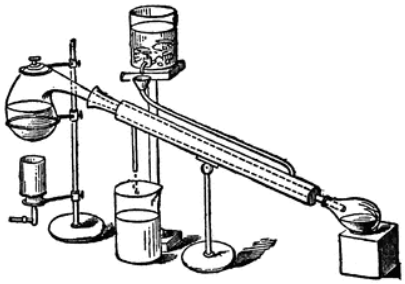
SOUTHWEST RETORT



SEVENTY-FIRST YEAR **OCTOBER 2018**

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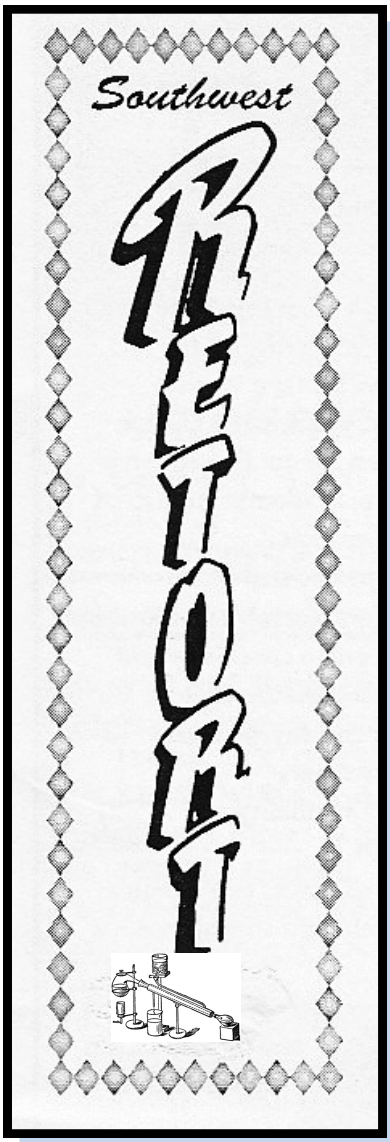

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FIFTY YEARS AGO IN THE SOUTHWEST RETORT

The two ACS October tour speakers were Professor R. S. Juvet, Jr., from the University of Illinois and Dr. Dean F. Martin of the University of South Florida. Juvet's two talks were "Gas Chromatography Separation of Metal Chlorides from Inorganic Fused-Salt Liquid Phases" and "Photolytic Degradation as a Means of Organic Structural Determination. Martin was to speak on "Chemical Challenge of the Sea" and "Recent Red Tide Research."

The 24th ACS Southwest Regional Meeting will be held in Austin Dec. 4-6. The General Chairman is Dr. D. M. Carlton of Tracor, Inc., and the Technical Program Chairman is Dr. J. J. Lagowski of the University of Texas at Austin.

The Ouachita Valley ACS Section has joined as a subscriber to The Southwest Retort. They are now the 15th ACS section to join The Retort. The section was chartered originally as the South Arkansas Section in 1949 and changed its name in 1966. It has its headquarters in Monroe, LA, in the northeast portion of the state. At present there are 100-120 members in the section.

At UT-Austin in the Central Texas ACS Section, Dr. George W. Watt represented the section as councilor at the Fall National Meeting of the ACS in Atlantic City. Dr. James E. Boggs was co-author of two papers presented at the Symposium on Molecular Structure and Spectroscopy held at Ohio State Sept. 3-7. Welch Professor Michael Dewar presented the Grahm Lecture at ETH in Zurich, Switzerland. His talk was on "MO Theory of Aromaticity and Electrocyclic Reactions." He also gave talks at several European universities. His scheduled talk at the University of Brussels was cancelled when the students took over the university.

At Texas Woman's University acting Chemistry Chair Dr. Lyman R. Caswell announced the appointment of three new faculty members. They are Dr. Linda Creagh, Dr. James E. Hardcastle, and Dr. Edward F. King. At Mobil Field Research Lab Dr. Earl S. Snavely, Jr. has been promoted to Research Associate. At the Southwest Center for Advanced Studies (the precursor to UT-Dallas) Drs. Harold Werbin, John Jagger and Claude S. Rupert presented papers at the 5th International Congress of Photobiology at Dartmouth Aug. 26-31.

