IGB Pioneers Seminar
*Complexity Made Simple: A Model Microbial Community to Dissect Function*
September 15, 2020, 12:00 p.m.
Join via Zoom
Jo Handelsman, PhD
Director, Wisconsin Institute for Discovery, University of Wisconsin-Madison

IGB Science Chat
*Personalized Nutrition Initiative At Illinois*
September 29, 2020, 12:00 p.m.
Join via Zoom
Sharon Donovan, PhD
Director, Personalized Nutrition Initiative
Professor and Melissa M. Noel
Endowed Chair in Diet and Health, University of Illinois
Hannah Holscher, PhD
Assistant Professor of Nutrition, University of Illinois
Naiman Khan, PhD
Assistant Professor of Kinesiology and Community Health, University of Illinois

IGB Seminar - MME
*Intestinal Epitelial Cell Functions in Host-Microbiome Interactions*
October 13, 2020, 12:00 p.m.
Join via Zoom
Maayan Levy-Thaiss, PhD
University of Pennsylvania Perelman School of Medicine; Assistant Professor of Microbiology

Donovan to direct new Personalized Nutrition Initiative

NSF awards $20M grant, AI institute for molecule synthesis

Monthly Profile:
Brian Cunningham

On the Grid: Happenings at IGB

This month's image is a tile scan of a whole brain of a cuprizone-fed mouse, obtained with an Ultra Microscope (a 2nd generation lightsheet microscope by Miltenyi Biotec) after CLARITY tissue clearing and subsequent staining with anti-proteolipid protein (PLP). The image was processed with the Imaris 3D Software System: UltraMicroscope II. Sample provided by Allison Yukiko Louie, Steelman Lab, Department of Animal Sciences. Imaged and processed by Dr. Kingsley Boateng at the IGB.

IGB News
Share your news with the IGB. Send ideas on stories, articles, and features to nvasi@illinois.edu.
Donovan to direct new Personalized Nutrition Initiative

Sharon Donovan, professor and Melissa M. Noel Endowed Chair in Diet and Health at University of Illinois, will assume the role of director of the newly established Personalized Nutrition Initiative (PNI).

The PNI is a partnership between the Carl R. Woese Institute for Genomic Biology (IGB) and the College of Agricultural, Consumer and Environmental Sciences (ACES) at U of I.

Precision or personalized nutrition, which was identified as a key area for strategic investment in the U of I’s The Next 150 2018-2023 Strategic Plan, is also a keystone of the new National Institutes of Health 10-year Strategic Plan for Nutrition.

“Personalized nutrition offers a way to optimize human health and the quality of life by tailoring recommendations based not only on diet history and phenotype, but also on an individual’s genetics, microbiome, and metabolome,” Donovan explains. “As it encompasses almost all known aspects of science, ranging from the genomes of humans, plants and microorganisms, to the highest levels of analytical sciences, computing and statistics of large systems, as well as human behavior.”

To meet this challenge, Donovan envisions the PNI building transdisciplinary collaborative efforts across campus to answer fundamental questions regarding how nutrition modulates health and disease across the lifespan.

Donovan’s research, administration, internal and external interdisciplinary collaborations, and industry relations experiences will bring significant value to the PNI in achieving its goal of coordinating transdisciplinary research, education, outreach, and entrepreneurship in the area of personalized nutrition at the U of I. She holds appointments in the Department of Nutritional Sciences in the College of ACES, as well as the Carle-Illinois College of Medicine, and the Microbiome Metabolic Engineering theme in the Carl R. Woese Institute for Genomic Biology.

An internationally recognized leader in nutrition who has extensive leadership experience both on- and off-campus, Donovan served as director of the Division of Nutritional Sciences from 1999-2009 and the Illinois Transdisciplinary Obesity Prevention Program from 2011-2016, both at Illinois. She also served as president of the American Society of Nutrition.

With a research focus on pediatric nutrition and the nutritional regulation of host-microbe interactions, Donovan has over 200 publications and has garnered more than $30M in external funding from federal funding agencies, foundations, and the food and pharmaceutical industry. She has been recognized by campus with the Paul A. Funk Recognition Award and the Spitze Land-Grant Professorial Career Excellence Awards from the College of ACES and as a University Scholar for her distinction in scholarship and service. She was elected to the National Academy of Medicine in 2017.

