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Greetings from the Department Head



Dear Alumni and Friends;

The end of the year is a time to celebrate. Around the world, in festivals like Diwali, Thanksgiving, Christmas, Hanukkah, New Year's and Kwanzaa, people gather together to make merry. In IPPH, we have a lot to celebrate this year, too, and we'd like to share it with you in this newsletter. We're celebrating the addition of our newest faculty member, Dr. Keith Chadwick, and we'll introduce him to you. We're celebrating the many awards and accomplishments of our faculty and students. For example, we're celebrating with Dr. Lynne Taylor and her group, who received two "best manuscript" awards from top journals this year. We're celebrating with Dr. Jim Litster, who recently received a national award for his work in fluid particle systems; we've included a piece on his research. We're also celebrating the 10th anniversaries of our Peck Research Symposium and of our Regulatory and Quality Compliance Program. And, with the rest of Purdue, we're getting ready to celebrate the installation of our 12th president, Mitch Daniels, when he completes his term as governor in January.

Thanks for taking the time to celebrate with us through this newsletter. We hope that your holiday season is filled with celebration, and that your New Year is filled with peace. Boiler Up!

Liz Topp
Dane O. Kildsig Chair and Department Head

Department Highlights

Faculty Highlights

- **Dr. Lynne Taylor** was named a Fellow of the American Association of Pharmaceutical Scientists (AAPS). Fellows are recognized for having made a sustained and impactful contribution to the pharmaceutical sciences.
- **Dr. James Litster** received the 2012 Thomas Baron Award in Fluid-Particle Systems at the 2012 annual AIChE meeting. The award is given by the Particle Technology Forum of the AIChE.
- **Dr. Stephen Byrn's** ongoing work in Tanzania made international news, including *The Guardian* and the *Ajaat AIDS Weekly*. For more information, read the articles on our website http://www.ipph.purdue.edu/index_photos/ByrnNewsScans.pdf and read our feature www.ipph.purdue.edu/features/AfricanMeds.php.

Department Highlights (cont.)

- **Dr. Gregory Knipp** joined industry professionals in teaching a new "Introductory Mechanistic Oral Absorption Modeling and Simulation" course (aka GastroPlus™) at Purdue in July. The short course was organized and taught by Drs. Manuel Vicente Sanchez-Felix and John Rose from Eli Lilly and Company, Michael Bolger from Simulations Plus, and Dr. Knipp, to enhance pre- and post-graduate education and research to include *in silico* training. Instructors taught the basic principles of absorption modeling and focused largely on the use of the GastroPlus™ program, which IPPH plans to use again in the future.
- **Drs. Jared Baird, Bernard Van Eerdenbrugh, and Lynne S. Taylor** won the 2012 Ebert Prize for their paper, "A classification system to assess the crystallization tendency of organic molecules from undercooled melts." [*Journal of Pharmaceutical Sciences* 99(9): 3787-3806, 2010.]
- **Drs. David E. Alonzo, Geoff G.Z. Zhang, Deliang Zhou, Yi Gao and Lynne S. Taylor** won the 2012 Meritorious Manuscript Award for their paper, "Understanding the behavior of amorphous pharmaceutical systems during dissolution." [*Pharmaceutical Research* 27(4): 608-618, 2010.]
- A paper by **Drs. Ann Newman, Gregory Knipp,** and George Zografi entitled "Assessing the performance of amorphous solid dispersions" appeared in the Editors' Picks on the *Journal of Pharmaceutical Sciences* website. [*Journal of Pharmaceutical Sciences* 101(4):1355-1377, 2012.]
- One of the ten most-downloaded articles for April-June 2012 was written by **Drs. Zohreh Amoozgar, J. Park, Q. Lin, and Yoon Yeo.** The paper was entitled "Low molecular-weight chitosan as a pH-sensitive stealth coating for tumor-specific drug delivery." [*Molecular Pharmaceutics* 9(5):1262-70, 2012.]

