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Volume 14 Number 2

UPCOMING EVENTS

IGB Pioneers Seminar - M-CELS

Programming Tissue Regeneration Using Polyelectrolyte Delivery Scaffolds

March 30, 2021, 12:00 p.m.

[Join via Zoom](#)

Paula Hammond, PhD
Massachusetts Institute of Technology
Department Head, Chemical Engineering; Professor in Engineering

IGB DEI Seminar Series

NAGPRA, Research, and Collaborative Partnerships with Native Nations

April 13, 2021, 12:00 p.m.

[Join via Zoom](#)

Jenny L. Davis
Associate Professor of Anthropology & American Indian Studies
University of Illinois Urbana-Champaign

Art of Science 11.0: Elemental

May 1-8, 2021, 11:00 a.m. - 3:00 p.m.

University of Illinois Arboretum
1800 South Lincoln Avenue, Urbana

The Art of Science 11.0 installation will be open for socially-distant outdoor viewing daily (weather permitting). Parking available.

IGB Fellows Symposium

May 6, 2021, 9:00 a.m. - 5:00 p.m.

[Register Here](#)

Learn about IGB research, submit a poster, and connect with other students on campus at the virtual 2021 Fellows Symposium.

FEATURED NEWS



Using a multipronged approach to investigate ancient dogs diet



Quantum leaps in understanding how living corals survive

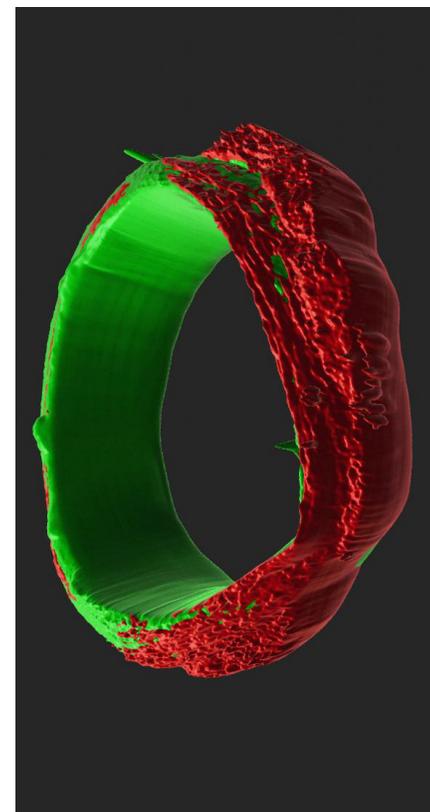


Monthly Profile: Hee Jung Chung



On the Grid: Happenings at IGB

IMAGE OF THE MONTH



This month shows engineered, three-dimensional (3D) skeletal muscle ring-shaped tissues under 1mm in thickness and 6mm in diameter, adhered to motor neuron rings of the same dimensions. The image was taken with the Miltenyi Ultramicroscope at the IGB Core Facilities by Dr. Kingsley Boateng of Core Facilities and 3D-rendered using Imaris Software. Sample provided by Lauren Gapinske of the Bashir Lab.

IGB News

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



Using a multipronged approach to investigate the diet of ancient dogs

Coprolites, or fossilized dog feces, are often used to understand the dietary preferences of ancient civilizations. However, the samples are often contaminated, making the analysis difficult. A new study, published in *Scientific Reports*, uses different techniques to improve the investigation of coprolites.

“We have been interested in analyzing coprolites for many years. We have attempted to extract DNA and look at the microbiome before, but the tools were not as robust,” said Ripan Malhi (GNBP/GSP/IGOH), a professor of anthropology. “As far as I know, this is the first time anyone has used multiple approaches to provide a snapshot of the daily diet, health, and the long-term trends in ancient dogs of the Americas, all in one study.”

The samples were recovered from Cahokia, near modern St. Louis, Missouri. At its peak, Cahokia was a large urban center with a population greater than London or Paris. Several other investigations have shown that there is an overlap between the diet of dogs and humans, either because the dogs were fed the same food or because they ate human food scraps. Therefore, investigating coprolites also provides an insight into human health and diet.

“Initially, the residents were growing crops such as squash and sunflowers. As the city got bigger, it is believed that the diet shifted to maize. Our analysis suggests the same since we saw that some of the dogs were also eating maize,” said Kelsey Witt, a postdoctoral researcher at Brown University and former PhD student in the Malhi lab.

