	M	A	N	V	B
C	M	N	Z	E	L	A	X	H	L	I	T	O	J	A
X	E	T	N	D	A	E	C	W	C	S	H	R	G	C
C	Z	T	A	T	O	M	C	S	B	T	O	T	G	C
S	I	S	Y	L	A	N	A	T	N	R	D	C	E	P
P	H	Y	S	I	C	S	K	C	I	Y	E	E	I	N
Q	G	X	D	P	A	U	J	W	U	O	D	L	O	H
A	L	T	E	R	N	A	T	O	R	J	N	E	N	O

Word bank:

ACID	ALTERNATOR	ANALYSIS
ATOM	BASE	BIOLOGY
BUOYANCY	CATHODE	CENTRIFUGAL
CHEMISTRY	CURRENT	DEFLECTION
DIVERGENT	ELECTRON	FLASK
ION	LASER	MASS
NEUTRON	PHYSICS	

Tougher, Stronger Crops: Dr. Khodakovskaya, UALR

Agriculture is an important part of the economy in Arkansas, producing millions in export dollars every year, yet Arkansas is not immune to the global challenges of drought and flooding that threaten agricultural output. Dr. Mariya Khodakovskaya, a professor at the University of Arkansas at Little Rock, believes it is important to know how to strengthen these plants at the genetic level to ensure that they not only survive, but thrive. In her lab at UALR, Khodakovskaya is working to modify corn and tomato plants so they can withstand extreme weather conditions such as floods, drought, and rapidly changing temperatures.

Dr. Khodakovskaya in her lab.

Researching growth in harsh environments is nothing new for Dr. Khodakovskaya, whose current work involves engineering plants to grow in the inhospitable environment of outer space. As a result, her work has inspired the publication of 17 articles covering her and her student's research, including past successes with carbon-based germination in plants. Dr. Khodakovskaya and her team are also studying plant pathways, hoping to genetically modify plants and increase their physical size. This would result in a higher crop yield, and ultimately a more prosperous season for farmers around the state.

First Annual Summer Research Institute

Many undergraduate students do not get any research experience, which can negatively affect the job search upon graduation. Most employers want to hire individuals that do not need extensive training, which makes it difficult for recent grads to enter the workforce. To address this problem, ASSET held a five day camp for undergraduate students, the Summer Research Institute.

The Summer Research Institute (SRI) was held in May 2015 at the Arkansas School for Mathematic, Sciences and Arts (ASMSA) in Hot Springs. The SRI was created to give senior undergraduate students a chance at much needed practice in their prospective fields prior to graduation. This not only prepares individuals for the work world, but also for graduate studies that they might pursue in the future. SRI gives the students experience to add to their resumes, which will aid them in securing a job.

Eighteen students participated in this program from several disciplines. Sessions on various important topics took place, such as Intro to Math Lab, Intro to Mathematical Modeling, Intro to 3D Modeling, Intro to 3D Printing, Biotechnology Bootcamp, Finding Sources for a Paper, Data Analysis in Excel, a graduate student panel discussion, Intro to Statistics, Research Certification, How to Communicate Your Science, and Consulting and Editing. The students were given assignments for example they were asked to prepare a ten-minute presentation and asked to attend all of the sessions that were offered during the event.

The sessions taught the most valuable techniques in each discipline. For example, the Biotechnology course focused on important lab techniques such as isolation of DNA, application of DNA by polymerase chain reaction, and visualization by gel electrophoresis. These lab techniques are used in almost every biology lab and every discipline, from forensic biology to plant biology. SRI was well-rounded and helped to prepare students for what happens after graduation, whatever path they may choose to take. The camp was so successful that ASSET will continue to host it every year for undergrads that work with ASSET researchers. (Photos below)

Making Devices Faster With Silicon Alloys: Dr. Yu, UAF

Silicon is used in many types of electronic devices, but is not as efficient as it could be. Combining silicon with other materials can provide benefits that could improve the quality electronics while remaining cost effective. Dr. Yu (pictured on left), an electrical engineering professor at the University of Arkansas at Fayetteville and a GREEN center researcher, is working to make the internal components of nano-devices more efficient.

