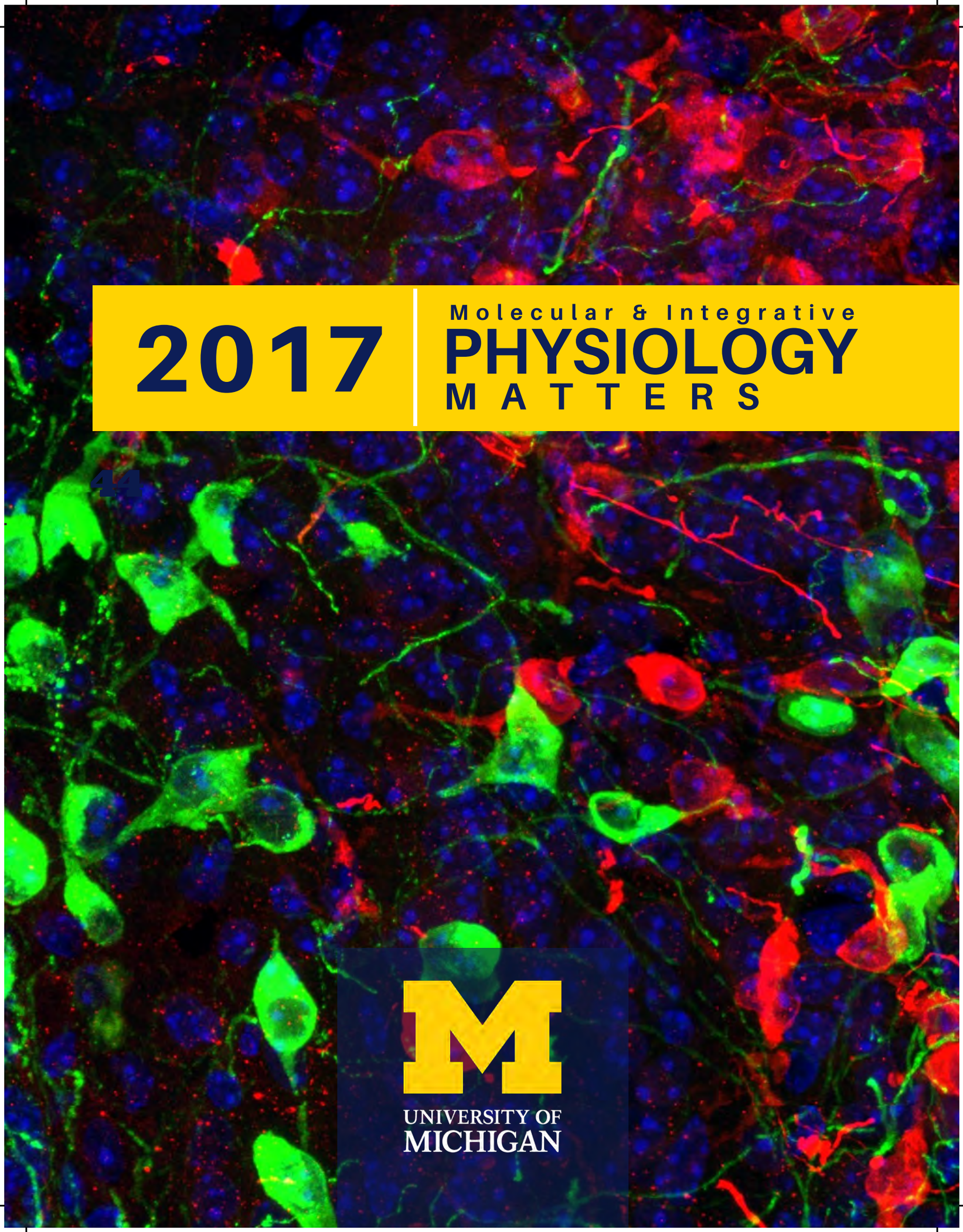


2017 Molecular & Integrative PHYSIOLOGY MATTERS

44

UNIVERSITY OF MICHIGAN

Santiago Schnell DPhil (Oxon), FRSC
Interim Chair, Department of Molecular & Integrative Physiology and John A. Jacquez Collegiate Professor of Physiology

It is an honor and privilege to serve as the interim chair of the Department of Molecular & Integrative Physiology. Our department was founded in 1882 as one of the first departments of physiology in the United States. We have played a central role in nurturing generations of physiologists through our research, mentoring and education, and service activities. Under the leadership of our past chair, Bishr Omary, we successfully navigated several challenges that are facing many departments nationally, thanks to the outstanding research, education contributions and service orientation of its members. Through these combined efforts, we became the top NIH-funded department of physiology in the nation.

The Department of Molecular & Integrative Physiology's place as one of the top physiology departments in the nation cannot be taken for granted; it is something we must work for each and every day. Our academic activities are enabled by research grants, as well as by generous support of department alumni and other donors (people like you!). Philanthropic investment in our department and its students and scholars enables us to pursue research, teaching and outreach at the very highest level, and thereby retain our standing in an ever more competitive world. In this newsletter, PHYSIOLOGY Matters 2017, we highlight examples of the extraordinary range of academic activities, being carried out by our members, and on which donations are having a lasting and positive impact.

I am truly delighted to serve as interim chair and to share the responsibility of championing our department's history as well as its future.

