

IPPH NEWSLETTER INDUSTRIAL & PHYSICAL PHARMACY



June 2017

Dear Alumni and Friends;

On July 1st, after eight years as Department Head, I'll be stepping down to return to the faculty. IPPH has accomplished a great deal during that time, and we have so much to be proud of. We've hired outstanding new faculty members and a terrific staff. Through a series of renovations, we've made significant improvements in the quality of our lab space. Between 2009 and 2015, we tripled our extramural research funding, surpassing that of the other departments in the College (which are three times our size). We've started new research initiatives in pharmaceutical solids, drug delivery, and pharmaceutical manufacturing. And we've trained more than 45 graduate students, 50 postdocs and 80 visiting scientists, most of whom have gone on to careers in the pharmaceutical industry, in regulatory agencies and in academia.

In the coming year, Dr. Tonglei Li has graciously agreed to serve as Interim Department Head. An alum of our Ph.D. program, Tonglei is the Allen Chao Chair and a Professor in our department. He's recently completed a term as the Associate Dean for Graduate Programs in the College of Pharmacy, too, so he's both an accomplished researcher and an experienced administrator. I'm confident that Tonglei will lead us well in the weeks and months ahead. We expect a national search for a permanent Department Head to begin in the fall.

They say that the jobs we do change us. Like Elphaba in *Wicked*, I do believe I have been changed for the better by my years as IPPH Department Head; I know I have been changed for good. It's been a great pleasure and privilege to lead the department and to get to know many of you. I look forward with tremendous optimism to the next chapter in our history. Boiler up!

Liz Topp
Dane O. Kildsig Chair and Department Head



FACULTY HIGHLIGHTS

Dr. Ray Galinsky is retiring from Purdue University on June 30, 2017. He has been a member of IPPH for more than twenty years, contributing to research, teaching and services, most notably in the area of pharmacokinetics.

Dr. Greg Knipp has been appointed Director of the Purdue Translational Pharmacology (PTP) Core Facility by the Bindley Bioscience Center. As Director, he will assist with experimental design and provide guidance to the core facility. The two-year appointment recognizes the considerable contributions Greg has already made to the PTP in an unofficial capacity.

Dr. Tonglei Li will be the interim Department Head for IPPH beginning on July 1, 2017.

Dr. Lynne Taylor received an award from the Office of the Executive Vice President for Research and Partnerships at Purdue University. The award is part of the University Core Facility Research Equipment Program, and will enable Dr. Taylor to purchase an on-line UPLC with on-line SPE technology.

Dr. Yoon Yeo has been appointed to the editorial advisory board of the *Journal of Controlled Release*. Editorial advisory board members provide the editors with guidance on the direction and publishing priorities of the journal. Membership thus is a recognition that the individual is considered a thought-leader in the field.

Dr. Yoon Yeo celebrated her 10th anniversary as an IPPH faculty member. A YouTube of the anniversary festivities was created by student, Joonyoung Park and can be viewed at <https://youtu.be/VHJDFP3uejw>



GRADUATE STUDENT and POST DOC HIGHLIGHTS



Ahmed Elkhazab (Taylor group) has received a travel grant from Purdue Graduate Student Government (PGSG). The award will help to cover costs to attend the 2017 Gordon Conference.



Hyesun Hyun (Yeo group) was selected to receive a 2017 AAPS Travelship from the Formulation and Drug Delivery (FDD) section. The travelship helped support Hyesun's attendance at the National Biotechnology Conference in San Diego, CA.



Anura Indulkar (Taylor group) has been selected to receive a Bilslund Dissertation Fellowship for the summer 2017 semester.



Dana Moseson (Taylor group) was awarded a Graduate School Summer Research Grant. The grant provides this first-year graduate student with two months of thesis research support for this summer.



Laura Mosquera-Giraldo (Taylor group) received a Chaney Graduate Student Travel Award of \$1500 from the College of Pharmacy. The award helped her attend the American Chemical Society National Meeting in San Francisco, CA.

Dr. Naila Mugheirbi (Taylor group) has been selected to receive a postdoctoral fellowship in pharmaceuticals from the Pharmaceutical Research and Manufacturers of America Foundation. This fellowship was awarded on the basis of a competitive proposal.



Aimable Ngendahimana (Knipp group) received the Graduate Teaching Award from the Teaching Academy at Purdue University. The award was presented at the Celebration of Graduate Teaching Ceremony on April 25th.

Hwee Jing Ong (Pinal group) received a 2017-18 PRF grant for her proposal entitled “Beyond amorphous solid dispersions for poorly soluble drugs: Novel excipient for extending the applications of hot melt extrusion to create physically stable solid dispersions”.



Joonyoung Park (Yeo group) was the recipient of the Change Graduate Student Travel Award from the College of Pharmacy. The award will help him attend a research conference this summer.