At Texas Tech in the South Plains Section Dr. Henry Shine was an invited speaker at the Free Radical Symposium at the ACS Atlantic City meeting. Dr. P. S. Song was an invited speaker at the International Conference on Molecular Luminescence held in Chicago Aug. 20-23 and also at the Fifth National Congress of Photobiology at Dartmouth Aug. 26-31. Dr. Song has received a two year grant from NSF to study "Electronic Structure and Photochemistry of Flavins."

contributed by
E. Thomas Strom

And Another Thing...

NOBEL

By Denise L. Merkle, PhD

As always at this time of year, the cooler temperatures (and in some cases post-holiday interactions with colleagues) inspires thoughts of Alfred Nobel - and the Prizes, of course. Nobel subjects are increasingly more complex and intercalated - at some point a discussion of the convergence of disciplines may not be amiss. But not this week.

Right now, the future evolution of the Nobel is irrelevant. What matters is this years' Nobel Laureates and their contributions - via the advancement of directed techniques to harness the power of life - to the world. Those of us who dream of Stockholm but have only been tourists may be relegated to clicking and reading to our hearts' (power supplies'?) content, all the while analyzing how we might possibly evolve enough to meet the King of Sweden, but we also revel in the accomplishments of those who have already evolved enough to make the trip.

The 2018 Nobel in Chemistry is shared by Dr. Frances H. Arnold of CalTech for "the directed evolution of enzymes" and Drs. George P. Smith of University of Missouri, Columbia and Sir Gregory P. Winter of MRC Laboratory of Molecular Biology in Cambridge, UK, "for phage display of peptides and antibodies."*

Understanding the natural world and its biochemical processes can save us all. It obviously—and deservedly —can take some of us to Sweden.

Kudos to the 2018 Nobel Laureates. May their research remain vibrant and rewarding.

*https://www.nobelprize.org/prizes/chemistry/2018/press-release/

All the Nobel information is fascinating. Check it out:

https://www.nobelprize.org/

From the ACS Press Room

Compound improves social interaction in autism mouse model

LIT-001, the First Nonpeptide Oxytocin Receptor Agonist that Improves Social Interaction in a Mouse Model of Autism

Journal of Medicinal Chemistry

Children with autism often find social interactions awkward, leaving them isolated. Now in a study appearing in ACS' *Journal of Medicinal Chemistry*, scientists report that they have discovered a first-of-its-kind compound that promotes social interaction among laboratory mice that display autistic traits. The finding could lead to the development of drugs capable of improving social behaviors in those who have autism.

Autism spectrum disorders (ASD) affect about one in every 59 children, according to the U.S. Centers for Disease Control and Prevention. Although symptoms vary, these disorders are often characterized by impaired social interactions, limited communication skills and repetitive behaviors. A few studies have shown that oxytocin, a hormone that acts like a neurotransmitter in the brain, can improve the ability of some ASD patients to interpret emotional cues and interact with others. However, oxytocin can't be taken orally, is rapidly metabolized when given via injection and doesn't readily cross the blood-brain barrier. Several research groups have tried to develop drug candidates that overcome these obstacles with little success. So Marcel Hibert and colleagues wanted to determine if other compounds that could mimic oxytocin — and also activate its receptor — might hold the key to helping ASD patients.

Some compounds that bind the oxytocin receptor also bind to another set of receptors for vasopressin, an antidiuretic hormone. The researchers found that these compounds share a common benzoyl benzazepine component. They tested variations of this structure, eventually finding one that appeared to have similar traits as oxytocin without its drawbacks. The team tested the compound in laboratory mice that were genetically altered so they behaved as if they had ASD. When given the compound, called LIT-001, the mice exhibited increased and more prolonged nose contacts than before — an indication that the mice were more social after treatment. The researchers concluded that this new compound could be an important step toward the development of drugs to relieve certain ASD symptoms.