The maize samples were examined using stable isotope analysis, which is used to measure different forms of carbon in a sample. Depending on the carbon concentrations, one can identify what kind of plant was consumed. The researchers also

“These samples were deposited a thousand years ago. After that, the environment changed, certain microbes died off, and new microbes took over. All these factors complicate the analysis.”

investigated the animal and plant remains in the coprolites to show that walnuts, grapes, a variety of fish, and duck were a part of the dogs’ diet.

The researchers also used DNA sequencing to determine the microbiome—the community of microbes—of the coprolites. “The technique we used came out in 2020. It helped us verify whether the samples were from dogs or humans, as well as confirm general aspects of diet which can only be done by comparing the microbiomes,” said Karthik Yarlalagadda, a PhD student in the Malhi lab.

Although the techniques are novel and more sensitive, coprolites are still challenging to study for a number of reasons. The DNA has already

passed through the digestive process in the dogs and has therefore been broken down. Furthermore, since the samples are ancient, the extracted DNA is degraded to a large extent due to weathering.

“One of the biggest challenges we faced was dealing with sample contamination,” Yarlalagadda said. “These samples were deposited a thousand years ago. After that, the environment changed, certain microbes died off, and new microbes took over. All these factors complicate the analysis.”

The researchers are working with the Indigenous communities to further understand what the diets looked like in their ancestors. “Since there are a lot of limitations to our research, talking to community members about what their ancestors ate and how they interacted with dogs helps us understand our results better,” Witt said.

The study “Integrative analysis of DNA, macroscopic remains and stable isotopes of dog coprolites to reconstruct community diet” can be found at <https://doi.org/10.1038/s41598-021-82362-6>. The work was sponsored by the Vice Chancellor of Research, University of Illinois, and the Illinois State Archaeological Survey. ■

Written by Ananya Sen. Photo by Malhi lab.



Quantum leaps in understanding how living corals survive

Coral reefs have thrived for millions of years in their shallow ocean water environments due to their unique partnerships with the algae that live in their tissues. Corals provide a safe haven and carbon dioxide while their algal symbionts provide them with food and oxygen produced from photosynthesis. Using the corals *Orbicella annularis* and *Orbicella faveolata* in the southern Caribbean, researchers at the IGB have improved our ability to visualize and track these symbiotic interactions in the face of globally warming sea surface temperatures and deepening seawaters.

“Corals are one of the most resilient organisms on the planet,” said Mayandi Sivaguru, the co-lead author of the study and Assistant Director of Core Facilities at the IGB. “They have survived ice ages, greenhouse conditions with no ice, and everything else in between that the planet has thrown at them.”

Although they have a long history of weathering disruptions, coral reefs are also sensitive enough to serve as indicators of climate change and oceanic health. As an example, when the sea surface temperature or the seawater acidity increases, corals eject their algal partners—a phenomenon called coral bleaching—which converts the corals from green to white. To understand why bleaching occurs, it is important to visualize how the corals interact with their algal partners.

Previously, researchers had to peel the skin of corals and place the samples in a blender to study their symbiotic algal partners. The current study uses a non-invasive technique instead. “We collect small samples of corals on the living reef, bring them back

to Illinois, and look at them under the microscope without further processing. Two-photon microscopy allows us to look at their three-dimensional structure, and determine how many algae and what biomolecules are present,” Sivaguru said. The technique uses light to scan living tissues, allowing the researchers to keep the corals in their original growth structure.

The researchers used these new methods to compare the symbionts in two environmental contexts. The first was from shallow to deeper seawater and the second was between seasonal warm-to-cool changes in sea surface temperatures. “In addition to analyzing the number of symbionts in the coral tissues, which the corals can alter, we also tracked simultaneous changes in mucus and biomolecules produced by the corals, some of which serve as a natural sun block,” Sivaguru said.

The microscopy studies revealed that shallow water corals have lower algal concentrations and produce higher levels of chromatophores, which are biomolecules that protect algae from sunlight damage. On the other hand, the researchers found the opposite pattern in deeper water corals. These corals receive lesser sunlight and would therefore require more algae to keep up with the photosynthetic demand. During seasonal sea surface temperature changes, the warmer water caused decreased mucus production and algal concentrations, but increased photosynthesis and coral skeleton growth. Conversely, cooler waters caused the opposite effect.

