

Letter from the Chair

Highlights in Pharmacology from 2017

Greetings from the University of Michigan Department of Pharmacology!

We have had another very successful year in our department. I am excited to update you on our recent accomplishments and our plans for the future.

Edward F. Domino Research Center:

An exciting new venture in our department is the opening of the Edward F. Domino Research Center. The Center, named in honor of Dr. Ed Domino, who has been on our faculty for over 50 years, was conceived by Dr. John Traynor (Associate Chair for Research), who will be the center's founding director. Initial start-up funds for this center have been generously provided by Dr. Marschall Runge, Dean of the Medical School, Executive VP for Medical Affairs and CEO of Michigan Medicine. Research in this center will use pharmacology and related sciences to tackle the problems of drug misuse and addiction, initially aimed at the current opioid epidemic. Members of the center will work on projects to provide treatments for overdose reversal, novel medications to manage addiction and the development of non-addicting pain relieving agents. Other Michigan Pharmacology faculty members involved in the Center's research effort in addition to Dr. John Traynor are Drs. Alan Smrcka, Manoj Puthenveedu, Emily Jutkiewicz, Carrie Ferrario, Henry Mosberg, and Margaret Gnegy (Associate Chair for Education) who will also act as liaison for local outreach efforts. Please read more on this on pages 8-9 of this issue.

New faculty: Please join us in welcoming two outstanding new faculty members to our department. Their profiles are featured in page three of this issue.

Dr. Manoj Puthenveedu: Dr. Puthenveedu, who came to Michigan Pharmacology on July 1 from Carnegie Mellon University, is an internationally recognized expert in the molecular pharmacology of G protein coupled receptors (GPCRs). He is an excellent GPCR biologist who focuses on developing innovative optical microscopy and molecular genetic techniques to study receptor trafficking and signaling in real time. Dr. Puthenveedu's research has significantly advanced the field of molecular pharmacology in our understand-

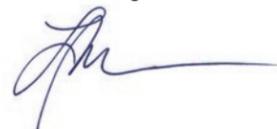
ing of the fundamental mechanisms underlying signal transduction by catecholamine and opioid receptors. He has contributed substantially to teaching undergraduate and graduate students and trainees in the laboratory as well as in the classroom. His accomplishments and scientific reputation are outstanding, as reflected by his broad publication record, his continuous extramural grant funding, and his receipt of national and international awards.

Dr. Carole Parent: Dr. Parent joined Michigan Pharmacology on August 1 as the inaugural Raymond W. Ruddon Collegiate Professor of Cancer Biology and Pharmacology. She arrived from the National Cancer Institute at NIH, where she served as Deputy Director of the Center for Cancer Research. Dr. Parent is an excellent cellular pharmacologist who studies the signaling pathways that regulate cell migration. Her research has provided many breakthroughs in our understanding of the signaling relays that control motility in both simple organisms and complex mammalian systems. Her research has far-reaching impacts on diverse physiological processes such as embryonic development, inflammation, immunity, tissue repair, and cancer metastasis. Dr. Parent has an extensive publication record, has won numerous awards and honors, has chaired multiple conferences on cell migration, and serves on the editorial board of several prestigious journals. She is an internationally recognized thought leader in the field.

Since 2014, our ranking has improved from 34th in the nation of NIH-funded Departments of Pharmacology to 14th! As we continue to strengthen the stature of our departmental community in terms of research, training, and national service, we are conducting faculty searches in the areas of Cancer Pharmacology/Oncology, Precision Medicine, Cardiovascular Pharmacology, Structural Biology, and Substance Abuse.

I hope you enjoy reading our newsletter. I invite you connect with us by email, social media, or in-person! Go Blue!

With kind regards,



Lori L. Isom, Ph.D.

Maurice H. Seevers Professor and Chair of Pharmacology



Lori L. Isom, Ph.D.

New Faculty Profiles



Manoj Puthenveedu, M.B.,B.S., Ph.D.

Associate Professor of Pharmacology

Education and Training

Postdoctoral Training, 2005-09
University of California, San Francisco

Ph.D., 1999-2004
Carnegie Mellon University, Pittsburgh, PA.

