IPPH NEWSLETTER
INDUSTRIAL & PHYSICAL PHARMACY

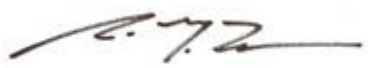
GREETINGS from the department head

Dear Alumni and Friends;

It's been a long, gorgeous fall here on the Purdue campus. We've had warm days, beautiful fall color, and students in shorts and flip-flops in November. The football team didn't do well, but with the weather we didn't mind so much, and basketball season looks promising. Campus images like these have been a backdrop for events far less temperate than the weather, though. Purdue students protested racism on our campus, in solidarity with those in Missouri and elsewhere. The terrorist attacks in Paris have left us shaken. Purdue President Mitch Daniels continues to champion affordability and accessibility in higher education, while student loan debt grows. It has been a season of contrasts: we have been serious and frivolous, earnest and apathetic, focused and distracted…and sometimes nearly simultaneously.

In the face of this, the scientific community here in IPPH seems at once very small and oddly important. We bring together faculty and students from all over the world with the audacious goal of working together to improve human health. You'll read about some of our progress in this newsletter. Meet our newest assistant professor, Qi "Tony" Zhou, who brings his expertise in pharmaceutical manufacturing and inhalational drug delivery to the department. Read about the "digital human" being developed by Drs. Kinam Park and Tonglei Li to simulate biodistribution and accelerate drug development. Meet graduate student Matt Jackson and learn about his work on amorphous solid dispersions, and take a peek at Dr. Lynne Taylor's newly renovated laboratory. And check out the many awards to our faculty, staff and students – we're so very proud of their accomplishments.

Our department exists to advance industrial and physical pharmacy, and to train the next generation of pharmaceutical scientists who can work together across cultural boundaries. Does that promote world peace? I like to think so. We wish nothing less for you and yours in this holiday season: peace in your life, peace in your home, peace in our world.



Liz Topp
Dane O. Kildsig Chair and Department Head

HIGHLIGHTS
from the department

FACULTY HIGHLIGHTS

Dr. Keith Chadwick received a Summer Faculty Grant from the Purdue Research Foundation. The grant provides $8,000 to support his research project entitled "Heterogeneous crystallization in polymeric microspheres: The advanced manufacture of oral dosage forms in four steps."

Dr. Rodolfo Pinal's company, Biokorf LLC, has received a First Tier Black Award from the Elevate Purdue Foundry Fund. The award provides seed funding to support the development of Biokorf's film-based dosage forms. The dosage forms consist of film layers that contain various components and can be assembled and dispensed by pharmacists. The Elevate Purdue Foundry Fund is operated jointly by the Purdue Foundry and Elevate Ventures. Read about Biokorf LLC and its research in prefabricated drug dosages in *MedCity News*, and watch a video about the company.

Dr. Liz Topp, IPPH department head, has created a new lyophilization consortium, LyoHUB, to improve freeze-drying technology to make food, pharmaceuticals and biotech products safer and more affordable. Topp co-leads the center with Alina Alexeenko, an associate professor of aeronautics and astronautics at Purdue. (Read more about the LyoHub below.)

Dr. Yoon Yeo was appointed as a standing member of the Developmental Therapeutics Study Section of the National Institutes of Health (NIH) beginning July 1. Study sections review the grant applications that are submitted to the NIH, providing opinions on the scientific and translational merit of the work proposed. Study section members are leading scientists whose accomplishments make their opinions valuable.

Dr. Yoon Yeo and staff member DeEtte Starr received a 2015 Bravo Award from Purdue University. The award recognizes contributions to IPPH's very successful 2015 Peck Symposium: Dr. Yeo for the outstanding job she did in organizing it, and Ms. Starr for her work supporting Dr. Yeo and the department.

Dr. Yoon Yeo was awarded an International Travel Grant by Purdue's Office of the Vice President for Research. The award provided support for her travel to the Controlled Release Society Meeting in Edinburgh, Scotland in July.

