Proposal for a Revision of the
Bachelor of Science in Pharmaceutical Sciences Program
The Ohio State University College of Pharmacy

Executive Summary

Herein, we propose to significantly revise the College of Pharmacy’s Bachelor of Science in Pharmaceutical Sciences (BSPS) degree program. We will describe changes in the program’s framework, degree requirements, and course plans, providing rationale and supporting data for these modifications.

This revision was unanimously approved by College faculty on November 14, 2014. Pending approval by the University, we plan a phased implementation of the revised curriculum in Autumn 2015.

Background

Historical context
The faculty of the College of Pharmacy approved the development of the BSPS program in November 1996, and the first students matriculated in Autumn 1999. The purpose of the program was “to provide students with educational experiences and training in the pharmaceutical and related health sciences, including medicinal chemistry, pharmacognosy, pharmaceutical analysis, pharmaceutics and pharmaceutical chemistry, pharmacology, toxicology, and pharmaceutical administration. The program was intended to prepare graduates with an educational background and training for pharmaceutical science-related or pharmaceutical marketing positions within the pharmaceutical industry or regulatory government agencies. Alternatively, a BSPS graduate would be prepared to enter graduate degree programs within the areas of the pharmaceutical sciences or graduate professional programs of study such as those in dentistry, law, medicine, optometry, pharmacy, or veterinary medicine”.

The original BSPS curriculum was designed with a foundation of coursework in biology, chemistry, mathematics, physics, and physiology. Students then applied this knowledge base in required and elective courses that focused on drug discovery, design, delivery, action, and pharmaceutical distribution in health care systems. Training in essential laboratory skills was emphasized. In order to ensure a liberal education, students also completed requirements within the University’s General Education Curriculum, including Writing, Social Sciences, Arts and Humanities, and Foreign Language coursework.

At the program’s onset, the College projected that the BSPS program would enroll about 10-20 students per academic year for an approximate total enrollment of 40-80 students. Specifically, it was believed that most BSPS students would be pursuing careers in pharmaceutical research, with intentions to directly enter the workforce after graduation or to matriculate into a graduate program in the basic sciences.

1 Proposal for a New Undergraduate Degree Program Leading to the Bachelor of Science in the Pharmaceutical Sciences, Autumn 1996
The Current Curriculum

Since its inception, the BSPS curriculum has undergone incremental revisions, the most significant occurring in Autumn 2012 during the quarter-to-semester conversion. At that time, the current version of the curriculum was adopted. In order to obtain a BSPS degree, students now complete the following:

- **General Education (GE) coursework (not fulfilled through core math and science coursework)**
  - Includes Writing (6 hours), Literature (3 hours), Arts (3 hours), Social Science (6 hours), Historical Study (6 hours), Foreign Language (12 hours)
  - 36 credit hours

- **Required core math and science coursework**
  - Includes Biology, Chemistry, Math, Organic Chemistry (with labs), Physiology, Physics
  - 53-58 credit hours

- **Required, Pharmacy-based coursework**
  - Includes Survey, Biomedicinal Chemistry, Medicinal Chemistry, Pharmaceutics, Pharmacology, Pharmaceutical Distribution and Health Care Systems, Pharmaceutical Sciences Laboratory
  - 16 credit hours

- **BSPS program electives**
  - 10 credit hours

- **Free electives**
  - Remainder

**MINIMUM TOTAL 120 credit hours**

Additional information about the current program (including detailed course plans, GE requirements, and advising sheets) can be accessed in Appendix 1 (pgs. 14-19).

The Current Program’s Learning Goals

Following the completion of the current BSPS program, graduates are expected to:

- Demonstrate an understanding of the essential content of the various pharmaceutical sciences and their interrelationship within the context of the health care environment and the drug discovery and development process.
- Apply laboratory and practical skills and theoretical and critical thinking skills to solve problems in the pharmaceutical sciences in an ethically responsible manner.
- Communicate scientific content and concepts verbally and in written form.
- Demonstrate an awareness of diversity in the context of the pharmaceutical sciences, particularly with respect to cultural, biological, organizational, and human values differences by engaging in intellectually meaningful interaction.
- Be aware of post-graduation opportunities and be prepared to matriculate to either an entry-level industry position or a graduate or professional program.