Santiago Schnell
February 2018

CONTENTS

***Cover:** Coronal section of wild-type mouse brain tissue, stained to show vasopressin (red) and oxytocin (green) -producing neurons in the Paraventricular Nucleus (PVN) of the hypothalamus. DAPI (blue) shows nuclei. Taken by Diane Somlo (now at Yale Medical School) in the Qi laboratory.*

PHYSIOLOGY BY THE NUMBERS

#1 Physiology Department in NIH Funding

$22.5M NIH FUNDING

- **44** RO1 Grants
- **6** Training Grants
- **5** Program Awards
- **15** Career Development
- **13** Other Grants

366 Published Papers 2017

41,552 Sq. Ft. RESEARCH SPACE

- **34** Tenure Track Faculty
- **36** Joint Faculty
- **57** Postdoctoral Fellows
- **43** PhD Graduate Students
- **32** Master's Students

SOME FACULTY HIGHLIGHTS

Justus Anumonwo: 2017 Circulation Research - Editorial Board Member

Peter Arvan: 2017 UMHS Distinguished Faculty Lectureship Award for Biomedical Research

Daniel Beard: 2017 Berman-Zech Award of Kinetics and Metabolism Society

Christy Carter-Su: 2017 New Associate Editorship: Endocrinology

Elise Hibdon: 2016 Research Investigator Research Award; 2017 NIDDK K01 Career Development Award, National Institutes of Health; 2017 UMCGR Pilot Feasibility Research Award, UM Medical School

Jun Hee Lee: 2016 Scientific Reports, Editorial Board Membership; 2017 Glenn Award for Research in Biological Mechanisms of Aging

Pilhwa Lee: 2017 Berman-Zech Award of Kinetics and Metabolism Society

Costas Lyssiotis: 2017 NextGen Young Investigator Award, American Association for Cancer Research; 2017 GI and Liver Physiology New Investigator Award, American Physiological Society

Daniel Michele: 2017 Frankel Cardiovascular Center Directors Research Award NIH SMEP Study Section

Sue Moenter: NIH MERIT Award

Hector Valdivia: 2017 Fulbright-Tocqueville Distinguished Chair Award, French Ministry of Higher Education & Research and the Franco-American Commission

Shawn Xu: 2017 American Association for the Advancement of Science Fellow

2017 Faculty

1st Row: Brian Carlson, Pilhwa Lee, Costas Lyssiotis, Sue Brooks, Santiago Schnell, Lou D'Alecy, Bishr Omary, Jimo Borjigin **2nd Row:** Amy Oakley, Sue Moenter, Rick Mortensen, Dan Beard, Yatrick Shah, Lisa Larkin, Jun Hee Lee, Christy Carter-Su, Carol Elias, Jessica Schwartz, Malcolm Low, Tony DeFazio, Roger Cone **3rd Row:** Linda Samuelson, Larry Argetsinger, Thomas Sanderson, Scott Leiser, Anatoli Lopatin, Howard Crawford, Ormond MacDougald, Greg Cartee, Shawn Xu, John Williams, Liangyou Rui, Scott Pletcher, Lig Qi (Not all Faculty available for Photo)

NEW JOINT & ADJUNCT FACULTY

Patrice Fort - Assistant Professor, Ophthalmology & Visual Science; Molecular & integrative Physiology

Todd Herron - Associate Research Scientist, Molecular & Integrative Physiology; Internal Medicine

Christopher Mendias - Adjunct Associate Professor, Orthopaedic Surgery; Molecular & Integrative Physiology

Vikram Shakkottai - Associate Professor, Neurology; Molecular & Integrative Physiology

FACULTY PROMOTIONS

Justus Anumonwo - Associate Professor of Internal Medicine and Associate Professor of Molecular and Integrative Physiology

Jun Hee Lee - Associate Professor, Molecular & Integrative Physiology; Institute of Gerontology

Daniel Michele - Professor, Molecular & Integrative Physiology; Internal Medicine

Geoffrey Murphy - Associate Director, Neuroscience Graduate Program, Research Professor, Molecular and Behavioral Neuroscience Institute and Professor of Molecular& Integrative Physiology

Bishr Omary Named Chief Scientific Officer & Executive Vice Dean for Research

Bishr Omary joined the department as its chair in 2008 and on May 1, 2017, was named University of Michigan Medical School's new chief scientific officer (CSO) and executive vice dean for research.

Dr. Omary served as chair of the Department of Molecular & Integrative Physiology, where he led the department to become the highest-ranked National Institutes of Health-funded physiology department in the U.S. Omary also helped the department grow its educational and training platforms and was instrumental in recruiting half of the department's current faculty. Prior to joining the University of Michigan, Omary spent 19 years at Stanford University, where he served in several capacities, including as the chief of the Division of Gastroenterology and Hepatology, director of a NIH-supported digestive disease center and director of a NIH-supported training grant.

In his new role as CSO, Omary will work closely with key stakeholders to develop and implement a robust strategy to foster excellence in biomedical research and clinical translation to improve disease prevention and treatment, in addition to promoting fundamental basic science research.

He will facilitate the formation of new strategic partnerships across the Medical School and main university campus and support and advocate for existing partnerships. He will also serve as a key member of the Michigan Medicine leadership team and assist with recruiting and retention efforts, faculty workforce planning, and facility and capital planning for the research enterprise.

Roger Cone Named Vice Provost, Director of the Biosciences Initiative

On May 18 2017, Roger Cone, director of the University of Michigan's Life Sciences Institute (LSI) and Professor of Molecular & Integrative Physiology, was named the first vice provost and director of the biosciences initiative at the University of Michigan.

Cone, a distinguished obesity researcher and experienced administrator, joined University of Michigan (UM) from the Vanderbilt University School of Medicine a year ago. The holder of several U.S. patents, Cone has published more than 160 scholarly papers and studies central control of energy homeostasis. His primary interest is understanding how the central nervous system regulates energy storage and the role of those neural circuits in obesity, disease cachexia and anorexia nervosa. While continuing as LSI director, Cone also will oversee a university-wide effort to strengthen biosciences research and education.

Cone will chair a coordinating committee composed of leaders drawn from the many UM units that conduct life sciences research. Thirty new faculty positions will be added in the biosciences and $150 million will be allocated by the new vice provost and the coordinating committee, with the goal of catalyzing the development of research and educational programs that tap into UM's great breadth.

The creation of the new vice provost position is part of a broader effort, led by the University of Michigan President Mark Schlissel, to strengthen the biosciences at UM, in part by leveraging existing strengths and improving campus-wide coordination across the biosciences and related fields.

PHD GRADUATE PROGRAM

Upward and Onward

Daniel Michele, PhD

With the continuing changing biomedical research workforce, the vast majority of our students are pursuing careers outside of academia. The outgoing director of the PhD program, Sue Moenter, lead curriculum reform, championed specific career development strategies, and promoted awareness amongst our faculty that providing time for these opportunities is essential for preparing our students for becoming leaders in their diverse career paths in science.