“We have combined the results of this study to identify universal mechanisms of biomineralization

found between water, microbes, living organisms, and rock,” said Lauren Todorov, the co-lead author, who completed this research as part of her undergraduate B.Sc. thesis at Illinois and is now completing her M.Sc. in Geology. “This study has allowed us to establish a comprehensive understanding of the coral system as well as make connections to the formation of layered rock in other systems such as hot springs, roman aqueducts, and even human kidney stones.”

“This project required several years to complete and required virtually all of the microscopes available in the IGB Core Facilities. Importantly, our research team included several students who worked on the project starting in high school and continued as part of their undergraduate and graduate research in institutions across the United States. This included fieldwork in Curaçao and well as work at the IGB,” said Bruce Fouke (BCXT), a professor of geology and microbiology at the IGB.

The study “Corals regulate the distribution and abundance of Symbiodiniaceae and biomolecules in response to changing water depth and sea surface temperature” was published in *Scientific Reports* and was funded by the Office of Naval Research, the IGB Undergraduate Summer Research Fellowship, the IGB Mark Tracy Fellowship for Translational Research, the Department of Molecular and Cellular Biology Jenner Family Summer Research Fellowship, and the Edward and Barbara Weil Research Fund. ■

Written by Ananya Sen. Photo by Bruce Fouke.

MONTHLY PROFILE



Hee Jung Chung is an Associate Professor of Molecular and Integrative Physiology. The Chung lab is interested in understanding what causes epilepsy in order to develop novel therapeutic interventions and early diagnostics for this common brain disorder

Understanding ion channel physiology to understand epilepsy and develop better therapeutics

Hee Jung Chung (M-CELS) spent her childhood in several countries, including the U.S., South Korea, and Japan. Consequently, she believes that it is important to expose oneself to different cultures. This realization led her to join the University of Illinois in 2010. “I love the multinational community of students at the university. We have a melting pot in the middle of Illinois where people are welcome regardless of their race, nation, ideology, or religion,” Chung said.

Chung was also drawn to the scientific community at Illinois. She was hired by the Department of Molecular and Integrative Physiology, which specializes in neuroscience and endocrinology. Her own research focuses on neuroscience and neurological disorders. Chung studies epilepsy, which is characterized by recurrent seizures. About 30-40% of epilepsy is caused by genetic mutations, but underlying mechanisms are unclear. “My lab studies a class of ion channels called KCNQ potassium channels. Mutations in these channels cause neonatal seizures which are often drug resistant, resulting in developmental delay, progressive cognitive decline, brain damage, and abnormal behaviors,” Chung said.

Her group has collaborated with Eric Bolton’s lab to develop an algorithm called the “Mutation Hotspot Finder”, which can detect which protein domains of KCNQ channels are important for their function and which locations have mutations. “We have found that the mutations located in specific hotspots perturb the function of these channels, which affects not only the potassium currents but also their location within neurons,” Chung said. “By associating the mutation hotspots with the patient’s disease severity and response to current anti-seizure drugs, we can develop a better algorithm to predict the treatment outcome of the patients.”

The Chung lab is also focused on studying neural plasticity, which is thought to underlie learning and memory. Specifically, Chung aims to understand how neurons persistently change their electrical activity and their communication with each other in response to the signals they receive. Understanding this mechanism is critical since about 60-70% of epilepsy patients

do not have the underlying genetic mutations. In these patients, their brain activity is hyperactive, but the mechanisms underlying this change remain unknown.

In collaboration with Hyunjoon Kong (M-CELS), Chung is also testing novel drugs that can reduce seizures. “One of the biggest challenges is developing a drug or a drug carrier that can pass the blood-brain barrier. We chose to construct the carrier and we have been using Kong’s expertise in nanoparticles to do so,” Chung said. Kong’s lab is developing and testing the nanoparticles which can attach specifically to cell markers that are characteristic of neural inflammation-- common in neurological disorders such as epilepsy and Alzheimer’s disease-- allowing them to preferentially deliver the drugs to inflammation-prone brain regions. “Inflammation can also generate reactive oxygen species. Kong’s lab is trying to modify the drug delivery system so that the potential anti-seizure drug is triggered only in the presence of these species,” Chung said.