Enrollment and Student Reception

During the 2013-14 academic year, 446 students were enrolled in the BSPS program, a number that greatly exceeds the original forecast of “40-80 students total”. In fact, since the program’s inception, total enrollment in the program has consistently exceeded early expectations, with year-to-year numbers hovering in the mid-400s (Figure 1).
Though the original BSPS program was primarily designed to cater to those students pursuing laboratory research and industry positions, the majority of students in the current program are pursuing professional practice careers. In 2014, 71% of graduating students planned to attend a post-baccalaureate professional program, and of that cohort, most planned to attend pharmacy or medical school. In that same year, 18% of students intended to pursue graduate school for a masters or doctorate degree, while only 9% of students planned to directly enter the workforce.  

Student satisfaction with the BSPS program is high (Table 1). As indicated, the vast majority of students would choose the BSPS major again and would recommend the major to a family member or friend. Overall, students consistently provided feedback about their “outstanding” experience with this “unique” “well-organized” degree program, praising the “excellent” instruction and mentoring in the “close-knit” College as well as the “exceptional” Student Affairs staff.

Still, some data suggest that program changes are needed. Students consistently report that the curriculum does an "inadequate job of preparing graduates for careers in pharmaceutical industry and research". One frustrated student said, “It seems as though this program is set up mainly for people who want to go to pharmacy school. I wish I would have been informed of this to begin with, as I would have switched majors.” Other students were frustrated by the extensive “overlap between courses” and the “depth and variety of elective courses”. Further, some were “dismayed” by the “lacking” emphasis on laboratory skill development, also suggesting that students should be “challenged more often to critically think and problem solve with each other”. In fact, to the latter point, objective assessment of our students’ problem solving skills (which includes lab-based and critical thinking skills) indicates that only 16-39% of our students demonstrated proficiency in this realm.

Rationale for Curricular Revision
The state of the current BSPS program is strong and has greatly exceeded early expectations with regard to student enrollment. However, we believe that a curricular revision is in order, namely for the following reasons:

- The base BSPS curriculum has now been in existence for 16 years, and the market needs are quite different now.
- The “one-size-fits-all” curriculum may not best prepare our students for diverse biomedical careers (i.e., clinical practitioner vs. laboratory research/industry careers).

Graduating Student Exit Survey, 2014
There exists some degree of curricular redundancy, with classes inefficiently re-teaching material already taught multiple times in the program.

Table 1: Student satisfaction with the current BSPS program
Excerpts from the 2014 Graduating Senior Exit Survey (n=53, 47.9% response rate).

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>% Agreement*</th>
</tr>
</thead>
<tbody>
<tr>
<td>The curriculum follows a logical progression (i.e., courses are properly sequenced and integrated.)</td>
<td>3.77%</td>
<td>3.77%</td>
<td>9.43%</td>
<td>35.85%</td>
<td>47.17%</td>
<td>83.02%</td>
</tr>
<tr>
<td>I am developing the skills needed to prepare me for a career or additional education after graduation.</td>
<td>3.77%</td>
<td>3.77%</td>
<td>7.55%</td>
<td>37.74%</td>
<td>47.17%</td>
<td>84.91%</td>
</tr>
<tr>
<td>If I were starting my college career over again, I would choose to study Pharmaceutical Sciences.</td>
<td>5.66%</td>
<td>13.21%</td>
<td>7.55%</td>
<td>26.42%</td>
<td>47.17%</td>
<td>73.59%</td>
</tr>
<tr>
<td>If I were starting my college career over again, I would choose to attend OSU.</td>
<td>3.77%</td>
<td>0.00%</td>
<td>7.55%</td>
<td>22.64%</td>
<td>66.04%</td>
<td>88.68%</td>
</tr>
<tr>
<td>I would recommend this major to a family member or friend.</td>
<td>3.77%</td>
<td>1.89%</td>
<td>11.32%</td>
<td>41.51%</td>
<td>41.51%</td>
<td>83.02%</td>
</tr>
<tr>
<td>I would recommend OSU to a family member or friend.</td>
<td>3.77%</td>
<td>0.00%</td>
<td>3.77%</td>
<td>20.75%</td>
<td>71.70%</td>
<td>92.45%</td>
</tr>
</tbody>
</table>

