BINGHAMTON
UNIVERSITY
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Date: April 26th, 2013
To: Provost Nieman
From: Pharmacy committee
Re: Report from the Committee on Academic Integration of a Pharmacy School

Our committee was charged in January 2013 to explore potential research synergies between a new School of Pharmacy and existing research in related areas on the Binghamton University campus. This report is part a much larger endeavor that will determine the financial feasibility and the curricular development of a pharmacy school, with these latter facets being contributed by other groups. As such, our report will focus on how a pharmacy school might be academically integrated at BU. Because top-tier pharmacy schools include both a Doctor of Pharmacy degree (Pharm.D.) and a PhD in pharmaceutical sciences, this venture has the potential to recruit new faculty who will increase the scientific research accomplishments of the campus, collaborate to produce new work with existing faculty, and enhance our national profile in research.

In preparation of this report, the committee met with the consultant, Dr. Robert Piepho, who came to campus to advise on issues regarding the start of a pharmacy school at Binghamton. Our committee met several times to discuss common core elements of pharmacy schools nationwide and how such programmatic elements might align with existing departments and programs at Binghamton University. These discussions led to our development of a schematic illustration (see Appendix) that suggests synergies between existing programs and what might be included in a pharmacy school at BU. This diagram, along with an explanatory note and set of questions designed to elicit feedback, was circulated broadly across campus using multiple listservs. Each committee member also served as an "ambassador" among the faculty, seeking additional input, providing clarification of our charge as necessary, and stimulating thoughtful discussion among colleagues, particularly within our respective departments. We received a wide range of feedback, much of which arrived as formally drafted memos representing the collective discussions of programs/departments, though feedback was also received from individual faculty and staff members as well. Based on this feedback, our own experience and knowledge, and thoughtful consideration of national trends, a draft report was constructed and revised by the committee.

Based on our fact-finding explorations with current faculty, we learned that the School of Pharmacy is likely to link with every other school in the university in the research being conducted by their faculty. Indeed, there are so many collaborative links that the committee envisioned many ways in which areas of research excellence could be established. Although the absence of a medical school was acknowledged as a defining feature of our approach, it was apparent that a pharmacy school at BU will have a positive impact on our ability to establish successful relationships with agencies like NIH and

accelerate grant funding for research related to health care on campus. It could also provide a unifying and attainable vision for the healthcare initiative that is already afoot at BU. With this in mind, we believe the following areas should be considered as initial cornerstones of research in a pharmacy school:

Potential Areas of research synergy:

- *Smart drug delivery and device development (SD4)*: BU has substantial depth in the development of biosensors and chemical detection that, when combined with areas of expertise in microfluidics and pharmacology, could allow for the development of drug delivery devices that are responsive to changing physiological parameters. The importance of smart drug delivery systems (including nanoparticle delivery) to future pharmaceuticals is underscored by the need to maintain plasma concentrations of drugs within a narrow therapeutic window where drug efficacy can be maximized while at the same time reducing unwanted side effects. Maintaining more stable plasma concentrations of drug also prevents the waxing and waning of disease symptomology, creating a better pharmacological experience for the patient and promoting more rapid recovery. Further development of biosensors may result in smart sensors that could also monitor other adverse consequences of drug administration (contraindications, toxicity, etc), biomarkers of disease state(s), or companion diagnostic systems to monitor responses and improve strategies for drug treatment. Combining existing strengths in mathematics with computer science and other areas of Watson and the life sciences could yield further productive advances in pharmacokinetic/pharmacodynamics modeling that would facilitate the design of drug delivery.

