Researchers Find Cost-Effective Method for Hydrogen Fuel Production Process

Researchers at the U of A have designed nanoparticles that act as catalysts, making the process of water electrolysis more efficient.

Nanoparticles composed of nickel and iron have been found to be more effective and efficient than other, more costly materials when used as catalysts in the production of hydrogen fuel through water electrolysis.

The discovery was made by University of Arkansas researchers Jingyi Chen, associate professor of physical chemistry, and Lauren Greenlee, assistant professor of chemical engineering, as well as colleagues from Brookhaven National Lab and Argonne National Lab.

The researchers demonstrated that using nanocatalysts composed of nickel and iron increases the efficiency of water electrolysis, the process of breaking water atoms apart to produce hydrogen and oxygen and combining them with electrons to create hydrogen gas.

Chen and her colleagues discovered that when nanoparticles composed of an iron and nickel shell around a nickel core are applied to the process, they interact with the hydrogen and oxygen atoms to weaken the bonds, increasing the efficiency of the reaction by allowing the generation of oxygen more easily. Nickel and iron are also less expensive than other catalysts, which are made from scarce materials.

This marks a step toward making water electrolysis a more practical and affordable method for producing hydrogen fuel. Current methods of water electrolysis are too energy-intensive to be effective.

Chen, Greenlee and their colleagues recently published their results in the journal Nanoscale.
Faculty News

On the Go


Foyssal Khan gave an invited talk, “Optimizing Conducting Polymer Modified Electrodes and Miniaturizing Instrumentation to Enhance Microfluidics Pumped by Redox-Magnetohydrodynamics (R-MHD),” at Pittcon 2019, Philadelphia, PA. Other authors are David Parette and Ingrid Fritsch.

Mahsa Lotfi-Marchoubeh gave an oral presentation in Neurochemistry Techniques to Study Neurotransmitters and Metabolites session, “Simultaneous and Differentiated Measurement of Catecholamines by Developing and Evaluating a Novel Neural Probe Suitable for In Vivo Studies,” at Pittcon 2019, Philadelphia, PA. Other authors are Mengjia Hu, Richard N. Pellegrino, Miguel Abrego Tello, and Ingrid Fritsch.

David Paul and Paul Adams attended the Emerging Researchers National Conference in STEM, Washington DC, February 21-23, 2019. They received a $2050 travel grant from the Graduate School, from the Graduate Recruitment Assistance Fund. Pictured below is Dr. David Paul, judging a researcher’s poster.

Nan Zheng gave a talk, “Development of New Chemistries of Photogenerated Distonic Radical Cations: From Mechanistic Investigation to Synthetic Applications” March 5, 2019 for the Department of Chemistry and Biochemistry at the University of Tulsa.


The following students made presentations at the Biophysical Society Annual Meeting in Baltimore, MD, March 2-6, 2019:


The Mole Street Journal

- Shilpi Agrawal, T.K.S. Kumar. Characterization of the structural forces governing the reversibility of the unfolding of the human acidic fibroblast growth factor.
- Vivek Govind Kumar, Shilpi Agrawal, T.K.S. Kumar, Mahmoud Moradi. A comprehensive investigation of the stabilization of monomeric hFGF1 by heparin hexasaccharide - Absolute binding free energy calculations.

Publications


Delivery of therapeutic agents by a collagen binding protein.


From the Chair ~ Wesley Stites

Bob Griffin, of the Francis Bitter Magnet Laboratory and the Department of Chemistry at MIT, was our Doris Mills Lecturer on February 25. He gave a great talk about his work using NMR to solve structures of amyloid fibrils associated with Alzheimer’s. We won’t reprise that here, but will share a bit more about his background, as he is a 1964 graduate of this department. Below are a series of questions and his responses, edited lightly for space and narrative coherence. We have embedded some hyperlinks he was kind enough to share.

Where were you originally from?

I was born in Little Rock and lived there for 7 years, then in Fort Smith for 5, returned to Little Rock and graduated from Hall High School. I was out of school my junior year because of the Little Rock integration crisis.

I went to Hendrix my freshman year with the intention of doing the 3-2 program with Columbia engineering. However, I was in a rock’n’roll band and the other members thought we could make it to the big time by moving to Fayetteville. So I transferred to the U of A my sophomore year.

However, I was also spending a lot of time on rock’n’roll music (at the Rockwood Club and Shamrock Club and traveling). Our band and my musical colleagues were quite accomplished and we interacted a lot with Ronnie Hawkins and the Hawks (he owned the Rockwood). The Hawks later became quite famous as The Band. One of my band mates, Wayland Holyfield, moved to Nashville and became a very successful country music composer—for example, he wrote what is currently the Arkansas state song—“Arkansas You Run Deep in Me.” However, I decided I was not going to make it as a “rock star” so in my junior year I retired from music.