Currently Dr. Yu is working with an alloy composed of silicon, germanium, and tin. The new material has similar benefits of silicon, but the other components in the material give other beneficial characteristics that make this material ideal for use in devices such as cameras or devices associated with the Internet.

Another component of Dr. Yu's research is nanostructures that can focus light in order to get high absorption of light in a solar cell, while using less material. The use of less material could increase the cost efficiency of the production process, and companies could pass the savings the consumer. Dr. Yu's new material has the potential to increase the processing speed of electronics and the Internet. Dr. Yu and his team are also working on utilization of a laser on the device that will assist in transferring signals at much higher speeds.

Dr. Yu hopes to commercialize the new silicon-germanium-tin alloy and create better quality devices that could be used in the public, private, and defense sectors. This research could potentially bring new industries and jobs to Arkansas, as well as new top-of-the-line electronics.

Building Electronics That Meet Society's Demand: Dr. Naseem, UAF

As the Internet expands, higher speeds and better processing capabilities are in high demand. Silicon is ubiquitous in the electronics world, and while it is extremely functional, it has reached its processing limit. Dr. Naseem is a Professor of electrical engineering, a researcher, and a faculty member at the GREEN center. The major focus of his research pertains to silicon films, deposition of polycrystalline silicon, and property characterization that can be used to make solar panels and other electronic devices more efficient.

Dr. Naseem and his team seek to change the way electronics are composed. For example, Dr. Naseem wants to find a new way to build transistors, which typically have numerous wires, that could improve the processing speeds. To accomplish this, he has replaced the traditional congested copper wiring with platforms of silicon, where where signals can be transmitted with light directly through the silicon. Dr. Naseem's work could improve many electronic systems that are currently in place. His innovative design integrates photonic devices with electronic devices. The signals that would normally be transmitted through copper wiring will be sent to a hub that will route the message to its destination in the most efficient manner.

Left to Right: Dr. Murtada Alher and Dr. Naseem in the lab.

Activity: Build A Watershed

Where does the water go when it rains? Find out by making it rain, right in your classroom! In this 1 hour activity, kids build a simple model of a landscape to see how water droplets flow and how the shape of the land helps collect water. By adding materials such as food coloring or paper to their landscapes, they also see how water carries pollutants.
Link: http://tinyurl.com/qgj45du

Virus Resistent Crops: Dr. Manoharan, UAPB

Agriculture is one of the most widespread and critical industries in the world, and it relies almost completely on plant defense systems. Farmers constantly battle environmental stressors like viruses that can not only reduce yield, but also destroy the crop itself. These viruses can spread from one crop to another and devastate entire fields

Dr. Muthusamy Manoharan is a professor at the University of Arkansas at Pine Bluff and specializes in agricultural biology. Dr. Manoharan provides Arkansas farmers with virus-free seedlings to plant, which enables higher crop yields.

Though Dr. Manoharan cannot provide 100% of the seedlings in Arkansas, He hopes to gradually increase the population of virus-free crops over time. Year by year, farmers can replace traditional seedlings with the new virus-free seedlings. This will eventually increase crop productivity and eliminate viruses in their field.

Dr. Manoharan creates these virus-free seedlings by genetic modification. He also produces genetically modified crops that produce more nutrients than traditional crops. These vitamin-enhanced crops would be useful in underdeveloped countries where diets are typically lacking in nutrients. Using these crops would result in more nutrition from less food, which positively impacts cost, land area, water usage, and other factors.

Dr. Manoharan demonstrating some of his equipment.

Dr. Sathish Kumar Ponniah working in the lab.

Bridging The Divide

The Bridge program is a 10 week summer program at Arkansas State University that teaches students the necessary tools, personal development skills, and work experience to successfully obtain graduate level degrees. Many universities do not have laboratory equipment or funding to give undergrad students optimal training. This program gives students from these establishments the ability to design and complete an experiment and learn laboratory techniques.

