Integrative Physiology
University of Colorado Boulder

Department Newsletter

IPHY

Issue #16 December 2016

Special points of interest:

- IPHY faculty conduct cutting-edge research on the relationships among sleep disruption, stress, and gut microbiota
- Cell Physiology (IPHY 3060) uses a worm model to study brain damage
- Anatomy instructor describes the process of preparing cadavers for teaching
- IPHY Club partners with Kaplan and SEMS to provide student services

Inside this issue:

A Few Words from the Chair by Pei-San Tsai

We are happy to report that IPHY had a busy fall semester to kick-start the 2016-2017 academic year! Below are some activities that might be of interest to our readers.

First, in collaboration with the IPHY Club, we have hosted a Freshmen Welcome Social for the very first time to provide a social platform for IPHY and open option freshmen interested in biological sciences to get acquainted with the IPHY major. This social took place on Sept. 15, 2016 on the Sewall Lawn and was attended by IPHY undergraduates, faculty, staff, and alumni. Very encouraging to us is that IPHY is now officially the most popular freshman major at CU-Boulder (http://www.dailycamera.com/cu-news/ci_30409584/cu-boulder-celebrates-record-setting-freshman-retention-rate). We acknowledge that the success of a major begins with its freshman class and will to do our best to ensure its retention. This event is described in greater detail in a subsequent article.

Second, it is with our well wishes that we bid farewell to our long-time friends and colleagues, Professors Anne Bekoff and Rodger Kram, as they officially retired from CU-Boulder. Professors Bekoff and Kram have served the university for 42 and 16 years, respectively. We are grateful for their devotion to our students, the department, and the university. The department and those who have been mentored by them will miss them dearly. We find consolation in the fact that both will stay with us a little longer to finish their involvement in IPHY internship programs, committees, and research projects. We wish nothing but the best for both!!

Lastly, IPHY's increasing research needs have necessitated our expansion into another building outside the main campus. The new building, located about 3 miles northeast of the main campus, is called Wilderness Place (http://www.dailycamera.com/cu-news/ci_25670642/cu-boulder-buy-wilderness-place-property-animal-research). This is a state-of-the-art research facility that IPHY will share with the Department of Psychology and Neuroscience. Drs. Moni Fleshner and Christopher Lowry have relocated their laboratories to this building to expand their cutting-edge programs. We look forward to many years of productive research in this high-tech facility.

As usual, we could not have done it without our alumni and supporters. Their comments, suggestions, and financial support have contributed to the success of our department. On behalf of IPHY, I wish all IPHY alumni and supporters a wonderful 2017!!

December 2016 Retirees:

Dr. Anne Bekoff (left)
Dr. Rodger Kram (right)

IPHY Freshman Welcome Social by Pei-San Tsai

On September 15, 2016, in collaboration with the IPHY Club, we hosted a Freshmen Welcome Social for the very first time. The impetus for hosting this event came from the observation that most IPHY students began as open option majors during their freshman year. Although open option allows undecided students to explore different interests, it can lead to a lack of a sense of community since these students do not have a home department and would not be able to interact with members of a specific unit. The goal of this event was to introduce students to the IPHY major, coursework, faculty, staff, and the IPHY Club, thereby promoting a sense of community. In addition to the informational booths, we provided lawn games, snacks, ice cream, and soft drinks. We also dispensed raffle tickets for students to win door prizes that included IPHY T-shirts, an anatomy model, travel mugs, and an iPad (see photo to the right of freshman Michaela-Jana Nasr winning an iPad)!!! Participating students were super excited to win these door prizes and at the same time obtain useful information.

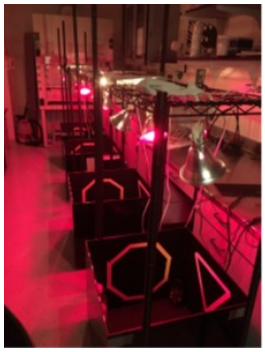
Some frequently asked questions that surfaced during the event were (1) the major differences between IPHY and other biological sciences majors, (2) the layout of our four-year plan, (3) how to approach faculty to conduct independent research, (4) the possibility of an internship, and (5) the type of services provided by the IPHY Club. We were happy that this event was able to serve 40-50 attending students and hope that we will serve a larger crowd next year.