*The sum percentage of students who either agreed or strongly agreed with each statement

The Curricular Revision Proposal

Action: Change the Program's Framework
We propose a restructuring of the curricular program such that students will complete the BSPS degree requirements through one of two tracks: the Healthcare Professions Pathway (largely designed for those students intending to pursue professional studies in pharmacy, medicine, veterinary medicine, dentistry, others) and the Drug Discovery and Development Pathway (largely designed for those students intending to pursue graduate school and/or research-based careers in the basic pharmaceutical sciences; Figure 2). While substantial commonalities are shared between the two tracks, each would offer unique specialization opportunities for its representative cohort.
**Basis for Action**
The existing BSPS program’s “one-size-fits-all” content does not optimally cater to the interests and training needs of our current students. Our graduates are pursuing diverse careers in the biomedical sciences, and in order to best prepare them, the curriculum should reflect that diversity. The pathway-specific content will afford our students the opportunity to specialize and contextualize their studies in a way that permits deeper learning and better training.

![Diagram of the new BSPS program framework](image)

**Figure 2: A schematic of the new BSPS program framework**

**Action: Re-organize and Update the Program’s Coursework Requirements**
In order to provide new, more specialized content in the track system as well as to improve the quality of the student experience, we propose a major revision of the program’s course plan. This includes a significant revamping of major classes, elective requirements, and GE coursework.

**Basis for Action**
The current BSPS curriculum must be updated in order to provide the customized training proposed in the track system. As a guide in the program’s design, we identified and targeted those skillsets necessary for successful careers as clinical practitioners or pharmaceutical science researchers (as put forth in the proposed learning goals). It is important to note that there intentionally remains considerable overlap between the tracks. The content of both pathways maintains a strong focus on the pharmaceutical sciences, thereby justifying a single major.

In **Appendix 2A (pgs. 21-29)**, we provide detailed information about the Healthcare Professions and Drug Discovery and Development Pathways, outlining general education (GE) coursework, common and pathway-specific coursework, and elective requirements (program-based and free).

**General Education Coursework**
The current program’s GE requirements will be retained with one exception. After extensive analysis, we propose to eliminate the Foreign Language GE requirement (up to 12 hours, 3 courses). We believe that this move is justified because: 1) our current number of GE credit.
hours exceeds all other programs on campus, 2) because of incoming credit and/or placement, less than 20% of our students actually complete all 3 foreign language courses, 3) the freed hours from dropping this element makes available space to provide more targeted opportunities and coursework for the student, and 4) a theme of diversity and cultural competency will now be threaded throughout the required BSPS coursework. Importantly, we will still encourage our students to study foreign language through their elective choices. With this change and as summarized in Appendix 2B (pg. 30), the revised GE requirements will be:

- Writing (6 hours)
- Social Science (6 hours),
- Arts and Humanities including:
  - Historical Study (3 hours)
  - Arts (3 hours)
  - Literature (3 hours)
  - Cultures & Ideas or Historical Study (3 hours)
- Mathematics (5 hours; fulfilled through core math and science coursework)
- Science (9 hours; fulfilled through core math and science coursework)
- Open Options (10 hours; fulfilled through core math and science coursework)

Excluding those hours fulfilled through core math and science coursework (i.e., Mathematics, Science, Open Options), the students would now take 24 credit hours of GE coursework (instead of the current 36 hours).