Joonyoung Park (Yeo group) was selected to receive a Lilly Endowment Gift Graduate Research Award for his proposal entitled “Nanoparticles with high drug loading and circulation stability for systemic delivery of anticancer drugs”.

Jun Xu (Yeo group) received a 2017-18 PRF grant for his proposal entitled “Evaluation of PK/PD behavior of paclitaxel-loaded leukocyte mimetic nanoparticles”.



2017 Peck Symposium
3-Minute Thesis Competition winners

1st place: **Venecia Wilson** (Taylor group)

2nd place: **Laura Mosquera-Giraldo** (Taylor group)

3rd place: **Hwee Jing Ong** (Pinal group)



Meet Laura Mosquera-Giraldo

Fourth-year graduate student Laura Mosquera-Giraldo (**Taylor group**) is from Cali, the third largest city in Colombia. Cali is located on a valley, surrounded by mountains, and is close to the Pacific Ocean. It is also well-known as the cradle of Salsa music. Laura's interest in pharmacy was piqued while working to generate perfumes in her family's perfumery shop and soap factory. This hands-on experience, and frequent conversations with her father about history and chemistry, awakened her interest in science. Upon high-school graduation, she decided to major in pharmaceutical chemistry, because she could gather knowledge from various areas in a single major.

Laura attended Universidad ICESI in Colombia for her undergraduate work with research in neuroscience and computational chemistry. Knowing that an internship in a different field would allow her to decide the focus of her PhD, and wanting to study in the United States, Laura contacted Dr. Lynne Taylor in IPPH at Purdue University, requesting and securing a summer internship with Dr. Taylor's group. "Being at Purdue that summer was like a dream-come-true, and I will be always grateful to Dr. Taylor for that opportunity. The internship in Dr. Taylor's group was a key element in my decision to start my PhD studies at Purdue", states Mosquera-Giraldo.

Currently at Purdue, Laura, along with Dr. Taylor's group, are studying the design of polymers which can be used to stabilize amorphous solid dispersions to improve drug solubility and bioavailability. This project is interdisciplinary and involves the work of several researchers to optimize the design of new materials. Dr. Edgar's group at Virginia Tech synthesizes cellulose based polymers with various chemical features. Then, in Dr. Taylor's group, they test the performance of these materials in terms of crystallization inhibition and performance in amorphous dispersions; and based on their observations provide feedback to Dr. Edgar's group about what chemical functionalities may provide effective polymers. "I like that IPPH research is highly applicable to solve industry problems. The constant collaboration between industry and our research groups help us get exposure to the pharmaceutical industry from early stages in our career. Having a big chemistry and engineering school also allows us to learn from people with different types of expertise, which is helpful when designing and executing our projects."

Laura is working to incorporate the use of computational chemistry to assist in the process of creating new materials. She believes that the information provided from simulations can help explain differences in polymer effectiveness at inhibiting crystallization. She works with Dr. Slipchenko's group at Purdue in the design of the methodologies to run these simulations. She hopes that by the end of her project there will be a better understanding about what chemical characteristics are important to create polymers that are effective at inhibiting crystallization.

While here at Purdue, Laura has been involved in the organization of two academic events with the Colombian Student Association at Purdue (CSAP), and in a program that intends to motivate kids from middle and high

school in Colombia to pursue science and engineering careers. Laura is grateful to the large Columbian community here at Purdue because, “when you feel homesick you can just talk to some other people who make you feel like home.”

She also plays the violin and enjoys traveling, reading history and philosophy books, and watching movies.

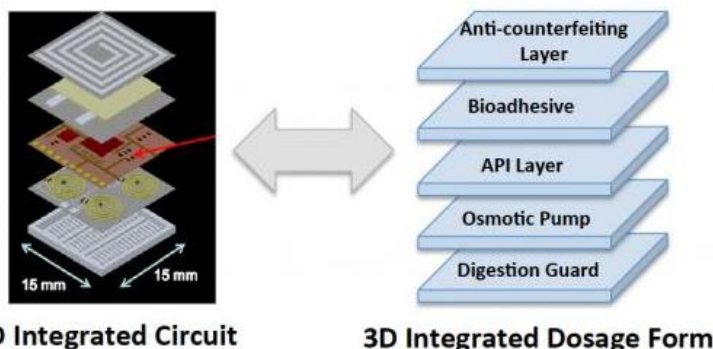


Dr. Rodolfo Pinal

Patient Centric Pharmaceuticals based on Prefabricated Components

Imagine going to the ophthalmologist today, and instead of leaving with a custom prescription to correct your vision, you were given only two prescriptions to choose from. That corrective power might help, but unless you were really lucky, it would not optimize your vision. This is the analogy that Dr. Rodolfo Pinal, Associate Professor of Industrial and Physical Pharmacy at Purdue University, uses when discussing his research and the spinout company Biokorf, which he helped found to translate his scientific findings into commercial applications. “Drug therapy is done on a one-size-fits-all basis, such that every single patient receives the same product,” says Pinal. Biokorf is working to put the focus on patient-centric medications, using a concept similar to that used with great success in the semiconductors area: integrated systems design. Pinal likens this process to stacking Legos, each with a specific pharmaceutical function.