The main goal of this program is to bridge the gap between degree levels and make the transition from undergraduate study to graduate programs. The Bridge team matches each student with a mentor to guide them in their research. The students work on research for 9 weeks, and then present their work, providing practice similar to a thesis or dissertation. The Bridge program also seeks to improve the support system for minority students that are interested in pursuing graduate degrees. The number of doctoral and masters students is significantly lower in some minority groups than others. Eight students participated in bridge program during the summer of 2015. Kimberly Richardson, Charese Simpson, Destiny Jones, and Kiah Ferrell from the University of Arkansas at Pine Bluff, along with Jordan Miller, Nykole DeVito, Kaprese Warren and Klarissa Kahill from Philander Smith College. All of these students are entering the Masters program in their areas of study, with the exception of Klarissa Kahill, who will be entering the Ph. D program in her field. The Bridge program is primarily funded by the National Science Foundation EPSCoR Track 3. Dr. Srivatsan from Arkansas State University in Jonesboro heads this project, with the assistance of Kandi Granberry. From the program website:

"The Bridge Program prepares undergraduates for doctoral degree through performing research and scholarly activities in STEM fields. The purpose of the Bridge Program is two-fold: (1) To inspire undergraduate students to progress into graduate studies by providing opportunities in the summer for research and professional development; (2) To ensure success in academic, research, and the professional development of graduate students (Masters and Ph.D.) by providing financial support, wrap-around mentoring, and a caring community so that the students will acquire the skills and experiences necessary to become successful scientists, innovators and role models. Under the mentorship of a faculty member in a research-rich environment, students will be able to receive hands on training in the lab, learn how to conduct research, analyze results/data, and present the results in research symposia or conferences. In addition to help with GRE preparation, through regular professional development training Bridge students will learn the soft skills necessary to launch a successful career as a scientist."

Bridge program students Klarissa Kahill (left) and Kaprese Warren (right) working in the lab.

Clockwise from top left: Kiah Ferrell, Jordan Miller, Kimberly Richardson, Charese Simpson, Nykole DeVito, Destiny Jones. Photos courtesy Melanie Mowrey

Visit:

www.astate.edu/a/bridge-program/

For more information about Bridging The Divide

More Crops, Less Fertilizer: Dr. Mukherjee, UCA

The rice industry in Arkansas is a million dollar industry. Over the past few years, rice farmers have witnessed fertilizer consumption and costs rise exponentially. During storms, excess nitrogen in fertilizer flows into local waterways such as the Mississippi river and its tributaries, which poses a threat to the local aquatic life. Excess nitrogen can also cause potentially fatal toxicosis in cattle in the region. To address these problems, Dr. Arijit Mukherjee is trying to lower the amount of fertilizer used by generating nitrogen in a more natural fashion.

Dr. Mukherjee is faculty member at the P3 facility, and is also an assistant professor at the University of Central Arkansas at Conway. Dr. Mukherjee's work focuses on the better understanding of microbial signals and signaling pathways that govern the development of beneficial plant microbial interactions by using different model systems. To accomplish this goal he is currently studying arbuscular mycorrhizal fungi and rhizobia bacteria. These organisms are both designated nitrogen fixers, meaning they can pull nitrogen from the atmosphere and convert it into a form that is absorbed and used by the rice plants. The bacteria and fungi form nodules on the rice plant roots that increase the nutrient transfer from the soil to the plants. These two organisms form a symbiotic relationship with the plants, providing nutrients in exchange for carbohydrates

A long-term goal of Dr. Mukherjee's research is to learn how these nodules grow, any potential gene involvement, and to determine the best conditions for growth of the bacteria and fungi. If the process can be enhanced, the results would increase crop productivity and yield, while simultaneously lowering fertilizer use and the overall cost of agricultural crop production. This research could be extremely important to agriculture in general, and the results could be applied to other crops that do not share a similar symbiotic relationship.