This past year we welcomed six new PIBS students with a primary interest in MIP as well as two MSTP students. Seven students successfully defended their PhD dissertations and have moved on to post-graduate opportunities. The graduate education fund continues to be a growing source of funds supporting our students who are presenting their work at national and international conferences, or attending career development events.

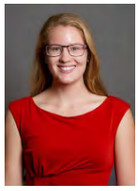
As the fund grows, we are beginning to look at ways of funding student-initiated research proposals through pilot grants.

One of the highlights for me personally is seeing our students present their work, whether at their defense, our Davenport Award Competition or our Student Seminar Series. Our students are doing amazing work, embracing state-of-the-art technologies and applying them to important physiological and biomedical research questions in ways I could never have imagined just a few years ago.

Some of you may know that I am an alumnus of the PhD program in MIP (2000). I love Michigan, and specifically I love MIP. My experience in graduate school was not only memorable for the outstanding training and high-impact science, but I have very fond memories of the welcoming family environment of supportive peers and inspiring mentors. Many, if not all, of my MIP peers remain friends to this day. Many of my past MIP mentors who shook me down at prelims are now my colleagues and friends. If I can do anything to foster those types of fond memories of their MIP PhD experience in our current students, I will consider it job well done.

1st Row: Kelly Young, Natalie Warsinger-Pepe, Liz Ronan, Kristy Holme, Sierra Nance, Edith Jones, Jeanine Ruggeri **2nd Row:** Ben Abdon, Hyo Sub Choi, Steven Romanelli, Eden Dulka, Jacob Johnson, Andrew Schwartz, Surojit Sural, Fangyun Tian, and Margo Emont **3rd Row:** Ian Gonzalez, Jon Dean, Danny Triner, Meggie Hoffman, Andrew Marquis, Jonathon Herrera, Jeff Phumsatitpong, Huilun Wang, Vi Tang, Rudi Starrett and Thomas Vigil

PhD Graduate Program Award Highlights



Tova Berg

Tova Berg, a graduate student in Sue Moenter's lab, successfully competed for an F30 Ruth L. Kirschstein National Research Service Award (NRSA), which is awarded by the National Institutes of Health to outstanding dual MD and PhD degree students. Berg's work on hypothalamic regulation of reproduction was funded by the Eunice Kennedy Shriver National Institute for Child Health and Development (NICHD).

Gonadotropin-releasing hormone (GnRH) neurons in the hypothalamus connect the brain systems controlling fertility to the downstream reproductive system. These neurons are overactive in most women with polycystic ovarian syndrome (PCOS), the most common cause of infertility. Recent evidence in young pubertal girls suggests that this hyperactivity may arise before pubertal maturation. Prenatal androgenization (PNA) programs several phenotypes similar to women with PCOS. Berg's funded proposal aims to understand the prepubertal development of GnRH neurons and the timing and mechanism of alterations that arise in PNA mice.

Andrew Schwartz

Andrew Schwartz, a graduate student in Yatrik Shah's lab, successfully competed for an F31 Ruth L. Kirschstein National Research Service Award (NRSA), which is awarded by the National Institutes of Health to outstanding PhD students. Schwartz will receive funding over three years for his studies into the mechanisms by which the liver and the intestine integrate to maintain systemic iron homeostasis from the National Institute of Diabetes, Digestive and Kidney Diseases.

Over one billion people worldwide are affected by iron overload, iron deficiency, and states of malnutrition that perturb iron homeostasis. Andrew's preliminary data challenges current dogma by showing that the maintenance of systemic iron metabolism by the liver-derived hormone, hepcidin, and the control of intestinal iron absorption by the transcription factor, HIF-2a, are directly integrated pathways. The funded research will explore the significance and molecular mechanism of the crosstalk between liver hepcidin and intestinal HIF-2a, which will provide novel insights into systemic iron homeostasis and will uncover potential therapeutic targets to alter systemic iron handling in diseases of iron overload and iron deficiency.

PhD Graduate Program Awards over the last year

Devika Bagchi: (MacDougald Lab) Center for Organogenesis Training Grant Predoctoral Fellowship; Graduate Student Award for Excellence in Service, PIBS; John A. Williams Award for Outstanding Service, MIP; Vander Teaching Award, MIP

Amelia Glazier: (Day Lab) American Heart Association; NIH NRSA

Kristy Holme: (Dus/Myers Labs) Graduate Student Research Fellowship

Edith Jones: (Inoki Lab) Rackham Research Pre-Candidate Award; Systems Biology T32

Jessica Lora: (PIBS) Rackham Merit Fellowship

Sierra Nance: *(PIBS)* Rackham Merit Fellowship; Maas Merit Fellowship

Steven Romanelli: (MacDougald Lab) Cellular Biotechnology Training Program Fellowship T32

Andrew Schwartz: (Shah Lab) NIH Individual NRSA

Joseph Starrett: (Moenter Lab) Bean Award, MIP

Matthew Taylor: (Rainey Lab) American Heart Association Fellowship

Danny Triner: (Shah Lab) NIH Individual NRSA

Spotlight on Alumni

Our own Dan Michele is one of this year's featured PhD alumnus. Dan was born and raised in Michigan, was a PhD student in Joe Metzger's laboratory and received his PhD in 2000. He went on to a postdoctoral fellowship at the University of Iowa and was recruited back to Michigan as an Assistant Professor in 2004. His research is focused on the molecular mechanisms of inherited muscular dystrophies, and he still uses many of the approaches in cardiomyocytes that he learned in Joe's lab to study the cardiomyopathy in these diseases. Dan was promoted to full professor in 2017, and in addition to supervising his lab, he is currently serving as Director of the MIP PhD Program and Director of the Physiology Phenotyping Core.

Most Memorable MIP Moment(s): I was sitting in Joe's office, which was in the back of the lab off the main hall way next to the departmental office. We were discussing science when all of sudden Joe says "Shhh, don't say a word." I hear some footsteps in the hallway and all of sudden the booming voice of the chair of the department John Williams rang out "Jooooooeee? Are you in there?" Joe was ready to leave for the day and looks at me with a look like don't you dare say anything. We had a good laugh after the coast was clear. Although he missed his mark that day, John Williams was a great chair and great advocate for students. I was fortunate to be in the departmental office one day when John told me he was getting rid of his high-back leather office chair because it had a hole in the arm and said I could have it if I wanted it. I lived the rest of my graduate days in style and wrote my thesis in The Chair's Chair.

