BIOrhythms

Washington University Biology Department Newsletter
February 2018

"Everything we do, every thought we've ever had, is produced by the human brain. But exactly how it operates remains one of the biggest unsolved mysteries, and it seems the more we probe its secrets, the more surprises we find."

-Neil deGrasse Tyson

Helpful Links

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BIOrhythms is a publication of the Washington University Biology Department for Undergraduate Majors

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Featured in this issue:

Faculty Spotlight: Keith Hengen

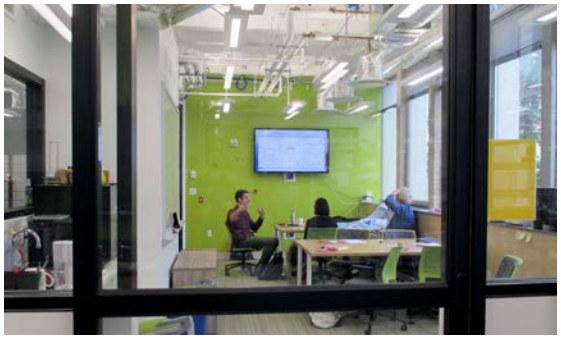
Walking through the newly renovated 2nd floor of Monsanto Hall on the Danforth campus, you might think you stumbled upon an IT department or media lab. The open floor plan and glass room dividers allow natural light to flood the lab space, accentuated by cheerfully painted walls. Work stations are on wheels for modular use and there are no sinks, hoods or anything else you normally expect to see in a biology lab. A waiting area with comfortable chairs and coffee table books against a colorful mural backdrop greets visitors. This is the vision of neuroscientist Dr. Keith Hengen, who joined the Biology Department in fall 2017. He designed the lab after careful study of modern companies such as Google and Microsoft, whose success can be at least partly attributed to the satisfaction and contentment of their employees due to a flexible and creative work environment. Scientific research can mean long hours and tedious work. Keith believes that lab staff and students thrive in a space that allows them to collaborate and be creative, comfortable, and essentially more productive.

The Hengen Lab studies homeostatic plasticity using in vivo long term recordings in freely behaving animals and in vitro patch clamp recordings. The lab addresses questions such as: What does it mean to have emergent stability (patterns of activity where cognition is contained/encoded)? How do individual neurons give rise to stable brain function and how do those neurons as a collective give rise to cognition and behavior? In describing the research, Keith uses this example: a number of individual neurons *—cont'd on p. 2*

Course Spotlight: Bio 3411: Principles of the Nervous System

This course will provide a broad introduction to neuroscience, starting at the level of cellular and molecular neuroscience, and ultimately ending at systems and theoretical neuroscience, with emphasis on the organization of the mammalian central nervous system. Topics will include neuronal structure, the action potential, information transmission between neurons, sensory/motor systems, emotion, memory, disease, drugs, behavior, and network dynamics. A fundamental goal of this course is to provide students with the ability to approach complex problems using the scientific method and to understand the limits of knowledge.

This course will also expose students to some of the neuroscience community at WashU. Prerequisite: Bio 2960, Bio 2970 recommended, Bio 3058 recommended or Psych 3401 and permission of instructor.



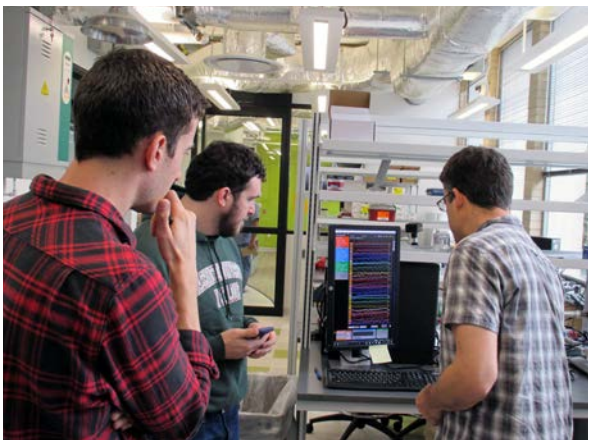
The Hengen Lab's bright open space with glass dividers and modifiable work stations encourages a creative and collaborative environment.

