

IGB NEWS

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Volume 12 Number 3

UPCOMING EVENTS

Fox Family Innovation and Entrepreneurship Lecture

A Scientist Can Make a Great Entrepreneur
April 23, 2019, 12:00 p.m.
612 Carl R. Woese Institute for Genomic Biology

Robert S. Altman, PhD
Adjunct Professor of Entrepreneurship
Entrepreneur-In-Residence
Polsky Center for Entrepreneurship and Innovation, University of Chicago

Lunch with the Core

3D Alignment and Segmentation of TEM-like Images
April 24, 2019, 12:00 p.m.
612 Carl R. Woese Institute for Genomic Biology

Kingsley Boateng
Senior Research Specialist, IGB Core Facilities

2019 David Gottlieb Memorial Lecture

Natural Products and the Gene Cluster Revolution
April 25, 2019, 4:00 p.m.
B102 Chemical & Life Sciences Lab

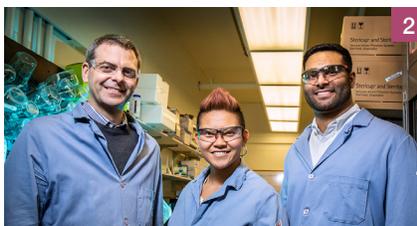
Paul Jensen, PhD
Professor, Center for Marine Biotechnology and Biomedicine
Scripps Institution of Oceanography
UC San Diego

Art of Science 9.0 Opening Reception

April 25, 2019, 5:00 p.m.
Springer Cultural Center,
301 N Randolph St, Champaign, IL

The IGB's Art of Science program celebrates the common ground between science and art, comprising images from IGB's research portfolio. This year's exhibit takes place in a new venue and centers around a theme of comparisons.

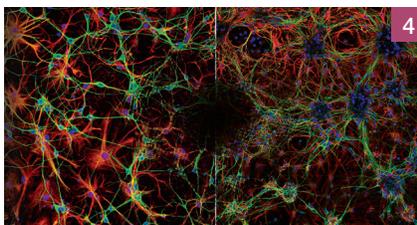
FEATURED NEWS



Cystic fibrosis treatment uses molecular prosthetic



Archaeologists find 200-year-old African DNA on tobacco pipe



Art of Science 9.0 Opening Reception

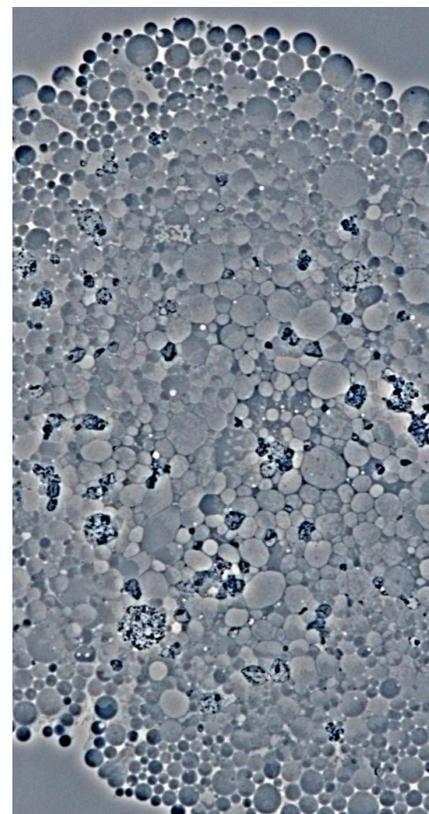


**KLEINMUNTZ
CENTER**

FOR GENOMICS IN BUSINESS & SOCIETY

**On the Grid:
Happenings at IGB**

IMAGE OF THE MONTH



This month features an image of archaeal cells which, lacking a surface layer, form large clumps. The cell sizes that can be seen here are clearly significantly varied. For reference, the largest cells measure approximately 10µm.

IGB News

Share your news with the IGB. Send ideas on stories, articles, and features to nvasi@illinois.edu.



Cystic fibrosis treatment uses molecular prosthetic for lung protein

An approved drug normally used to treat fungal infections could also do the job of a protein channel that is missing or defective in the lungs of people with cystic fibrosis, operating as a prosthesis on the molecular scale, says new research from the University of Illinois and the University of Iowa.

Cystic fibrosis is a lifelong disease that makes patients vulnerable to lung infections. There are treatments for some but not all patients, and there is no cure. The drug restored infection-fighting properties in lung tissue donated by human patients as well as in pigs with cystic fibrosis. It has potential to become the first treatment to address all types of cystic fibrosis, regardless of the genetic mutation that causes the protein deficiency.