- *CNS therapeutics:* Given existing strengths in the neurosciences at BU and a growing role for pharmacotherapy in the treatment of psychological disorders, a point of strength could be an emphasis on Central Nervous System (CNS) therapeutics. In addition to having a wide range of preclinical models in which to test novel therapeutics, BU recently opened a state-of-the-art animal research facility (science 5), providing the necessary infrastructure to grow in this area in the near term. In addition, national trends toward brain mapping initiatives highlight a timely opportunity to build tests of novel CNS therapeutics on the foundation of what is expected to be achieved by more fundamental studies of brain mapping. Specific examples of established areas of excellence at BU lie in the areas of substance use and abuse, evidenced by the Interdisciplinary Tobacco Use Research Program (ITURP) as well as the Developmental Exposure Alcohol Research Center (DEARC), though there are many other emerging areas of strength as well (eg., growing strength in neurodegenerative disorders).

- *Individualized Pharmacotherapy:* In recent years, there has been growing emphasis on the observation that achieving positive pharmacotherapeutic results can be determined by characteristics of the individual, not just through understanding general chemical properties of the drug or mechanisms of drug action. This

observation raises three points of opportunity that could be considered in the development of pharmaceutical sciences research at BU. First, BU has substantial strength in both early development and aging across multiple academic units. Examples of this lie in the Institute for Child Development (ICD; psychology), Center for Intergenerational Studies (social work), Center for Development and Behavioral Neuroscience (CDBN), Biomedical Anthropology Program, and the DNP Program in Gerontological Nursing. An emphasis on how the response to therapeutics changes across the lifespan could therefore capitalize on existing strengths in these areas. Second, an emphasis on pharmacogenomics could extend existing strength in biochemistry and molecular biology into the realm of personalized medicine, where one's genetic background is used as a platform from which to develop effective pharmacotherapeutic strategies and better understand why drug treatments often fail. Finally, disparities in healthcare access and outcomes could be folded under the general rubric of individualized pharmacotherapy. For instance, an emphasis on sex-specific drug treatments and/or responses could be advanced through establishment of a women's health cluster, or investigation into how one's race and ethnicity impact the response to drugs or propensity to seek/comply with conventional pharmacotherapy could be envisioned.

- *Immunopharmacology*. Although there was much consideration of whether specific disease states (cancer, diabetes, etc) could be an area of emphasis, it was recognized that BU probably does not have critical mass in any single disease state to mount a program that could effectively compete with schools of pharmacy linked to medical schools. However, Binghamton's research could be competitive, even premier, if the rubric were expanded to a broader level such as immunopharmacology to emphasize that aberrations in immune function (immune deficiencies or enhanced inflammatory processes) play a key role in the initiation, development and expression of numerous disease states. Thus, growing the foundation in immunology, microbiology and/or pathogenicity at BU could provide a springboard for an emphasis that would broadly impact immune function (drugs with pro-inflammatory or anti-inflammatory action, targeting new or existing signaling pathways). Ultimately, this area could also integrate with smart drug delivery as well (as noted above) because mitigation of inflammation could be critical to sensor and device implantation.

- *Healthcare management and outcomes assessment*. A natural strength at BU could arise by combining expertise across colleges to establish next-generation policies and approaches in pharmacy administration. A strong core of faculty in healthcare systems engineering could be combined with the more practical day-to-day caregivers from DSON and social work, as these two groups represent the front-lines of patient care and individualized healthcare management. Growing expertise in biomedical ethics (philosophy) and economics of healthcare, geographical distribution of disease and healthcare (geography, anthropology), and healthcare management (SOM) could be brought together to establish a core emphasis on pharmacy administration. In addition, strengths in statistical approaches and

population analysis in the math department could be applied toward assessment of effective drug treatment strategies, clinical trial efficacy, and other aspects of the drug development process.

Although the five areas above are described as separate elements, there are many points at which they overlap and one could consider developing certain cross-cutting themes that would effectively straddle all five proposed areas. For instance, it was often noted in feedback that the need for a better understanding of polypharmaceutical impacts is a significant void nationwide. Simultaneous administration of multiple drugs can lead to synergistic and/or unpredictable outcomes/toxicities, and it is widely recognized that aging individuals (in particular) tend to be treated with numerous drugs in unison. Thus, polypharmacy could be a cross-cutting theme that is embedded within each research area to provide a unifying thread among them. In a similar vein, it was noted that the continuum of drug testing, ranging from mathematical modeling→ lab-on-a-chip→ in vivo/preclinical modeling→ human translational studies will need to be given careful consideration and strategic prioritization to enable an effective and comprehensive pharmaceutical research pipeline.