Chung became interested in neurobiology during her undergraduate studies at Cornell University. Although she initially pursued a double major in mechanical engineering and biochemistry, she later switched to chemistry and biochemistry. “I was fascinated by the chemistry and biological processes. It is mysterious and not something you can calculate from equations, which you do in engineering,” Chung said. Her first research project involved synthesizing lipids and characterizing the role of cholesterol in the fluidity of lipid bilayers. Although the project was chemistry- and biophysics-heavy, it involved biological concepts that fascinated her. During her junior year, Chung was awarded the HHMI Undergraduate Research Fellowship, which allowed her to branch out into other research areas. “I was exposed to multiple science disciplines and I became interested in studying diseases that affect the brain and central nervous system. I was also personally invested because some of my cousins have neurological diseases,” Chung said.

This interest in neuroscience prompted Chung to look for graduate labs, at Johns Hopkins University School of Medicine, that focused on neuronal communica-

tions. She studied how learning and memory are affected by connections at the synapse, areas where signals are transmitted between neurons. “The prevailing hypothesis was that synaptic connections need to be strengthened to aid learning and memory. This is called synaptic plasticity. However, we did not know which proteins were involved or how these connections could be strengthened,” Chung said. “My thesis work revolved around how ligand-gated ion channels, specifically glutamate receptors, are regulated and expressed at the synapse.”

For her postdoctoral work Chung wanted to move away from glutamate receptors and focus on the role of other ion channels in synaptic plasticity. She moved to the University of California, San Francisco to study potassium channels which play critical roles in many diseases including epilepsy. Chung worked on GIRK potassium channels to understand how they modulate synaptic plasticity. She also worked on the role of KCNQ channels in neonatal epilepsy, which her lab currently studies.

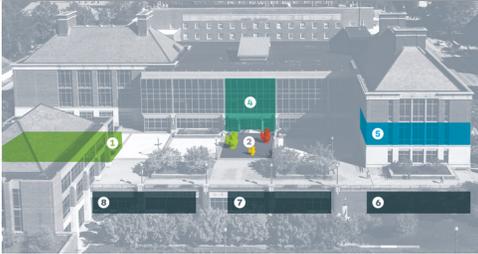
Additionally, Chung wanted to work for a female scientist during her postdoctoral training. “I noticed that in Asia, there is a bias against women in science. I joined the lab because I wanted to see how a prominent female scientist mentors her students and deals with the challenges of managing a lab,” Chung said. “As a graduate student I felt that women need to change their personalities to be more like men. However, my advisor was very gentle and feminine, which did not undermine her scientific brilliance.”

Chung is trying to maintain the same nurturing environment in her lab. “I believe that women scientists face more challenges when it comes to maintaining a work-life balance: It became much harder during the pandemic and I could see that it took a toll on my lab members,” Chung said. “However, once we had robust safety plans, my lab became productive. I am very grateful to my postdoc and graduate students for working so hard on their research.” ■

Written by Ananya Sen. Photo courtesy of Hee Jung Chung.

ON THE GRID HAPPENINGS AT THE IGB

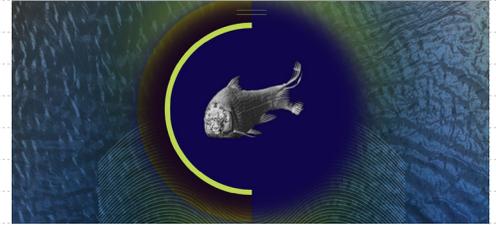
TOUR



SEE THE IGB

Visit the IGB virtually and stop by some of our key locations such as Darwin's Playground, the Walk of Life, and the Gatehouse Atrium on our new virtual tour page. Visit See The IGB to get started.

EXHIBITION



ART OF SCIENCE 11.0: ELEMENTAL

This year's Art of Science 11.0 installation will be open for socially-distant outdoor viewing, May 1 to May 8th from 11am-3pm daily (weather permitting) at the University of Illinois Arboretum. Parking is available at 1800 South Lincoln Avenue near the Noel Welcome Garden, along South Lincoln Avenue, or north of Japan House. Opening day will be April 30th from 3:00-7:00pm.

For in-person visitors, masks and social distancing are required, but selfies with the art are encouraged!

