

# STRATEGIC PLAN: 2016-2021

Pharmaceutics Department

College of Pharmacy, University of MN

Approved by the Pharmaceutics Faculty 07/29/2016.

## ATTENDEES:

Faculty: Drs. Elmquist, Fairbanks, Panyam, Siegel, Sun, Sury, and Wiedmann.

(Drs. Kandimalla, Prabha, and Zimmerman were absent.)

Staff: Amanda Hokanson and Katie James

Other departments: Dr. Esam El-Fakahany, Jeannine Conway, Caroline Gaither, Robert Busch

Dean: Marilyn Speedie

## I. INTRODUCTION

The Department of Pharmaceutics' faculty members developed the following strategic plan after consideration and review of the Department's past missions, visions, and accomplishments as outlined in their 2012 retreat minutes as well as their future aspirations for the Department. The faculty also discussed changes that have occurred since 2012 and are likely to occur before 2021, which will directly or indirectly impact the Department's ability to fulfill its missions.

## II. MISSION STATEMENT

The mission of the Department of Pharmaceutics is to educate and inspire future pharmacists and pharmaceutical scientists of the highest caliber through innovative research and teaching, to provide future pharmacy practitioners with a solid understanding of dosage forms, pharmacokinetics, and drug delivery, and to train pharmaceutical scientists for outstanding careers in academia, industry, and government.

## III. BACKGROUND

Pharmaceutics is a scientific discipline whose focus is the development and evaluation of drug delivery systems.<sup>1</sup> It involves the application of physical, chemical, biological, and engineering principles to design and optimize drug products and understand the disposition and pharmacologic effects of drugs in the body following administration. Research in Pharmaceutics includes the design and analysis of drug delivery systems, and investigation of molecular, cellular, and physiological mechanisms underlying absorption, distribution, metabolism, excretion, and pharmacologic effect of drug molecules.

---

<sup>1</sup> <http://www.pharmacy.umn.edu/sites/pharmacy.umn.edu/files/pceuts-graduate-studies-brochure.pdf> 08/17/16

Over the years, the role of the pharmacist has shifted from just distributing medication to also addressing the complex drug therapy needs of consumers and society. Today's pharmacists advise their patients, physicians and other health practitioners on the selection, dosages, interactions and side effects of medications, as well as monitor the health and progress of those patients to ensure that they are using their medications safely and effectively.<sup>2</sup> Pharmaceutics faculty have developed research collaborations with other faculty across the AHC and other Campus units who wish to take advantage of our expertise. Pharmaceutics faculty have participated in interdisciplinary training grants, NIH grants, program project grants, and other trans-departmental grants. The Department of Pharmaceutics is the administrative home for AeroCore, which provides aerosol delivery services, the Center for Translational Drug Delivery, and the Brain Barriers Research Center.

As of 2016, the Pharmaceutics graduate program at the University of Minnesota is in its 58<sup>th</sup> year of training advanced degree candidates.<sup>3</sup> The program has had a long and distinguished history of being among the top pharmaceutics programs in the country and is well recognized internationally. Designed to prepare students for research in the development and testing of drug products, graduate students take courses and conduct research dealing with the physicochemical basis underlying formulation and drug delivery systems, and the complex interaction of drugs with complex biological systems. Pharmaceutics graduates enjoy a 100-percent placement rate. Many of the graduate students also receive awards throughout their studies from the American Association of Pharmaceutical Scientists (AAPS) and other societies in areas such as: formulation design and development, physical pharmacy and biopharmaceutics, pharmacokinetics, pharmacodynamics and drug metabolism, and manufacturing science and engineering.

#### IV. STRATEGIC PLAN 2012-2016 FACULTY GROWTH

These developments are based on the 5-year plans outlined by the faculty at the July 20<sup>th</sup>, 2012 retreat.

1. Dr. William Elmquist proposed having 4 graduate students and 5 postdoctoral associates during this time-span. Currently, he has 5 graduate students and 3 postdoctoral and visiting scientist collaborators. In regards to his research, he has a project underway that is designed to examine the determinants of anticancer drug permeability in the blood-brain barrier.<sup>4</sup>
2. Dr. Carolyn Fairbanks proposed having 6 graduate students and 2-3 postdoctoral associates, of which 2 students and 1 postdoctoral associate would be dedicated to Pharmaceutics during this time-span. Currently, she has 3 graduate students along with 2 postdoctoral and visiting scientist collaborators, of which 1 student and 1 postdoctoral associate are dedicated to Pharmaceutics. Dr. Fairbanks also hopes to grow the success of her lab, with support from both NIH and DoD. Her research examining the role of agmatine in the neuroplasticity of opioid-

---

<sup>2</sup> <http://www.pharmacy.umn.edu/about/history> 08/17/2016

<sup>3</sup> EDR p. 4 "A Brief History of the Department and Graduate Program". 1958 est.