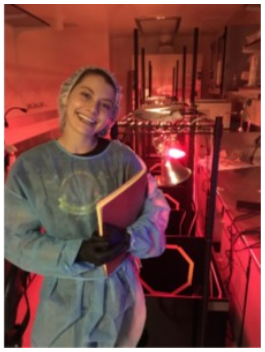
Do Change in the Gut Microbiome during Sleep and Circadian Disruption Alter Host Physiology and Behavior
by Ken Wright, Moni Fleshner, and Christopher Lowry

Scientific evidence shows that the trillions of bacteria that live in our gut (aka the gut microbiota) influence human physiology and behavior with important implications for health, cognitive function, and responses to stress. Good bacteria help us digest our food, release chemicals that help our body function, and act as antigens to regulate the immune system, whereas bad bacteria and the chemicals they release have been shown to be associated with obesity, diabetes, and stress-related psychological disorders such as depression, anxiety, and posttraumatic stress disorder.

IPHY Professor Ken Wright is leading a team of internationally recognized investigators that includes IPHY Professors Monika Fleshner and Christopher Lowry, Northwestern University Professors Fred Turek and Martha Vitaterna, and University of California San Diego Professors Pieter Dorrestein and Rob Knight. The team will be studying mice, rats and humans and will determine if stressors such as sleep loss, being awake at night, diurnal rhythm disruption, and social stress disrupt gut microbial ecology and metabolic function; and if microbiome-based immunomodulatory and/or dietary interventions can protect and support health-promoting good gut bacteria. In addition the team will determine if interventions that promote optimal gut microbial composition also prevent the negative physiological and cognitive consequences of such stressors.

The research is supported by the Office of Naval Research as sleep and circadian disruption are common in military operations. Findings are also expected to have implications for development of countermeasures for other conditions where sleep and circadian disruption are common, including long work hours, shift work, jet lag as well as sleep, circadian, medical, and psychiatric disorders.





Students in Cell Physiology Develop New Model for Traumatic Brain Injury

by Chris Link

Figure 1. ***Video-equipped fluorescence microscope.*** *Cell physiology student observing transgenic fluorescent worms as they move on a petri plate. Note strong blue light used to induce fluorescence.*

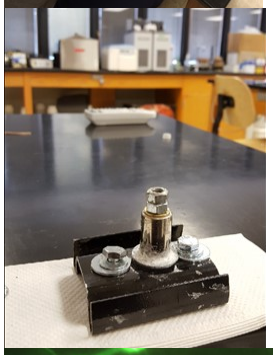


Figure 2. ***The Hijmans Abuse Chamber (version 1).*** *Worms are placed in a small chamber under the brass washer. Impacts to the nuts on top transmit pressure wave to worms in suspension in the chamber.*

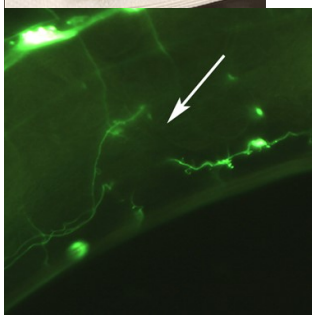


Figure 3. ***Neuronal damage induced in worm TBI model.*** *Fluorescence image of transgenic fluorescent worm body after exposure to impacts in the abuse chamber. Arrow points to broken and displaced neuronal process. Picture courtesy of student team "The Wormaholics" .*

Over the last few years, students in the laboratory sections of Cell Physiology (IPHY 3060) have used *C. elegans* as a model organism for many of their experiments. This simple nematode worm is transparent and can be readily engineered to express Green Fluorescent Protein, so students can readily visualize specific tissues, cells, or proteins using the fluorescence microscopes we have in the student labs. This semester we have tried a new set of experiments to see if we could model aspects of traumatic brain injury (TBI). Specifically, our students have attempted to develop treatments that replicate in transgenic worms the neuronal damage that is believed to underlie TBI. These experiments have involved both "high tech" and "low tech" equipment. This semester we acquired a powerful fluorescence dissecting microscope that allows us to video record fluorescent worms as they move (see Figure 1). Thanks to our lead Teaching Assistant, Jamie Hijmans, we have also constructed an impact chamber that enables us to expose worms to controlled pressure waves that mimic the blast or impact exposures that can cause traumatic brain injury. Jamie repurposed an old socket wrench and car parts to devise a sturdy chamber that holds a small volume of worm suspension (officially designated the "HAC", or Hijmans Abuse Chamber, see Figure 2).