Junior Research Fellow, 1996-98
National Center for Biological Sciences, Bangalore, India

M.B.,B.S., (equivalent to an M.D.) 1989-96
Government Medical College, Calicut, India

Most recent appointment

Associate Professor, Biological Sciences, Carnegie Mellon University, Pittsburgh, PA

Notable awards, funding, and honors

Dana Foundation Awardee, 2017-20
Curci Foundation Awardee, 2016-18
Newsmaker, The Pittsburgh Tribune, 2016
Editorial Board Member, Traffic, 2016-present
Editorial Board Member, Matters, 2015-present
Heinz Endowment Awardee, 2015-17
Winters Foundation Awardee, 2015-16
BrainHUB ProSEED Awardee, CMU, 2015-16
Keynote Speaker, CMINDS Annual Symposium, Pennsylvania State University, 2015
Review Editor, Frontiers in Cell Biology, 2013-present
American Heart Association BGIA Awardee, 2013-15
Postdoctoral Association Invited Speaker, ETH, Zurich, 2013
Eberly Family Professorship, CMU, 2013
Invited Speaker, GI Core Center Inaugural Symposium, Johns Hopkins University, 2012
Federal Funding Recipient (NSF, NIH R01, R21, K99/R00 Pathway to Independence) 2008-current
National Merit Scholar, Government of India, 1989
National Merit Fellow, Government of India, 1987



Carole Parent, Ph.D.

Raymond W Ruddon Collegiate Professor of Cancer Biology and Pharmacology
Professor of Pharmacology
Adjunct Research Professor, Life Sciences Institute

Education and Training

Senior Leadership Program, 2013
National Institutes for Health

Postdoctoral Training, 1992-96
Johns Hopkins University, Baltimore, MD

Ph.D., 1988-92
University of Illinois at Chicago, Chicago, IL

B.Sc. and M.Sc., 1981-87
Université de Montréal, Montréal, Québec, Canada

Most recent appointment

Deputy Director, Center for Cancer Research, National Cancer Institute, NIH, Bethesda, MD

Notable awards, funding, and honors

NCI Director's Awardee, 2016
Editorial Board Member, PLoS Biology, 2016-present
Federal Technology Transfer Awardee, 2015 & 2016
Johns Hopkins University Society of Scholars, 2015
Chair, Directed Cell Migration Gordon Conference, 2015
Arthur S. Flemming Awardee, 2013
Editorial Board Member, Current Opinion in Cell Biology, 2011-present
Mini Symposium Chair, Cell Motility and Migration, ASCB Annual Meeting, 2010
Editorial Board Member, Science Signaling, 2008-16
NIH Merit Awardee, 2006 & 2012
Associate Editor, Molecular Biology of the Cell, 2006-present
Mini Symposium Chair, Cell Motility and Migration, ASCB Annual Meeting, 2005
NCI Intramural Funding Awardee, 2000-2017
MRC Postdoctoral Fellowship Awardee, 1993-1996
FCAR Graduate Studentship Awardee, 1990-1992

Featured Accomplishments

Jessica Anand (Postdoc, Jutkiewicz lab), Best Oral Presentation, Behavior, Biology, and Chemistry: Translation Research in Addiction Meeting

Richard Auchus (Faculty), Elected to Association of American Physicians

Mark Cohen (Faculty), Excellence in Curriculum Innovation in Entrepreneurship at the Deshpande Symposium Awards

Amanda Davis (Student, Osawa lab), Best Oral Presentation, Annual Pharmacology Research Colloquium

Chad Frasier (Postdoc, Isom lab), 2017 American Epilepsy Society's Early Career Award

Kevin Jones (Faculty), University of Michigan Neuroscience Scholar, Joint Neuroscience Committee

Kathleen Ignatoski (Research Staff, Jenkins lab), 2nd place in Alfred Taubman art competition for cover of the Alfred Taubman abstract book for the symposium. Picture accepted for Bioartography portfolio.

Jorge Iñiguez-Lluhí (Faculty), University of Michigan Endowment for the Basic Sciences Teaching Award

Lori Isom (Faculty and Chair), Javits Neuroscience Investigator Merit Award, NIH and NINDS

Andrew Nelson (Student, Jenkins lab), Best Poster Presentation, Annual Pharmacology Research Colloquium; 1st Place Graduate Student Poster Award, Silverman Research Conference, Department of Psychiatry; Best Poster Award, 10th Annual Translational Research Institute Scientific Retreat

Joel Maust (Student, Leopold and Wang labs), Dr. Benedict and Diana Lucchesi Graduate Education Fellowship

Les Satin (Faculty), Award for Sabbatical Research, Wenner-Grenn Research Foundation of Sweden, Uppsala University

John Traynor (Faculty), Founders Lectureship, International Narcotic Research Conference

Below Left: Jorge Iñiguez-Lluhí, Ph.D. and Lori Isom, Ph.D.