Graduate Student Highlights

- **Chris Kulczar** (Knipp group), a second-year graduate student, won first place in June for the best poster presented at the 2012 PGSRM conference in Omaha, NE, for his poster entitled "Juvenile Pigs as Surrogates for Human Pediatrics During Preclinical Pharmacokinetic Testing: A Possible Means to Expedite Pediatric Drug Development?"
- **Hillary Holback** (Yeo group), a senior graduate student, received a 2012-2013 Ronald W. Dollens Graduate Scholarship in the Life Sciences in August. The scholarship provides merit-based support for graduate students in the Department of Biomedical Engineering and in the College of Pharmacy who are studying in the broad area of hybrid cardiovascular devices, including implantable biomaterials design, drug-delivery systems and biochemical sensors.
- **Shweta Raina** (Taylor Group), a senior graduate student, received a 2012-2013 McKeehan Graduate Assistantship in Pharmacy in September. The award provides partial stipend support and fee remissions for Ph.D. students in the College of Pharmacy with research interests in the physical sciences.
- **Lindsay Wegiel** (Taylor group), a senior graduate student, was chosen to give a podium presentation as part of the graduate student symposium of the Analysis and Pharmaceutical Quality section at the 2012 AAPS Annual Meeting in October.
- **Grace Ilevbare** (Taylor group), a senior graduate student, was chosen to give a podium presentation as part of the graduate student symposium in Formulation Design and Development at the 2012 AAPS Annual Meeting in October.
- **Shweta Raina** (Taylor Group), a senior graduate student, received a travelship from the Formulation Design and Development (FDD) Section of AAPS to support her attendance at the 2012 AAPS Annual Meeting. She was recognized at the FDD Section Joint Membership Meeting on October 15.
- **Grace Ilevbare** (Taylor group), a senior graduate student, received a travelship award from the International Pharmaceutical Excipients Council Foundation (IPEC) to support her attendance at the 2012 AAPS meeting in October. The award recognizes excellence in graduate research related to excipients. In addition, Grace's AAPS poster presentation was designated as an IPEC scholarship winner.
- **Lindsay Wegiel** (Taylor group), a senior graduate student, received the IPPH 2012 Dr. Herbert Lieberman Award in October. The award recognized Lindsay's outstanding service as a Teaching Assistant in IPPH 562 and her many contributions to the Department since 2008. 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*.

Welcome New Faculty: Keith Chadwick

Dr. Keith Chadwick joined the IPPH faculty in August. He holds a B.Sc. in Chemistry from the University of Manchester Institute of Science and Technology (U.K.) and a Ph.D. in Chemical Engineering from the University of Manchester. He has spent the past three-and-a-half years working as a Postdoctoral Associate at the Massachusetts Institute of Technology in the MIT-Novartis Center for Continuous Manufacturing, studying the effect of heterogeneous surfaces on the nucleation of organic crystals. His research interests include the crystal engineering of cocrystals, polymorphs and salts with desired physicochemical properties, developing mechanistic understanding of crystal nucleation and the control of crystal habit (morphology). The overall vision of his research is for the rational design of materials, such as small molecule pharmaceuticals, by controlling the internal and external three-dimensional structures of crystals. In his spare time he enjoys playing sports, especially soccer. Having been raised in Manchester, England, he is a diehard Manchester City fan (English Premier League) and never misses watching a game. He is married to Dr. Jie Chen, who has accepted a position as Research Scientist in Dr. Lynne Taylor's group.



Saradha Chandrasekhar (l)
and Lindsay Wegiel (r)

- **Saradha Chandrasekhar** (Topp group), a third-year graduate student, was selected in October to receive a 2012 Kienly Award as the outstanding graduate Teaching Assistant in the Department of Industrial and Physical Pharmacy. The award recognized her contributions as a Teaching Assistant in IPPH 471 (Parenteral Products).
- **Lindsay Wegiel** (Taylor group), a senior graduate student, was selected in October to receive a 2012 Jenkins-Knevel Award for Outstanding Graduate Research. Lindsay's work was recognized at the College of Pharmacy's Graduate Student Awards Symposium on November 8, where she presented her research.