We discovered that impacting a suspension of worms in the HAC (using a hammer or metal weight drop) results in a fraction of worms seemingly "concussed": they transiently stop or slow their usual movement. More importantly, imaging these worms under the fluorescent microscope revealed damage to the axons of neurons, the cellular change seen in TBI (see Figure 3). Lab teams are now using the HAC in their own student-designed experiments. These include experiments to determine how impact exposure affects subsequent behavior, how genetic changes affect the sensitivity to impacts, and how impact exposure affects the subcellular distribution of specific proteins. There is tremendous interest in understanding the cellular basis of TBI, and we anticipate using this "whack-a-worm" model both in subsequent Cell Physiology classes and my own research lab.

Cadaver Dissection in the Human Anatomy Lab

by Leif Saul

Graduate student lead dissector Karlie Johansen and her team of undergraduate dissectors, Spring 2016. From left: Jordan Green, Karlie, Sophie Schneider, Jake Morawiec.

The Human Anatomy Lab is a unique course in the IPHY program and a favorite with many students because we use real preserved human cadavers, supplemented with plastic models. The result is a much more effective and engaging course than in other programs where cats or fetal pigs are used. Over the years, the IPHY department has prioritized the installation and upkeep of a modern cadaver lab facility to make this possible.

Our students benefit from the generosity of individuals who bequeathed their remains to be used for educational purposes. The cadaver donation program is not the same thing as organ donor programs that many people are familiar with. It requires planning and paperwork on the part of the donor. We are fortunate that these individuals had the foresight to participate in this process so that their bodies can serve as a dynamic, central part of a living community of students and instructors.

The cadaver dissection process follows a schedule that is dictated to a large extent by the structure of the human body. The first several weeks are spent removing the skin and subcutaneous fat that conceals the muscles. During this time, students are learning from our collection of real and plastic bones, and do not use the cadavers. Students are first introduced to the cadavers when they start learning muscles. At this unveiling, we emphasize respect for the individual and the unique opportunity these cadavers provide.

During these early weeks of the semester, dissectors are working hard every Friday (when labs are not in session) to prepare the cadavers in time for their use in the course. Fortunately, we have a small army of dissectors. Each of the four cadavers has a team consisting of a lead dissector (**Heidi Bustamante**, **Ruth Heisler**, **Steve Hobbs**, myself, or sometimes a qualified graduate student), two dissecting interns, and a cadaver specialist undergraduate teaching assistant (graduate student TAs often assist as well). Undergraduates have always assisted in this process but a few years ago, these positions were created so that students can have the opportunity for more rigorous training in human anatomy and receive course credit for it. This is a win-win situation, because the lab benefits from both their dissecting work and the enthusiasm they bring to it. We also have undergraduates who serve entirely as teaching assistants; they are welcome to participate in dissection, although it is not required. All of these positions are very popular and highly competitive.

After the muscle unit, we cut into the cadavers to expose internal organs. This is a moment of high drama that none of the student dissectors ever wants to miss. A bone saw is used that is similar to saws that physicians use to take off a cast after a broken limb has healed. It vibrates back and forth so it leaves soft tissue intact, but easily cuts through rigid tissue like bone. After the ribs are cut, the front of the ribcage is lifted off, exposing the heart and lungs. At this time we also expose the organs of the abdomen and pelvis. This begins the third unit which includes the heart, blood vessels, and respiratory and digestive organs.

For the final unit, we begin with the dissection of the brain and spinal cord. These organs are well protected by bone so this takes considerable work using the bone saw, often supplemented by hammer and chisel. Some brains are removed whole, but others have only the left or right half removed in order to show key structures in the midline of the brain. Finally we expose major nerves, the muscles that control eye movement, and the urinary and reproductive organs.

Our cadavers are obtained from the body donor program at Washington University School of Medicine in St. Louis. All tissues from each cadaver are kept separate from the others throughout the semester, and nothing is discarded. At the end of the semester, we return all remains to the body donor program, which has them cremated, and then scatters the cremated remains in a tranquil natural setting.