Dr. Qi "Tony" Zhou received the 2015 AAPS Postdoctoral Fellow Award sponsored by Merck. The award includes a certificate and travel funds to the AAPS annual meeting.

GRADUATE STUDENT HIGHLIGHTS

Hyesun Hyun (Yeo lab) received a Lilly Endowment Gift Graduate Research Award for her proposal entitled "Development of environmentally-adaptive nanoparticulate drug delivery systems for cancer therapy."

Anura Indulkar (Taylor group) received a travelship from the Formulation Design and Development (FDD) Section of AAPS. The award provided funds to support her attendance at the AAPS Annual Meeting in Orlando from October 25-29. Anura was recognized at the FDD Section Townhall and reception in Orlando on October 26th.

GRADUATE STUDENT HIGHLIGHTS (continued)

Jing Ling (Chadwick group) received a research grant from the Purdue Research Foundation for her proposal entitled "The Rational Design of Excipient Surfaces for Controlling the Crystallization and Physicochemical Properties of Drug Compounds." The grant provides partial salary support as well as insurance and fringe benefits for one year.

Laura Mosquera-Giraldo (Taylor group) was awarded the Colombian Student Association Travel Grant to present her work "Impact of chemically diverse polymers on the nucleation induction times of highly supersaturated drug solutions of telaprevir" at the AAPS annual meeting in Orlando, Florida this October.

Laura Mosquera-Giraldo (Taylor group) received a 2015 AAPS Foundation Graduate Student Fellowship. The fellowship is based on a research application Laura submitted describing her doctoral research. The award provides annual support and is renewable for a second year. Laura is one of five students internationally to be honored with this award.

Ehab Moussa (Topp group) was selected to serve at the student representative for the protein aggregation and biological consequences (PABC) focus group of the AAPS Biotech section for 2015-2016. Dr. Linda Narhi (Amgen) serves as the focus group chair.

Aimable Ngendahimana (Knipp group) and **Joonyoung Park** (Yeo lab) were each selected to receive a 2015-2016 Ronald W. Dollens Graduate Scholarship in the Life Sciences from Purdue University. The scholarship is based on academic merit and a competitive application. The Dollens Scholarship is awarded to graduate students studying in the broad area of hybrid cardiovascular devices; students engaged in research related to implantable biomaterials design, drug-delivery systems, and biochemical sensors are also eligible.

Haichen Nie (Byrn lab) has received the 2015 Jenkins-Knevel research award for Outstanding Graduate Research from the College of Pharmacy. Haichen received the award as the result of a competitive application based on his work on molecular-scale interaction patterns and structural elements of a drug-polymer complex. The award honors Dr. Glenn L. Jenkins, Dean of the School of Pharmacy from 1941 to 1966 and Dr. Adelbert M. Knevel (PhD '57), professor emeritus, School of Pharmacy.

Haichen Nie (Byrn lab) has received a 2015 research award from the American Chinese Pharmaceutical Association (ACPA). The award consists of $500 and recognition at the ACPA banquet at the AAPS Annual Meeting.

Haichen Nie (Byrn lab) received the 2015 AAPS Graduate Student Research Award in Analysis and Pharmaceutical Quality. This award recognizes excellence in graduate education in the fields of pharmaceutics, bioanalytical chemistry and pharmaceutical analysis. The award consists of $250, partial reimbursement of travel expenses for the AAPS annual meeting and recognition at the Awards Ceremony.

Haichen Nie (Byrn lab) received the 2015 International Pharmaceutical Excipient Council of the Americas (IPEC) Foundation Graduate Student Scholarship Award. The scholarships recognize significant contributions to formulation science and technology with excipients brought about by highly innovative research. The scholarship consists of a cash award of $1,500 and the winners present their research in poster format at the AAPS annual meeting.

GRADUATE STUDENT HIGHLIGHTS (continued)

Hwee Jing Ong (Pinal group) received the 2015 Herbert A. Lieberman Award. The award recognizes her outstanding service as a Teaching Assistant in IPPH 562 (Introduction to Pharmaceutical Manufacturing Processes) and in the PharmD parenteral product courses, as well as her contributions to excellence in research laboratory safety. The award was funded by Mr. Bruce A. Lieberman to honor his father, Dr. Herbert A. Lieberman, who co-authored *The Theory and Practice of Industrial Pharmacy*. The award consists of a monetary prize and was presented during the department seminar on October 19th.