PhD Graduates

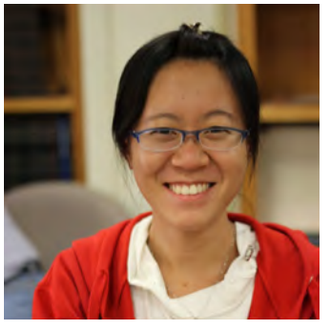
2016-2017

Francisco Alvarado Guillen

Mentor: Hector Valdivia, MD, PhD

Thesis: Mechanisms of Tyanodine Receptor 2 Regulation in Cardiac Pathophysiology

Current Position: Postdoc Fellow, University of Wisconsin-Madison



Xi Chen

Mentor: Hector Valdivia, MD. PhD

Thesis: The Role of Sorcin in Excitation-Contraction Coupling in Normal and Diseased Hearts

Current Position: Postdoc Fellow, University of Michigan

Margo Emont

Mentor: Jun Wu, PhD

Thesis: Subcutaneous Fat: Thermogenesis and Metabolic Benefits

Current Position: Postdoc Fellow, Beth Israel Deaconess Medical Center

Joanne Garbincius

Mentor: Daniel Michele, PhD

Thesis: Mechanical Regulation of Striated Muscle Nitric Oxide Signaling in Muscular Dystrophy

Current Position: Postdoc Fellow, Temple University

Jonathan Gumucio

Mentor: Christopher Mendias, MS, PhD

Thesis: Michondrial Leads to Skeletal Muscle Myosteatosis in Chrobnic Rotator Cuff Tears

Current Position: Senior Scientist, Merck

Kristoffer Sugg

Mentor: Christopher Mendias, MS, PhD & Susan Brooks, MS, PhD

Thesis: eceptor Tyrosine Kinases Regulate the Growth and Remodeling of Tendon

Current Position: House Officer, University of Michigan Plastic Surgery

Chanisa Thonusin

Mentor: Charles Burant, MD, PhD

Thesis: Effects of Intrinsic Cordiorespiratory Fitness and Caloric Restriction on Metabolites and Skelatal Muscule and Sjkeletal Muscle Mitochondrial DNA

Current Position: Postdoc Fellow, University of Michigan

The environment in Michigan Physiology changes you as a person.

Allison Ho, PhD Student

SEEK
SCIENCE EDUCATION &
ENGAGEMENT FOR KIDS
UNIVERSITY OF MICHIGAN

SEEK – SCIENCE EDUCATION & ENGAGEMENT FOR KIDS

The science done in the department is critical to help understand the world we live in, in particular how organisms function in health and what goes wrong in disease. The pay offs are knowledge and ultimately cures. Also crucial to our mission is promotion of science throughout the community. Our trainees and faculty participate in a number of activities, most prominent of which is SEEK, Science Engagement and Education for Kids.

SEEK is a new and developing program that grew out of visits by Physiology PhD students to local elementary schools including Wylie in Dexter and Holmes and Estabrook in Ypsilanti. Our students designed and led hands-on activities designed to introduce how the brain, heart, digestive, immune and breathing systems work. This program has grown at the grass-roots level through word-of-mouth and now has students from several programs at Michigan participating.

These day or half-day visits are both useful and a lot of fun, but our goal for SEEK is to make it a more enduring exposure to science. We are working with the Center for Research on Learning and Teaching to incorporate more frequent, shorter visits to underserved schools as an option for completing requirements of the Teaching Certificate. This is a win-win: our trainees get to make science a part of the curriculum for kids and also gain valuable teaching and communication skills.

Front Row: Liz Ronan, Devika Bagchi, Jeanine Ruggeri, Hanh Truong, and Edith Jones **Back Row**: Sue Moenter, Ally Cara, Joseph (Rudi) Starrett, Andrew Marquis, Kristy Holme, Meggie Hoffman, Brenda Cisneros Larios, and Ben Abdon

MS PROGRAM

The primary objective of the MS program is to enhance students' preparedness and credentials to compete successfully for research positions in academia or industry or admission to basic science doctoral programs, medical or dental school, or other health-related professional programs.

Success is defined as a student having matriculated to their desired graduate program or having found a job in their career field of choice. So how are our students doing? Since the first program graduates in 2012 through 2016 graduates, more than 85% of our graduates are in their desired positions; others have applications pending during the current cycle. Of our 2017 graduates, 27% matriculated into medical school or PhD programs immediately upon completion of the MS degree, with remaining applying during the current or next cycle. Our alumni are at prestigious medical, dental and graduate schools around the country, including several right here at University of Michigan. Some from our first class are now entering residency, with matches including Sidney Kimmel Medical College, Department of Surgery; Western Michigan University, Department of Internal Medicine; University of Michigan Medical School, Department of Pediatrics; Henry Ford Hospital, Department of Internal Medicine.

The current class of 2018 has 34 total students: 29 in the coursework and 5 in research track (in the labs of Jimo Borjigin (2), Patrice Fort (1) and Yatrik Shah (2)). The class of 2018 is well on its way to great success and we look forward to another outstanding application cycle this Spring for the class of 2019!!

Beth Rust, Director

The Faculty & Staff of the program have helped me tremendously in the Medical School application process & truly care about my well-being & success, as well as that of my peers.

Kianna Eurick, MS Student

MS Alumna: *Vishvanie Jayasundera*

What is your current job title? Pediatric Resident of the Department of Pediatrics and Infectious Diseases at the University of Michigan, CS Mott Children's Hospital. I am currently in my second year of residency.

What do you do in a typical day? My typical day consists of caring for amazing kids and families, in both the inpatient and outpatient worlds, as part of a multidisciplinary team, while at the same time learning from my colleagues and Michigan Medicine faculty at lectures and conference.

What do you like most about your job? *What do you like the least?*
Most: The best part about my job is getting to work/play with little victors all day long. A very close second is learning from the incredible members of our team, who are often leaders in their various fields.
Least: The part that I like the least is the daily realization that despite making amazing advancements in the field of medicine, we remain painfully limited in what we can do to help.