Hengen Lab cont'd—are involved in the brain's ability to recognize an object, such as a pen. Once we learn that the object is a pen, we will never not know it's a pen (unless our brains are compromised somehow). The ability to take in new information (essentially learn) means that processes happening in the brain are not static. How do we reconcile the stability of that constant recognition of the pen with the fact that the brain is actually an unstable environment?

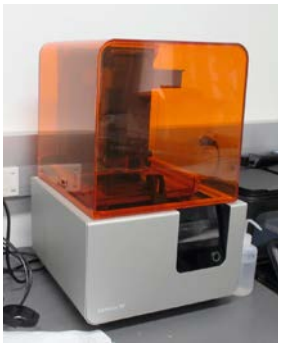
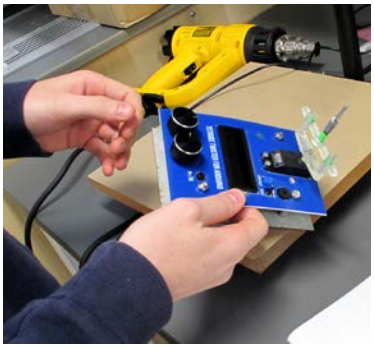
The Hengen Lab has a unique ability to track individual neurons in freely behaving animals continuously, sometimes for months. The research staff can perturb the genetic mechanisms underlying stability, targets that may represent the underpinnings of disease. Understanding aspects of behavior that are stable and reliable is the backbone of brain research. The brain is a powerful, self-organizing and self-stabilizing machine and scientists are barely scratching the surface of how this is sustained.

Systems neuroscience has traditionally been a labor-intensive process, but the Hengen Lab has been designed to circumvent the traditional hurdles in this line of work. They rely heavily on robotics, computers, and advanced tools. The University provided an ultra-fast data connection to high performance clusters across the campus. The Hengen Lab has the capacity to collect and move data 40 times faster than in traditional lab setups. The fundamental goal of the lab design was to turn the research into a much more productive line of work. As a result, the Hengen Lab can study freely behaving animals in a way that yields powerful insight into the relationship between brains and behavior.

Keith has an atypical background in that he did not always want to be a neuroscientist. In fact, he planned to race mountain bikes as a career. He grew up in New Hampshire, and began racing mountain bikes as early as elementary school and semi-professionally later on. Though he grew up with highly educated parents that encouraged him, he actively resisted any push towards becoming a doctor or professional scientist . While at Bates College in Maine, he sustained bike-related head injuries that forced him *—cont'd on page 3*



PI Keith Hengen, grad student Sam Funderburk, and collaborator Tim Blanche (White Matter, Seattle,WA) examine live streaming data. The lab has the capacity to capture 40 times more data than a traditional lab setup.

The Lab has a "Maker Space," where some equipment can be built from scratch on site. Tools include a 3D printer, laser cutter, electronics workbenches, drill press, grinders and many tools.

Hengen Lab cont'd—to consider other careers. Unable to race, Keith took a job at the campus grill and quickly realized he wanted something more challenging. This desire led Keith to go out on a limb and ask Todd Kahan, an energetic and enthusiastic young professor, if he could work in his cognitive psychology lab. Enthralled by research, Keith also joined the lab of neuroscientist Roxanne Prichard. Keith's work in the labs of Kahan and Prichard Lab led directly to his career in neuroscience. He eventually completed his PhD in Dr. Mary Behan's laboratory at the University of Wisconsin-Madison. From there, Keith feels lucky to have landed a high profile postdoctoral fellowship with Dr. Gina Turrigiano at Brandeis University, just outside of Boston, Massachusetts.