Below Right: Carrie Ferrario, Ph.D.

Right: "Building a Wall" from the 2017 UM Bioartography collection



Michigan Pharmacology Bags Several Awards and Accolades at the 2017 American Society for Pharmacology and Experimental Therapeutics (ASPET) Meeting

Rachel Altshuler (Student, Gnegy and Jutkiewicz labs), 2nd in the Behavioral Pharmacology Division Best Abstract Competition

Colleen Carpenter (Student, Gnegy lab), 2nd in the Neuro Pharmacology Student-Postdoc Poster Competition

Megan Hawley (Postdoc, Holinstat lab), Special Presentation Category Award for the Trainee Showcase Competition (among all graduate students and postdoctoral fellows) in the Translational and Clinical Pharmacology Division Event

Hannah Stoveken (Postdoc, Tall lab), 1st place ASPET postdoctoral poster award for Molecular Pharmacology.

Benjamin Tourdot (Postdoc, Holinstat lab) 1st place, Postdoctoral Fellow Poster competition, Translational and Clinical Pharmacology Division

Jennifer Yeung (Student, Holinstat lab), 1st Place for the Trainee Showcase Competition (among all graduate students and postdoctoral fellows) in the Translational and Clinical Pharmacology Division Event

Carrie Ferrario (Faculty), Early Career Investigator Award, ASPET Division for Neuropharmacology

Peggy Gnegy (Faculty), Elected as Secretary/Treasurer of ASPET

Alan Smrcka (Faculty), Elected as Councilor of ASPET

Greg Tall (Faculty), ASPET Outstanding Leadership Award in Molecular Pharmacology.

Trailblazer for Women Scientists: Dr. Peggy Gnegy

By Shoba Subramanian, Ph.D.

An almost 28-year old, fearless female scientist Margaret (Peggy) Gnegy, Ph.D. was the first woman hired on the instructional track faculty at Michigan Pharmacology, in 1977, when Jimmy Carter was in the first year of his presidency. Back then, women professors in the tenure track were almost non-existent. Gnegy, now Professor and Associate Chair for Education at Michigan Pharmacology, recalls one of the main challenges then as a lack of "real" role models to look up to. She credits Anita Payne, Ph.D., who died in 2009, a reproductive endocrinologist and university professor at the University of Michigan, as a role model in her career. It was almost 20 years since Gnegy's appointment, till the next woman faculty Lori Isom, Ph.D. (now Professor and Chair of Pharmacology) was hired in the mid-90's. Around the same time as Isom's hire, Donna Shewach, Ph.D. transitioned from a research track to become a tenure track faculty member in the department. Poor representation of women and minorities in STEM careers, including tenure track, is an issue that continues to be a national challenge 40 years later. In Michigan Pharmacology, currently, almost 30% of primary tenure track faculty are female, which is a significant change from 1977! Although extremely proud of the existing gender diversity at Michigan Pharmacology, both Gnegy and Isom agree that there is much more work to be done to bridge the gender gap in developing future women leaders in the scientific enterprise. Impressively, over these 40 years, Gnegy has been relentless in building means and pathways toward empowering young women in scientific research and has made strides in Michigan for recruiting and retaining diversity in science. "I have the greatest job in the world", Gnegy said. At the same time, research conducted in her lab has made lasting contributions to science. Gnegy's passion and commitment to this noble cause of nurturing and mentoring women scientists has not gone unnoticed.

Carol Stratford, a successful patent lawyer, who earned her PhD from Michigan Pharmacology followed by a law degree while being a mother, felt that she owes much of her triumphs to Gnegy. Gnegy's constant guidance during and after her Michigan days has been an important influence in Stratford's life. Stratford was a Michigan Center for the Education of Women (CEW) scholar during her graduate training, and she decided that there is no better way to pay it forward to future women trainees and to celebrate Gnegy than by creating a new CEW scholarship fund named after Gnegy, the "Margaret E. Gnegy Scholarship".

Erica Cooper is the inaugural recipient of the Margaret E. Gnegy Scholarship in 2017. Working on a Navajo reservation between her MPH and PhD years at the University of Michigan, Cooper is committed to studying global health problems with a focus of maternal and child nutritional interventions. This an apt tribute to Gnegy, whose lifetime goal has been to improve the lives of women, and who believes and lives her motto "Women have to support each other!"



Above: Peggy Gnegy, Ph.D., Erica Cooper, Carol Stratford, Ph.D.