The researchers published their findings in the journal [Nature](#).

“Instead of trying to do gene therapy – which is not yet effective in the lung – or to correct the protein, our approach is different. We use a small molecule surrogate that can perform the channel function of the missing protein, which we call a molecular prosthetic,” said Dr. Martin D. Burke, the leader of the study (pictured above, left, with graduate students Katrina Muraglia and Rajeev Chorghade). Burke is a professor of chemistry at Illinois and the associate dean for research at the Carle Illinois College of Medicine, and a member of the IGB’s Mining Microbial Genomes research theme.

Healthy lungs have a layer of liquid on the surface of the airways that helps protect against infection. Cells in the lining of the lung secrete bicarbonate, or baking soda, into the liquid to make it inhospitable to invading bacteria. However, in people with cystic fibrosis, the protein in the cell membrane that vents the bicarbonate to the surface, called CFTR, is defective or missing altogether.

“Losing CFTR channel function makes airway surface liquid more acidic and disrupts salt secretion. These defects cripple two important lung defenses: the antibiotic activity of airway liquid and the clearance of mucus. As a result, people become vulnerable to infection,” said study co-author Dr. Michael J. Welsh, a professor of internal medicine at the University of Iowa Carver College of Medicine and a Howard Hughes Medical Institute investigator.

Burke’s group has long investigated the channel-forming properties of a drug used to treat fungal infections, amphotericin (am-foe-TARE-is-in). In the new study, the researchers explored it as a treatment candidate for cystic fibrosis. They found that amphotericin can form channels in the surface membrane of lung tissue donated by people with cystic fibrosis that was caused by various mutations in the CFTR gene. The channels released bicarbonate that had built up in cells and brought the pH and thickness of the airway surface liquid back within normal range.

The researchers also treated pigs with cystic fibrosis using a version of amphotericin formulated for delivery to the lungs. In both the experiments, in human tissue and in pigs, the researchers saw a restoration of the infection-fighting properties in the liquid lining the lung surfaces.

“Just as a simple prosthetic device can restore a lot of function to those missing a limb, we found that although amphotericin is not a perfect mimic of the CFTR protein, it can function as a bicarbonate channel and restore defense mechanisms in the airway surface liquid,” Burke said.

Unlike drugs that target defective CFTR proteins and work to correct their misfolded structure, the molecular prosthetics approach bypasses the defective protein to form new channels – an important feature for

the 10 percent of people with cystic fibrosis who are completely missing the CFTR protein and therefore cannot be treated with corrector drugs.

“Whereas many of the latest advances in cystic fibrosis treatment have been targeted to specific mutations, this approach would benefit everyone with cystic fibrosis, regardless of mutation,” said Emily Kramer-Golinkoff, a co-founder of the nonprofit cystic fibrosis research foundation Emily’s Entourage, which in part funded the research. “Second, and perhaps even more importantly, this approach presents an opportunity to repurpose an existing, approved drug and bring it to the clinic quickly.”

Next, the joint Illinois-Iowa research team will conduct clinical trials to see whether amphotericin delivered to the lungs is effective in humans with cystic fibrosis.

“Since amphotericin is an already approved drug, the path to clinical translation is more direct. It’s already been shown to be safe when delivered directly to the lung, and it doesn’t get into the rest of the body, so we can avoid the negative side effects that the drug is known for,” Burke said. “We are hoping to conduct clinical trials soon, especially with people for whom correctors are not beneficial.”

“The cystic fibrosis community is truly in need of new therapies to reduce the burden of this disease. We are interested to see how this potential treatment performs in clinical trials in the future,” said Dr. James Kiley, the director of the Division of Lung Diseases at the National Heart, Lung, and Blood Institute, part of the National Institutes of Health, which also funded the work. ■

Written by Liz Touchstone. Photo by red Zwicky.

RESEARCH



Archaeologists find 200-year-old African DNA on tobacco pipe

DNA found on tobacco pipe stems uncovered by archaeologists from the Maryland Department of Transportation State Highway Administration (MDOT SHA) and Anne Arundel County from 200-year-old stone slave quarter at Belvoir along MD 178 is most closely related to Mende in Sierra Leone.

“When Africans stepped on those slave ships, they lost not only their freedom but their identity,” said Dr. Julie Schablitsky, MDOT SHA chief archaeologist. “This is one way archaeologists can help descendants reclaim their heritage.”