The authors acknowledge funding from the French government, the Centre National de la Recherche Scientifique, the University of Strasbourg, the LabEX Medalis and the LabEX MabImprove.

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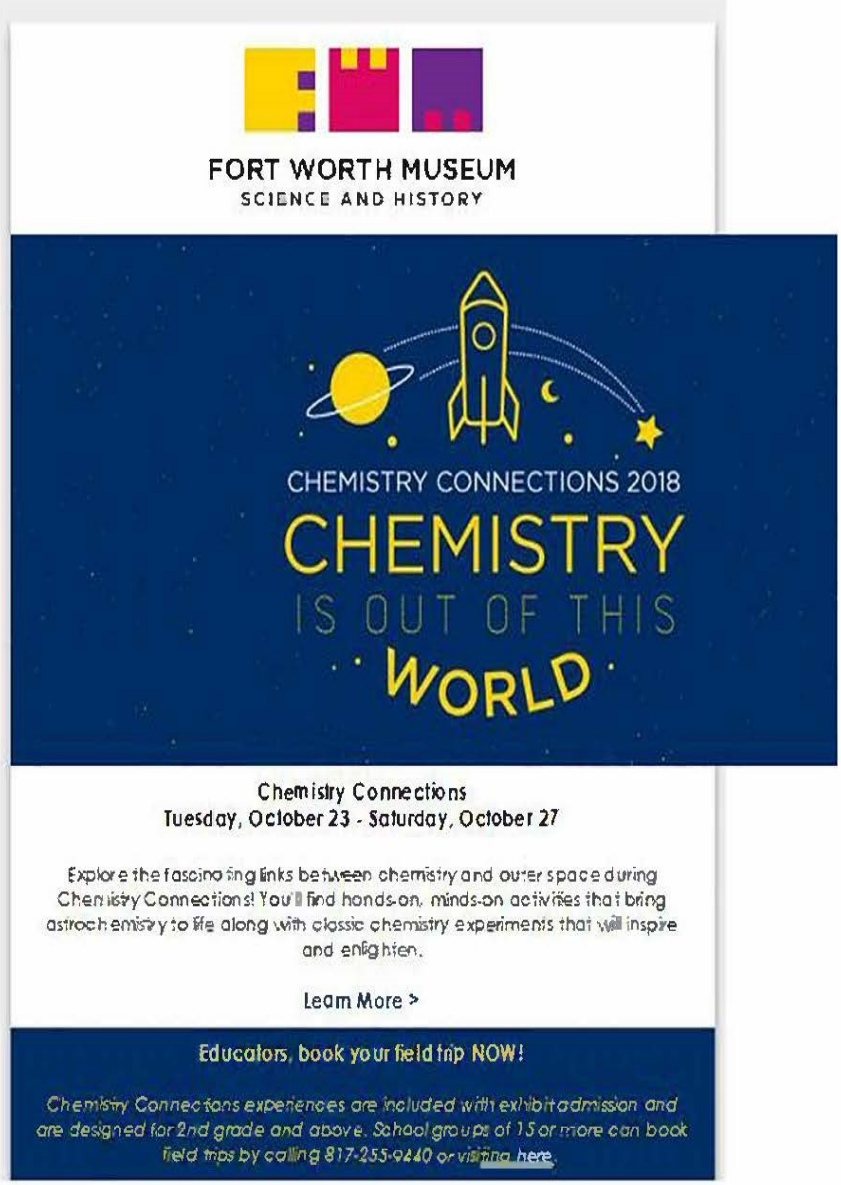

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From the ACS Press Room

Paintable chemotherapy shrinks skin tumors in mice

Enhanced Transdermal Drug Delivery by Transfersome-Embedded Oligopeptide Hydrogel for Topical Chemotherapy of Melanoma

ACS Nano

Skin acts as the first line of defense against pathogens and other harmful material from outside the body. Yet this barrier also excludes some beneficial drugs that could treat skin diseases. Now, researchers have taken the first steps in developing a chemotherapy for melanoma that can be "painted" directly on the skin, rather than injected or taken orally. They report their results in ACS *Nano*.