Each of our cadavers is unique, and it is a great privilege to learn from them. The intricacy of the human body is astounding, even if we limit our study to structures visible to the naked eye. Some parts, like the blood vessels, are highly variable, even between the two sides of the same person. We've had missing muscles, extra muscles, and lungs with extra lobes. We've seen pancreatic, lung, and brain cancers, and other pathologies including inguinal and hiatal hernias, gallstones, kidney stones, polycystic kidney disease, aortic aneurysms, Alzheimer's disease, a collapsed lung, and a lung with emphysema. We've seen artificial joints, surgically fused vertebrae, a reconstructed jaw, stomach bypasses, and penile and breast implants. We've seen stents to support the trachea and

major blood vessels, and a shunt to drain excess fluid from the brain. We've had lots of individuals who, at some time in their life, had their appendix, gallbladder, or uterus removed, and one who had already donated her corneas. Most of all, we've seen many hearts with bypasses, and lots of pacemakers.

For our students, being involved with cadaver dissection is a unique opportunity to gain intimate familiarity with human anatomy at an early stage in their career. It's an important lesson in individual variation, and it's an exciting chance to get an up-close look at medical conditions and surgeries. Many students come to the dissection experience already with some interest in the health professions, and they leave with both an expanded skill set and redoubled enthusiasm to turn that experience into a lifelong passion.

A New Biostatistics Student Club by John Harsh

Executive members of the Biostatistics Club.

Bottom left: Darby Houck (Research Chair), Rose Callahan (Clinical Chair), Yiran Zhang (GRE Chair), Uma Hatangadi (Service Chair), top left: Erik Maki (Treasurer), Madden Brewster (CO-President), and Halei Moody (CO-President).

The Integrative Physiology Biostatistics Club is a new department club started last spring semester by a small group of very capable undergraduate IPHY majors wanting to stimulate interest in and enthusiasm for the role of biostatistics in clinical and research fields. The students crafted a general mission statement which has as its primary focus, the development of greater scientific inquiry and statistical reasoning skills especially among those students interested in scientific or medical careers. The Club is a University-approved student organization.

Club activity for the fall 2016 semester, primarily focused on creating a core of club members (see picture of these core members) with appropriate backgrounds and interest in promoting the following activities:

- Invited talks and discussions with researchers, graduate and medical students, MDs and others interested in sharing their perspectives on the role of biostatistics in clinical and research areas
- Development of a strategy for ensuring student readiness for MCAT, GRE, and other entrance exam questions requiring knowledge of biostatistics and scientific reasoning skills
- Fundraising to support research areas of club interest
- Service activities on the CU campus and at local schools in the form of tutoring and discussion of statistics-related topics
- Expanding club membership to include students in other departments and programs

Starting a journal club for review and discussion of statistical findings in research reports

The Club is very pleased to report major progress getting key initiatives off the ground. In a Club-sponsored lecture, Dr. Matt Kraeutler, a member of the research faculty in the Department of Orthopedics at the University of Colorado School of Medicine, highlighted meta-analysis and evidence based medicine in his research on ACL reconstruction. The talk was exceptional and very well received by the 60 plus undergraduate and graduate students who attended. Fundraising is off to a good start and includes a pledge of $2000 from Kaplan that can be applied to their educational offerings. Service activities have included "statistics" help sessions for students taking IPHY 2800 and "R Studio" help sessions for students using this tool in their classes. A journal club has been started and an exam-prep plan is being solidified.

The Biostatistics Club is eager for faculty suggestions and can be contacted at iphybiostats@colorado.edu.

New Partnerships with Integrative Physiology Student Board

by Heidi Bustamante

It is very exiting for us to announce that the IPHY student club has teamed up with two different organizations to offer services to our students. Our recent collaborations are with the Students for Education, Medicine and Service (SEMS) and with Kaplan Test Prep. Many students in the IPHY department are looking for ways in which they can advance their studies, or open their doors to new possibilities. This can mean anything from internship opportunities at various different clinics, to being more confident and feeling more prepared for upcoming entrance level exams. A vast majority of our IPHY students aspire to work in the health care field under a variety of different professions. As our students prepare for their future careers, it is important for them to gain real world experience by either volunteering or working under the profession in which they wish to excel in. Sometimes, students have difficulty taking the first steps into these endeavors, and the IPHY Club hopes to take out the mystery of these processes by serving as a resource to guide students by providing them with excellent opportunities in house.

Recently, SEMS and the IPHY Club offered free CPR, first aid, and BLS classes for both IPHY club members as well as any other students that were able to sign up. These classes were run specifically by the students of SEMS and featured the appropriate techniques and protocols used in a variety of health care settings. These classes are accredited by the American Heart Association and offer certification, which is valid for two years from when the class was completed and certification issued. The IPHY Club advertised this class, recruited students, signed up members, and requested the space used to run the class. The IPHY Club hopes that this will provide many opportunities for our students where these types of certifications are required. This allows our students to gain the field experience that they need for the programs they wish to attend or careers they wish to build. Additionally, having this certification provides students with a way to build their resumes and become more competitive candidates once they graduate and start applying to various different programs.