The slave quarter was discovered as part of an MDOT SHA Transportation Enhancement Program project to learn more about the history of along MD 178 (General’s Highway) in Anne Arundel County. The program is partially funded by the Federal Highway Administration.

The excavation yielded thousands of artifacts, including broken dishes, animal bones, and clay tobacco pipes. Knowing that DNA can survive on archaeological artifacts, Dr. Schablitsky sent four tobacco pipe stems from the slave quarter for DNA analysis to better understand the story of these Marylanders. Dr. Schablitsky conferred with Dr. Ripan Malhi (CGRH/GNDP/RBTE), who leads an ancient DNA (aDNA) laboratory at the University of Illinois Urbana-Champaign and hoped he could link the aDNA from the pipe stems with the living descendants who had genetic ties to Belvoir’s ancestors.

“We usually study ancient human skeletal remains, so having the opportunity to recover aDNA from tobacco pipes a few hundred years old was a unique challenge,” Dr. Malhi stated. He and Dr. Kelsey Witt Dillon successfully identified a woman’s aDNA on the pipe stem, but it was too degraded to link to living descendants.

(above) Descendants of people believed to have been enslaved in Crownsville, Md., hold pieces of clay pipes that archaeologist Julie Schablitsky found on the site of a former slave cabin.

To learn more, Dr. Malhi contacted Dr. Hannes Schroeder at the University of Copenhagen. Dr. Schroeder found the woman to be most closely related to Mende living in present day Sierra Leone in West Africa. “This is the first time scientists have lifted human DNA from a 200-year-old pipe stem and connected it with a person’s ancestry,” stated Dr.

Schroeder. The results were published in the *Journal of Archaeological Science*.

Dr. Schablitsky believes it was an important genetic breakthrough for archaeologists and more importantly, for descendant communities.

Visiting a place where their ancestors once stood is a powerful feeling for the Belvoir descendants; knowing the location in Africa from where they came from is inspiring, descendants like Wanda Watts said. “It has been a fantastic journey watching history unfold itself on the Belvoir Plantation. Every new discovery gives us a glimpse into the lives of our Ancestors and where they may have lived before being enslaved on this continent,” Watts said.

Pamela Brogden’s ancestors were also enslaved at Belvoir. “The people in Sierra Leone are remarkable and resilient. To possibly have their blood flowing through us is an honor,” she stated. ■

Written by MDOT SHA Communications. Photo by Mary F. Calvert for The Washington Post.

ON THE GRID HAPPENINGS AT THE IGB

AWARD



**KLEINMUNTZ
CENTER**

FOR GENOMICS IN BUSINESS & SOCIETY

KLEINMUNTZ CENTER PROOF-OF-CONCEPT PROGRAM NOW OPEN

The Catherine and Don Kleinmuntz Center for Genomics in Business and Society (Kleinmuntz Center) is committed to supporting innovation and commercialization taking place here at the Carl R. Woese Institute for Genomic Biology. As a result, the Kleinmuntz Center will be providing resources to support faculty with their innovations with a new pre-commercialization Proof-of-Concept (POC) program named the "Mikashi Awards."

The Kleinmuntz Center Mikashi Awards aim to fund IGB projects that demonstrate market viability to help projects succeed. Recipients will be awarded \$50,000-\$75,000 per year for up to two years. Application submissions open March 11th, 2019 and close May 1st, 2019. These awards are open to all Carl R. Woese Institute for Genomic Biology faculty and affiliates. Full information available [here](#).

FACILITIES & SERVICES



PERSONAL PACKAGES

Please note the following policy from our Facilities & Services department: Shipping and receiving of personal packages to the Carl R. Woese Institute for Genomic Biology is prohibited, only items associated with University projects or research may be shipped or received.

AWARDS



BRENDAN HARLEY

Brendan Harley, Professor, Chemical & Biomolecular Engineering (RBTE Theme Leader), was inducted into the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows, honoring those who have made outstanding contributions to engineering and medicine research, practice, or education.



PAUL HERGENROTHER

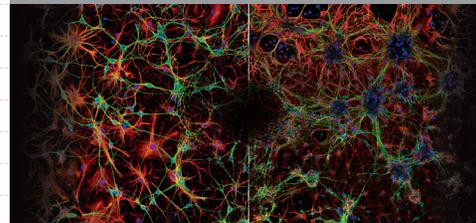
Paul Hergenrother, Professor of Chemistry (ACPP Theme Leader/MMG) received the George and Christine Sosnovsky Award for Cancer Research from the American Chemical Society for outstanding achievements leading to the discovery and development of improved cancer therapeutics.