As these multiple possibilities suggest, the general tenor of the feedback we received from the campus regarding the impacts of a pharmacy school on research activities at BU was strongly positive. Only a few notable exceptions were observed, citing concerns regarding the general need for a pharmacy school (given the high number of pharmacy programs nationwide) and worries that a significant new venture like this might usurp resources from existing programs. These issues of feasibility were beyond the purview of our charge, and thus the general tenor of our discussions—and ultimately our recommendation to you—is one of strong enthusiasm for how a pharmacy research program might positively influence existing academic programs at BU. Other feedback related to curricular issues and how existing academic offerings would benefit from, or be complemented by, the expected curriculum of a pharmacy school. In this sense, there appears to be substantial support for a pharmacy school at the level of both research and teaching. Though this latter point was not a part of our charge, we feel it is worth noting in this report.

Overall, we find that BU has distinctive strengths in research that could be used to support a strong foundation for a pharmacy school, while benefitting in turn from new synergies with pharmacy research. Our recommendations are not intended, of course, to obligate any particular faculty member, program or department to participate in the development of a pharmacy school, nor do we wish to omit any potentially significant linkages either. Undertaking a significant new academic venture such as this requires a starting point, which we hope to have provided in this report. Assuming that a pharmacy school at BU is established and matures over time, so will its synergies with other, unexpected areas of campus and community life and their positive impact.

We thank you for the opportunity to provide feedback on this (potential) next step for our great University.

Terrence Deak (chair)

Susan Bane

Amber Doiron

Gary James

Karin Sauer

Susan Strehle

Appendix:

- Letter to campus soliciting feedback.

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March 26, 2013

Dear Colleagues:

As you probably know, one proposal that emerged from the Roadmap Planning process was the suggestion that Binghamton University should pursue a significant new venture in the Life Sciences, including the establishment of a Pharmacy School. As a result, Provost Nieman charged a faculty committee with the task of identifying existing areas of research at BU that might intersect with a new Pharmacy School and providing recommendations for areas of research excellence that might form initial research foci in the pharmaceutical sciences. We write to seek your input on the following issues:

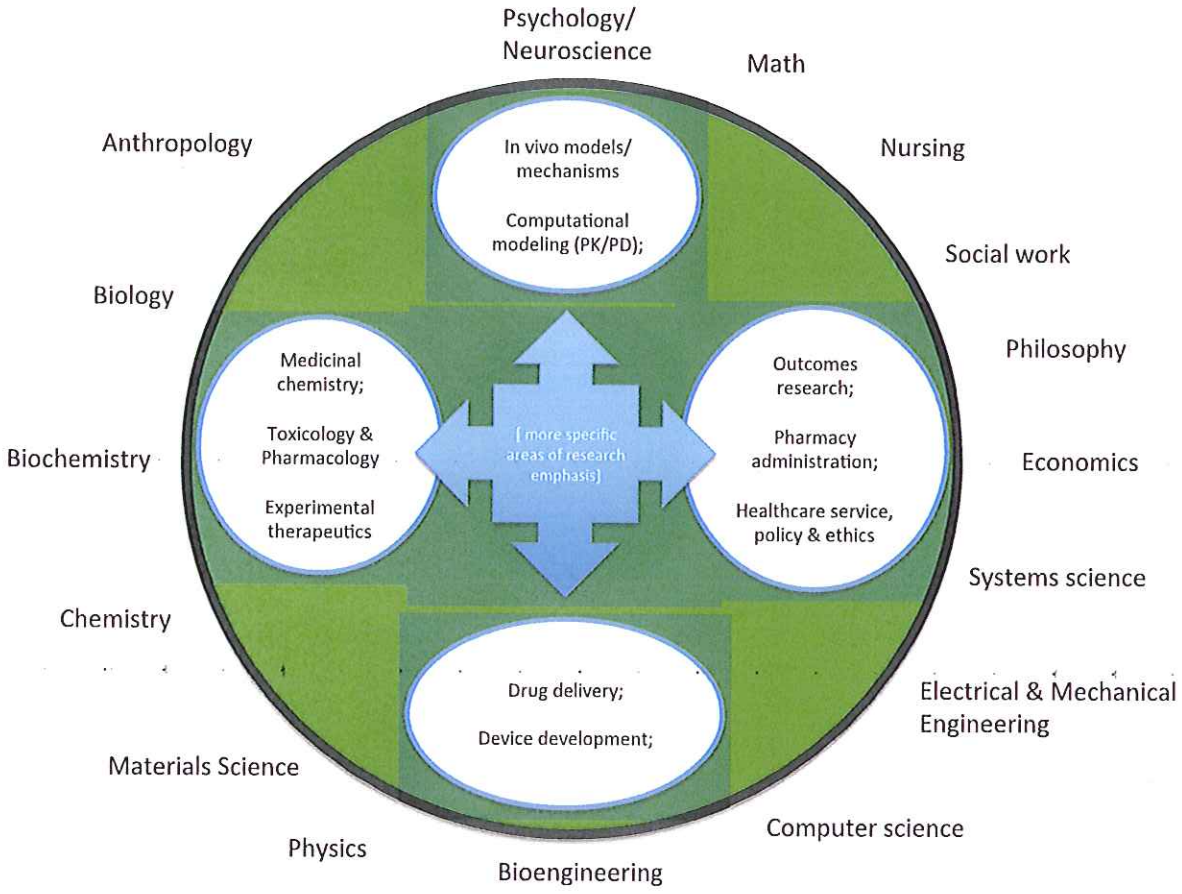
i. How might your own research intersect positively with research in a pharmacy school?
ii. Are there ways in which your program and/or department might benefit by synergies with a Pharmacy school at Binghamton University?
iii. Among the many research areas in which pharmacy-related research and scholarly activity might be oriented, are there specific areas that you think offer significant opportunities for Binghamton University?

We have prepared a preliminary structural diagram (below) to provide a rough visual alignment between some existing departments/programs at BU (listed outside the circle) and programs/departments that typically form the backbone of top-tier pharmacy schools (in the center bubbles). Please note that this preliminary draft is just that—we do not mean to exclude any particular area or over-emphasize the role that any area might play We seek feedback that will help us identify areas of research where establishment of a pharmacy school might positively enrich or intersect with the work of existing faculty, programs.

Please respond by email to pharmacy@binghamton.edu by **Friday April 5th**. Once we have received and synthesized input from the campus, we will then circulate a draft summary for additional feedback and refinement from the campus. Please feel free to contact any member of the Pharmacy team (listed below) if you would like to share your ideas with us directly.

The Pharmacy Team,

Terrence Deak, Behavioral Neuroscience Program, Department of Psychology (chair of committee)
Susan Bane, Chemistry
Amber Doiron, Bioengineering
Gary James, Decker School of Nursing/Biomedical anthropology
Karin Sauer, Biology
Susan Strehle, English & Interim Dean of the Graduate School


Psychology/
Neuroscience
Math
Anthropology
Nursing
In vivo models/
mechanisms
Computational
modeling (PK/PD);
Social work
Biology
Philosophy
Medicinal
chemistry;
Toxicology &
Pharmacology
Experimental
therapeutics
[more specific
areas of research
emphasis]
Outcomes
research;
Pharmacy
administration;
Healthcare service,
policy & ethics
Biochemistry
Economics
Systems science
Chemistry
Drug delivery;
Device development;
Electrical & Mechanical
Engineering
Materials Science
Computer science
Physics
Bioengineering