Keith always possessed a non-traditional attitude toward education and has a creative unbounded view of how scientific research should be done. Witnessing the competitive, ambitious academic scene in Boston inspired him, but he realized that it was often a zero-sum game, stating that the feeling of being in direct competition with everyone around you can undermine a sense of open exploration and genuine curiosity that he feels is important to good scientific research. His desire for a more collaborative welcoming environment led him to his first appointment as Assistant Professor at Wash U.

Wash U is in the top 20 institutions for neuroscience research and has amazing resources, but also fosters a sense of openness and community between grad students and faculty who share a collaborative attitude, leading to the synthesis of new ideas. This welcoming and non-territorial work ethic is partly departmental, but also reaches across departments as a university-wide sentiment and mode of operating. Physics, biomedical engineering, neurology, anesthesiology, and genetics are all departments that share resources and ideas.

Keith will begin teaching the undergraduate course Bio 3411: Principles of the Nervous System in fall 2018. This course explores the basic anatomical, physiological, and chemical organization of the nervous system; how nerve cells communicate with each other, the ionic basis of nerve signals, the function and properties of chemical agents in the nervous system, the development of neural circuitry, and how neurons interact to produce behavior. He is currently a Bio 500 mentor with two undergrads working in the Hengen Lab and anticipates taking on more independent research students once the lab is fully up and running. Students interested in opportunities with the lab are encouraged to contact him here: *https://hengenlab.org/contact*.

Keith is also a serious rock climber, which keeps him busy during his free time. To learn more about Keith and the Hengen Lab, check out the website: *https://hengenlab.org*.

Career Center Events in Spring 2018

Feb 15: Army Healthcare St. Louis, Information Session, for pre-med students, DUC, Room 233, 6pm

Feb 19: Rush Medical College, Information Session, DUC, Room 234, 5pm

Feb 21: Etiquette Dinner, DUC, Room 128 (Orchid Room), 5:30pm, RSVP by Feb 16!

Mar 1: Missouri University of Science & Technology, Information Session for Graduate Programs in STEM, Urbrauer Hall, Room 116, 4pm

You can always stop by the Career Center's Quick Question hours in the main office Monday-Friday, 10am-5pm for assistance with CAREERlink, writing your resume and cover letters, or for quick guidance or to set up an appointment. *careercenter.wustl.edu*

Locations:
Danforth University Center, Suite 110; satellite offices in Lopata Hall and Steinberg Hall

Main Office Hours in the Danforth University Center:
Monday-Friday: 8:30-5:00
Contact Us:
Phone: 314.935.5930
Fax: 314.935.5905
E-mail: *careers@wustl.edu*
Website: *careercenter.wustl.edu*

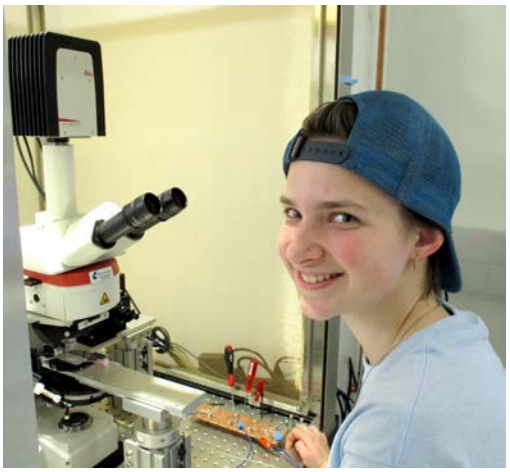
Applications for Summer Opportunities

Are you interested in finding a summer opportunity? The Washington University Biology Summer Undergraduate Research Fellowship Program (BioSURF) introduces WashU undergraduate students to research in the life-sciences under the guidance of WashU faculty mentors. BioSURF is modeled on the grant-seeking process, and students gain a sophisticated and practical knowledge of the research enterprise as they enter the research environment and network within the community of scientists. Students experience the process of research as a creative intellectual activity and gain a more realistic view of the opportunities and demands of a professional research career. Application deadline is Feb 15. Get more info here: *https://undergradresearch.wustl.edu/wu_biosurf*

The Biology Department website also has a whole section dedicated to posting summer opportunities outside of the university for undergrads: *http://undergradresearch.wustl.edu/research-funding/summer-research-programs-wu*

Deadlines for all of these programs typically fall around early February so check it out now!