One of the largest partnerships that the IPHY Club has created is the partnership with Kaplan Test Prep (KTP). KTP is an organization that offers materials, courses, and other support resources for standardized testing. IPHY students are looking at the road ahead and realizing that for just about any post-baccalaureate program they wish to attend, there is a standardized test in their future. For our students that are medical school bound, it is the MCAT; for students that are graduate school bound seeking a MS or PhD, or those who want to go to nursing school, they are potentially looking at the GRE. Kaplan offers a service that can improve scores, thus making candidates more competitive for their respective programs of interest. Through their partnership with KTP, the IPHY Club is able to offer many benefits to our students. Included among these benefits is a one-course scholarship per academic year (value up to $2,299.00), a 10% discount for IPHY Club members and a 25% discount for IPHY executive board members off the retail course price of any Kaplan In Person, Live Online or Self-Paced course. In addition to these discounts, Kaplan Test Pres also offers access to their event series, such as free practice test, sample classes and nationally hosted info sessions as well as access to their digital study guide for all members.

IPHY Internships Offer Training Opportunities

by Cameron Hardison and Sweta Patel

IPHY offers internship credits to students for participating in a number of clinical activities. Although these internships are not paid positions, they are tremendously helpful in building one's experience towards a specific career path. Two IPHY students share their thoughts on these internships below.

Cameron Hardison

Throughout my academic career, I have received credit from the University of Colorado Boulder for academic internships in the field of dental medicine. I have spent over 200 hours with different dentists to observe their everyday practice, and these observations enabled me to acquire valuable knowledge in dental medicine.

There are several noteworthy experiences associated with my internships. First, I was able to learn about how computer technology goes hand in hand with a treatment plan of a patient. Specifically, programs are available that allow an orthodontist to take x-rays of a patient and render a 3D image for each stage of treatment. This aspect of shadowing was meaningful because it allowed me to see the progression of technology associated with dental medicine. Another technology-associated experience was when I observed the ability to create a crown in the practice without sending a model to a lab. The technology uses a milling machine to create a soft model. The model is then baked and inserted into the patient's mouth. This technology is revolutionary with only 10% of general dentists using it today. The machine allows crowns and several other apparatuses to be made in a single appointment rather than several, which is the usual for crowns. Along with gaining experiences associated with technology, I was also able to work closely with the dental and orthodontics assistants to achieve experience in the lab. I have been able to help with a variety of tasks from molds of teeth to working up crowns. Shadowing through internships gave me the opportunity to both learn and ensure that I wanted to attend dental school. I highly recommend it to anyone looking to move into a medical field.

Sweta Patel

In early 2015, I went to an optometrist for a routine eye exam. When I walked into the pre-testing room, I was immediately taken aback by the new diagnostic technology. I began to get curious, and thought to myself, "Why is the technician using a device to puff air into my eye? Why are they checking my blood pressure? Why was any of this necessary when I just needed a new prescription?" I took this chance to ask the optometrist my questions. I learned the importance of how blood pressure could affect the blood vessels in my retina, how blowing that puff air into my eyes checked if I'm at risk for glaucoma. Near the end of the exam, the optometrist asked me if I would like to intern with her in a similar position as the intern who preceded me.

I then earned IPHY credit for interning as an optometric technician at this optometry clinic, Altitude Optometry inside of Lens Crafters. I quickly learned some of the answers to the questions I had as a patient, only to realize that there was so much more I wanted to learn. The majority of my time consisted of patient pre-testing, taking a thorough patient history and working with various vision and medical insurances to determine co-pays. After my internship ended, I was fully trained to accept a part-time paid position as an optometric technician. These ***eye***-opening experiences allowed me to have first hand patient interaction that will prove to be vital in optometry school.

IPHY Shaped My Career in Research by Brooke Tata

I was not born a scientist, but became one thanks to my undergraduate experience in IPHY. It was through many opportunities offered by IPHY that I found my passion and confidence in research. The most significant experience was being able to conduct independent research during my undergraduate years. I would like to share my journey of becoming a neuroendocrinologist who studies reproductive brain hormones.