Jainik Panchal (Topp group) was selected for a 2015-16 McKeehan Graduate Fellowship in Pharmacy. The Fellowship provides partial support for graduate students in the College of Pharmacy with research interests in the physical sciences, and is awarded on the basis of a competitive application.

Joonyoung Park (Yeo lab) received the Kienly Award for Outstanding Graduate Teaching. The award recognizes Joonyoung's contributions as a Teaching Assistant in PHRM 829 Dosage Forms II and in PHRM 846 Principles of Pharmacokinetics. The Kienly Awards have been endowed since 1976 by gifts from Dr. Albert V. Kienly, Jr. of the Class of 1940, as well as by an anonymous faculty gift in memory of Dr. Kienly's father and mother. Dr. Kienly's father graduated from the Purdue University School of Pharmacy in 1901.

Hitesh Purohit (Taylor group) was selected by the IPPH faculty to receive the2016 Migliaccio / Pfizer Graduate Fellowship in the pharmaceutical sciences. The fellowship provides partial stipend support for an outstanding senior graduate student in the department.

Hitesh Purohit (Taylor group) received a travelship from AstraZeneca, providing funds to support his attendance at the AAPS Annual Meeting in Orlando from October 25-29.

In June, **12 IPPH graduate students** participated in the Pharmaceutics Graduate Students Research Meeting (PGSRM) 2015, held at the University of Kentucky College of Pharmacy. This year's theme was "Joining Forces: Collaborative Efforts toward Finding Cures". Delegates from more than 20 pharmacy schools and several pharmaceutical companies met, presented their research, and received valuable feedback from peers. Featured speakers from various specialized areas were: Hamid Ghandehari, Bradley Anderson, Renier J. Brentjens, Kim Brouwer, and Paul J. Hergenrother. They presented their work and advised graduate students on aspects of life inside and outside of school. The IPPH delegates benefited by listening to the featured speakers, showcasing their ability to conduct research, and connecting with industry delegates. "This meeting proved to be a great opportunity to build peer networks," said **Anshul Mishra** (Topp group).

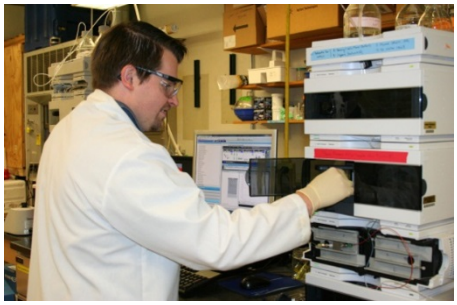
IPPH STAFF HIGHLIGHTS

Research Scientist **Dr. Niraj Trasi** (Taylor group) received the 2015 AAPS Postdoctoral Fellow Award sponsored by Merck. The award includes a certificate and travel funds to the AAPS annual meeting.

In July the department said a fond farewell to **DeEtte Starr**, who served as Communications and Events Coordinator for IPPH and CPPR for 4 years. DeEtte has now moved to a full time position at the Industrial Engineering department, where she is the Communications Specialist and Liaison for the department. We wish her all the best in her new position!

In September we welcomed two new staff members to the department. **Sarah Ruh** is now Communications and Events Coordinator for IPPH and the Center for Pharmaceutical Processing Research. **Jennifer Gray** was brought on as Communications and Events Coordinator for the new LyoHub project in IPPH.

SPOTLIGHT
IPPH graduate student



Meet Matt Jackson

Fifth-year graduate student **Matt Jackson** (Taylor group) hopes his research will create a better understanding of the consequences of using an enabling dosage form, such as amorphous solid dispersions. Jackson has focused on the phase behavior upon dissolution of amorphous solid dispersions. His goal has been to use multiple analytical techniques to differentiate different phase transformations in solution.