Dr. Gnegy's Impact by the Numbers

- 15 Female doctoral students trained
- 6 Female postdoctoral fellows trained
- 7 Faculty mentored
- 98 Peer reviewed manuscripts published
- 12 Chapters in books published

Mentoring Accolades

2009, Rackham Faculty Mentoring Award
2012, Basic Science Teaching Award in Pharmacology

Education and Training

- 1967-1971 West Virginia University, B.S. (Chemistry—Cum Laude)
- 1971-1975 West Virginia University, Ph.D. (Biochemistry) Fellowship - National Defense Education Association
- 1974-1977 Staff Fellow, Laboratory of Preclinical Pharmacology, Division of Special Mental Health Research, National Institute of Mental Health, Saint Elizabeth's Hospital, Washington, D.C.

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UM Pharmacology Celebrates 125th Anniversary

Three day celebration honors nation's oldest Department of Pharmacology

By Nicholas Griggs and Nicole Michmerhuizen

Last fall, Pharmacology at the University of Michigan celebrated its 125th anniversary. As the oldest Department of Pharmacology in North America, we take milestones pretty seriously. Before bringing back some Wolverine nostalgia—in regards to our 3-day celebration last fall—let us rewind the clock just a bit further...

In 1891, John Jacob Abel established the first Department of Pharmacology in the US at the University of Michigan. Prior to this, Abel had earned his Bachelor of Philosophy from the University of Michigan in 1883 and held academic appointments at Johns Hopkins University and research institutions across Europe. Although Abel's tenure at the University of Michigan was only for several years, the enduring legacy of the 'Father of American Pharmacology' has lived on for more than a century in the UM Pharmacology department.

A 3-day anniversary celebration for alumni and current members of the UM Pharmacology department officially started on Thursday, September 29th, 2016. Our chair, Dr. Lori Isom, and the current graduate students honored tradition by participating

in annual meetings with the Alumni Steering Committee (ASC). This esteemed group of UM Pharmacology graduates is chaired by Dr. Robert Gussin, former Chief Scientific Officer of Johnson & Johnson. The ASC generously offers input regarding the direction of the department and serves as a resource and network for students during their time in Ann Arbor and throughout their careers.

On Thursday evening, the ASC members joined many other UM Pharmacology department alumni, as well as current faculty, staff and students for an extravagant dinner at the Michigan football stadium; affectionately known as 'The Big House'. After walking tours of the players' locker rooms, guests enjoyed cocktails and dinner at the prestigious Jack Roth Stadium Club. To kick things off, Drs. Isom and Gussin highlighted the past, present, and future successes of UM Pharmacology. Dr. Marschall Runge, Dean of the University of Michigan Medical School, then presented the Edward F. Domino Professorship to Dr. John Traynor. This endowed professorship was announced by Dr. Gussin in September 2015 and honors the incredibly successful career of Dr. Domino, who came to the University of Michigan as an assistant professor in 1954. Dr. Domino was a pioneer in elucidating the therapeutic effects of the dissociative anesthetic ketamine, and ever since he has contributed immensely to the field of neuropsychopharmacology. As the Edward F. Domino Professor of Pharmacology, Dr. Traynor will continue in Dr. Domino's footsteps, serving as the director for a new addiction research center focusing especially on the study of opioid drugs and opioid addiction.

Recognition of the Edward F. Domino Research Professorship continued on Friday at the Rackham Graduate School, with sincere remarks by Dr. Domino followed by the inaugural address



given by Dr. Traynor. Reflections on the prosperous 125-year history of UM Pharmacology were led by Dr. Raymond R. Ruden, who shared stories from his experiences as a PhD student, faculty member and department chair at UM Pharmacology. Over lunch, students presented their research at a poster session, after which came the annual Outstanding Alumni Keynote address and a panel discussion on the direction of the department as a whole. Dr. Glenn Triesman, a 1986 UM Pharmacology graduate and current AIDS Psychiatry Service Director and Professor of Psychiatry and Behavioral Sciences at Johns Hopkins University, was selected as the 2016 Outstanding Alumni recipient for his accomplishments in the study of mental illness and in HIV positive populations. Commemorative events continued into Friday night with bowling and a private dinner at Zingerman's Roadhouse for ASC members.

The weekend of festivities concluded on Saturday, when past and present UM Pharmacology students and faculty joined once more to hail not only the department but also the University as a whole. Dr. Isom hosted a tailgate party at her home prior to the afternoon football game against the University of Wisconsin. The Wolverines came away with a win, defeating

Wisconsin 14-7 to end the weekend on a high note.