When I first joined IPHY as an undergraduate, I was a young woman from the south with very little experience in academia. Being a tennis champion, I did not know what I could achieve intellectually. I knew I was good at sports but never thought I could be involved in advanced scientific endeavors. It was through the independent research opportunity provided by IPHY and individualized mentoring of the Reproductive Endocrinology Laboratory directed by Dr. Tsai that I discovered my aptitude for research.

IPHY promoted undergraduate research training through programs such as the BSI/HHMI, UROP and BURST, all of which helped build my foundation in research. These opportunities allowed me to learn not only how to conduct research, but also how to write grants and communicate scientific findings. The learning process was challenging but rewarding. As an undergraduate, I defended my honor's thesis and presented an abstract on my research at the Society for Neuroscience meeting, where I networked with other scientists to advance my career. My undergraduate experience solidified my determination to pursue a doctoral degree, and the IPHY program undoubtedly provided the critical transition toward this career path. Importantly, I discovered that a major passion of mine when conducting research was not only about the experiments, but also about communication and networking with a diverse scientific audience. Consequently, I decided to pursue my graduate degrees in a multi-cultural environment in France.

I obtained my master's and Ph.D. degrees in 2012 and 2015, respectively, from the Sorbonne-University of Paris. My research projects involved reproductive neuroendocrinology and fertility defects. During that time, I obtained multiple research awards from the Endocrine Society, the Society of Neuroendocrinology (SNE) and the GnRH COST European Network which enabled me to communicate my findings globally. Immediately after my Ph.D., I began my postdoctoral training to study polycystic ovary syndrome in the laboratory of Dr. Paolo Giacobini in the public research institute at INSERM in Lille, France. An important take-home message from my experience is that *anyone* with a true passion for research can create a career in research for him/herself. My overarching goal in life is to provide opportunities and help others find their passion in science as IPHY has done for me. As for the future, I hope to obtain a tenure-track faculty position so I can fulfill my dream of educating others and conducting research at the bench.

Footnote: Brooke Tata graduated from IPHY in 2010 with Summa Cum Laude honors.

Kudos

Dr. ***Josiane Broussard*** recently received a NIH/NIDDK Mentored Research Scientist Development Award to study tissue-specific effects of insufficient sleep and a Vice Chancellor of Research Innovative Seed Grant to examine the role of the skin as a tool to assess circadian rhythms and function of peripheral metabolic tissues.

Dr. ***Josiane Broussard*** recently co-authored a review on the changing microbial landscape of Western society.

Dr. ***Marissa Ehringer's*** group recently published a paper showing an association between genes involved in the cholinergic system and nicotine behaviors in both European and African Americans.

Dr. ***Marissa Ehringer***'s team was part of a large international consortium that performed a meta-analysis to assess the association between a genetic variant in the gene for an opioid receptor (OPRM1) and drug behaviors, recently published in *Behavior Genetics*.

In 2016, Dr. ***Roger Enoka*** gave invited keynote talks at scientific meetings in Vienna (Austria), Beijing (China), Heidelberg (Germany), and Antalya (Turkey).

Dr. ***Alena Grabowski*** was recently interviewed by the Washington Post regarding her research on the effects of using a running-specific prosthesis for long jump performance by athletes with a leg amputation, specifically regarding the performance of Markus Rehm.

Dr. ***Rodger Kram*** received a Marinus Smith Recognition Award for making a significant, positive impact on the lives of CU-Boulder students.

Dr. ***Rodger Kram*** discovered that older adults over age 65 who run for exercise maintain the same efficiency as young runners and published the results in *Medicine and Science in Sports and Exercise.*

Dr. ***Tom LaRocca*** received a CU-Boulder ASSETT award to get students involved in writing and research for a public outreach website.

Dr. ***Monique LeBourgeois*** received a 2-year grant from the National Institute of Mental Health to study how extending sleep time in kindergarteners changes their brains and emotion processing skills.

Dr. ***Chris Link*** was a co-author on a paper in *Science* that characterized a gene that may be a therapeutic target for the most common form of inherited ALS.

Dr. ***Tom Maslanik***, an IPHY PhD graduate, has recently started a research reagent company following a stint as head of new product development for a large antibody supplier. His new company, enQuire Bio (www.enquirebio.com) currently provides recombinant proteins as well as antibodies for immunohistochemical staining of human tissue.