The Core Math and Science Coursework (requirements common to both pathways)

The new BSPS curriculum (regardless of the pathway) maintains a strong STEM foundation; as such, students will be required to take a number of rigorous science and math courses, including:

- General Chemistry (CHEM1210,-20; 10 credit hours)
- Biology (BIO1113,-1114, 8 credit hours)
- Organic Chemistry with Labs (CHEM2510,-20,-40,-50; 12 credit hours)
- Physics (PHYSICS1200,-01; 10 credit hours)
- Calculus (MATH1151; 5 credit hours)
- Human Physiology (EEOB2520 or equivalent; 3 credit hours)
- Biostatistics (STAT2480 or equivalent; 3 credit hours)

Further, all students (regardless of pathway) will specialize their pharmaceutical science studies with College of Pharmacy-based coursework, including:

- Pharmaceutical Sciences Survey\(^3\) (PHR1100; 1 credit hour)
- Careers in the Pharmaceutical Sciences (PHR2100; 1 credit hour)
- Intro to Evidence-Based Medicine OR Reading and Writing Pharmaceutical Sciences Literature courses (PHR2367.01,-02; 3 credit hours each\(^4\))
- Drug Discovery, Development, and Delivery (PHR2500; 3 credit hours)
- Biochemistry for the Pharmaceutical Sciences (PHR3200; 5 credit hours)
- Integrated Pharmaceutical Sciences course series (PHR4000,-10; 10 credit hours),
- Ethics and Professionalism in the Pharmaceutical Sciences (PHR3500; 2 credit hours)
- Pharmaceutical Sciences Laboratory class (PHR4600; 2 credit hours).

\(^3\) The Survey class is only required for freshman students who have already declared the BSPS major.

\(^4\) PHR2367.01, -.02 hours counted towards the GE writing requirement.
The Healthcare Professions Pathway-Specific Coursework
This pathway’s curriculum presents opportunities and coursework that explores the pharmaceutical sciences from a patient-care perspective. Because students in this pathway will likely pursue post-baccalaureate training, this course of study must permit students to complete prerequisite courses required for professional school admission. While creating this pathway’s course plan, we consulted prerequisite needs for Pharmacy, Medicine, Veterinary Medicine, and Dentistry doctoral programs, primarily using Ohio State University programs as a point of reference. As these data indicate, we will require these students to take Anatomy (ANATOMY2300.04 or EEOB2510, 3-4 credit hours) and Microbiology (MICRBBIO4000, 4 credit hours) courses.

The Drug Discovery and Development Pathway-Specific Coursework
This pathway’s curriculum explores the pharmaceutical sciences from a rigorous laboratory research-based perspective. All students in this pathway will gain additional hands-on experience in the laboratory through an Instrumental Analysis and Techniques course (PHR4610; 3 credit hours). Additionally, students in this track will also enroll in a set number (at least 4 credit hours) of designated “advanced electives”, which are distinct from the BSPS program or free electives (discussed below). The intent of these classes is to build on concepts learned in other pharmaceutical sciences coursework, and thus we would expect students to enroll in these in the final year of the program.

A comparison of the current and revised BSPS major coursework (required courses) is shown in Table 2.

Table 2: Comparison of required PHR coursework in existing (top) and revised (bottom) curricula