ZAN LUTHEY-SCHULTEN

Zan Luthey-Schulten, William H. and Janet G. Lycan Professor of Chemistry (BCXT), was invested as the Murchison-Mallory Endowed Chair in Chemistry, established to aid the university in efforts to provide fundamental instruction to undergraduate students in fields such as engineering, medicine, and chemistry.

OPENING



ART OF SCIENCE 9.0 OPENING RECEPTION

The Carl R. Woese Institute for Genomic Biology's Art of Science program is a celebration of common ground between science and art. This year's exhibit centers around a theme of comparisons. To compare is to take the time to observe, consider, read, and even measure similarities and differences. By building comparisons into this year's show we hope to invite you into a mode of perception that can reveal the beautiful work of science at the IGB.

Opening Reception

April 25th 5:00–8:00pm

Springer Cultural Center

301 N Randolph St, Champaign, IL 61820

Refreshments Provided

BLOOD DRIVE



BLOOD DRIVE

DONATE BLOOD

Community Blood Services of Illinois will be holding another blood drive at IGB. Please consider a donation by stopping by or contacting Erin Johnson at ejohns@illinois.edu.

Monday, April 22

9:00a.m. to 12:00p.m.

612 IGB Conference Center

DEPARTMENT ANNOUNCEMENTS

BUSINESS

FY20 BENEFIT CHOICE ENROLLMENT FOR UNIVERSITY OF ILLINOIS EMPLOYEES

The FY20 Benefit Choice period will begin on Wednesday, May 1, 2019 and end on Friday May 31, 2019 with an effective date of July 1, 2019.

If you are eligible for State of Illinois insurance and benefits, you will no longer use NESSIE to make Benefit Choice changes. Instead, you will use the state's new CMS MyBenefits Marketplace website: <https://my-benefits.illinois.gov/account/login/choseclient>.

There are two helpful resources for using the new MyBenefits site:

- MyBenefits Tips blog post found at <https://blogs.illinois.edu/view/1418/472472> is a quick-start guide for registering, logging in, and using the site.

- MyBenefits Marketplace FAQs found at <https://www.hr.uillinois.edu/benefits/segip/mybenefitsFAQ> will help to address some common questions.

Questions

For assistance with your state benefit plans (health, dental, and life insurance, and flexible spending accounts) contact the MyBenefits Marketplace Service Center. Bilingual customer service representatives are available.

- Phone: 844-251-1777 or TTY 844-251-1778
- Hours: 8:00 a.m. – 6:00 p.m. CT Monday through Friday

For questions about university plans or benefit counseling, please contact University Payroll and Benefits by sending an e-mail to benefits@uillinois.edu or via phone at (217) 265-6363. ■

RECENT PUBLICATIONS

Please include your connection to the IGB in your author byline when submitting publications, as it will greatly help track potential newsworthy items and increase the possibility of coverage.

Barber, E. A., Turasan, H., Gezer, P. G., Devina, D., Liu, G. L., & Kokini, J. (2019). Effect of plasticizing and crosslinking at room temperature on microstructure replication using soft lithography on zein films. *Journal of Food Engineering*, 250, 55-64. <https://doi.org/10.1016/j.jfood-eng.2019.01.018>

Tannous, P. J., & Alleyne, A. G. (2019). Fault Detection and Isolation for Complex Thermal Management Systems. *Journal of Dynamic Systems, Measurement and Control, Transactions of the ASME*, 141(6), [061008]. <https://doi.org/10.1115/1.4042675>

Wang, Z., Dien, B. S., Rausch, K. D., Tumbleson, M. E., & Singh, V. (2019). Improving ethanol yields with deacetylated and two-stage pretreated corn stover and sugarcane bagasse by blending commercial xylose-fermenting and wild type *Saccharomyces* yeast. *Bioresource Technology*, 103-109. <https://doi.org/10.1016/j.biortech.2019.02.123>

Gao, H., Mao, Y., Zhao, X., Liu, W-T., Zhang, T., & Wells, G. (2019). Genome-centric metagenomics resolves microbial diversity and prevalent truncated denitrification pathways in a denitrifying PAO-enriched bioprocess. *Water Research*, 275-287. <https://doi.org/10.1016/j.watres.2019.02.020>