According to the Skin Cancer Foundation, melanoma is the deadliest form of cancer because of its tendency to spread, or metastasize, from the skin to other parts of the body. Common treatments include surgery, radiation therapy and intravenous chemotherapy, but these can cause pain or unpleasant side effects. If scientists could find a way to administer chemotherapy through the skin, they could target the treatment directly to the tumor site and possibly avoid side effects. Bingfang He, Ran Mo and colleagues wanted to develop a gel that patients themselves could apply to a skin tumor. But first they had to figure out how to get the therapy to penetrate deep within the skin.

For this purpose, the researchers assembled nanoparticles called "transfersomes," which consist of a phospholipid bilayer and surfactants that encapsulate drugs or other molecules --- in this case, the chemotherapy drug paclitaxel. The surfactants made the particles more deformable so that they could better infiltrate the skin; these compounds also affected the lipid matrix of the skin to help the particles more easily pass. The researchers added a peptide to the surface of the transfersome to further help the particle penetrate the skin, as well as enter tumor cells. To increase the time that the transfersomes persisted on skin, the researchers embedded the nanoparticles into a hydrogel. Then, they painted the gel on tumors of melanoma-bearing mice once a day, in combination with intravenous administration of paclitaxel every other day. After 12 days, the tumors of these mice were about half the size of tumors in mice treated with intravenous paclitaxel alone, suggesting that the transfersome gel helped slow tumor growth.

The authors acknowledge funding from the National Natural Science Foundation of China, the Natural Science Foundation of Jiangsu Province of China, the Program for Jiangsu Province Innovative Research Talents, the Program for Jiangsu Province Innovative Research Team and the Jiangsu Synergetic Innovation Center for Advanced Bio-Manufacture.

ACS Local Section
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On Thursday November 1, 2018

Please Join the

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6p - 7p Social Hour on the Patio

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8p - 9p Awards Presentations and Talk by Dr. D'Souza:

Light Capture and Conversion by Mimicking Nature

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The ACS DFW Local Section Needs You!

Interested in becoming more involved in the Local Section?

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We are looking for nominees for Chair-Elect (3-year term), Treasurer (2-year term), Councilor (3-year term), and Alternate Councilor (3-year term). Terms for newly elected officers will begin on January 1, 2019.

Descriptions of each position and duties may be found at

http://dfw.sites.acs.org/officerduties.htm.

To run for office, please submit a 1/3-page biography, single-space typed to Amanda Dark, the Secretary of the DFW Section at **mailto:amanda.m.dark@gmail.com**.

Deadline to run is November 1, 2018.

Questions about positions? Contact Chair Kirby Drake at **mailto:kirby.drake@klemchuk.com**.

ACS DFW Science Advocacy Workshop

Tuesday, November 13, 2018 6 pm
University of Texas Arlington

In the words of ACS Past-President Katie Hunt: "Chemistry is at a crossroads. Globalization is upon us, and there is no turning back. Our challenge is how to keep our nation strong in an increasingly global marketplace. Strengthening the roots of American innovation and competitiveness—education, basic research, and a business environment to drive innovation—is how we as a nation will meet this challenge."

This is the message that the ACS DFW Local Section can bring to Congress and to the Texas Legislature.

The 2018 elections are over and the time for advocacy is now. Make plans to attend this workshop and learn from ACS National as well as local leaders about:

ACS Policy Statements

ACS Resources for Advocacy including Act4Chemistry, Twitter, and the Advocacy Toolkit

How to Contact and/or Prepare for a Meeting with Legislators

What to Expect in 2019 Texas Legislative Session re: Science

How to Get More Involved in Advocacy

Watch for E-Blast Coming Soon to Sign-Up and Get Involved!