Dr. ***Matt McQueen*** received a 2-year grant from the Pacific (Pac)-12 Athletic Conference to study health and wellness of CU Boulder student-athletes.

Dr. ***Matt McQueen*** recently published a paper in *BMC Public Health* evaluating the clinical relevance of waist-to-height ratio among young adults.

Dr. ***Suzanne Nelson*** took a team of undergraduate students with her to St. John, U.S. Virgin Islands to study white-tailed deer health and disease parameters, a project critical to the Virgin Islands National Park's management resource decisions.

Dr. ***Suzanne Nelson*** won the Marinus Smith Award after being nominated by an undergraduate student for her commitment to teaching.

Dr. ***Doug Seals*** has received a 2-year grant award from NIH to determine the role of a new anti-inflammatory protein, interleukin-37, in vascular, metabolic and motor dysfunction with aging, as well as the underlying mechanisms of action.

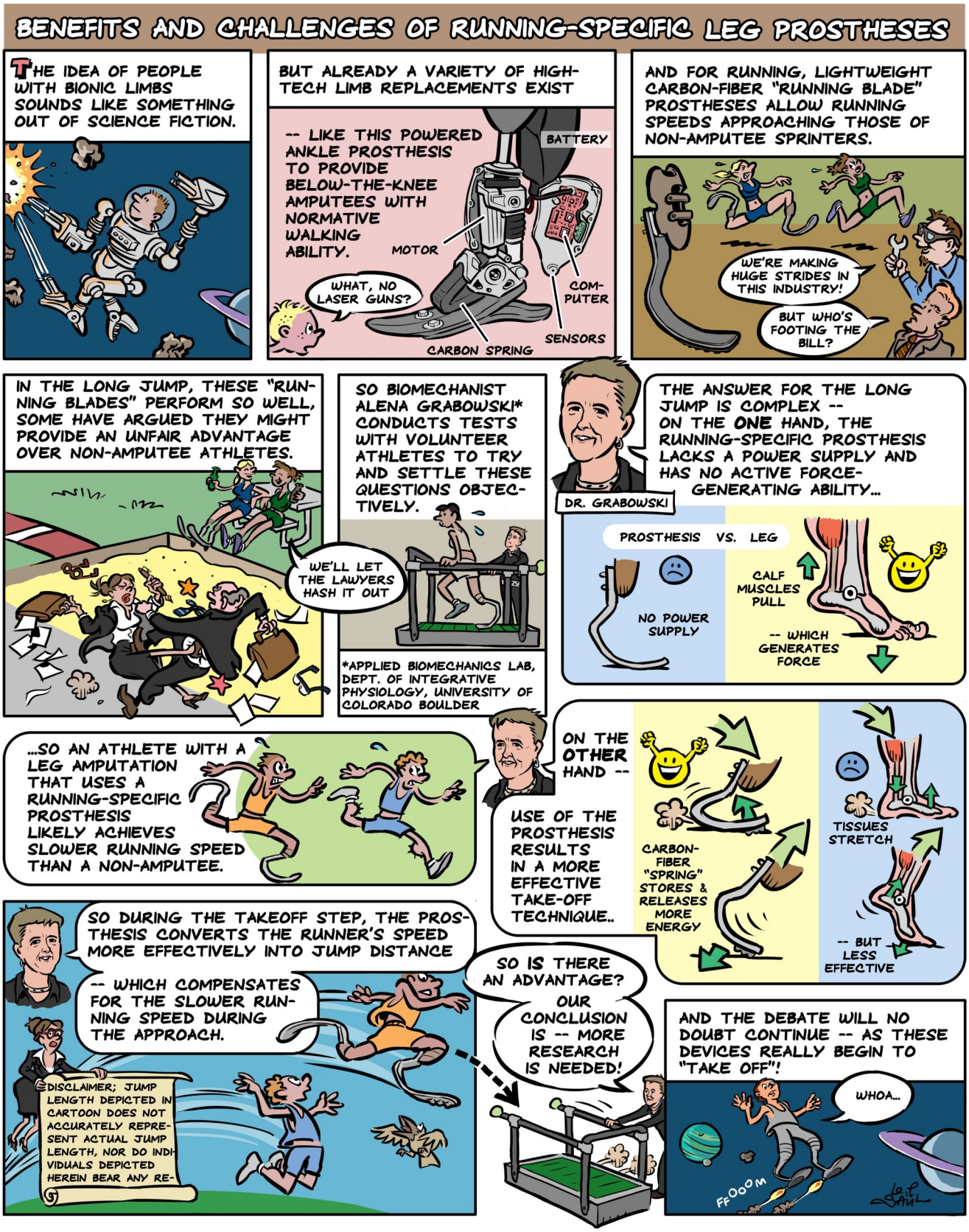
Dr. ***Doug Seals*** has received a 2-year grant award from NIH to determine the efficacy of supplementation with a mitochondrial specific antioxidant, MitoQ, for improving vascular function in late middle-aged and older man and women.