As current PhD students in the UM Pharmacology department, it was an incredible honor to be part of this celebration. Standing as part of the largest group of trainees of any pharmacology department in the nation—a group that includes executives of pharmaceutical companies, deans and department chairs at esteemed universities, research directors and government executives—is both humbling and motivating. And yet, beyond the academic rigor and scientific success of UM Pharmacology and its alumni, we have a concern for our society that is second to none. John Jacob Abel would certainly have been proud. This commitment to 'healing through discovery' is obvious not only in landmark anniversary years but also in the everyday research laboratories, seminars, grant writing, coursework, and conferences. It is what makes Michigan the first and the best and will push us to new heights in the years ahead.



Edward F. Domino Research Center: Next Generation Science

By Veronica Taylor, Ph.D.

All Scientific Hands on Deck! called NIDA Director Nora Volkow and NIH Director Francis Collins in an article discussing the role of scientists in today's opioid crisis. The negative effects of addiction and overdose due to opioid painkillers have touched all demographics across the United States, even warranting legislation such as the Comprehensive Addiction and Recovery Act (CARA) which appropriated \$181 million a year to address issues of opioid use. To briefly understand how this crisis came about, one must look to the 1990s when prescriptions for opioid painkillers escalated in response to criticism that pain was being undertreated. Unfortunately, the future implications of the addictive nature of these opioid drugs was not considered. Similarly, cocaine was also once considered safe, even being used in the late 1800s for the original Coca-Cola recipe. That perception has now clearly changed, with a 2014 government study showing that about 913,000 Americans met criteria for cocaine abuse or dependence in the prior 12 months, yet currently there are still no FDA approved treatments to treat cocaine addiction. In current discussion, marijuana legalization has become an increasingly debated political issue, and critical questions about its effects and regulation must still be answered to best assure public health in the future. One common theme through these examples is that our knowledge of drugs and addiction disorders is often imperfect. It is evident that science must continue to address the gaps in knowledge and, such as in the case of opioids, time is of the essence.

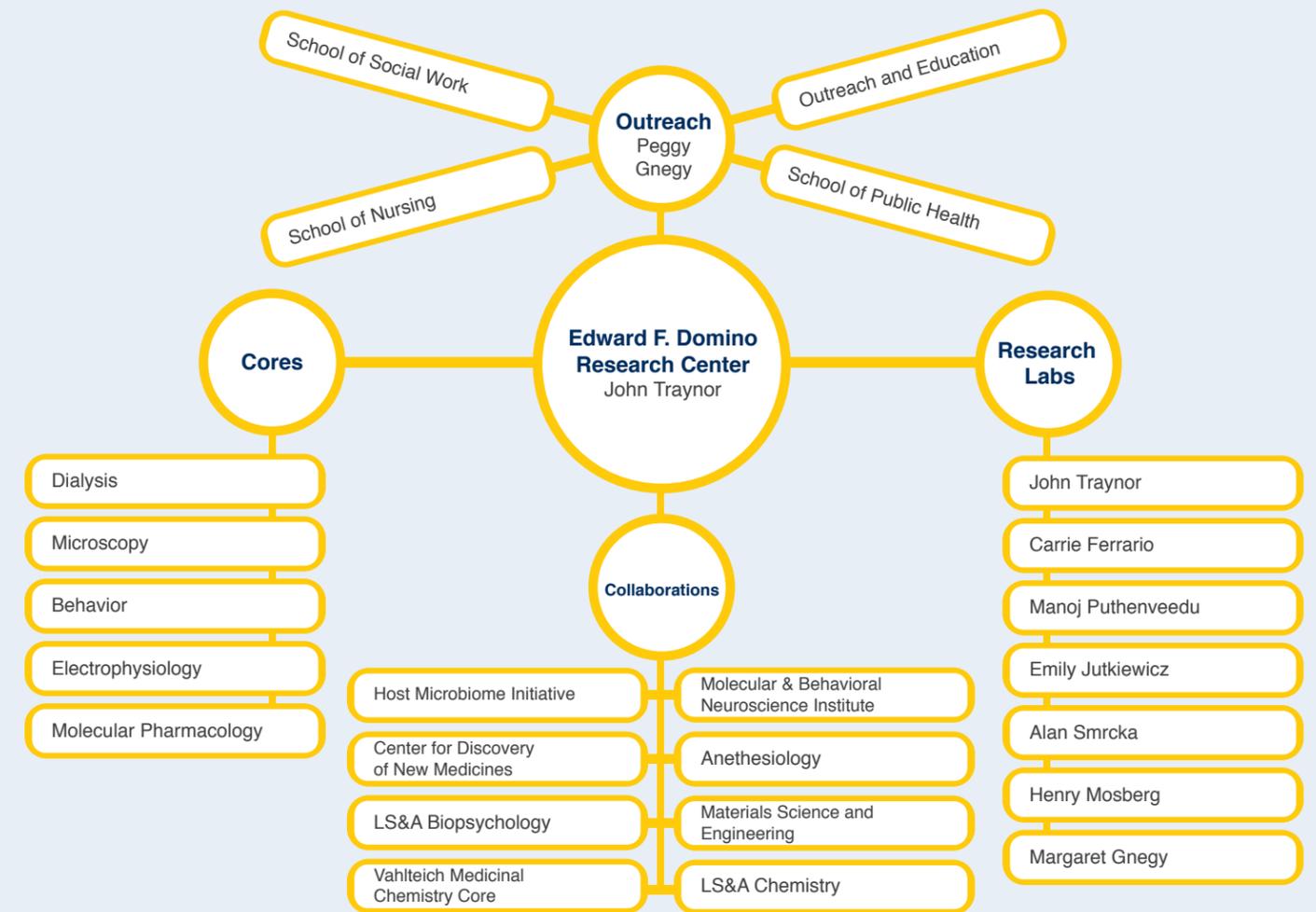
But who will answer the call to answer these difficult questions? Since the days of Professor Maurice Seevers, the Department of Pharmacology has long held a role as an international hub of excellence for drug abuse research. Seevers was an expert in anesthesiology and drug dependence, serving as Chairman to the department from 1942-1971. In support of this, the department also has a long history of NIDA funding, including the Biology of Drug Abuse Training Program for postdoctoral fellows led by John Traynor, Ph.D., Associate Chair of Research at Michigan Pharmacology. To these trainees and to the many who have worked in his lab, Traynor has been able to offer over 25 years of experience in opioid research. He is former president of the International Narcotics Research Conference and the former Director of the University of Michigan Substance Abuse Research Center. It is therefore fitting that Traynor would conceive the idea of establishing a center at UM to address society's need for more evidence-based medications for addictive disorders. Created with initial start-up funds provided by Marshall Runge, M.D., Ph.D., Executive Vice President for Medical Affairs, CEO of Michigan Medical, the new Edward F Domino Research Center is named in honor of Ed Domino, M.D. (Emeritus Professor) who served over 50 years as a member of the Pharmacology faculty. Domino is an apt namesake for the center not only for his service to the department but also