When I was at Hendrix, I had been doing research at the U of A Graduate Institute of Technology (GIT) in Little Rock during high school. GIT at the time was run by Raymond R. Edwards who was previously Department Chair at Fayetteville. He was a radiochemist who did his PhD with Charles D. Coryell at MIT -- on Albany Street! (Ed.- the Francis Bitter Magnet Lab is located on Albany Street in Cambridge, MA.) The people at GIT connected me with Edward S. Amis, whose lab I worked in while at the U of A. So I continued research doing electrochemistry for 2-3 years and published two papers with Amis and others.

Among the faculty in the department that I recall were Edward S Amis, Robert Kruh, Paul Kuroda, George Blyholder, Sam Siegel, Arthur Fry, Wally Cordes, Richard Porter, and William Noyce.

I can tell you stories about each. However, Noyce was special in that he taught a 3-person tutorial on Saturday morning to Kent Gordon (CalTech), Marvin Kemp (Univ of Illinois) and myself. We read and discussed many different books and topics on science and philosophy. Not sure what happened to him, but I remember him well and still think of him as the first real and terrifying “scholar” that I ever met and talked to. His organic course was superb.

Richard Porter came during my senior year and Lee Pedersen moved from the Amis Group to Porter. Lee then went to Harvard to postdoc for Martin Karplus and then to UNC Chapel Hill. His brother Pete Pedersen worked for Siegel and then was a post-doc at Hopkins where he became a rather famous biochemistry professor. He worked a lot on hexokinase interacting with VDAC among other things.

I departed in 1964 (55 years ago!), and I have been back only once for a seminar, maybe 25 years ago. Wally Cordes, from whom I first learned about NMR, was still active at the time. At that point many things had changed dramatically, and I imagine even more change has occurred since then.

I am sure that you know Wally passed away after a struggle with brain cancer. He was a great guy.

Cordes was a really nice fellow and a very inspiring teacher. I took an outstanding course from him my senior year on Molecular Spectroscopy where he introduced me to NMR. He did not know anything about NMR except that it was something new that could locate protons. He was more interested in and was just learning small molecule X-ray diffraction, and convinced one of my class mates, Kent Gordon, to learn to do structures. Kent went to CalTech for graduate school and did X-ray diffraction and is now at Timekeeper.

I took P. Chem from Robert Kruh who was Department Chair and did his PhD at Wash Univ in St. Louis. He convinced me to apply there because they had a great program in magnetic resonance. He was correct — Sam Weissman, who I did my PhD with, was a pioneer in ESR, and Richard Norberg was in Physics and had just shown that FT’ing an FID gave you the frequency spectrum.

After St. Louis I left for John Waugh’s lab at MIT and have been in Boston since May, 1970.
Biophysical Society Meeting

Left: Brooke Nunn
Right: Sara Sustich
Middle Left: Jenny Afrose and Dr. Roger Koeppe
Middle Right: Matthew McCay
Lower Left: Kelsey Marr

Lower Right: Roger Koeppe, Julia Koeppe, Brooke Nunn, Matthew Brownd, Matthew McKay, Kelsey Marr, Sara Sustich, Denise Greathouse, and Jenny Afrose.
Student Passes Cumulative Exams

**Chujun Zhou** passed his seventh Organic course on March 8, 2019. Chujun received his BS from Sun Yat-Sen University in July of 2016, and joined this department in the fall of 2018. He is from the Xianqzhou district of Zhuhai, China. Chujun is a member of Nan Zheng’s lab.

Khan Receives Travel Award

**Foysal Khan** was awarded with the Society for Electroanalytical Chemistry (SEAC) Student Travel Award. The SEAC Graduate Student Travel Grants, sponsored by CH Instruments, Gamry Instruments, and Pine Research Instrumentation, are awarded to promising graduate students and encourage the new generation of electrochemists to offset the cost of travel to the Pittsburgh Conference.

SURF Grants Awarded

**Kelsey Marr** and **Jake Price** have each been awarded a Student Undergraduate Research Fellowship (SURF) from the Arkansas Department of Higher Education for support of their honors research.

Kelsey is from Tulsa, OK. Her project is entitled “Lipid optimization to improve the solid-state NMR spectra from membrane-spanning helices with glutamic acid.” She is addressing the importance of membrane lipid composition and specifically, the membrane surface charge for the properties of peptide helices that are embedded in lipid bilayer membranes that mimic the cell membrane. She presented an update of her recent results at the 63rd Annual Meeting of the Biophysical Society. Her research is ongoing, and she plans to graduate in May, 2020.