<sup>4</sup> EDR page 12 paragraph 4.

induced analgesic tolerance, addiction, and chronic pain has been published in many journals. Dr. Fairbanks has also developed a strong scientific partnership with UMN colleagues in genetics and neuroscience for optimizing gene delivery of a variety of therapeutics to the CNS.<sup>5</sup>

3. Dr. Karunya Kandimalla proposed having 1 graduate student, postdoctoral associate, and visiting scientist collaborator for each of his three sections during this time-span. He was encouraged by faculty not to restrict himself to just three. Currently, he has 4 graduate students and 2 postdoctoral associates. In regards to his research, Dr. Kandimalla had been considering how to position himself in Alzheimer's pathophysiology. Currently, Dr. Kandimalla is developing theranostic nanovehicles (TNV) that can permeate the blood-brain barrier, bind specifically to cerebrovascular amyloid, and serve as contrast agents for the detection of CAA using MRI and SPECT imaging. He was also recently awarded another grant for the "Early Diagnosis of Brain Insulin Resistance in AD and Non-Demented Elderly Subjects".<sup>6</sup>
4. Dr. Jayanth Panyam proposed having 3 graduate students and 1 postdoctoral associate during this time-span. Currently, he has 5 graduate students. In regards to his research, Dr. Panyam is currently focused on understanding how various biological factors and carrier properties affect the effectiveness of targeted delivery systems. His two major areas are 1) Reverse-engineering tumor invasiveness for improving tumor penetration of nanomedicine and 2) Targeting metastatic breast cancer.<sup>7</sup> He is also a co-investigator on the June 2016 NIBIB grant, "Targeting solid tumors using nanoengineered MSCs" with doctors Swayam Prabha and Timothy O'Brien.
5. Dr. Ronald Siegel proposed having 2 graduate students and 2 postdoctoral associates during this time-span. Currently, Dr. Siegel has 2 graduate students. In 2012, he wrote many proposals geared toward glucose-sensitive hydrogels (with Babak Ziaie at Purdue), had a provisional patent, a project regarding implantable biodegradable polymers, another project based on the soluble release of enzymes, a starter proposal for nasal diazepam (with Jim Cloyd and Gunda Georg). Presently, his lab is investigating four main areas of interest: 1) intranasal formulation using organic excipients for the delivery of benzodiazepines such as diazepam and midazolam; 2) biodegradable osmotic pumps to prevent surgical adhesions, and to provide rhythmic, pulsed delivery of hormones to match endogenous secretion patterns; 3) self-assembling nanoparticle systems to target and encapsulate viruses; and 4) polymeric surfaces as medical device coatings to prevent microbial adhesion and/or inflammation following implantation.<sup>8</sup>
6. Dr. Changquan Calvin Sun proposed having 5 graduate students and 2 postdoctoral associates during this time-span. Currently, Dr. Sun has 8 graduate students, 1 postdoctoral associate, and 5 visiting scientist collaborators in his lab group. In regards to his research, Dr. Sun focuses on the manufacturing science of solid dosage forms. To that end, his lab investigates three main

---

<sup>5</sup> EDR page 14 points 2 & 3.

<sup>6</sup> EDR page 16 points 2 & 3.

<sup>7</sup> EDR pg. 18 points 1 & 2

<sup>8</sup> EDR pg. 23 Research Interests

areas of interest: 1) the specification of physico-mechanical properties of drugs; 2) the incorporation of appropriate excipients for optimum mechanical properties; and 3) optimization of process such as mixing, granulation, and compaction- based on a mechanistic understanding.<sup>9</sup> To support those aims, Dr. Sun has recently received grants from Boehringer Ingelheim, AstraZeneca, and Eli Lilly.<sup>10</sup>

7. Dr. Raj Suryanarayanan proposed having his last group of students- 4 graduate students and 4 postdoctoral associates- during this time-span and stated that he enjoyed training research associates. Currently, Dr. Sury has 5 graduate students, 2 postdoctoral associates, and 1 research associate in his lab group. In regards to his research, Dr. Sury currently focuses his projects on three main areas: 1) the design, manufacture, evaluation, and stabilization of amorphous dispersions; 2) the characterization and quantification of phase transformations induced during pharmaceutical processing and their implications on product performance; and 3) the development of novel applications of X-ray powder diffractometry to characterize pharmaceutical systems.<sup>11</sup> As of January 2016, Dr. Sury has also been serving on an executive committee, which includes representatives from both the National Institute for Pharmaceutical Technology and Education and Sun Pharma to create training programs in QbD and engineering.<sup>12</sup>
8. Dr. Timothy Wiedmann proposed having no further graduate students or postdoctoral associates during this time-span as he expected to be entering phased retirement. Currently, Dr. Wiedmann has no graduate students or postdoctoral associates in his lab group. In regards to his research, Dr. Wiedmann continues to focus on characterizing the physical chemical properties of biological systems for optimizing drug delivery. By working with various clinical groups, Dr. Wiedmann has also been involved the development, evaluation, and achievement of successful drug delivery systems for specific routes of administration.<sup>13</sup>