Postdoc Highlights

- **Dr. Andrew Otte** received a 2012 Purdue Realization and Entrepreneurship Postdoctoral Fellowship (PREPP) in August from the Burton D. Morgan Center for Entrepreneurship in Purdue's Discovery Park. The fellowship will help to support his work on particle engineering and prefabricated dosage forms. The program will also provide him with training on commercialization and business development related to these novel delivery systems. Drew is a postdoctoral research associate in Dr. Rodolfo Pinal's group.

Alumni Highlights

- **Dr. Todd Chermak, IPPH RQC Graduate Certificate** (2003), received a 2012 Distinguished Alumnus Award from the College of Pharmacy on November 9. Dr. Chermak, R.Ph., Ph.D. is currently the Divisional Vice President, Abbott Nutrition Regulatory Affairs. [*Read more on p. 5*]

Did you recognize the images?

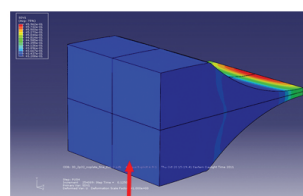
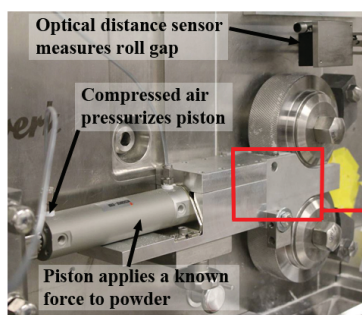
- P. 1 & 3 - A partial 3D rendering of a granule made from glass ballotini and PVP binder.
P. 2 & 5 - A 2D projection slice of a granule made from glass ballotini and PVP binder.

(Graphics: Steven)

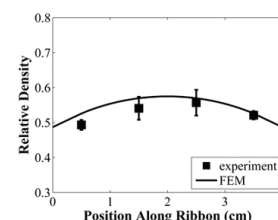
Research Spotlight: Building Up Particle Structures for Solids Dosage Form and Manufacture

In solid dosage form manufacturing, a granulation step often takes place prior to tableting, since pharmaceutical materials often are not amenable to direct compression. This process agglomerates micron sized powders into sub-millimeter granules using a liquid binding agent ("wet" granulation) or the application of mechanical force ("dry" granulation). The size enlargement and densification reduces dusting and improves flowability. As an added benefit, components in a powder blend are also locked into individual granules, preventing them from segregating when subjected to further processing.

A significant portion of **Dr. James Litster's** research revolves around understanding the granulation process. A multi-scale approach is central to the research methodology. For example, for investigating dry granulation, the Litster group uses Finite Element Method (FEM) simulations to investigate how pharmaceutical powder blends behave on both microstructure and macroscopic (equipment) levels. An example of FEM simulations for a roller compactor is shown in



Finite element method (FEM) model simulates the roll compaction process. Experimentally measured data are used as the model inputs.



FEM-predicted ribbon density distributions agree well with experimentally measured ones.

Graduate Student Spotlight: Steven Dale

Steven Dale finds formulation science a fascinating challenge – whether it's creating a microbrew or improving the wet granulation process.

A fourth-year student in the IPPH Ph.D. program, Dale first became interested in pharmaceutical research when he took Dr. Lynne Taylor's IPPH 580 class as a senior BSPS student at Purdue. "She explained that IPPH was research-based, which I liked," he said. He had worked the previous summer as an undergraduate intern at Mylan Pharmaceuticals, completing investigation reports. After he graduated but before graduate school, Dale interned at Eli Lilly & Company. "I worked on characterizing the compaction of two lots of the same API that behaved differently," he explains. "We wanted to see if the two lots would have different granule sizes and flow properties after roller compaction."

Dale conducts research in the Particle Design and Formulation Lab of **Dr. James Litster** and **Dr. Carl Wassgren**, relating the intra-granular distribution of binders to particle strength, compaction and attrition. Dale likes the combination of pharmaceutical research and chemical engineering. "I'm trying to understand how structure relates to strength in order to optimize the structure," he says. He uses X-ray microtomography (XRCT) to examine where particles, binder and air are located in granules.