Top (L-R): Ed Domino, M.D., Lori Isom, Ph.D., Patricia Gussin, M.D., Bob Gussin, Ph.D.
Bottom Left: Marschall Runge, M.D., Ph.D.
Bottom Right: John Traynor, Ph.D.

because his research encompassed various aspects of neuropsychopharmacology, including opioids as well as tobacco and marijuana dependence. As Director, Traynor has made the mission of the center to be the use of pharmacology and related sciences to address drug abuse and addiction disorders of all types. While the initial focus will be on the opioid crisis, Carrie Ferrario, Ph.D. (Assistant Professor) will also spearhead future center projects related to stimulants and food.

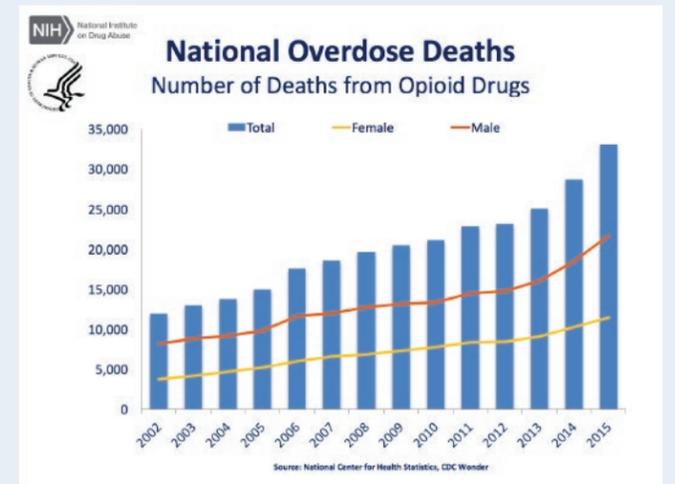
The center will be well-equipped to take a multi-faceted approach to addressing the need for better overdose reversal, opioid addiction management and development of safer pain management methods. Several newly created cores will be available within the areas of behavioral studies, microscopy, dialysis, electrophysiology, and molecular pharmacology. Additionally, Margaret Gnegy, Ph.D., Associate Chair for Education will act as liaison to the School of Social Work, the School of Nursing, and other outreach and education efforts. Gnegy's



outreach is part of a larger plan of current and potential collaborations by the center across the University of Michigan campus. These collaborations may provide expertise and skill, such as small-molecule synthesis by the College of Pharmacy Vahlteich Medicinal Chemistry Core or LS&A Chemistry. Other collaborations may provide a crucial exchange of information and feedback for bench-to-bedside research, such as the Michigan Opioid Prescribing Engagement Network (Michigan-OPEN).