What do you wish you had known when you were a student in the MS Program in Physiology? There will never come a day when you know everything there is to know. One of the most crucial steps to learning is being patient with yourself so that you make the most of every opportunity to learn and keep moving forward, enriched by your unique experiences.

What are your long-term professional goals? After I graduate from residency, I plan on pursuing fellowship training to specialize in the field of adolescent medicine.

1st Row: Raquelle Wilson, Christine Byun, Mollie Mahoney, Marissa Ray, David Miller, Noah Kuhlmann **2nd Row:** Nathan Cowdin, Merna Sitto, Shivani Kaushal, Abir Azeem, Name Retracted (Advisor), Dr. Elizabeth Rust (Director), Gabriel Stuber **3rd Row:** Vivian Liu, Lucas Allen, Lauren Mills, Kianna Eurick, Alaina Skotak, Grace Denney, Mussa Ibrahim, Dr. Amy Oakley (Assoc. Director) **4th Row:** Joel Rose-Kamprath, Galloway Thurston, Joseph Taranto, Aaron Schwark, Reid Fursmidt, Alexandra Hogan, Mazen Hasan, Henry Lent **5th Row:** Stephen Collins, Bradley Richey, Joshua Szczepanski, Kevin Eid, Joseph Hellrung, Jr., Ahmad Chehab, Sreten Franovic

POSTDOCTORAL FELLOWS

The MIP Postdoctoral Association is happy to report another successful year of events designed to support the career development of the postdoctoral fellows and research investigators within the department. We would like to thank Dr. Yatrik Shah, our faculty advisor, who has been instrumental in helping select themes for the year and securing speakers for our monthly meetings. Dr. Shah continues to be an outstanding resource for career advice and mentorship, and we look forward to working with him to produce another successful program for next year.

This year, the MIP Postdoctoral Association focused on three main topics: core facilities, career planning, and research seminars. During the first half of 2017, we continued the theme of the previous year, highlighting core facilities at the University of Michigan. We met with Claudia Lalancette, who heads the Epigenomics Core, Dave Adam, the head of the Flow Cytometry Core and Justin Colacino, who heads to the single-cell analysis initiative. Up-to-date knowledge of what is available at our UM core facilities will continue to be important as fellows design and execute experiments, as cores allow them to stretch beyond the expertise of their own labs. In the area of career development, we were fortunate to host MIP graduate student alumnus Tyler Sisk, now a science patent lawyer. Tyler discussed in length his transition from scientific PhD to law, as well as aspects of intellectual property and patent law. The second half of the year focused on research seminars given by our fellow MIP postdocs. Hyang Kim and Mauricio Torres from the Qi lab spoke about the importance of ERAD function, Hui Ju from Crawford lab showed new data on pancreatic cancer, and Sadeesh Ramakrishnan from the Shah lab presented data on hypoxiasignaling in metabolic homeostasis. Finally, we enjoyed a lunch meeting with Sir Stephan O'Rahilly, this year's Faulkner Lecturer, during which we discussed our current research and our career trajectories.

On a final note, all three members of executive committee of the MIP Postdoctoral Association will be moving to new positions at the end of this year. We have had a wonderful time working with Dr. Shah, the MIP faculty, and our fellow postdocs. We thank Dr. Omary for his support and wish him best in his new position, and Dr. Schnell for his continuing support of the MIP Postdoctoral Association. Our meeting attendance remains strong and we appreciate the encouragement and support of our department's postdocs and research investigators. Thank you to Heather MacFarland, Michele Boggs, Angie Tucker and the rest of the MIP staff for organizational help. We have had another wonderful year and look forward to a successful 2018 under our new leadership!

Mark Jimenez-Canet, Nicole Bellefontaine & Elise Demitrack

Postdoctoral Program Award Highlights

Kavaljit Chhabra, PhD - (Low Lab) Outstanding Postdoctoral Teaching Award; NIDDK K01 Career Development Award; Outstanding Postdoctoral Award, UM; Early Investigators Award, Endocrine Society; Outstanding Postdoctoral Fellow Award, UM

Yewei Ji, PhD - (Qi Lab) 2017 ADA Fellowship

Geun Hyang Kim, PhD - (Qi Lab) ADA Postdoctoral Fellowship

Kenneth Lewis, PhD - (MacDougald Lab) NIH Postdoctoral Multidisciplinary Training Program in Basic Diabetes Research (T32)

Ziru Li, PhD - (MacDougald Lab) ADA Award

Min-Jung Park, PhD - (Omary Lab) Recipient MICHR PTSP (Postdoctoral Translational Scholar Program) Grant

Juilee Rege, PhD - (Rainey Lab) Outstanding Abstract - Endocrine Society Meeting 2017

Mauricio Torres, PhD - (Qi Lab) 2017 Pew Latin American Fellowship

Charlotte Vanacker, PhD - (Moenter Lab) Poster Award, Endocrine Society Meeting 2017; Lalor's Foundation Fellowship Program

Spotlight on Alumni

Dr. David I. Yule. Presently, Professor of Pharmacology and Physiology, University of Rochester, School of Medicine. I obtained a PhD from the University of Liverpool in the United Kingdom in 1989 working on Ca2+ signaling in exocrine cells in the Medical Research Council laboratories of Dr. David Gallacher and Ole Petersen. Having met at a meeting in Dublin, Ireland in 1988, in 1990, I applied to and subsequently joined Dr. John William's laboratory in The Department of Physiology at The University of Michigan for postdoctoral training. Being one of the foremost labs in the world working on exocrine pancreas, this was both a natural progression from my thesis work, as well as a wonderful opportunity to learn more techniques and develop a broader understanding of pancreatic physiology. My time in Michigan was extremely valuable in that the Williams laboratory and department as a whole provided a vibrant environment to both hone bench skills and "street skills" to survive in the US academic environment. Particularly important were John's words of wisdom, which I have tried to emulate. These include "We have more money than time" (that one has been difficult to match!) and "if we can't always be first, make sure the data is best". My post-doc sojourn to the USA was originally designed to be a brief, typical European style post-doc of a couple of years to sample the scientific and cultural opportunities on offer in the USA, before returning home. Time flies, and it actually took me 7 years to leave Michigan, that allowed me to share season tickets with John for 1997's Football National Championship (Go Blue-better times to come!) and all these experiences convinced me to ultimately stay permanently in the USA. I moved to the Department of Pharmacology and Physiology at the University of Rochester in 1997 to establish my independent research lab. Over the past 20 years, my lab has continued to be interested in Ca2+ signaling in exocrine cells and has focused on structure function relationships that control regulation of Ca2+ release channels.