Jackson became interested in pharmacy through his pharmacist grandfather. Once at Purdue, he sought out research opportunities and got in touch with IPPH's Dr. Lynne Taylor. After working in her lab as an undergrad for about a year and attending several pharmaceutics symposiums, he decided to pursue a graduate career in IPPH. "She helped me decide to go to graduate school to pursue pharmaceutics," he said, "of which Purdue has one of the strongest programs." He finished his Purdue BSPS with an IPPH specialization in May 2010.

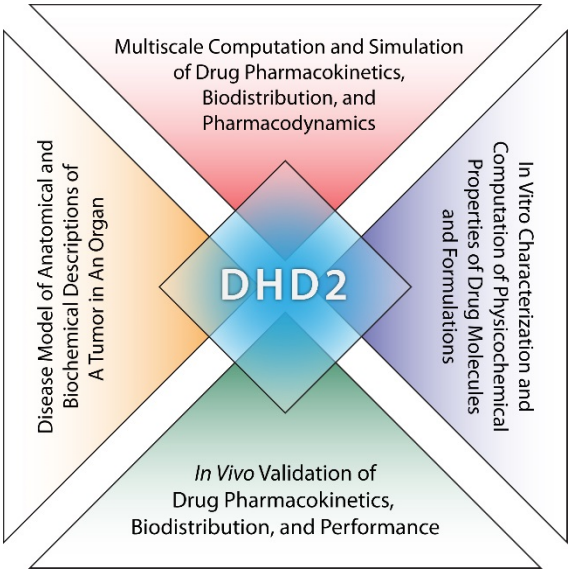
"Working in Dr. Taylor's group has been such a blessing in my graduate career," says Jackson. "Dr. Taylor herself is an absolutely wonderful teacher and mentor, and she really knows how to pull the best out of each one of her students and colleagues."

Matt graduates in December 2015, but since August has worked as a Scientist I in the Analytical Development Group at Celgene in Summit, NJ. He is working on solid-state analysis of compounds.

Throughout his undergraduate career, Matt worked as a Resident Assistant, Staff Resident, and Senior Operations Assistant for Purdue University Residential Life. He is from Brownsburg, IN, and married his wife, Melissa, in October 2013. Melissa and Matt are expecting their first child in March of 2016. Both of his parents also graduated from Purdue. He enjoys sports, plays saxophone, is learning the guitar, and likes cooking on his "Boilermaker Special" look-alike grill.

RESEARCH
IPPH faculty

Dr. Tonglei Li and Dr. Kinam Park:
The Digital Human Project

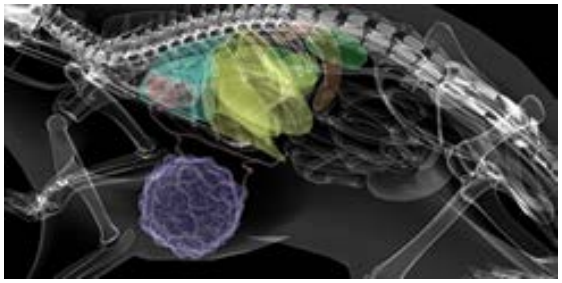


One of the challenges in medicine is that pharmaceutical trials are based on the results of thousands of test subjects, yet there is no such thing as a truly "average" patient. Everyone responds differently to medication, whether it's due to differences in genetics, metabolism, physiology, or countless other variables. Since each person is unique, finding the optimal treatment for a specific person can become an exercise in trial and error.

Now imagine a sophisticated computer model that replicates the human body, accurate down to the genetic level. This "digital human" could act as a virtual guinea pig on your behalf, testing out various drugs and simulating their effects. Researchers could discover the safest, most effective method of treatment for specific individuals, rather than a one size fits all approach.