Dr. ***David Sherwood*** published a paper with former graduate student Dr. ***Keith Lohse*** and Dr. Alice Healy of Psychology in the *Journal of Motor Learning and Development* on how changes in mental attention affect dart-throwing accuracy.

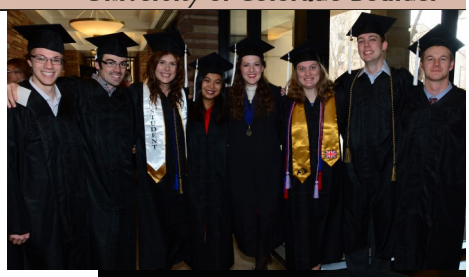
Dr. ***Jerry Stitzel*** and former IPHY graduate student ***Jen Wilking*** published a book chapter on how to use genetics to understand the function of nicotinic receptors.

Dr. ***Pei-San Tsai*** received a 5-year NIH grant to study how the reproductive brain overcomes inherent genetic defects to propagate offspring.

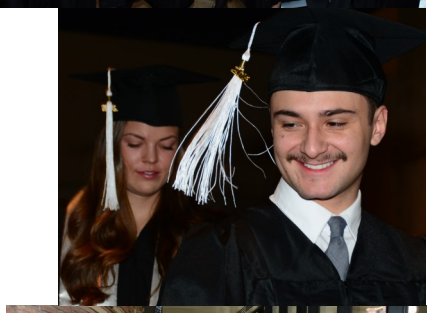
A Cartoon Representation of Dr. Alena Grabowski's Research *by Leif Saul*



December 2016 Bachelor of Arts



Alexa Ary
Aaron Christopher Beckmann
Alexander Bell
Emily Joy Bernhardt
Tracy Christine Bliss
Eric Stephen Brown
Claire Dlise Caplan
Emilia Louise Cassidy
Charles Macallister Cassin
Bradley William Chalker
Chainn-Yuh Samantha Chang
Valerie Janet Daniels
Jodie Davis
Andrew Ryan Diaz
Joseph Paul DiMercurio
Forrest Donnell
Vanessa Dorrance
David Michael Ehlers
Tristan Elias
Anna Fisher
Sean Andrew Fitzsimmons
Alexander Jaime Flores
Kourtney Noelle Fosse
Nicole Griggs
Alaina Lynn Hansen
Jacob Robert Henry
Alexandria Feren Herman
Sarah Anne Horan
Victoria Hounshell
Katherine Manivone Inkhamfong
Nicolas Ross Johnson
Maria Christina Kalasountas
Luke Dalton Karlovich
Sachio Kameo Kimura
Makenzie Taylor Kline
Xiaojian Lu
Kevin Michael McGunigal
Nicholas Milburn
Sweta Sudhir Patel
Brandon Douglass Renshaw
Catherine Rose Ross
Cierra Marie Russ
Saydie Allapowa Sago
Logan Christopher Shelton
Carolyn Rose Stroud
Anna Sulkko
Rashi Taneja
Mark Tapley
Jenna Grace Turner
Toua Vang
Hilda Janet Villagrana
Linh D. Vu
Aaron Joshua Wildman
Amanda Kay Wilson
Natalia Jo Zaremba



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Agnieszka K. Mika	PhD
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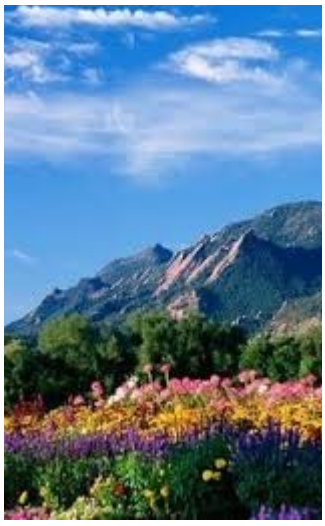

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