Bio 500 Research Spotlight: Molly Shallow, Hengen Lab



The brain is a complex and fascinating system of networks that lies behind everything from our most simple reflexes to a concert pianist's ability to play a full concerto from memory. Despite the brain's fundamental importance in our everyday lives, there are still so many questions that we don't understand. Many of these questions are rooted in concepts involving the homeostatic regulation in the brain, which has been theorized to exist for decades, but has proved much more difficult to understand in living animals. Through new techniques and cutting-edge technologies, our lab is uniquely poised to delve into many of the ideas that have yet to be fully understood.

Throughout my time in the Hengen Lab, my role has evolved from that of a summer lab manager as the lab was first getting started at the university, to a full-time science role in the new semester. Over the course of the past eight months, I have learned and assisted on parts in almost every different aspect of the lab. This involves everything from building electrode arrays for in vivo recordings, and 3D printing custom parts for our experiments to helping with the process of establishing a protocol for the lab and setting up a patch clamp rig.

As the lab's main questions aim to look at the homeostatic plasticity in the brain and the mechanisms behind this, we look to examine these ideas on many different levels. In vivo models of freely behaving animals and their neural activity are used to probe the network level changes that these mechanisms can cause, as well as their impacts on a single neuron's firing rates. While in vivo studies are running, my research focuses more heavily on the in vitro patch clamp recordings from individual neurons.

Still in its beginning stages, the goal of establishing patch clamping experiments is to be able to look at the cellular level changes that occur in response to perturbations to the mechanisms thought to play a role in synaptic homeostasis. This allows us to examine variations in synaptic strength and drive in addition to the variations in firing rate that are elucidated in the in vivo recordings. These mechanisms, when broken down, are thought to be implicated in many different disease models that are yet to be fully understood. Through this multilayered approach to data, we are able to dive into the mechanisms and truly try to learn how they play a role not only at the cellular level, but also at the network and behavioral level.

Do You Have…
An announcement you'd like to make?
An interesting story or fun fact you'd like to share?
A professor or course you'd like to suggest for a spotlight?
We want your input! Send ideas and information to:
gerrity@wustl.edu

Disease Detectives: Public Health at Washington University

Disease detectives: Outbreaks of deadly and contagious diseases are happening more frequently and with greater death tolls. Do you know who is on the front-lines of protecting communities from these diseases? The answer may surprise you. It is not just the clinicians you see on TV! Public health professionals like epidemiologists, biostatisticians, and environmental scientists play a key role of identifying the root causes of disease parthenogenesis and ways to protect the public during outbreaks. To be clear, public health professionals protect us against a lot more than infectious diseases. In fact, Master of Public Health (MPH) students at Washington University are going all over the world to help solve some of the most pressing problems of our time. Whether it is studying the relationship between sustainability and human health in Costa Rica, fisheries management and nutrition in Haiti, the relationship between lead exposure and violent crime here in St. Louis, or cancer outbreaks around the world, our MPH students are having an impact on the well-being of communities around the globe.

The MPH degree is a rigorous program that prepares scientists for careers in public health. Students with undergraduate education in biology, chemistry, environmental studies, and other scientific fields are well-prepared for the MPH degree and able to apply what they have learned in their undergraduate studies in ways that have immediate impact on the well-being of people and communities. Many of our undergraduate biology majors might consider careers in public health and even consider an MPH degree. The public health program in the Brown School recently launched a 3-2 program that allows students to complete an undergraduate degree in biology and a MPH degree in 5 years. If you are interested in learning more about careers in public health or the new 3-2 program, call or email Dr. Lora Iannotti, Associate Dean for Public Health (314) 935-4396, *liannotti@wustl.edu* or Josh Walehwa, Associate Director of Admissions and Recruitment (314) 935-6694, *jwalehwa@wustl.edu*.