<table>
<thead>
<tr>
<th>Current #</th>
<th>Name</th>
<th>Hours</th>
<th>Content as it relates to current curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHR1100</td>
<td>Pharmaceutical Sciences Survey</td>
<td>1</td>
<td>Maintained in new curriculum</td>
</tr>
<tr>
<td>PHR4100</td>
<td>Biomedical Chemistry</td>
<td>3</td>
<td>Expanded into new Biochemistry for the Pharmaceutical Sciences (PHR3200)</td>
</tr>
<tr>
<td>PHR4200</td>
<td>Intro to Medicinal Chemistry</td>
<td>3</td>
<td>Incorporated into new Integrated Pharmaceutical Sciences series (PHR4000,-10)</td>
</tr>
<tr>
<td>PHR4300</td>
<td>Intro to Pharmaceutics</td>
<td>2</td>
<td>Incorporated into new Integrated Pharmaceutical Sciences series (PHR4000,-10)</td>
</tr>
<tr>
<td>PHR4400</td>
<td>Integrated Pharmacology</td>
<td>2</td>
<td>Incorporated into new Integrated Pharmaceutical Sciences series (PHR4000,-10)</td>
</tr>
<tr>
<td>PHR4500</td>
<td>Pharmaceutical Distribution and Health Care Systems</td>
<td>3</td>
<td>Some content will be covered in new Drug Discovery, Development, and Delivery course (PHR2500)</td>
</tr>
<tr>
<td>PHR4600</td>
<td>Pharmaceutical Sciences Laboratory</td>
<td>2</td>
<td>Maintained in new curriculum</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>New #</th>
<th>Name</th>
<th>Hours</th>
<th>Content as it relates to current curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHR1100</td>
<td>Pharmaceutical Sciences Survey</td>
<td>1</td>
<td>Remains as ongoing course</td>
</tr>
<tr>
<td>PHR2100</td>
<td>Career Exploration in Pharmaceutical Sciences</td>
<td>1</td>
<td>New</td>
</tr>
<tr>
<td>PHR2367.01</td>
<td>Introduction to Evidence-Based Medicine</td>
<td>3</td>
<td>New</td>
</tr>
<tr>
<td>PHR2367.02</td>
<td>Reading and Writing Pharmaceutical Sciences Literature</td>
<td>3</td>
<td>New</td>
</tr>
<tr>
<td>PHR2500</td>
<td>Drug Discovery, Development, and Delivery</td>
<td>3</td>
<td>Some of PHR4500 (Pharm. Dist. and Health Care Systems)</td>
</tr>
<tr>
<td>PHR3200</td>
<td>Biochemistry for the Pharmaceutical Sciences</td>
<td>5</td>
<td>PHR4100 (Biomedical Chemistry) plus PHR4110 (Intermediary Metabolism and Therap.)</td>
</tr>
<tr>
<td>PHR3500</td>
<td>Ethics and Professionalism in the Pharmaceutical Sciences</td>
<td>2</td>
<td>Some of PHR5140 (Professional Ethics)</td>
</tr>
<tr>
<td>PHR4000</td>
<td>Integrated Pharmaceutical Sciences I</td>
<td>5</td>
<td>Integration of PHR4200 (Med Chem), PHR4300 (Pharmaceuticals), PHR4400 (Pharmacology)</td>
</tr>
<tr>
<td>PHR4010</td>
<td>Integrated Pharmaceutical Sciences II</td>
<td>5</td>
<td>Integration of PHR4200, PHR4300, PHR4400; new applied content</td>
</tr>
<tr>
<td>PHR4600</td>
<td>Pharmaceutical Sciences Laboratory</td>
<td>2</td>
<td>Remains as ongoing course</td>
</tr>
<tr>
<td>PHR4610</td>
<td>Instrumental Analysis and Experimental Techniques</td>
<td>3</td>
<td>New</td>
</tr>
</tbody>
</table>

Elective Courses (Program-Based, Advanced, and Free)
Students will be able to personalize their academic experience through a selection of BSPS program elective courses (at least 10 credit hours for the Healthcare Professions Pathway students; at least 11 credit hours for the Drug Discovery and Development Pathway

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5 We recognize that these prerequisite data are not all-inclusive or unchanging. Our Director of Undergraduate Studies and BSPS Program Committee will stay abreast of changing prerequisite demands and make curricular changes as necessary.
students). These will draw from any elective course taught in the College of Pharmacy as well as other relevant non-Pharmacy courses approved by our BSPS Program Committee.