Basic Concept of 3D IP Technology



Each part of the drug formulation is separated out into drug-carrying wafers that a pharmacist can then assemble into a personalized dosage and load it into capsules, for example. This differs from the prevalent process, *continuous production of identical copies* of the same product.

Biokorf’s current focus is on developing these pre-fabricated “Legos” for use in hormone replacement therapy, where the therapy regimen adapts to the patient, not the other way around. Dr. Pinal hopes to one day see the realization of patient-centric pharmaceuticals and be able to say, “I was involved in how this began!” The company received funding from the National Science Foundation’s I-Corps and through Purdue. Pinal credits

Purdue Research Foundation for assisting and supporting him every step of the way through the entrepreneurial process, which calls for skills that do not come naturally to him.

Dr. Pinal's emergence into the world of pharmacy is credited to a much feared ninth grade chemistry teacher in Mexico City, who was so strict, that if a student got top grades on a test, the student was brought in front of the class the next day, and faced with more questions in order to show that the high grade was a deserved one, and that luck had nothing to do with it. During this rigorous course, Pinal discovered a penchant for chemistry, and later in high school, for biology. Once at the University of Arizona, he chose to pursue pharmacy because he felt it beautifully blended his inclination toward biology and chemistry.

After graduation from the University of Arizona, and completing post-doc work at the University of Florida, Pinal spent 13 years in industry, working for Hoffman-La Roche. During his time at Roche, he encountered many "fascinating challenges" with formulation, but there was no time to delve deeply into these issues. So, when the opportunity to enter academia presented itself, Pinal leaped at the opportunity to get to explore many pending scientific questions. Why Purdue? "For Industrial Pharmacy, Purdue is it!" says Pinal.

At Purdue, Dr. Pinal's research focuses on drug solubility and solubilization. He believes that the hot melt extrusion (HME) technology is underutilized in pharmaceuticals. Pinal is exploring new applications for HME, taking it beyond the already proven success in amorphous solid dispersions. The goal is to develop novel HME formulation approaches, complementary to the existing ones.

Dr. Pinal is also the Director of the Dane O. Kildsig Center for Pharmaceutical Processing Research (CPPR), a consortium that fosters industry-academia collaboration on pharmaceutical processing-related research. Dr. Kildsig, Purdue IPPH Professor Emeritus and founder of the CPPR, was an inspiring mentor to Pinal and many Purdue IPPH students during his lifetime of teaching and leadership, from 1967 until his death in 2006. During his first year as director in 2005, Pinal requested the NSF add the "Dane O. Kildsig" eponym to the official name of the center. Pinal values the pre-competitive focus of the CPPR activities, which allow members of industry and academia to work freely and openly on large, common interest issues.

Outside of the classroom and office, Dr. Pinal enjoys reading books about the history of science, which he finds inspiring. According to Pinal, "No endeavor can be perfect unless it embraces the possibility of self-contradiction. Science is not perfect, but it is resolutely introspective, creating a path where truth becomes inescapable."



CONGRATULATIONS IPPH GRADUATES!

May 2017

- Ehab Moussa, PhD
 - Hyesun Hyun, PhD
 - Anshul Mishra, MS
-

PURDUE AAPS STUDENT CHAPTER RECEIVES GRANT!

The Purdue Student Chapter of AAPS received a grant from the Student Organization Grant Allocation (SOGA) Board of Purdue University to support the chapter's First Annual Career Day which was held on April 1st. Activities for Career Day included panel discussions, resume review and a job fair.

PURDUE UNIVERSITY NOW FULL MEMBER OF GLOBALIZATION OF PHARMACEUTICS EDUCATION NETWORK (GPEN)!

Purdue University, through IPPH, has full member status in the Globalization of Pharmaceutics Education Network (GPEN). In light of the increasingly global pharmaceutical industry, GPEN was founded to increase the exposure of graduate students and postdocs in the pharmaceutical sciences to science and culture at an international level. GPEN meetings are typically held every two years at universities across the world. The scientific program features short courses by participating faculty and presentations by student and postdoc participants. Visit <https://pharmchem.ku.edu/globalization-pharmaceutics-education-network-gpen> for more information.