Written by Stephanie Henry.
Photo by L. Brian Stauffer.

“Personalized nutrition offers a way to optimize human health and the quality of life by tailoring recommendations based not only on diet history and phenotype, but also on an individual’s genetics, microbiome, and metabolome.”
The NSF is establishing five new AI institutes to accelerate research, expand America’s workforce, and transform society in the decades to come. Enabled by sustained federal investment and channeled toward issues of national importance, continued advancement in AI research holds the potential for further economic impact and improvements in quality of life.

With an investment of over $100 million over the next five years, NSF’s AI Institutes represent the nation’s most significant federal investment in AI research and workforce development to date. The $20 million investment in each of five NSF AI institutes is just the beginning, with more institute announcements anticipated in the coming years.

“Over the past decade there have been major advances in both AI and automated chemical and biochemical synthesis, making the timing for the launch of the MMLI both judicious and urgent,” said NSF Director Sethuraman Pan

The MMLI focuses on development of new AI-enabled tools, such as AlphaSynthesis, to accelerate automated chemical synthesis and advance the discovery and manufacture of novel materials and bioactive compounds. Researchers use the data generated from the analysis of these molecules to guide further development of synthesis planning and catalyst design tools using AI and machine learning. The institute also serves as a training ground for the next generation of scientists with combined expertise in AI, chemistry, and bioengineering.

“The MMLI is a first-of-its-kind research infrastructure that will have a powerful impact on the U.S. research community,” said Zhao. “This proposed infrastructure will respond to high-priority needs of communities seeking to 1) discover and optimize a wide range of molecular functions (Molecules), 2) harness the power of data to advance the science of molecular synthesis (Data), and 3) inspire a broad audience of scientists, teachers, students, and citizen scientists to participate in the process of molecular innovation (Open Door). The MMLI will revolutionize the way chemistry is taught and capture the imagination of a new generation of molecule makers.”

Advanced AI and machine learning (ML) methods enable the MMLI to achieve AI-enabled synthesis planning, catalyst development, molecule manufacturing, and molecule discovery.

To learn more about the MMLI, visit moleculemaker.org.

Written by Alisa King. Photo by L. Brian Stauffer.
Brian Cunningham
Personalizing cancer diagnostics

When assessing whether or not a tumor is benign or cancerous, a needle biopsy is the usual method of diagnosis. The tissue can then be analyzed to determine what mutations are present that are specific to the patient. Because this method is invasive, it's generally only used once. During and after chemotherapy, imaging tests are used to monitor the size of the tumor; however, imaging only shows the physical characteristics of the tumor—it fails to monitor what is actually happening to the cells.

Research being conducted through the Holonyak Micro & Nanotechnology Lab is working to develop a device that can detect cancer biomarkers with just a few drops of blood. The method would provide rapid results, enabling the clinician to quantitatively observe the effects of treatment on the tumor by measuring increases or decreases in strategically selected molecules. The team recently received a $2 million grant from the National Institutes of Health (NIH) to fund this work.

“The future of cancer diagnosis is moving towards the idea of "liquid biopsy" in which cancer-specific molecules can be found and measured from easily obtained bodily fluids,” says Brian Cunningham (CGD Director/MMG), the Intel Alumni Endowed Chair with appointments in electrical and computer engineering and bioengineering.

“Since each person is genetically unique, each cancer can also be unique, and medicine is driving towards something becoming known as ‘personalized medicine’ in which a highly effective treatment can be selected based on measured characteristics from the patient.”

The team will develop a new approach for detecting a novel class of cancer biomarkers from just a few droplets of blood, such as those collected with a finger prick. Cunningham’s team will use molecules called “micro RNA” that have specific nucleic acid sequences present in a cancerous mutation.

The blood then will be filtered through a device that separates small objects called exosomes, which are carriers of micro RNA, from the cells. (Some researchers hypothesize that exosomes can carry mutated nucleic acids with them that can “seed” cancer in remote parts of the body and start the process of cancer metastasis, the process by which cancer spreads throughout the body). These exosomes will be broken open and examined with a highly sensitive biosensor that can count each cancer-specific molecule.