Schablitsky, J. M., Witt, K. E., Madrigal, J. R., Ellegaard, M. R., Malhi, R. S., & Schroeder, H. (2019). Ancient DNA analysis of a nineteenth century tobacco pipe from a Maryland slave quarter. *Journal of Archaeological Science*, 105, 11-18. <https://doi.org/10.1016/j.jas.2019.02.006>

Barakat, R., Seymore, T., Lin, P. C. P., Park, C. J., & Ko, C. (2019). Prenatal exposure to an environmentally relevant phthalate mixture disrupts testicular steroidogenesis in adult male mice. *Environmental Research*, 172, 194-201. <https://doi.org/10.1016/j.envres.2019.02.017>

Teo, J. Y., Seo, Y., Ko, E., Leong, J., Hong, Y. T., Yang, Y. Y., & Kong, H. J. (2019). Surface tethering of stem cells with H₂O₂-responsive anti-oxidizing colloidal particles for protection against oxidation-induced death. *Biomaterials*, 201, 1-15. <https://doi.org/10.1016/j.biomaterials.2019.01.039>

Duffy, D. M., Ko, C., Jo, M., Brannstrom, M., & Curry, T. E. (2019). Ovulation: Parallels With Inflammatory Processes. *Endocrine reviews*, 40(2), 369-416. <https://doi.org/10.1210/er.2018-00075>

Hanley, D., López, A. V., Fiorini, V. D., Reboreda, J. C., Grim, T., & Hauber, M. E. (2019). Variation in multicomponent recognition cues alters egg rejection decisions: A test of the optimal acceptance threshold hypothesis. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 374(1769), [20180195]. <https://doi.org/10.1098/rstb.2018.0195>