This may sound like the stuff of science fiction, but Purdue researchers are already taking steps in this direction with the Digital Human for Drug Development (DHD2) project, led by **Kinam Park**, Showalter Distinguished Professor of Biomedical Engineering and professor of pharmaceutics, **Tonglei Li**; Allen Chao Chair and professor of Industrial and Physical Pharmacy; and Bumsoo Han, associate professor of both biomedical and mechanical engineering. The project is a collaboration among researchers in pharmaceutics, pharmacy, biomedical sciences, and mechanical engineering at Purdue University and the Korea Institute of Science and Technology (KIST). Purdue's researchers are also working closely with researchers at the Indiana University School of Medicine (IUSM), whose expertise includes physiologically based pharmacokinetic modeling and molecular genetics.

The project began in 2014, and this September, the group convened in Korea at the KIST campus to hold their third symposium. The team is already at work on developing a graphical user interface that runs on smartphones, simulating drug distribution inside solid tumors in mice, and bioimaging human brain structures. Future goals include plans to start building out an open software platform which would allow new disease models and simulation methods.



A digital mouse model is being developed by Dr. Li. The 3D model is physiologically accurate and capable of simulating and visualizing drug transport and pharmacokinetics of a drug delivery system.

NEWS & EVENTS
department happenings

CONGRATULATIONS IPPH GRADUATES!

August 2015

- Saradha Chandrasekhar

December 2015

- Sara Ahmed Abouelmagd
- Lavanya Iyer
- Matthew Jackson
- Yang Song

LyoHub Holds Technology Roadmapping Workshop at Purdue

The new consortium on lyophilization, LyoHub, held a technology roadmapping workshop in October at Purdue, with participants including academic scientists, industry representatives and representatives from NIST and FDA.

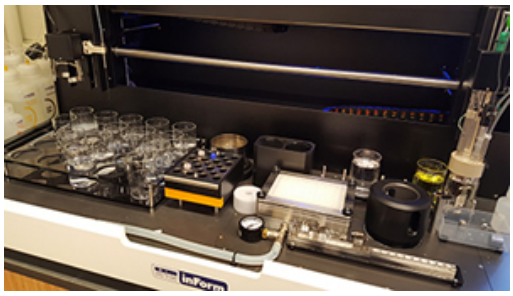
Led by **Dr. Liz Topp**, IPPH Department Head, the LyoHub consortium aims to improve freeze-drying technology to make food, pharmaceuticals and biotech products safer and more affordable. Topp co-leads the center with Alina Alexeenko, an associate professor of aeronautics and astronautics at Purdue.

The workshop was led by John Saiz, formerly the chief technology officer at NASA's Johnson Space Center and a senior industrial fellow with the Institute for Manufacturing at the University of Cambridge. Participants worked together to prioritize research and development projects, and to set goals within desired time parameters.

Taylor Group Moves into Newly Renovated Lab Space

Professor Lynne Taylor's research group recently moved into a newly renovated lab on the 4th floor of the RHPH building. The next phase of the project will be to renovate the spaces they just vacated, in G57 and G59. When all renovations are complete, Taylor's group will have use of both spaces, providing space for her group of 20 graduate students, postdocs and scientists. Funding has been provided by the College of Pharmacy and Purdue's Discovery and Learning Laboratory Renovation Program (DL2).

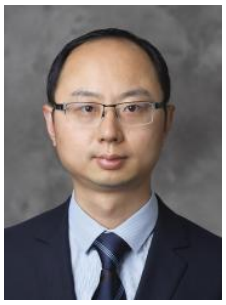
The Taylor lab has been expanding both in number of members and the amount of equipment, and found the existing lab could no longer support the research, both in terms of space, and the electrical framework required for the instruments. The new office space on the fourth floor accommodates 12 group members, and the lab provides sample preparation areas and houses a multitude of equipment. There are now two dark rooms where light sensitive experiments can be run. Prior to the renovation, instruments used by the lab group were in various labs around campus, but now the majority are consolidated within the new lab. By streamlining the workflow, students are now saving time and are able to be more productive.



One piece of new equipment in the lab is the Sirius InForm, a platform for biorelevant dissolution and solubility analyses. "My group's overall goal is to enhance drug delivery by optimizing and understanding the physicochemical properties of drugs and excipients," said Taylor. "The InForm allows us to perform automated experiments with a wide range of customizable parameters, and keeps our students on the cutting edge of research."