Cunningham’s team invented a new type of biosensor microscope and a new detection approach so this test can be performed very simply and easily. While this microscope has many applications, the challenging demands of detecting miRNA from blood was a motivating factor in its invention. This technology makes repetition of this test simple so it can be performed as often as necessary to evaluate how exosomes change during and after cancer treatment.

“We think that our approach could be used to enable the physician to pivot from a non-working treatment to a better one based on measured changes in the micro-RNA molecules,” says Cunningham, who is also affiliated with the Cancer Center at Illinois (CCIL). “They can measure how the tumor is responding on a much more detailed and frequent basis than measuring the tumor size by imaging.”

The Illinois research team also includes Manish Kohli at the Huntsman Cancer Institute and Utkan Demirci at Stanford University, as well as chemistry professor Yi Lu (BSD/CABB/C GD) and professor of epidemiology Rebecca Smith (I G OH).

The potential impact of this research is substantial, according to Rohit Bhargava, CCIL director.

“This NIH grant is bringing together visionary engineers with expertise in devices, chemists and clinicians to transform the way we bring diagnostic capabilities to the patient. Professor Cunningham and his team illustrate the tremendous potential for technology to make accurate diagnoses early and more precisely,” said Rohit Bhargava, professor of bioengineering.

Cunningham’s passion for this research comes from personal experience.

“My parents both passed away from cancer at too young of an age,” says Cunningham. “Since that time, I have been working towards using engineering tools to develop better drugs and diagnostic methods for cancer. My hope is that someday cancer will become a disease that is effectively managed, but to do so will require detailed knowledge about the genetics of each patient’s tumor.”

Written by Lizzie Roehrs.
Photo by L. Brian Stauffer.

Cancer Center at Illinois

The Cancer Center at Illinois unites world-class faculty who uncover fundamental knowledge, innovate new technologies, and enable cancer-free lives. With interdisciplinary expertise in science and engineering, exceptional facilities, and novel educational experiences, they are changing the way to take on cancer.
AWARDS

RASHID BASHIR, CARLA CÁCERES
Rashid Bashir (CGD/M-CELS), Dean of the Grainger College of Engineering, Grainger Distinguished Chair in Engineering and Professor of Bioengineering, and Carla Cáceres (IGOH), Director of the School of Integrative Biology and Professor of Evolution, Ecology, and Behavior, were named 2020-21 President’s Executive Leadership Program (PELP) Fellows by the University of Illinois.

HELEN NGUYEN
Thanh (Helen) Nguyen (IGOH) has been named an Ivan Racheff Endowed Professor in Civil and Environmental Engineering, in recognition of her outstanding contributions and leadership in her field of expertise.

WILFRED VAN DER DONK
Wilfred Van der Donk, Richard E. Heckert Endowed Chair in Chemistry (MMG), received the Royal Society of Chemistry’s Pedler Award, which recognizes originality, impact of research, and contribution to the chemical sciences industry or education.

CARLA CÁCERES
Carla Cáceres, Professor of Evolution, Ecology and Behavior and Director of the School of Integrative Biology (IGOH), received the Executive Officer Distinguished Leadership Award from the Office of the Provost, which recognizes outstanding academic leadership and vision by an executive officer within a college or campus unit.

SHARON DONOVAN, JEFFREY MOORE, DONALD ORT
Sharon M. Donovan (MME), Professor of Food Science & Human Nutrition, Jeffrey Moore (BSD), Professor of Chemistry and Materials Science & Engineering, and Donald Ort (GEGC Leader/BSD/CABBI), Professor of Plant Biology & Crop Sciences, were appointed Center for Advanced Study (CAS) Professors. (July 2020)

MADHU KHANNA
Madhu Khanna, ACES Distinguished Professor (CABBI), was named president-elect of the Agricultural and Applied Economics Association (AAEA), a not-for-profit association serving the professional interests of members working in the fields of agricultural and applied economics.

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Vijay Singh (CABBI/GEGC), Distinguished Professor in Agricultural and Biological Engineering, received the International Food Engineering Award from the American Society of Agricultural and Biological Engineers (ASABE).

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COMMITTEE ON DIVERSITY TASK FORCE
What can I do to make genomics more inclusive? With the guidance and support of the IGB Committee on Diversity (COD), we are establishing a COD task force that will amplify diversity, equity, and inclusivity efforts of the COD through programs, partnerships, dialogues, and other actionable events.