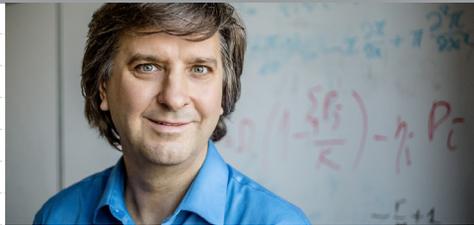
Sponsored by the IGB, BodyWork Associates, and the Catherine and Don Kleinmuntz Center for Genomics in Business and Society

AWARDS



LISA AINSWORTH

Lisa Ainsworth, a research plant physiologist with the USDA Agricultural Research Service (ARS) and adjunct professor of plant biology and crop sciences (CABBI/GEGC), received the Distinguished Senior Research Scientist award as part of the 2021 ARS Employee Recognition Program. Representing the best of the best within the ARS, Lisa was chosen specifically for her work towards advancing understanding of crop responses to global climate change and science advocacy through both service and outreach.



SERGEI MASLOV

Sergei Maslov, Professor and Bliss Faculty Scholar of Bioengineering (BCXT/CABBI) was elected Fellow of the American Institute for Medical and Biological Engineering (AIMBE), in recognition of his contributions to computational biology including microbiome dynamics, microbial and viral ecology, genomics, and studies of complex biological networks.



RIPAN MALHI

Ripan Malhi, Professor of Anthropology (GNBP/GSP/IGOH) was named a 2021-22 Levenick Institute for Sustainability, Energy, and Environment (ISEE) Teaching Sustainability Fellow in recognition of the creation of a new course built around sustainability elements, "Transforming Science from Colonial to Sustainable Practice."



CARI VANDERPOOL

Cari Vanderpool, Professor and Associate Head of Microbiology (IGOH/MME) was elected Fellow of the American Academy of Microbiology (AAM) in recognition of her scientific achievement and original contributions towards advancing the field of microbiology.

SYMPOSIUM

IGB FELLOWS SYMPOSIUM

IGB FELLOWS SYMPOSIUM MAY 6, 2021

Learn about IGB research, hear about current issues in the life sciences, and connect with other students on campus at the 2021 Fellows Symposium. With keynote lectures from Dr. James Davis, Former IGB Fellow and Computational Biologist at Argonne National Laboratory, and Dr. Paul Turner, Rachel Carson Professor of Ecology and Evolutionary Biology at Yale University. Register for free at fellows.igb.illinois.edu.

ON THE GRID HAPPENINGS AT THE IGB

STUDY



MOST-CITED RESEARCHERS

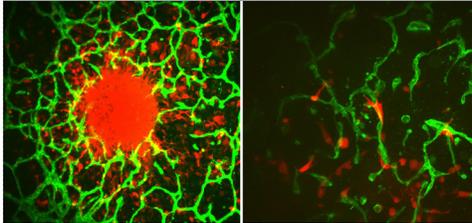
Dozens of professors in the College of LAS, including many from the IGB, rank among the most-cited researchers in the world in a new, widely hailed analysis designed to provide a clearer view of scientific and scholarly impact.

According to datasets published in PLOS Biology, 125 LAS professors rank among the top 100,000 most-cited researchers since the mid-1990s. The dataset includes about 8 million researchers worldwide—active, retired, or deceased—who published at least five papers in their career. Another 28 LAS professors outside of the top 100,000 are still ranked among the top 2 percent of most-cited researchers in their fields.

According to the study, the most-cited LAS researcher since the mid-1990s is the late Carl Woese, professor of microbiology and IGB namesake who is best known for his discovery of archaea, a third domain of life. Ranked 650 on the list, Woese passed away in 2012. Next on the list is Kenneth Suslick, in the Department of Chemistry, ranked 833.

Other LAS professors ranked in the top 10,000 on the list include Catherine Murphy, chemistry, 1,648; Harry Triandis (deceased), psychology, 2,171; Jeffery Moore (BSD), chemistry, 2,424; Scott Denmark, chemistry, 2,599; Stephen Long (BSD/CABBI/GEGC), plant biology, 2,851; James Imlay, microbiology, 3,096; Gene Robinson (IGB Director/GNDP), entomology, 4,284; Benita Katzenellenbogen (CGD), molecular and integrative physiology and cell and developmental biology, 4,342; Edward McAuley (emeritus), psychology, 5,455; John Cronan (MMG), microbiology and biochemistry, 6,107; Yi Lu (BSD/CABBI/CGD), chemistry, 6,384; Brent Roberts (GNDP), psychology, 6,901; Ralph Nuzzo, chemistry, 7,916; and Hugh Robertson (emeritus, GNDP), entomology, 9,041.