Questions? Contact Chair Kirby Drake at mailto:kirby.drake@klemchuk.com

Section Chair Kirby Drake presents the Werner Schulz Award to Dinner to 2018 Award Recipient

Maggie Mixon

Martin HS, Arlington TX

……..September 25, 2018

Around-the-Area

UTD

Dr. Mihaela Stefan has been promoted to full professor and named a Eugene McDermott Fellow. **Dr. Jie Zheng** has been promoted to full professor and named a Cecil H. and Ida Green Fellow.

UTA

The UTA Department of Chemistry and Biochemistry hosted the Portal Theater Group's performance of "**No Belles**" on Friday, Oct. 5, in the new Science Engineering Innovation Research (SEIR) Building. The group from Portland, OR, featured actors Melissa Schenter, Jade Strong, and Kimberly Wilson with musical background from artistic director Michael Phillips. The piece told the story of six women Nobel Laureates, Marie Curie, Maria Geoppert Mayer, Rita Levi-Montalcini, Francoise Barre-Sinoussi, Gertrude Belle Elion, and Rosalyn Yalow plus two famous women chemists, Rosalind Franklin and Lise Meitner, who deserved the Nobel Prize but did not receive it. An audience of 120 students, faculty, and visitors came to the performance and participated in the question and answer discussion at the end of the piece.

South Plains Section/Texas Tech

The South Plains ACS local section is sponsoring Prof. Emeritus **Diana Mason** from UNT for a department and public seminar series on Oct 31st. Her seminar is *Knowledge Decay, Diagnostic Identifiers and Persistence in General Chemistry* to our faculty and grad students. In the evening, Dr. Mason will give the public presentation *Texas Discoveries That Have Changed the World*.

University of Arkansas

On the Go

Chen, J. Engineering polydopamine- coated gold nanocages for biomedical applications, SWRM ACS meeting, Little Rock, AR (Nov. 7-10, 2018; invited talk).

Chen, J. Nanoparticle-mediated Photothermal Approach to Treatment of Biofilm Infections, SciX 2018, Atlanta, GA (Oct. 21-26; invited talk).

Charles Wilkins presented "Matrix Assisted Ionization Mass Spectrometry" for the NSF Chemical Innovation Center for Aerosol Impacts on Chemistry and the Environment (CAICE) located in the Scripps Institute for Oceanography, University of California, San Diego, Sept. 18, 2018.

Fan, C. Genetically incorporating two distinct post-translational modifications into one protein simultaneously. 2018 Genetic Code Expansion Conference, Corvallis, OR, USA, Aug. 9-11, 2018.

Fan, C. Studying post-translational modifications by genetic code expansion. Arkansas Biosciences Institute Fall Research

Symposium, Little Rock, AR, USA, Sept. 25, 2018.

Pickens, J.B., Striegler, S. Study of galactonoamidines as transition state analogs of glycosidases, CARB 107, 256th ACS National Meeting, Boston, MA, Aug 21, 2018. (talk by J. Pickens).

S. Striegler, Probing galactonoamidine scaffolds toward potent glycosidase inhibition, ORGN 198, 256th ACS National Meeting, Boston, MA, Aug 20, 2018.

Sharma, B.; Striegler, S. Microgel matrix effect (MME): Influence of cross-linking on catalytic behavior, POLY-377, 256th ACS National Meeting, Boston, MA, Aug. 21, 2018

Orizu, I., Striegler, S. Synthesis of bulky galactonoamidines for the inhibition of galactosidases, ORGN 385, 256th ACS National Meeting, Boston, MA, Aug. 21, 2018 (poster).

Whaley, M.; Sharma, B.; Strieg- ler, S. Designing matrix effects in poly- acrylate microgels, POLY-410, 256th ACS National Meeting, Boston, MA, August 21, 2018. (poster).

Pickens, J.B., Striegler, S. Probing interactions of β-galactosidases with galactonoamidines, BIOL 81, 256th ACS National Meeting, Boston, MA, Aug. 19, 2018. (poster).

Sharma, B., Striegler, S. Glycoside cleavage via crosslinked microgel catalysts, CARB-242, 256th ACS Na- tional Meeting, Boston, MA, Aug. 19- 20, 2018 (poster).