RECENT PUBLICATIONS

- Wilson, J., Sarthak, K., Si, W., Gao, L., & Aksimentiev, A. (2019). Rapid and Accurate Determination of Nanopore Ionic Current Using a Steric Exclusion Model. *ACS Sensors*, 4(3), 634-644. <https://doi.org/10.1021/acssensors.8b01375>
- Zhang, J. J., Lan, T., & Lu, Y. (2019). Molecular Engineering of Functional Nucleic Acid Nanomaterials toward *In Vivo* Applications. *Advanced Healthcare Materials*, 8(6), [1801158]. <https://doi.org/10.1002/adhm.201801158>
- Makurath, M. A., Whitley, K. D., Nguyen, B., Lohman, T. M., & Chemla, Y. R. (2019). Regulation of Rep helicase unwinding by an auto-inhibitory subdomain. *Nucleic acids research*, 47(5), 2523-2532. <https://doi.org/10.1093/nar/gkz023>
- Thapa, S., Gates, M. K., Reuter-Carlson, U., Androwski, R. J., & Schroeder, N. E. (2019). Convergent evolution of saccate body shapes in nematodes through distinct developmental mechanisms. *EvoDevo*, 10(1). <https://doi.org/10.1186/s13227-019-0118-5>
- Berenbaum, M. R. (2019). Out of Order. *American Entomologist*, 65(1), 3-5. <https://doi.org/10.1093/ae/tmz012>
- Alcalde, R. E., Michelson, K., Zhou, L., Schmitz, E. V., Deng, J., Sanford, R. A., ... Werth, C. J. (2019). Motility of *Shewanella oneidensis* MR-1 Allows for Nitrate Reduction in the Toxic Region of a Ciprofloxacin Concentration Gradient in a Microfluidic Reactor. *Environmental Science and Technology*, 53(5), 2778-2787. <https://doi.org/10.1021/acs.est.8b04838>
- Sweedler, J. V. (2019). Salami Publications and Duplicate Submissions: Put Them on Your List of Things to Avoid. *Analytical chemistry*, 91(5), 3177-3178. <https://doi.org/10.1021/acs.analchem.9b00904>
- Kim, B. M., Amores, A., Kang, S., Ahn, D. H., Kim, J. H., Kim, I. C., ... Park, H. (2019). Antarctic blackfin icefish genome reveals adaptations to extreme environments. *Nature Ecology and Evolution*, 3(3), 469-478. <https://doi.org/10.1038/s41559-019-0812-7>
- Oba, P. M., Utterback, P. L., Parsons, C. M., Cattai de Godoy, M. R., & Swanson, K. S. (2019). Chemical composition, true nutrient digestibility, and true metabolizable energy of chicken-based ingredients differing by processing method using the precision-fed cecectomized rooster assay. *Journal of animal science*, 97(3), 998-1009. <https://doi.org/10.1093/jas/sky461>
- Valluru, R., Gazave, E. E., Fernandes, S. B., Ferguson, J. N., Lozano, R., Hirannaiah, P., ... Bandillo, N. (2019). Deleterious mutation burden and its association with complex traits in sorghum (Sorghum bicolor). *Genetics*, 211(3), 1075-1087. <https://doi.org/10.1534/genetics.118.301742>
- Cheng, M. H., Dien, B. S., & Singh, V. (2019). Economics of plant oil recovery: A review. *Biocatalysis and Agricultural Biotechnology*, 18, [101056]. <https://doi.org/10.1016/j.bcab.2019.101056>
- Detweiler, K. B., He, F., Mangian, H. F., Davenport, G. M., & Cattai de Godoy, M. R. (2019). Effects of high inclusion of soybean hulls on apparent total tract macronutrient digestibility, fecal quality, and fecal fermentative end-product concentrations in extruded diets of adult dogs. *Journal of animal science*, 97(3), 1027-1035. <https://doi.org/10.1093/jas/skz015>
- Detweiler, K. B., He, F., Mangian, H. F., Davenport, G. M., & Cattai de Godoy, M. R. (2019). Extruded feline diets formulated with high inclusion of soybean hulls: Effects on apparent total tract macronutrient digestibility, and fecal quality and metabolites. *Journal of animal science*, 97(3), 1042-1051. <https://doi.org/10.1093/jas/skz014>
- South, F. A., Liu, Y. Z., Huang, P. C., Kohlfarber, T., & Boppart, S. A. (2019). Local wavefront mapping in tissue using computational adaptive optics OCT. *Optics Letters*, 44(5), 1186-1189. <https://doi.org/10.1364/OL.44.001186>
- Pereira, I. S., do Nascimento, H. E. M., Vicari, M. B., Disney, M., Delucia, E. H., Domingues, T., ... Hofhansl, F. (2019). Performance of laser-based electronic devices for structural analysis of Amazonian terra-firme forests. *Remote Sensing*, 11(5), [510]. <https://doi.org/10.3390/rs11050510>
- Jaiswal, D., De Souza, A. P., Larsen, S., LeBauer, D. S., Miguez, F. E., Sparovek, G., ... Long, S. P. (2019). Reply to: Brazilian ethanol expansion subject to limitations. *Nature Climate Change*, 9(3), 211-212. <https://doi.org/10.1038/s41558-019-0423-y>
- Juneja, A., Sharma, N., Cusick, R., & Singh, V. (2019). Techno-economic feasibility of phosphorus recovery as a coproduct from corn wet milling plants. *Cereal Chemistry*, 96(2), 380-390. <https://doi.org/10.1002/cche.10139>
- Hughes, K. J., Rodriguez, A., Flatt, K. M., Ray, S., Schuler, A., Rodemoyer, B., ... Vidal-Gadea, A. G. (2019). Physical exertion exacerbates decline in the musculature of an animal model of Duchenne muscular dystrophy. *Proceedings of the National Academy of Sciences of the United States of America*, 116(9), 3508-3517. <https://doi.org/10.1073/pnas.1811379116>
- Parks, C. A., Henning, K. R., Pavelko, K. D., Hansen, M. J., Van Keulen, V. P., Reed, B. K., ... Pease, L. R. (2019). Breaking tolerance with engineered class I antigen-presenting molecules. *Proceedings of the National Academy of Sciences of the United States of America*, 116(8), 3136-3145. <https://doi.org/10.1073/pnas.1807465116>
- Kolbe, A. R., Studer, A. J., Cornejo, O. E., & Cousins, A. B. (2019). Insights from transcriptome profiling on the non-photosynthetic and stomatal signaling response of maize carbonic anhydrase mutants to low CO₂. *BMC genomics*, 20(1). <https://doi.org/10.1186/s12864-019-5522-7>
- Zhu, Q., Ren, X., Shang, J., Zhang, Y., El-Kishky, A., & Han, J. (2019). Integrating local context and global cohesiveness for open information extraction. In *WSDM 2019 - Proceedings of the 12th ACM International Conference on Web Search and Data Mining* (pp. 42-50). (WSDM 2019 - Proceedings of the 12th ACM International Conference on Web Search and Data Mining). *Association for Computing Machinery, Inc.* <https://doi.org/10.1145/3289600.3291030> ■

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