SUMMER FELLOWSHIP PROGRAM

This year we received over 200 applications for our four undergraduate summer research programs:

- **Summer Undergraduate Research Fellowship program (SURF)**
- **Short Term Educational Program (STEP)**
- **Summer Undergraduate Research in Physiology (SURP)**
- **Cancer Research Summer Fellowship Program**

Our programs engage students in a 12-week summer research experience, with a long-term goal of inspiring them towards a career in biomedical research and a short-term goal of recruiting them back to graduate programs at the University of Michigan. The hands-on laboratory research experience is complemented by a weekly noon lecture series with presentations on responsible conduct of research, aspects of normal physiology, how disorders of physiology lead to disease, and career advice. Students concluded their research experience by participating in undergraduate research fora, which were held in August 2017. Many of the students contribute substantially to research papers, and are included as co-authors.

The SURF is MIP's longest-running program for undergraduate education, with students supported in part by philanthropy, the department and research grants. This year, we welcomed eleven undergraduate students from across the country. The STEP program is funded by an NIH/NIDDK R25 grant that was just renewed for five years (2016-2021, PI - Santiago Schnell). It is specifically targeted to encourage students from quantitative engineering backgrounds to apply their training to research relevant to digestive and metabolic diseases. This year, the STEP program welcomed twelve undergraduate students from across the country.

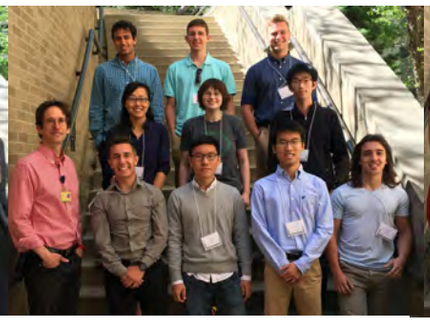
The SURP Program is supported by another recently renewed NIH/NHLBI R25 (2017-2022, PI - Jimo Borjigin). Its goal is to attract students from underrepresented groups to pursue research in heart, lung and blood diseases. Recruitment of the SURP students and selection of summer seminar speakers were conducted in collaboration with the summer program at the Cardiovascular Center directed by Dan Michele. SURP supported 14 students this year.

The Cancer Research Summer Fellowship Program, directed by Yatrik Shah, was supported by MIP, Translational Oncology Program, Comprehensive Cancer Center and PIBS. The goal of the program was to recruit undergraduates from underrepresented backgrounds to conduct research in gastrointestinal cancers. In this second year, we supported five students. Due to the success of the pilot program, a R25 has been submitted to NCI.

Our summer programs show our department's commitment to encourage and foster the success of students from all backgrounds to attain advanced degrees, research careers, and positions of leadership in physiology and biomedical sciences. We have continued to increase the proportion of underrepresented undergraduate students participating in the SURF and STEP programs thanks to the generous support of the University of Michigan Rackham Faculty Allies for Diversity in Graduate Education, which provided support for two additional underrepresented students. Feedback on these programs from our undergraduate researchers has been extremely positive, and we are all looking forward to next summer's programs.

SURP Program

SURF Program



STEP Program

IRACDA Program

Believing that our work will have an impact on what young people want and need is where the greatest satisfaction lies.

Dr. Santiago Schnell, Interim Chair

RESEARCH NEWS

From Urine Output to Disease, Study Shows the Importance of Hormone Quality Control

Discovering a puddle of mouse urine seems like a strange scientific "eureka" moment. But for one research team, it's exactly what led to a new discovery. The findings may enhance understanding of how our bodies balance water content — 50 to 60 percent of our weight. It may also lead to better understanding of hormone-related diseases that can cause conditions ranging from diabetes to obesity.

Starting from that abnormally wet cage litter, the researchers traced the cause all the way into tiny nerve cells in the mice's hypothalamus. Clues and experiments led them into the protein turnover within the endoplasmic reticulum, or ER.

The ER is the first stop for many items that cells send out into the world. If the hypothalamic neuron is a hormone factory, then the ER is both the quality control department and the packaging and shipping department for those hormones. The team's discovery shows that the ER quality control machine does more than just keep the cell from shipping poorly made goods, destroying bad products before they do damage.

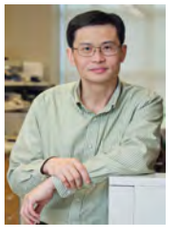
What might one see in a mouse that lets too much water go in its urine? Perhaps an unusually wet mouse cage. University of Michigan physiology professor Ling Qi, Ph.D., explains that the findings, published in the Journal of Clinical Investigation, illustrate a new role for a process called endoplasmic reticulum-associated degradation, or ERAD.

"Before our study, there was a limited understanding of ERAD function," he says. "We demonstrate that the machinery of the ERAD process controls the level of hormones released from cells and thereby controlling systemic water balance." Qi, along with postdoctoral fellows Guojun Shi, Ph.D., and Geun Hyang Kim, Ph.D., and undergraduate student Diane Somlo, now a Yale University medical student, and colleagues from around the world, show that ERAD plays an essential role in hormone maturation within the ER.

When they impaired ERAD function, the mice started drinking a lot more water and producing watery urine, mirroring symptoms seen in people with a rare hormone disorder known as diabetes insipidus. The disease, which occurs in about 1 in 25,000 people, is known to be caused by a lack of vasopressin, or decreased ability of kidneys to respond to it.

Through painstaking research, the team showed that when ERAD doesn't happen normally, misfolded hormone molecules were not cleared, and formed aggregates, or clumps, with normal hormone molecules.