Orizu, I., Striegler, S. Designing galactonoamidines as inhibitors of α-galactosidases, CARB-23, 256th ACS National Meeting, Boston, MA, Aug. 19, 2018 (poster).

Frank Millett was a session chair and also presented a poster at the 20th European Bioenergetics Conference in Budapest, Hungary, August 25- 30, 2018. "Definition of the Electron Transfer Pathway between Cytochrome c and Cytochrome Oxidase. Authors are **Francis Millett, Martha Scharlau, Lois Geren, Eugene Y. Zhen, Ling Ma, Ray Rajagukguk, Bill Durham, and Shelagh Ferguseon- Miller.**

Publications

Song, L.; Liang, Z.; Ma, Z.; Zhang, Y.; Chen, J.; Adzic, R.R.; Wang, J.X. Temperature-Dependent Kinetics and Reaction Mechanism of Ammonia Oxi- dation on Pt, Ir, and PtIr Alloy Catalysts. J. Electrochem. Soc. 2018, accepted.

Li, J.; Sun, K.; Li, J.; Meng, Q.; Fu, X.; Yin, W.-G.; Lu, D.; Li, Y.; Babzien, M.; Fedurin, M.; Swinson, C.; Malone, R.; Palmer, M.; Mathurin, L.; Manso, R.; Chen, J.; Konik, R.M.; Cava, R.J.; Zhu, Y.; Tao, J. Probing the pathway of an Ultrafast Structural Phase Transition to Illuminate the Transition Mechanism in Cu_2S. App. Phys. Lett. 2018, 113, 041904.

Sakon, J.; Philominathan, S.T.L.; Katikaneni, R.; Matsushita, O.; Ponnapakkam, T.; Koide, T.; Gensure, R.C.; Nishi, N. Delivery of therapeutic agents by a collagen binding protein. European Patent 2 790 717 B1, Issued May 30, 2018.

Sakon, J.; Matsushita, O.; Ponnapakkam, T.; Gensure, R.C. Fusion proteins of

collagen-binding domain and parathyroid hormone. European Patent 3 091 075 B1 Iss. June 14, 2018.

Chen, H.; Venkat, S.; Wilson, J.; McGuire, P.; Change, A.; Gan, Q.; Fan, C. Genome-wide Quantification of the Effect of Gene Overexpression on Escherichia coli Growth. Genes, 2018; 9 (8):414.

B. Sharma, J.B. Pickens, S. Striegler, J.D. Barnett. Biomimetic glycoside hydrolysis by a microgel template with a competitive glycosidase inhibitor, ACS Catal. 2018, 8 (8), 8788- 8795.

B. Sharma, S. Striegler, M. Whaley. Modulating the catalytic performance of an immobilized catalyst with matrix effects — a critical evaluation. ACS Catal. 2018, 8(8), 7710-7718.

B. Sharma, S. Striegler. Cross- linked microgels as platform for hydrolytic catalysts. Biomacromolecules 2018, 19(4), 1164-1174.

Hassan Beyzavi et al. Magnetic Nanoparticle Anchored Deep Eutectic Solvents as a Catalyst for the Etherification and Animation of Naphthols. Advanced Synthesis & Catalysis, 2018, ASAP DOI: 10.1002/adsc.201800743.

Hassan Beyzavi et al. Highly Emissive Cycloplatinated(II) Complex- es Obtained by the Chloride Abstraction from the Complex [Pt(ppy)(PPh3) (CI)]:Employing Various Silver Salts. Organometallics 2018, ASAP. DOI: 10.1021/ acs.organomet.8b00461.

Lecturer in Chemistry
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UTPB is accepting applications for a full-time *Chemistry Lecturer*. The position is open for immediate hire and will be filled as soon as the successful candidate is identified.

The selected candidate will teach general chemistry labs and possibly organic chemistry labs. Opportunities for teaching lectures are also available and depend on the candidate. While no research is required, it is strongly encouraged and supported.