Tackling addiction is an overwhelming task, but the Edward F Domino Research Center promises to be an exciting endeavor for the University of Michigan in using pharmacology to benefit society. The center showcases the range of talent in the Pharmacology department and its ability to draw upon the rich resources and collaborations across the university.

Help us tackle addiction and fast track research at: <https://victors.us/dominoresearchcenter>



National Overdose Deaths—Number of Deaths from Opioid Drugs. The figure above is a bar chart showing the total number of U.S. overdose deaths involving opioid drugs from 2002 to 2015. Included in this number are opioid analgesics, along with heroin and illicit synthetic opioids. The chart is overlaid by a line graph showing the number of deaths of females and males. From 2002 to 2015 there was a 2.8-fold increase in the total number of deaths.

Staff Awards



Dennis Ondreyka (center), Department Administrator, celebrated 40 Years of service in the Medical School.



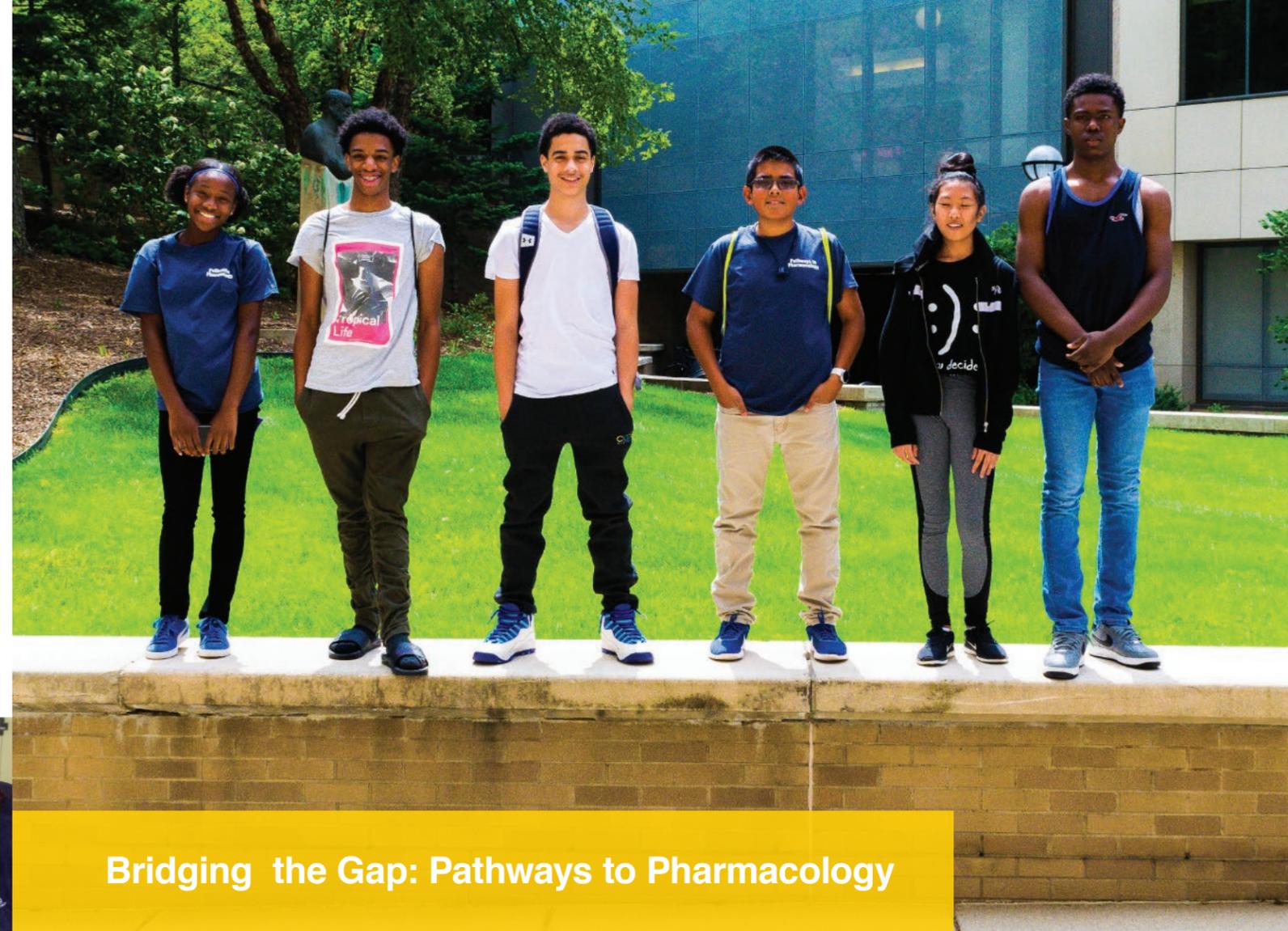
Thomas Larmee, from the Pharmacology Shop, celebrated 45 Years of service in the Medical School.