Tiny Worms May Offer New Clues About Why It's So Hard to Quit Smoking



"What's really fascinating is that ERAD appears to control secretion of hormone by degrading misfolded proteins and allowing the good ones to go," says Qi. "Without ERAD, the bad ones attach to the good ones, which then become stuck in the ER. This suggests that ERAD may play a more significant role in health and disease than previously anticipated." Efforts to boost ERAD function could help normal prohormone folding and shipping go more smoothly

Researchers in MIP and the University of Michigan Life Sciences Institute have found that a previously dismissed genetic mechanism may contribute to nicotine dependence, and to the withdrawal effects that can make quitting smoking so difficult.

Scientists in the lab of Shawn Xu, Ph.D. recently published these findings in Cell Reports. They examined withdrawal responses in the millimeter-long roundworms Caenorhabditis elegans (C. elegans), which get hooked on nicotine just like humans. The study takes a fresh look at a previously dismissed biological mechanism. Most research in the field has focused on how proteins called nicotine acetylcholine receptors contribute to dependence. Xu and his colleagues focused on an earlier step in the genetic coding process and discovered that a series of genes are involved in a process that ultimately increases the production of the nicotine receptor proteins, with microRNAs — a class of small RNA molecules that help fine-tune gene expression — playing a pivotal role.

"We're seeing a clear link between nicotine, microRNA, the receptor proteins, and nicotine-dependent behavior," says Jianke Gong, Ph.D., a researcher in Xu's lab and one of the lead authors on the study. This mechanism had been dismissed as unimportant to nicotine dependence; however, Xu points out, those conclusions were made decades ago, using less sophisticated techniques. Xu's lab previously demonstrated that the worms exhibit behavioral responses to nicotine similar to what mammals experience, and that some of the genes involved in nicotine dependence in worms are conserved in mammals — meaning the worms are a good genetic and behavioral model for studying nicotine dependence.

Xu hopes that this latest discovery in C. elegans will lead other scientists to reexamine the role of these microRNAs in nicotine dependence in mammals, and ultimately lead to a better understanding of what causes the dependence.

"People believed this question had been settled," says Xu. "But we have better tools now. We, as a field, need to take another look at this mechanism in nicotine addiction."

Inauguration of the Howell and Jacquez Collegiate Professorships in Physiology

On August 23rd, 2017, Carol Bradford, Executive Vice Dean for Academic Affairs at the University of Michigan Medical School, and Charles J. Krause, M.D., Collegiate Professor of

Otolaryngology installed Dr. Scott Pletcher as the William H. Howell Collegiate Professorship in Physiology, and Dr. Santiago Schnell as the John A. Jacquez Collegiate Professorship in Physiology. Endowed professorships are very important to our Department and Medical School because they showcase the power of philanthropy and also allow us to bestow upon select faculty one our school's highest honors.

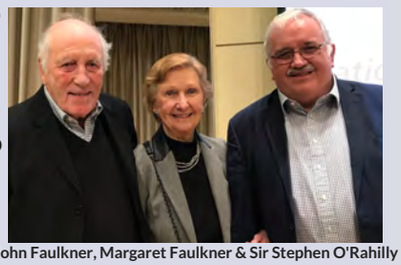
Dr. Howell was a preeminent American physiologist and pioneer in the physiology and pathology of blood. While he spent just a few years at Michigan (1889-1892), his contributions resonate today, especially his insistence on the preservation of optimal health rather than just the study of disease. The Jacquez Professorship honors a pioneer in the field of mathematical biology.

Dr. Jacquez was Professor of Physiology in the Medical School and Biostatistics in the School of Public Health (1962-1990). He served as interim Chair of the Department of Physiology from 1985-87. Among his research endeavors was the mathematical analysis of the kinetics of cellular amino acid uptake, the transmission of the AIDS virus, and AIDS vaccine development.

John Faulkner Lectureship

The 6th Annual John and Margaret Faulkner Lecture was held on October 18th, 2017. Professor Sir Stephen O'Rahilly, head of the Institute of Metabolic Sciences at Cambridge University, gave a highly insightful overview of the causes and consequences of human obesity. His group has successfully identified the genetic bases for many rare and extreme forms of human diseases, including obesity and insulin resistance.

His mechanistic studies of the molecules and signaling pathways pinpointed have provided a found-ation for our understanding of physiology and pathophysiology within the general population. Dr. O'Rahilly is an internationally-renowned investigator, who is a foreign associate of the National Academy of Sciences, and knight bachelor for contributions to medical sciences. He enthusiastically met with graduate students, postdoctoral fellows and faculty, and provided us an opportunity to thank John and Margaret, and John's friends and past trainees, for their generous gift that made this lectureship possible.



John Faulkner, Margaret Faulkner & Sir Stephen O'Rahilly

Passing of Emeritus Professor Richard L. Malvin

Richard L. Malvin. Emeritus Professor of Physiology, died at his home on the evening of November 19, 2017. Richard retired from active faculty status as of December 31, 1992, after a most productive career as a teacher and researcher. He was named Professor Emeritus of Physiology in 1993.

Richard was born on August 19th, 1927. A native of Brooklyn, New York, he did his undergraduate studies at McGill University and then studied for an MS at New York University, a PhD at the University of Cincinnati, receiving the latter in 1956. Richard then joined the University of Michigan as Research Associate and was appointed Instructor in the Department of Physiology in 1957. In 1959 he was promoted to Assistant Professor, in 1964 to Associate Professor and in 1967 to Professor of Physiology.

A renal physiologist of distinction, Richard was one of the originators (with Walter Wilde and Lawrence Sullivan) of the stop-flow technique, a method for localizing function in nephrons. Although he has been active in many areas of renal physiology, he is best known for his work on the role of renin and angiotensin. He found that there are multiple forms of renin, demonstrated the central nervous system action of angiotensin, and contributed substantially to the study of the role of these substances in the development of hypertension.

Richard taught medical students and graduate students, and was known for his popular undergraduate course on quackery and fakery in medicine and science. A large number of today's renal physiologists received their training in the Malvin laboratory.

In addition to research and teaching, Richard was active on University committees and served on many national scientific committees and editorial boards of scientific journals. He was one of the founders of the American Society of Nephrology. Another major contribution was his activist role, first as Chairman of the Public Information Committee and then as President of the Michigan Society for Medical Research. In honor to his contributions to the physiological sciences, the American Physiology Society interviewed him as part of the Living History of Physiology Project. Richard provides insights into his careers as well as advice in this interview: http://www.the-aps.org/mm/Membership/Living-History/Malvin.aspx

Dr. Malvin is internationally renowned for the development of the stop-flow technique to measure renal function.