Requirements: Candidates for the position must have an M.S. in Chemistry; a Ph.D. in Chemistry is preferred. Teaching experience is preferred but not required.

Applications materials should be directed to: Dr. Milka Montes, Chair of the Physical Sciences Department, at **montes_m@utpb.edu**.

Candidates should send a letter of application, curriculum vitae—especially including relative teaching experience, very brief information on research interests, and names and contact information for three references, no later than October 31, 2018. Applications will be given immediate consideration and the search will continue until the position filled.

OBITUARY

Danny Dunn
1946-2018

Danny LeRoy Dunn was born July 12, 1946 in Wichita, Kan., to Delmer and LeEtta Dunn. He received Bachelor's and Master's degrees in chemistry from Wichita State University in Wichita, Kan. Danny received his Ph.D. from the North Texas State University in Chemistry. He was a loving husband, father and grandfather. SURVIVORS: Wife, Nancy Dunn; children, Andrew Dunn and wife, April, and Wendy Elizabeth Dunn;

Adapted from Danny's election bio in 2014:

Danny worked at Alcon Laboratories for 31 years starting as a Senior Scientist developing analytical methods for new ophthalmic products. In 2003, he was promoted to Vice President and became responsible for the entire Analytical Chemistry Group which developed analyses for new raw materials and products, generated stability data, worked closely with regulatory agencies to obtain product approvals, and performed all routine testing needed to support new product development. He retired from Alcon in 2009. Danny received a B.S. in chemistry and an M.S. in organic chemistry from Wichita State University. He received his Ph.D. in Organic Chemistry from North Texas State University working with Gordon Skinner. Before starting work at Alcon, Danny was a postdoctoral fellow at Southwestern Medical School working in the Biochemistry Department with Russ Prough. He has been an ACS member for over 40 years. During his tenure as Treasurer of the DFW Section of the ACS, official tax free status was obtained from the State of Texas, and electronic banking was established. He also served as Chairman of the Awards Committee and contributed book reviews to the Southwest Retort. Since retirement, Danny was a volunteer for Tarrant County Meals on Wheels. He was also an active member of the Fort Worth Camera Club and the Fort Worth Chess Club.

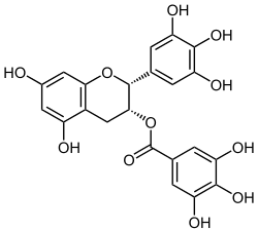
From the ACS Press Room

Green tea compound helps siRNA slip inside

Green Tea Catechin Dramatically Promotes RNAi Mediated by Low Molecular Weight Polymers

ACS Central Science

Drinking green tea has been linked to health benefits ranging from cardiovascular disease prevention to weight loss. Although many of these claims still need to be verified in the clinic, an antioxidant in green tea called epigallocatechin gallate (EGCG) appears to have beneficial effects in cells and animals. Now, researchers have found a surprising use for EGCG: sneaking therapeutic RNAs into cells. They report their results in ACS Central Science.



Small interfering RNAs (siRNAs) have great therapeutic potential because they can dial down the expression of disease-related genes. However, getting siRNAs into cells where they can do their job has been challenging. Being relatively large and negatively charged, siRNAs cannot easily cross the cell membrane, and they are susceptible to degradation by RNA-chomping enzymes. To overcome these problems, some researchers have tried coating siRNAs with various polymers. However, most small polymers can't shuttle siRNAs into cells, whereas larger polymers can be effective but are generally toxic. Yiyun Cheng and colleagues wondered if they could use EGCG, which is known to bind strongly to RNA, in combination with a small polymer to form nanoparticles that safely deliver siRNA into cells.

The team made their nanoparticles by first combining EGCG and siRNA, which self-assembled into a negatively charged core. Then, the researchers coated this core with a shell consisting of a small, positively charged polymer. These nanoparticles efficiently knocked down the expression of several target genes in cultured cells, showing that the particles could cross the cell membrane. Next, the researchers tested the nanoparticles in a mouse model of intestinal injury, using an siRNA that targeted a pro-inflammatory enzyme. The nanoparticles improved symptoms such as weight loss, shortening of the colon and intestinal inflammation. In addition to the gene-silencing effects of the siRNA, EGCG could contribute to the nanoparticles' effectiveness through its antioxidant and anti-inflammatory properties, the researchers say.