Senior graduate student **Hitesh Purohit** was one of the students involved in the planning meetings, and came away with a fresh perspective on the process of lab design.

"Ordinarily I would never have thought of all the small details and notes of caution that need to be considered while renovating a lab space," said Purohit. "Overall, it was an educational experience, and it's great to see that mental effort materialize into a space we are now using daily."



Welcome New Faculty Member: Qi "Tony" Zhou, PhD

Assistant Professor, Industrial and Physical Pharmacy

This fall, **Dr. Qi "Tony" Zhou** was appointed as Assistant Professor in Industrial and Physical Pharmacy in the College of Pharmacy. He joins us from the University of Sydney in Australia, where he was an Australian Biomedical Early Career Fellow with the National Health and Medical Research Council.

Dr. Zhou's research is concerned with the direct treatment of respiratory diseases by delivering the therapeutics straight to the airway. This method of delivery offers rapid onset of drug action, high therapeutic efficacy and reduced systemic exposure. Dr. Zhou's research aims to apply a multidisciplinary approach to develop, characterize and understand novel inhalation formulations for emerging applications such as inhaled antimicrobials, biotherapeutics and anti-cancer therapies. His work includes the design and manufacturing of novel formulations, characterization of physico-chemical properties of the formulation, and *in vivo* evaluation in animal models. The outcomes of these projects will lead to safer and more efficacious aerosol treatments, as well as more efficient manufacturing processes for inhalation products.

Dr. Zhou received his BEng degree in Pharmaceutics from Shenyang Pharmaceutical University in China, and a MSc of Pharmacy from National University of Singapore. He received his PhD in Pharmacy from Monash University in Australia in 2011, and was a Postdoctoral Fellow at both Monash and University of Sydney.

Please join us in welcoming Dr. Zhou to the department!

Thank you and Farewell to Dr. James Litster

Jim has been with Purdue since August 2007, and will be leaving at the end of December to take a position as Professor of Chemical and Pharmaceutical Engineering at Sheffield University in the UK. Jim held a joint appointment as Professor of Chemical Engineering and Professor of Industrial and Physical Pharmacy at Purdue, where he was recruited to be part of the NSF funded Engineering Research Center for Structured Organic Composite Systems (CSOPS). Prior to his time at Purdue, he spent 20 years at The University of Queensland, as Head of the School of Engineering (2005-2007) and Director of the Particle and Systems Design Centre (2001-2007).

Jim is an internationally recognized leader in particle science and technology. He has a PhD from The University of Queensland and spent several years working for BHP at their Newcastle Research Laboratories. From 1987 till 2007 he held a faculty appointment at The University of Queensland in Chemical Engineering, which included five years as Chair of the Department. He also has held a regular appointment as Distinguished Visiting Professor at the University of Delaware.

We wish Dr. Litster all the best in his new position, and we thank him for his years of service to Purdue.

THIRTEENTH ANNUAL GARNET E. PECK SYMPOSIUM

March 30 & 31, 2016
Purdue University - West Lafayette, Indiana
"Pharmaceutical Crystallization: Fundamentals and Applications"

Co-chaired by:

- Dr. Lynne Taylor, Professor of Industrial and Physical Pharmacy
- Dr. Keith Chadwick, Assistant Professor of Industrial and Physical Pharmacy

The Peck Symposium is hosted by the Department of Industrial and Physical Pharmacy and the College of Pharmacy at Purdue University.

Registration will be available online in early 2016. Questions? Emailipphcomm@purdue.edu

*The annual Peck Symposium honors the late **Garnet E. Peck, Ph.D.**, Professor Emeritus of the department of Industrial and Physical Pharmacy at Purdue University. Dr. Peck left a record of enduring contributions to the pharmaceutical sciences, including the development of latex-based tablet coatings that have been used in the industry for more than thirty-five years. The goal of this event is to stimulate interest in the symposium's focus areas and to identify opportunities for new research.*

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PURDUE UNIVERSITY

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