Lisa F. Garber, Education Coordinator, won the "Professional Staff of the Year" award as part of the Medical School Dean's Awards.

“What I love most about working in Pharmacology is partnering with trainees to make the most of their time at Michigan.”
—Lisa Garber

2017 Annual Departmental Retreat



Bridging the Gap: Pathways to Pharmacology

Collaboration with Wolverine Pathways Program Creates New Joint Program

By Alexandra Bouza

This year the Department of Pharmacology collaborated with the Wolverine Pathways program to create a new joint program, Pathways to Pharmacology. Wolverine Pathways is a program that partners with families and schools from Detroit, Southfield, and Ypsilanti to provide middle and high school students with learning experiences to help these students succeed in college

and beyond. Students who successfully complete the rigorous, year-round programming and are admitted to the University of Michigan (UM) receive a full, four-year tuition scholarship to UM.

Women and minorities are traditionally underrepresented in science, technology, engineering, and math (STEM). Pathways to Pharmacology aimed to help increase diversity in STEM by providing five weeks of biomedical education and laboratory experience to six rising ninth grade students from Ypsilanti and Southfield. Students learned the fundamental concepts of cell and molecular biology and how underlying dysfunctions in a cell can lead to disease. They were also introduced to how pharmacological agents can hijack underlying cellular mechanisms to treat disease states. Didactic lecture provided by numerous graduate students in the Department of Pharmacology allowed the students to gain the necessary knowledge to conduct their own experiments alongside graduate students and faculty members. Experiments included predicting deoxyribonucleotide (DNA) size after restriction digest by using the principles

“The pathways to pharmacology program has taught me so many scientific terms and devices and has really developed my passion for science.”

—Wolverine Pathways Student Participant

(Continued on back cover)



(Bridging the Gap: Pathways to Pharmacology. Continued from page 11)

of gel electrophoresis, identification of proteins by western blot, and subcellular localization of exogenously expressed proteins by fluorescent microscopy. Students also learned basic optics, how to build their own microscopes, and some of the innovative optical technologies used in biomedical research.

The primary goal of the five-week experience was to challenge the students' critical thinking skills and excite them about the fundamental questions of nature. Studies have shown that early exposure to science can help to maintain students' interest in STEM fields and build confidence to reduce social barriers to pursuing a STEM-based education and career. Long-term, we aim to expand this program to other departments within the medical school, amplifying our ability to incorporate as many students as possible. When asked to reflect on their summer experience, one student stated, "the pathways to pharmacology program has taught me so many scientific terms and devices and has really developed my passion for science" and five out of six students finished with the goal of pursuing various STEM-based careers. Ultimately, we hope opportunities through the Pathways to Pharmacology program, and others of its kind, increase diversity in STEM.



Support Graduate Education at Michigan Pharmacology

Your donations fund learning and training opportunities for our outstanding graduate students, enabling them to advance their knowledge and enhance their skills in basic science research in varied and complex areas of study.

<http://victors.us/pharmacologygradfund>



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Executive Leadership of Michigan Medicine: Marschall S. Runge, M.D., Ph.D., Dean, Medical School; Executive Vice President for Medical Affairs, U-M; and CEO, Michigan Medicine; Carol R. Bradford, M.D., Executive Vice Dean for Academic Affairs, Medical School; Bishr Omary, M.D., Ph.D., Executive Vice Dean for Research and Chief Scientific Officer, Medical School; David A. Spahlinger, M.D., Executive Vice Dean for Clinical Affairs and President, Michigan Medicine

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