## V. 2016 STRATEGIC PLANS

These goals were developed by the Department of Pharmaceutics faculty at the July 29<sup>th</sup>, 2016 retreat.

### GOAL #1: NEW HIRES

**The department is planning for a new line hire within the next year, with a possible second line established under the new deanship if the need is suitably justified.** When discussing the qualifications of the present hire, the majority of the faculty agreed on the importance of replenishing the pharmacokinetics expertise and reputation lost with Dr.

---

<sup>9</sup> EDR page 25 first paragraph.

<sup>10</sup> COP newflash 01/19/2016.

<sup>11</sup> EDR page 27 points 1-3.

<sup>12</sup> COP newflash 07/06/2016.

<sup>13</sup> EDR page 29 paragraphs 2 & 4.

Cheryl Zimmerman's 2016 full retirement. In addition, the faculty aims to use this hire to diversify the Department's research scope. Areas discussed included those where the University already has an established reputation (such as neuroscience), macromolecule delivery, biological engineering, modeling, quantitative analysis of drug disposition, protein diseases, polymers, and solid-state formulation. The second line hire, if offered, is likely to be in similar areas but with a greater emphasis on physical pharmacy aspects.

The professional level of the hires remains a point of consideration. Presently, all but two of the faculty are full professors, with one almost certain to be promoted, leaving a single associate professor and no assistant professors. Several of the senior faculty are expected to retire in the next 5-10 years. As senior faculty leave, it will be important to fill the ranks at starting and intermediate levels. Such faculty can be expected to contribute ~20 years or more to the Department. Several faculty members also believe that mentoring can be more effective with starting hire than with an intermediate level hire who already has an established career trajectory. New hires are also less costly, salary wise. On the other hand, intermediate level hires can bring additional funding and research resources to the Department, and enhance its reputation.

#### GOAL #2: EXPAND INFLUENCE & GAUGE IMPACT

**Strengthening the Department's position at the UM Foundation.** Robert Busch will help the Department contact non-traditional funders (e.g. families who have lost a relative to specific diseases, and grateful patients). Faculty will also meet with alumni and civic or corporate leaders face-to-face whenever possible (e.g. during business travel) to better market the Department's capabilities.

#### GOAL #3: MAINTAINING A TOP CALIBER STUDENT BASE

**Recruitment of domestic students.** In recent decades, the Pharmaceutics graduate program has primarily recruited foreign students. These students are of high caliber and they are in high demand by industry and government. However, a top program should have a substantial fraction of domestic students. Domestic students benefit the Department by being eligible for fellowships not available to international students. Recognizing some inherent disadvantages due to Minnesota climate, which has hindered our ability to recruit nationwide, enhanced efforts at marketing directly to students already at the U of M or other nearby small or private colleges will be made.

Recruitment of under-represented minorities to Pharmaceutics has been difficult, in part due to the historical demographics of Minnesota, but also due to our failure to "get the message out" that Pharmaceutics is a field that offers a path to lucrative employment. To address the latter shortcoming, the Department will consider ways to involve itself in STEM programs at the high school and early collegiate levels.

Service credit will be given for the kinds of outreach activities described in the previous paragraphs.

## VI. CURRENT & FUTURE ISSUES

### A) SPACE RENOVATION

**A large fraction of the faculty will be replaced in the coming 5-10 years.** Since there is no plan for a new Pharmacy building, it is imperative that Pharmaceuticals space will be upgraded to 21<sup>st</sup> century standards. Such revamping of space is needed in order to be competitive in attracting new faculty.

### B) EQUIPMENT REPLACEMENT AND MAINTENANCE

**Research requires that state-of-the-art equipment be purchased and maintained.** While mechanisms for joint purchases of large equipment are available, equipment maintenance is mostly left up to the individual investigators. Mechanisms to utilize ICR to support service contracts should be looked into.

### C) FAMILY LEAVE

**The Department supports 3-month family leave for all employees.** Unfortunately, salary is paid out by the investigator(s), which may lead to difficulties in timing, particularly for grants of short duration. The University should look into centralized means to fund family leave.