Student Groups: JCUBES, Wash U Women in STEM

JCUBES: Journal Club for Undergraduates in Biological Engineering and Sciences is WashU's undergraduate science journal club, established with the goal of enabling students to bring the world of science and technology to their peers in an environment that fosters critical thinking and discussion. At each meeting, a student presents either their own research or current science of personal interest to the group, followed by an open Q&A session. Meetings with complimentary food will be held 2/16, 3/2, 3/30, and 4/13 at 5 pm in Life Sciences 311. For more information, visit *https://wustljcubes.wordpress.com/* or email *wustljcubes@gmail.com*.

Wash U Women in STEM featuring EmpowHERment Week events:

Monday, Feb 5-Donuts at the DUC, 11am-2pm
Tuesday, Feb 6-Workshop with Professor Daschbach, 4pm, DUC 232
Wednesday, Feb 7-Social with other STEM Clubs, 7:30pm, DUC 276
Thursday, Feb 8-Grad Student Panel, 8pm, DUC 232
Friday, Feb 9-Whiteboard Campaign

For more information: email:
wuwomeninstem@gmail.com
FB Group: *WU Women in STEM*

Synapse Neuroweek Events

Mind Melt (Feb 5th 6-7pm, Tisch Commons)-
Is getting back into the swing of classes stressing you out? Come to Tisch Commons on February 5th from 6-7pm for a relaxing environment and free cookies! Co-hosted by Stressbusters.

Surgery Screening (Feb 6th 6-7pm, DUC 234)-
Join us as a WashU physician presents and explains a surgery screening! You'll also have the opportunity to learn more about the daily life of a WashU doctor.

Case Studies Presentation (Feb 7th 6-7pm, DUC 276)-
Synapse and Beat Therapy are partnering to host a Washu professor present on cognition. There will be free food!

NeurOlympics (Feb 8th 6-8pm, Room TBD)-
Answer neuroscience and psychology trivia with your friends and compete against other teams to win prizes. Fill out this **google doc** to register by February 1st. Food will be provided!

Biology Department Calendar

Links to General Calendars and Regular Events:

Washington University Record Calendar: *http://news.wustl.edu/Pages/Calendar.aspx*

Bioforum, Fridays, 4:00pm, McDonnell 362, check the website for topics/schedule: *http://wubio.wustl.edu/events*

Biology Department Seminars, Mondays, 4:00pm, Rebstock 322, check the website for topics/schedule: *http://wubio.wustl.edu/events*

Evolution, Ecology, & Population Biology Seminars, Thursdays, 4:00pm, Rebstock 322, check the website for topics/schedule: *http://wubio.wustl.edu/events?field_event_tags_tid=18*

History & Philosophy of Science Seminar Series: *http://pages.wustl.edu/hpbm/events*

PMB Lunch: most Wednesdays 12:00-1:00 in Life Sciences 311: *http://wubio.wustl.edu/events/pmb-supergroup-seminar-series*

Donald Danforth Plant Science Center (DDPSC), Weekly Seminar Series—check the website for event details and topics: *http://www.danforthcenter.org/events/scientific-seminars*

Division of Biology and Biomedical Sciences (DBBS), all lectures and seminars: *http://dbbs.wustl.edu/Pages/Events.aspx*

February 2018

5th Synapse Neuroweek (Feb 5-8), check this article for details
Wash U Women in STEM EmpowHERment Week (Feb 5-9), check this article for details

13th Major/Minor Welcome Session 4:00, Wilson 214

16th JCUBES meeting, 5:00, Life Sciences 311

March 2018

2nd JCUBES meeting, 5:00, Life Sciences 311

11th Spring Break

28th Summer Registration Begins: *https://summerschool.wustl.edu/registration*

30th JCUBES meeting, 5:00, Life Sciences 311

April 2018

2nd Advising Period Begins

16th Fall 2018 Registration Begins