We are seeking volunteers who are willing to make a significant commitment toward developing, organizing, and realizing these efforts. At a time when these issues are highly visible, we must advocate to keep ourselves and our community motivated and involved.

Email us at CODTF@igb.illinois.edu to learn more and join the COD task force.

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ON THE GRID
HAPPENINGS AT THE IGB

IGB CHAT

IGB SCIENCE CHAT: PERSONALIZED NUTRITION INITIATIVE AT ILLINOIS
Join Sharon Donovan, Director, Personalized Nutrition Initiative and Professor and Melissa M. Noel Endowed Chair in Diet and Health; Hannah Holscher, Assistant Professor of Nutrition; and Naiman Khan, Assistant Professor of Kinesiology and Community Health for our next IGB Chat "Personalized Nutrition Initiative at Illinois." Bring your questions and join our Zoom call on September 29 at 12:00. To keep up to date on PNI please visit our sign up page!

IGB ANNUAL REPORT

IGB 2019 ANNUAL REPORT
Have you visited our 2019 Annual Report site? You’ll find the latest - sometimes unexpected - ways genomics are impacting your lifestyle, the daily choices you make, and the world we all live in, alongside research articles and stories from the previous year.

Start exploring at www.igb.illinois.edu/ar2019.

IGEM

ILLINOIS TEAM TRACKS COVID ‘SPIKE’ PROTEIN FOR 2020 IGEM COMPETITION
The COVID-19 pandemic created unprecedented challenges for a worldwide competition that brings high school and college students together to tackle big questions in synthetic biology.

But it also provided a unique research opportunity for the University of Illinois team competing in this year’s International Genetically Engineered Machine (iGEM) contest.

The six undergraduates are pooling their talents — remotely — to contribute to the fight against SARS-CoV-2, the coronavirus that causes COVID-19. They’re creating a web tool to build visual models of a key part of the virus as it mutates — specifically the infamous “spike” protein that allows it to attack human cells so easily. The hope is to give researchers crucial information about the virus as they design new drugs and vaccines.

“Our database will be real time, and it will allow researchers to upload their newly collected coronavirus sequences and get those newly mutated protein models for their research,” said Yan Luo, a sophomore in bioengineering on the Illinois team.

Mentored by graduate students and postdocs, iGEM teams meet in the spring to brain-storm ideas for innovative synthetic biology research and develop them over the summer. The projects culminate at the annual Giant Jamboree, iGEM’s international competition, to be held virtually this year in November. The event attracts teams from nearly every continent who can earn bronze, silver, or gold medals by achieving certain standards. Overall winners are chosen from the gold-medal teams.

Read the full story here.

COV-COURSE

COV-COURSE: A MULTI-DISCIPLINARY APPROACH TO UNDERSTANDING THE PANDEMIC
COVID has turned your life upside down, but how much do you really know about this unprecedented public health crisis?

Broaden and deepen your understanding of the pandemic in a free, multidisciplinary course taught by experts at the U of I. No matter what your area of interest is — education or history, economics or theatre — the pandemic is impacting your field and every facet of life on this planet. This is your opportunity to grasp the big picture.

The COVID-19 pandemic has created an unprecedented public health crisis. In this course, created by provost Andreas Cangellaris and other campus leaders, you will gain a comprehensive, multidisciplinary understanding of the pandemic. The course will guide you through past, present and future perspectives on the pandemic, with weekly topics that range from history, biology and business to data security, racial disparities, mental health and more.

This non-credit course is free of cost and open to all. Classes will be held online from 8:00–9:00 p.m. every Sunday evening during the fall semester. See the course schedule for details about the instructors and topics covered.

View the course schedule or register for the course by visiting https://covcourse.web.illinois.edu/
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.


Yadzi, S. M. H. T., Gabrys, R., & Milenkovic, O. (2020). Author Correction: Portable and Error-Free DNA-Based Data Storage (*Scientific Reports*, (2017), 7, 1, [5011], 10.1038/s41598-017-05188-1). *Scientific reports*, 10(1), [7026]. https://doi.org/10.1038/s41598-020-60080-9