Jake is from Bryant, AR. His project is entitled “Attempted ‘Rescue’ of Glutamic Acid by Arginine in a Transmembrane Helix.” He is addressing the possible interactions of charged amino acid side chains in lipid-bilayer membranes. Such interactions could influence the biophysical properties of folded helices in membrane proteins. His research is ongoing, and he plans to graduate in May, 2020.

Congratulations to both!

Future Chemists Arrive!

Aaryaa Adwitiya Dutta (left) was born to **Nandita Halder** and Atanu Dutta November 21, 2018 at 9:14 p.m., weighing 3 lb. 14 oz. Nandita is a member of David Paul’s lab, and Atanu is a UA PhD alum from the department of electrical engineering.

Isaac Samuel Durham (right) was born January 14, 2019 to **Sarah Shelby** and Joshua Durham. He weighed 6 lbs. 7 oz., and was 19.5 inches long. Sarah works in the chemistry department stockroom. Proud grandparents are **Bill Durham** and Carol Andrews.

Benjamin Gordon Nuckels (lower right) was born January 31, 2019 at 2:09 p.m., weighing 6 lbs. 8.6 oz. and was 20” long. He is the son of **Estelle Huff Nuckels** (PhD ’09) and Craig Nuckels. Benjamin joins big brother Michael at home. Estelle (Stella) was a member of the Peter Pulay lab.
New Approach to Cancer Diagnosis Receives NIH Funding

**Hassan Beyzavi**, assistant professor of chemistry at the University of Arkansas, is researching the use of nanotechnology to improve early cancer diagnosis. His project was recently awarded by the National Institutes of Health (NIH). Beyzavi is researching positron-emission tomography, commonly known as PET, which is a noninvasive biomedical imaging approach that uses fluoride isotopes to detect tumor cells. PET has also applications in brain imaging for neurological disorders, drug discovery, and tailoring the treatments for cardiological diseases. The isotopes must be bound to molecules called tracers. Tracers are specially designed to bind to receptors of tumor cells or enzymes, and then these cells can be detected through the radiation released by the fluoride isotope.

Currently, a molecule called fluoro-deoxyglucose (FDG) is used as a tracer for PET scans in oncology. This molecule, which is a form of sugar, is consumed by tumor cells. However, it also travels to other parts of the body, and this can make it difficult for oncologists to distinguish between the tracers that have attached to tumor cells and those that show up in cancer-free areas. In order to diagnose cancer with high contrast using FDG, unfortunately the tumor must be large enough to be detectable and distinguishable from healthy cells. Therefore, the topic of early-stage cancer diagnosis becomes an important and challenging area for researchers to pursue.

Beyzavi explained that this problem could be solved with new tracer molecules that selectively bind to cancer cells, but not healthy cells. Several of these have already been designed, but putting them into use presents two challenges. First, it is difficult to get the fluoride isotope to bind to these new molecules, a process called fluorination. The second challenge is the limited time available for fluorination. Fluoride isotope ([¹⁸F]-fluoride) has a half-life of less than two hours, which means that its radioactivity is reduced by half every two hours, which is very fast. Tracers must be synthesized and then transported to the location of the PET scanner with enough radiation left to be effective, which means that the fluorination process must happen quickly.

Beyzavi has proposed a solution to these challenges in the form of a nanoreactor mimicking enzymes made of metal-organic frameworks, an emerging class of porous nanomaterials. Beyzavi's reactors are capable of performing the chemical reactions necessary to bind fluoride isotope to promising tracer molecules, and they can accomplish this significantly faster than the current methods. This research could lead to faster cancer diagnoses and more effective treatments. “Cancer is the second most common cause of death in the United States,” Beyzavi explained. “However, the mortality rate can often be greatly reduced by early diagnosis and therapy.”

Visit the Beyzavi Group for other exciting information!
Obituary for Jerry Homesley

Jerry Joe Homesley, 70, of Elkins, AR, answered the Lord’s call on March 4, 2019 at his home in Elkins. Jerry was born August 23, 1948 in Fayetteville, AR to John and Geneva Homesley.

His parents and younger brother John David Homesley preceded Jerry in death.

Jerry graduated from Nathan Hale High School, Tulsa, OK in 1966. He received an Associate degree in industrial electronics from Tulsa Technical College, Tulsa, OK in 1968. Jerry continued his education at Oklahoma State University, Tahlequah, OK majoring in math and geology. He was a NASA board-certified solderer.