American Physiological Society

Institutional Research & Academic Career Development Award Post-Doctoral Program

In the Fall of 2016, we launched our NIH-funded Institutional Research and Academic Career Development Award (IRACDA) Post-Doctoral Program. The four-year program for each trainee scholar involves an initial three years of 75%-time research training coupled with 25%-time teaching at one of two partner institutions, Henry Ford College (HFC) and Wayne County CC District (WCCCD), followed by a fourth year working exclusively on research. Upon receipt of the award in August 2016, we initiated a search for our first group of fellows. We obviously had limited lead time, but we were able to attract two excellent scholars – Drs. Victor Cazares and Wylie Stroberg. Year two of the program started in August 2017 with a robust cohort of four – Drs. Delawrence Sykes, Jen Judge, Neda Nourabadi and Zoe Thompson. The faculty coordinators and the group of teaching mentors at both institutions have been nothing short of excellent.

Dean Patricia Hurn at IRACDA Symposium

In an effort to increase the impact of our IRACDA program, we held Outreach Symposiums for students from both HFC and WCCCD on April 8 and November 11 of this year. In coordination with our Center for Education Outreach, we rented buses to bring in students and faculty mentors from both partner institutions for symposium at the University of Michigan. We welcomed the Deans of Engineering and of Nursing, presented some general science talks, provided information on career choices and transferring to a 4-year college in addition to the well-received student panel made up of transfer students to the U. Overall, we feel this was a tremendous success and we look forward to repeating this in the years ahead.

Last summer we recruited 6 students (3 from HFC and 3 from WCCCD) for a 12-week research internship at the University of Michigan. The financial support for this program comes entirely from University of Michigan funds, and it provided the opportunity for these first- and second-year students to get hands-on experience in a research lab. Students were placed in the labs of our IRACDA research mentors, in other labs, and when possible, worked directly with our IRACDA fellows.

Christin Carter-Su Collegiate Professorship

Thanks to the generous support of our donors, we will be able to honor one of the first women independently recruited to the Department of Molecular & Integrative Physiology as a faculty member, Dr. Christin Carter-Su, by inaugurating the Christin Carter-Su Collegiate Professorship in Physiology.

Dr. Carter-Su is the first of our female faculty to have a named Collegiate Professorship in her honor. She received her Ph.D. from the University of Rochester in New York. She did postdoctoral fellowships at the University of Rochester and Brown University. She was recruited here from Brown and rose through the ranks, reaching full professor in 1992. Dr. Carter-Su's ground-breaking research on endocrinology and signal transduction led to our current understanding of the molecular mechanism of growth regulated by the pituitary growth hormone. She has also served the University of Michigan Medical School community as Associate Director of the Michigan Diabetes Research Center since 1997. In 2012, she was endowed as the Henry Sewall Collegiate Professor of Physiology, and in 2013 named the Anita H. Payne Distinguished University Professor of Physiology. Dr. Carter-Su may well have been an important part of our department impact on you; she mentored more than 50 undergraduate students, 15 graduate and medical students, and 25 postdoctoral fellows, as well as many colleagues for decades.

The Christin Carter-Su Collegiate Professorship in Physiology will be the first endowed professorship established in honor of a female faculty member not only in our department, but in any basic science department at the University of Michigan Medical School. It will be awarded to a distinguished member of our faculty, or to recruit an exceptional individual to join our faculty. The collegiate professorship will provide annual discretionary research support that can be used for innovative, high-risk research projects.

I am greatly humbled that my friends and colleagues have honored my contributions to cell physiology research and the University of Michigan with this endowed chair. I hope that this chair will facilitate others to make that great discovery, as well as inspire other basic science departments to honor the contributions of their women faculty.

Dr. Christin Carter-Su

THE DEPARTMENT OF MOLECULAR & INTEGRATIVE PHYSIOLOGY PHILANTHROPY FUNDS

We hope our successes this past year make you proud of the University of Michigan Department of Molecular & Integrative Physiology. Our philanthropy funds play a key role in strengthening our department, faculty, and trainees. We hope you will play part and join many others in supporting Molecular & Integrative Physiology by making a gift to the funds below:

Graduate Education Fund in Physiology: Your gift will propel the development of future biomedical researchers currently enrolled in the Molecular & Integrative Physiology PhD Program. These individuals are studying the mechanistic basis of human diseases such as cancer, diabetes, and obesity. Donate online on ***http://victors.us/mipgraduate***

John and Margaret Faulkner Lectureship.: You will be supporting an annual lectureship by a prominent invited speaker selected by the students and faculty in honor of John and Margaret Faulkner. Donate online on ***http://victors.us/faulknerfund***

Louis G. D'Alecy Fund: You will be supporting the future establishment a new endowed professorship honoring Dr. D'Alecy's contributions. Dr. D'Alecy has dedicated his research career to classical physiology research working at the bench to investigate fundamental mechanisms of cardiovascular physiology using challenging in vivo and in vitro approaches. He has also been an outstanding teacher of medical and graduate students. Donate online at ***http://victors.us/louisdalecyfund***

Master's Education Fund in Physiology: The MS in Physiology is designed for students who plan to pursue employment in a research laboratory, or to continue their education as PhD, medical, dental or other health professional schools. Your gift will provide financial assistant to master students. Donate online at ***http://victors.us/mipmaster***

Physiology Summer Research Fellows Fund: Your gift will support undergraduate students that are interested in research in physiology and/or biomedical sciences. This fund provides financial support to summer research fellows, their research and the summer program activities. Donate online at ***http://victors.us/mipsummer***

SEEK Fund: The Science Engagement and Education for Kids is an outreach effort driven by the physiology students and department members to promote science in the community. This fund supports the development of outreach educational program and outreach activities. Donate online on ***http://victors.us/mipseek***

If you would like to discuss making a major donation to any of the above funds, leaving a gift for us in your will, or offering a pledge or gift of appreciated stock, please contact Chrissy Barua, our development officer, at 734-763-4938, or ***cebarua@umich.edu***.

We want to say thank you for your generous donations! Working together, we can continue to achieve our goals!