He hopes to finish his Ph.D. by December 2013, and would like to work in the pharmaceutical industry as a formulation scientist. He's interested in conducting research on which excipients to add to an API and in designing the process to manufacture final dosage forms.



Steven Dale assembling a DIOSNA high shear granulator.

Speaking of designing processes, Dale's recent hobby has been a foray into home brewing. "It involves a lot of chemistry and microbiology," he grins, and says he finds it fun to dabble in those areas again. He got started by listening to a podcast about home brewing, then read a book about it, and has since made several experimental batches. His goal is to create a beer that tastes like a favorite Wisconsin microbrew that's not available in Indiana, and he enjoys sharing his creations with friends. Dale is from Kokomo and is married to Lauren, a civil engineering Purdue graduate. They have a Boxer "with lots of personality" named Zoe.

IPPH Happenings



This open-concept research lab is part of Phase I of the renovation, and used to be rooms G5, G7 and G9.

Ground Floor Renovations

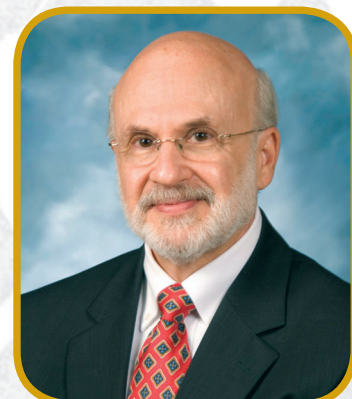
Renovation of our ground floor laboratories is moving forward on schedule. We expect that Phases I and II of the project will be substantially complete by the end of 2012, with occupancy scheduled for March 2013. We have begun planning for Phase III, which will renovate rooms G57 and G59 and update HVAC for that area. Check out our website <http://www.ipph.purdue.edu/renovations/> to see the latest video updates on construction. Floor plans posted on the site show what's happening with the space.

RQC 10-Year Anniversary

The Regulatory & Quality Compliance (RQC) graduate program celebrated its 10-year anniversary during the fall of 2012. RQC held a celebration event on July 20 at the University Center of Lake County in Grayslake, IL. Over 40 RQC students, faculty, alumni, educational partners and guest speakers enjoyed reconnecting and sharing what the program had meant to them. (View the Celebration Photo Feature at http://www.ipph.purdue.edu/features/2012-07-20.RQC_ILReception/.)

Spielberg Delivers 2012 Varro E. Tyler Lecture

The College of Pharmacy and the Department of Industrial and Physical Pharmacy together hosted this year's annual Varro E. Tyler Lecture on November 16. The speaker was Dr. Stephen P. Spielberg, M.D., Ph.D., Deputy Commissioner for Medical Products and Tobacco of the U.S. Food and Drug Administration. Dr. Spielberg spoke on "Precision Medicine and the Future of Therapeutics", discussing advances in biomedical science and the opportunities they bring to selectively target therapeutic agents to provide drug therapy with greater benefit:risk.



Dr. Stephen Spielberg



Pictured are (l to r): Dr. Elizabeth Topp, Lindsay Wegiel, Debbie Chermak, Dr. Todd Chermak, Ying Lu, Yang Song, Aimable Ngendahimana, and Dr. Steve Byrn.

2012 IPPH Distinguished Alumnus

Dr. Todd Chermak, R.Ph., Ph.D., met with IPPH students for a roundtable discussion, after receiving a 2012 Distinguished Alumnus Award from the College of Pharmacy. During his visit, Dr. Chermak spoke on "Regulatory Science and Industrial Pharmacy."

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Peck Symposium

The Tenth Annual Garnet E. Peck Symposium took place at Purdue University on October 11, 2012.



Dr. Garnet E. Peck enjoyed reconnecting with three of his former graduate students (from left to right): Drs. Holly Bonsignore, Alton Johnson, Garnet Peck and Karen Nagel

Are you connected?

Join our IPPH LinkedIn group to see what great things our department is doing! Or visit us online at www.ipph.purdue.edu.