AWARD



NATIONAL CANCER INSTITUTE AWARD

Several Cancer Center at Illinois (CCIL) and IGB members, Mayo Clinic, and Georgetown University are collaborating on an expansive project targeting improved treatment for glioblastoma (GBM), the most aggressive form of brain cancer. The team, led by Brendan Harley (RBTE leader/EIRH), professor of chemical and biomolecular engineering, recently received a \$3M grant from the National Cancer Institute (NCI) for their research which will unite the cell biology, bioengineering, and chemistry behind cancer drug development.

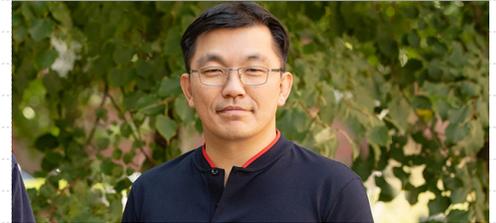
Glioblastoma is historically difficult to treat, with only a 25% survival rate over five years. When a cancer patient is diagnosed with GBM, they will most likely be undergoing surgery to remove the tumor.

During a separate project, Harley and Paul Hergenrother (ACPP leader/MMG), professor of chemistry and the CCIL's Deputy Director, realized that Hergenrother's expertise in cancer therapeutics could aid the team in addressing MGMT.

"Since we knew the high level of resistance because of MGMT, my lab thought that we could design a compound that applies another mutation to the DNA that would not get removed, as well as something that gets into the brain more efficiently," Hergenrother said. "The Harley lab will develop more predictive models, which will help us to evaluate the success of the cancer agents we create at a more rapid pace."

The research team will explore how they can create a mutated version of TMZ that MGMT cannot remove, allowing for this new version of TMZ to successfully destroy cancerous cells. This grant is a part of the NCI's Cancer Tissue Engineering Collaborative which will support the team's efforts to better understand the physiological processes driving cancer progression and drug resistance.

THEME



NEW DIRECTIONS IN CANCER RESEARCH

Hyunjoo Kong (M-CELS leader/EIRH/RBTE), Robert W. Schafer professor of chemical and biomolecular engineering, approaches cancer research from a perspective that integrates cell engineering and biomaterials. The Kong research team has been working with Georgia Tech University and Massachusetts Institute of Technology (MIT) over the past 10 years under the National Science Foundation (NSF) Science and Technology Center Grant.

Most recently, the American Association for Advancement of Science (AAAS) published his lab's work on cephalopod-mimicking technology to transfer thin sheets of cell clusters and bioelectronic sensor. The applications of this project are broad, spanning from sensor administration to drug delivery and cell therapies. With regard to cancer discovery, this could change the way that scientists and clinicians administer tests and treatments.

"We wanted to make tissues using stem cells. Typically, these tissues from in-vitro cultures are very thin, and we realized how hard it was to manipulate these sheets. We hypothesized that a suction cup could help us solve this, and it was successful," said Kong.

Kong is leading a new Multi-Cellular Engineered Living Systems (M-CELS) theme within the IGB. He calls this new direction an "unanswered black box" that they want to open. They want to interrogate how cell communication influences body, tissue, and pathogen development. Cancer is one of these developments that they are intending to pursue.

Their application goal is to help other clinicians and researchers better understand the cell-to-cell communication. With this new-found knowledge, they can diagnose and treat patients with higher knowledge of the disease and implications of the balance between normal and cancer cells.

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.

Wang, J., Park, J., Zhang, X., Park, I., Kilicarslan, E., Kim, Y., Bashir, R., Gazzola, M. (2021). Computationally assisted design and selection of maneuverable biological walking machines. *bioRxiv*. <https://doi.org/10.1101/2020.09.01.278622>

Poddar, A., Azam, M. S., Kayikcioglu, T., Bobrovskyy, M., Zhang, J., Ma, X., Labhsetwar, P., Fei, J., Singh, D., Luthey-Schulten, Z., Vanderpool, C. K., & Ha, T. (2021). Effects of individual base-pairs on in vivo target search and destruction kinetics of bacterial small RNA. *Nature communications*, 12(1), [874]. <https://doi.org/10.1038/s41467-021-21144-0>