Dr. Mukherjee's team is comprised of several students, including Graduate student Ryan Hiltenbrand and Undergraduate students Hamilton Newhart, Alexander Howell, Hannah Posey, Ashley Spurr and Jackie Thomas.

Dr. Mukherjee working in the greenhouse.

2015 Annual Arkansas EPSCoR State Meeting

The annual Arkansas EPSCoR state meeting was held this fall in Fayetteville. The meeting was a two-day event that brought together the faculty, students, and adminstrators of the Verticallly Integrated Center for Transformative Energy Research (VICTER), Plant Powered Production (P3), Arkansas Center for Nanoplasmonic Solar Cell Research (GREEN) Center, the Plant Imaging Consortium (PIC), and the new Center for Advanced Surface Engineering (CASE). The purpose of the annual meeting is to highlight the accomplishments of these organizations, foster collaboration, and discuss the future of the program.

The event took place at the Hilton Garden Inn and featured many speakers, work groups, a student poster session, and a group tour of some of the research facilities. Mike Preston, Director of the Arkansas Economic Development Commission (AEDC), discussed with attendees his plans to help boost Arkansas's economy by bringing new jobs to the state and how critical research is for economic development. He acknowledged the role that new technologies and patents that have arisen from the NSF EPSCoR program play in creating jobs and bettering the state's future.

Arkansas EPSCoR Program Director Dr. Gail McClure expressed thanks to the attendees for their hard work, and excitement for accomplishments yet to come. The keynote speaker, Dr. Meyya Meyyappan, is Chief Scientist for Exploration Technology at NASA Ames Research Center in Moffett Field, California. Dr. Meyyappan spoke about the future of nanotechnology and new materials that have been developed. The P3 Center Director Carole Cramer and Center Manager Molly Alexander honored Dr. McClure and Arkansas EPSCoR Program Administrator Cathy Ma with certificates of appreciation for their continued dedication to the program and the State of Arkansas.

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GREEN MOBILE

INTERACTIVE SOLAR ENERGY LAB

RESERVE IT FOR YOUR SCHOOL OR SPECIAL EVENT!

The GREEN Mobile is a solar energy laboratory bus, equipped with hands-on learning activities for K-12 students.

The electronics and activities on the bus are powered by the attached solar panels.

The GREEN Mobile is currently managed by the UAPB STEM Academy, and can be toured at the STEM Academy for free.

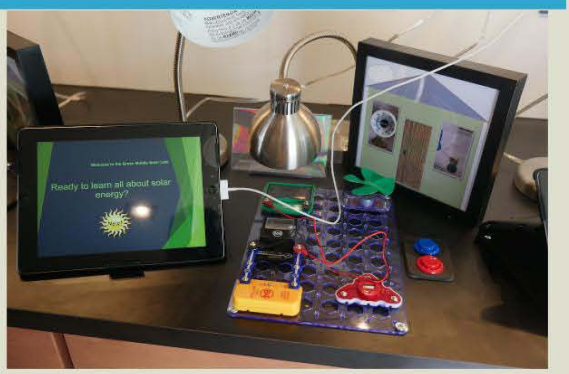
GREEN MOBILE HISTORY

The GREEN Mobile was created with the help of the National Science Foundation, Arkansas EPSCoR Program ASSET II Initiative, the Arkansas Department of Education, and the University of Arkansas system.

The bus can be rented by schools, private organizations, non-profits, or anyone who wants kids to learn about alternative energy sources.

The GREEN Mobile currently serves the Southern, Central, and Eastern parts of Arkansas.

INTERACTIVE WORK STATIONS



The GREEN Mobile has 10 interior solo workstations, and the instructors will set up 2 outdoor multi-student workstations about biodiesel and currents. Curriculum can be customized for different ages.

WANT TO BOOK THE GREEN MOBILE FOR YOUR SCHOOL OR SPECIAL EVENT?

For pricing or to make a reservation, email:
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