He served in the US Army 1969-1972. He deployed in Germany as part of the Hawk Control Missile Readiness Unit. Jerry was honorably discharged as a Specialist 5 rank and received an Expert Rifleman commendation.

Jerry worked for several Tulsa oil and gas research companies from 1972-1999. With Geophysical Research Corporation, he built an automated parking meter and was the electronic lead with TRW on a gas pipeline “pig” used to detect underground pipeline corrosion.

In 1999, Jerry joined the University of Arkansas Chemistry-Biochemistry Department as a Master Scientific Research Technician where he worked for 16 years, retiring in 2015. The Mole Street Journal, published by the University of Arkansas Chem-Biochem Department, described Jerry’s work as “most important responsibility was to always ensure that students and professors could prove their research on equipment that was working accurately and consistently.”

Jerry, Dr. Wally Cordes and Chancellor Dave Gearhart managed the research, building and installation of the Tower Clock in Old Main in 2010 as part of the Campaign for the 21st Century. The clock was completely handmade by the Balzer Clock of Maine, one of the very few companies in the world who design, handcraft and install massive tower clocks. Jerry was the clock caretaker from 2010-2015.

A private family graveside service with military honors will be held under the direction of Beard’s Chapel.

Pallbearers include Brad Aguillard, Darren Claybrook, Duane Claybrook, Gary Geise, Worden Parrish and KZ Schein.

The family requests that donations be made in Jerry Homesley’s name to the Boy Scouts of America, Westark Council, 1401 Old Greenwood Rd, Fort Smith, AR 72901 or by contacting Dr. Wes Stites, wstites@uark.edu (Dr. Stites will respond to direct contributions for the Old Main Tower Clock Care Fund).

Jerry’s wife, Terry R. Homesley, died March 15, 2019 at her home in Elkins, AR. She was born January 27, 1950.
Calendar of Events

**April**
08 Seminar-Michelle Personick, Wesleyan University, 3:30 CHEM 144
15 Seminar-Jun Qi, Dana-Farber Cancer Institute, 3:30 CHEM 144
22 Honors & Majors Day
28 Seminar-Mukund Sibi, North Dakota State University, 3:30 CHEM 144

**May**
3 Dead Day
6-10 Finals Week
11 Commencement
19 Summer REU and INBRE programs begin
27 Memorial Day Holiday - Office closed

**FALL**
September 7
October 5
October 26
November 16
December 7

**SPRING**
January 25
March 8
March 29
April 26

CHEM 144, 5:00-6:00 p.m.

The department web page is located at chemistry.uark.edu. There you will find links to departmental information, news, and people. But best of all, alumni can stay in touch through the Alumni & Friends link. We want our alumni to stay in touch! Please take a few minutes to browse the page and submit any update you'd like published (or not). We welcome pictures, too!

**2018-2019 CUME Schedule**

**MAHSA’S MIRTH**

The department of chemistry and biochemistry at the University of Arkansas strives for excellence in research, teaching and service in chemistry - the central science. We aspire to positions of leadership regarding the discovery of new scientific knowledge, the training of students, and the economic development of the State of Arkansas. We seek to recruit and retain a diverse group of the best faculty, students and staff to address the challenges of the future through interdisciplinary and multidisciplinary research and education.

**Library Hours**

**Spring Semester Hours: January 14 - May 10**

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<th>Day</th>
<th>Hours</th>
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<tr>
<td>Sunday</td>
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<tr>
<td>Monday – Thursday</td>
<td>8:00am – 9:00pm</td>
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<tr>
<td>Friday</td>
<td>8:00am – 6:00pm</td>
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<tr>
<td>Saturday</td>
<td>CLOSED</td>
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**Exceptions to Regular Spring Hours**

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<th>Day</th>
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<tr>
<td>Monday</td>
<td>January 21, MLK Holiday</td>
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<td>Friday</td>
<td>March 15</td>
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<tr>
<td>Monday – Thursday</td>
<td>March 18-21, Spring Break</td>
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<td>Friday</td>
<td>March 22</td>
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<td>May 10</td>
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The chemistry and biochemistry library resources can be accessed in the following LibGuides: http://uark.libguides.com/content.php?pid=110953. Please bookmark for future use.

Theses and dissertation resources can be found on the following LibGuide: http://uark.libguides.com/content.php?pid=123035 &sid=1057466.

For more information: Check the Libraries’ web site (http://libinfo.uark.edu) for updated information on hours and services. Library hours are also available by dialing 479-575-2557.