The authors acknowledge funding from the National Natural Science Foundation of Chinaand the Shanghai Municipal Science and Technology Commission.

NOTE: *Epigallocatechin gallate (EGCG: epigallocatechin-3-gallate) is a polyphenol under basic research for its potential to affect human health and disease and is the most abundant catechin in tea, particularly green tea.*

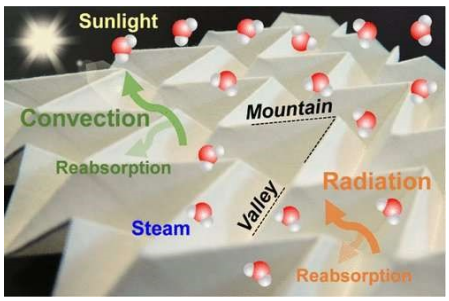
From the ACS Press Room

Origami inspires highly efficient solar steam generator

Nature-Inspired, 3D Origami Solar Steam Generator toward Near Full Utilization of Solar Energy

ACS Applied Materials & Interfaces

Water covers most of the globe, yet many regions still suffer from a lack of clean drinking water. If scientists could efficiently and sustainably turn seawater into clean water, a looming global water crisis might be averted. Now, inspired by origami, the Japanese art of paper folding, researchers have devised a solar steam generator that approaches 100 percent efficiency for the production of clean water. They report their results in ACS *Applied Materials & Interfaces*.



Solar steam generators produce clean water by converting energy from the sun into heat, which evaporates seawater, leaving salts and other impurities behind. Then, the steam is collected and condensed into clean water. Existing solar steam generators contain a flat photothermal material, which produces heat from absorbed light. Although these devices are fairly efficient, they still lose energy by heat dissipation from the material into the air. Peng Wang and colleagues wondered if they could improve energy efficiency by designing a three-dimensional photothermal material. They based their structure on the Miura fold of origami, which consists of interlocking parallelograms that form "mountains" and "valleys" within the 3D structure.

The researchers made their solar steam generator by depositing a light-absorbing nanocarbon composite onto a cellulose membrane that was patterned with the Miura fold. They found that their 3D device had a 50 percent higher evaporation rate than a flat 2D device. In addition, the efficiency of the 3D structure approached 100 percent, compared with 71 percent for the 2D material. The researchers say that, compared to a flat surface, origami "valleys" capture the sunlight better so that less is lost to reflection. In addition, heat can flow from the valleys toward the cooler "mountains," evaporating water along the way instead of being lost to the air.

The authors acknowledge funding from the King Abdullah University of Science and Technology.

From the editor

The DFW Section has a lot going on this month—it is October, the month of Mole Day (10/23). The Section is sponsoring two Mole Day events. *Voyage to Mars: Red Planet Chemistry*, an ACS Program-in-a-Box, will be presented on October 23 at several locations (see page 9). National Chemistry Week (or Mole Week) celebrations will be at the Fort Worth Museum of Science and History October 23-27 (page 10).

Be sure to save the dates for the Doherty award meeting (November 1)and a program on Science and Advocacy at UTA (November 13).

Hands down, my favorite press release this month deals with solar panels inspired by origami, specifically the Miura-ori fold. Here are some neat videos illustrating it and how to make it—note: if you search Miuri on YouTube, I am not sure how many hits you get...they just kept coming.

https://www.youtube.com/watch?v=nw5RLvN7fYA

https://www.youtube.com/watch?v=nYVKU1AFao4

The Miuri fold is a form of tessellation...covering a surface with polygons so no gaps are formed. The artist M. C. Escher was a master of using tessellations in his prints—woodcuts, mezzotints, and lithographs. LiveScience.com has a nice article on the topic:

https://www.livescience.com/50027-tessellation-tiling.html

Best regards,
Connie