NIIMBL PURDUE UNIVERSITY AND THE NATIONAL INSTITUTE FOR INNOVATIONS IN THE MANUFACTURING OF BIOPHARMACEUTICALS (NIIMBL)

Over the past year and a half, Purdue has been part of a multi-institutional effort to create a new **National Institute for Innovations in the Manufacturing of Biopharmaceuticals (NIIMBL)**. The goal of NIIMBL is to advance innovation and workforce development in the manufacture of biologics, and to enhance U.S. manufacturing competitiveness in this important sector of the pharmaceutical industry. Led by the University of Delaware, participating institutions include MIT, Georgia Tech, North Carolina State University, the University of Maryland, Purdue University and several others.

A proposal was submitted to the National Institute of Standards and Technology (NIST) by the National Network for Manufacturing Innovation (NNMI) program in mid-July 2016. In December, we learned that NIIMBL **will receive \$70 million** from NIST to launch this new institute. NIIMBL will also be supported by an initial private investment of at least \$129 million from various sources. For additional information, please see <https://www.commerce.gov/news/press-releases/2016/12/us-secretary-commerce-penny-pritzker-announces-biopharmaceutical>

NIIMBL will provide exciting new opportunities to advance pharmaceutical manufacturing technologies, long known as a core strength of Purdue's IPPH. It is anticipated that NIIMBL will also create new external collaborations with NIIMBL partner institutions, and will help strengthen the internal collaborations with the College of Engineering and Purdue Polytechnic Institute, among others.

FOURTEENTH ANNUAL GARNET E. PECK SYMPOSIUM



The **14th Annual Garnet E. Peck Symposium** was held at Purdue University from March 28-29, 2017 with the topic for this year's symposium being "Outside the Box: Celebrating the Life and Work of Stephen R. Byrn." Co-Chaired by Dr. Lynne Taylor, Retter Professor of Pharmacy & Dr. Elizabeth Topp, Dane O. Kildsig Chair and Department Head, this symposium beautifully captured the work and outreach of Dr. Byrn expressed through the speakers who shared mutual ties and interests. The talks not only presented impressive research such as high energy x-ray diffraction from amorphous pharmaceuticals and 3D microstructural perspective to observe solid dosage systems, they also exposed attendees to complex pharmaceutical patent litigation, entrepreneurship journeys, and the challenges and rewards of establishing an industrial and physical pharmacy program in Africa.

Presenters included:

- **Dr. George Zografi**, Emeritus Professor and former Dean of the School of Pharmacy, University of Wisconsin,
- **Dr. Peter York**, Professor of Pharmacy, University of Bradford, Bradford, West Yorkshire, England
- **Dr. Chris Benmore**, Senior Physicist, X-ray Science Division, Advanced Photon Source, Argonne National Laboratory, Argonne, Illinois
- **Mr. Eyal Barash**, Attorney, Pharmaceutical Patent Counsel, Barash Law LLC, Lafayette, Indiana
- **Mrs. Sally Byrn**, Co-founder of SSCI, West Lafayette, Indiana
- **Sister Zita Ekeocha**, Medical Missionaries of Mary, Kilimanjaro School of Pharmacy Moshi, Tanzania, Africa
- **Dr. Kari Clase**, Professor of Technology, Leadership and Innovation & Agricultural and Biological Engineering, Director of Biotechnology Innovation and Regulatory Science Center, Purdue University
- **Dr. Allen Templeton**, Assistant Vice President, Formulation Sciences, Merck, Kenilworth, New Jersey

The welcoming reception was held at SSCI, a cGMP research company founded by Dr. and Mrs. Stephen Byrn, and located in the Purdue Research Park in West Lafayette.

Poster sessions and three minute thesis presentations from graduate students spotlighted the research being done in Industrial and Physical Pharmacy at Purdue University. Venecia Wilson, a graduate student in Dr. Lynne Taylor's group, won the Three Minute Thesis Competition with her presentation, *The Prediction of Amorphous Solid Dispersion Performance in vivo from in vitro Experiments*.

This annual symposium honors the late Garnet E. Peck, Professor Emeritus of Industrial and Physical Pharmacy, and his contributions to the pharmaceutical sciences, including the

development of latex-based tablet coatings that have been used in the industry for more than 35 years.



Dr. Stephen Byrn



Dr. Elizabeth Topp, Dr. Stephen Byrn, Dr. Lynne Taylor



Attendees at the Peck Symposium



(L-R) Mr. Eyal Barash, Dr. Peter York, Sister Zita Ekeocha, Dr. George Zografi, Dr. Lynne Taylor, Dr. Allen Templeton, Dr. Stephen Byrn, Mr. Gerry Migliaccio, Mrs. Sally Byrn, Dr. Chris Benmore, Dr. Elizabeth Topp, Dr. Kari Clase, Dr. Ken Morris



Dr. Chris Benmore, graduate student Venecia Wilson

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