Hamed, S., Shawky, R. M., Emara, M., Schlauch, J. M., & Rao, C. V. (2021). Hile is required for synergistic activation of SPI-1 gene expression in *Salmonella enterica* serovar Typhimurium. *BMC microbiology*, 21(1), [49]. <https://doi.org/10.1186/s12866-021-02110-8>

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Sorrells, J. E., Martin, E. M., Aksamitiene, E., Mukherjee, P., Alex, A., Chaney, E. J., Marjanovic, M., & Boppart, S. A. (2021). Label-free characterization of single extracellular vesicles using two-photon fluorescence lifetime imaging microscopy of NAD(P)H. *Scientific reports*, 11(1), [3308]. <https://doi.org/10.1038/s41598-020-80813-0>

Lee, M. J., Rittschof, C. C., Greenlee, A. J., Turi, K. N., Rodriguez-Zas, S. L., Robinson, G. E., Cole, S. W., & Mendenhall, R. (2021). Transcriptomic analyses of black women in neighborhoods with high levels of violence. *Psychoneuroendocrinology*, 127, [105174]. <https://doi.org/10.1016/j.psyneuen.2021.105174>

Gulley, J. M., & Izenwasser, S. (2021). Adolescent drug addiction. *Pharmacology Biochemistry and Behavior*, 203, [173151]. <https://doi.org/10.1016/j.pbb.2021.173151>

Jones, M. B., Brandt, S. A., Henry, E. R., & Ambrose, S. H. (2021). Improved ostrich eggshell and ungulate tooth enamel radiocarbon dating methods reveal Later Stone Age occupation in arid MIS 2 southern Somalia. *Journal of Archaeological Science: Reports*, 36, [102844]. <https://doi.org/10.1016/j.jasrep.2021.102844>

Reed, C. J., Lam, Q. N., Mirts, E. N., & Lu, Y. (2021). Molecular understanding of heteronuclear active sites in heme-copper oxidases, nitric oxide reductases, and sulfite reductases through biomimetic modelling. *Chemical Society Reviews*, 50(4), 2486-2539. <https://doi.org/10.1039/d0cs01297a>

Khaw, Y. M., Tierney, A., Cunningham, C., Soto-Diaz, K., Kang, E., Steelman, A. J., & Inoue, M. (2021). Astrocytes lure CXCR2-expressing CD4+ T cells to gray matter via TAK1-mediated chemokine production in a mouse model of multiple sclerosis. *Proceedings of the National Academy of Sciences of the United States of America*, 118(8), [e2017213118]. <https://doi.org/10.1073/pnas.2017213118>

Richbourg, N. R., Wancura, M., Gilchrist, A. E., Toubbeh, S., Harley, B. A. C., Cosgriff-Hernandez, E., & Peppas, N. A. (2021). Precise control of synthetic hydrogel network structure via linear, independent synthesis-swelling relationships. *Science Advances*, 7(7), [eabe3245]. <https://doi.org/10.1126/sciadv.abe3245>

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Mao, Y., Zeineldin, M., Usmani, M., Uprety, S., Shisler, J. L., Jutla, A., Unnikrishnan, A., & Nguyen, T. H. (2021). Distribution and Antibiotic Resistance Profiles of *Salmonella enterica* in Rural Areas of North Carolina After Hurricane Florence in 2018. *GeoHealth*, 5(2), [e2020GH000294]. <https://doi.org/10.1029/2020GH000294>

Žuraskas, M., Iyer, R. R., & Boppart, S. A. (2021). Simultaneous 4-phase-shifted full-field optical coherence microscopy. *Biomedical Optics Express*, 12(2), 981-992. <https://doi.org/10.1364/BOE.417183>

Adil, M. T., & Henry, J. J. (2021). Understanding cornea epithelial stem cells and stem cell deficiency: Lessons learned using vertebrate model systems. *Genesis*, 59(1-2), [e23411]. <https://doi.org/10.1002/dvg.23411>

Sivaguru, M., Todorov, L. G., Fouke, C. E., Munro, C. M. O., Fouke, K. W., Fouke, K. E., Baughman, M. E., & Fouke, B. W. (2021). Corals regulate the distribution and abundance of Symbiodiniaceae and biomolecules in response to changing water depth and sea surface temperature. *Scientific reports*, 11(1), 2230. <https://doi.org/10.1038/s41598-021-81520-0>

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