The Drug Discovery and Development Pathway students will be required to enroll in 4 hours of designated “advanced” electives (though Healthcare Professions Pathway students may take these if they choose). Currently, our College is teaching 5 courses at this level (i.e., those electives with a 4000-level number), but we are planning to develop more in the next several years when these students would be reaching their final year. There is also an opportunity to identify non-Pharmacy advanced-level courses to fulfill this requirement (as monitored by the BSPS Program Committee).

If a student fulfills all of his/her major and elective coursework requirements without accumulating 121 credit hours, the remainder of these hours would be reached with free electives of the student’s choosing. These would include any course(s), including non-remedial classes at the 1100-level or above.

A Note about Research Experiences for the BSPS Students
Though we strongly value the experience of scholarly activities outside of the classroom as a critical complement to our coursework, the BSPS students will not be required to engage in research activities. All students will be able (and strongly encouraged to) enroll in PHR4999 hours that would contribute to their elective hour requirements. However, we feel that requiring a research experience would unnecessarily burden students as well as the faculty advisors.

The Overall Mechanics of the Newly Proposed BSPS Curriculum
As summarized below, a student would need to complete 121 credit hours to fulfill the requirements of the new BSPS degree. This value is equivalent between the two pathways and only slightly changed from the current program (120 credit hours).

### The Healthcare Professions Pathway:

- **General Education coursework (not fulfilled through required core math and science coursework)**
  - Includes Writing (6 hours), Literature (3 hours), Arts (3 hours), Social Science (6 hours), Historical Study (6 hours)  
    - **24 credit hours**

- **Required core math and science coursework**
  - Includes Biology, Chemistry, Organic Chemistry (with labs), Calculus, Physics, Physiology, Statistics  
    - **51 credit hours**

- **Required Pharmacy-based coursework**
  - Includes Survey, Career Exploration, Drug Discovery→Delivery, Biochemistry, Ethics and Professionalism, Integrated Pharm. Sciences, Pharm. Sciences Lab  
    - **24 credit hours**

- **Required pathway-specific coursework**
  - Includes Anatomy, Microbiology  
    - **7-8 credit hours**

- **BSPS program electives**
  - **10 credit hours**

- **Free electives**
  - **4-5 credit hours**

**MINIMUM TOTAL**  
**121 credit hours**
The Drug Discovery and Development Pathway:

- **General Education coursework (not fulfilled through required core math and science coursework)**
  - Includes Writing (6 hours), Literature (3 hours), Arts (3 hours), Social Science (6 hours), Historical Study (6 hours) 24 credit hours

- **Required core math and science coursework**
  - Includes Biology, Chemistry, Organic Chemistry (with labs), Calculus, Physics, Physiology, Statistics 51 credit hours

- **Required Pharmacy-based coursework**
  - Includes Survey, Career Exploration, Drug Discovery Delivery, Biochemistry, Ethics and Professionalism, Integrated Pharm. Sciences, Pharm. Sciences Lab 24 credit hours

- **Required pathway-specific coursework**
  - Includes Instrumental Analysis/Tech. 3 credit hours

- **BSPS program electives**
  - 11 credit hours

- **Advanced electives**
  - 4 credit hours

- **Free electives**
  - 4 credit hours

**MINIMUM TOTAL** 121 credit hours

**Action: Amend the Program’s Learning Goals**

We propose a revision of the program’s learning goals to better reflect the desired outcomes of the updated curriculum. As presented below, the BSPS degree program will have only one set of goals that would address the content of both tracks.

**Upon completion of the Bachelor of Science in Pharmaceutical Sciences program, students will be able to:**

1. Demonstrate an understanding of the essential content of the pharmaceutical sciences and their interrelationship within the context of healthcare and the drug discovery and development process.
2. Apply practical and critical-thinking skills to solve complex problems.
3. Acquire, assess, and evaluate information.
4. Effectively communicate scientific content and concepts, both verbally and in written form.
5. Understand professionalism while appreciating ethics, cultural awareness, and teamwork in all aspects of performance.
6. Demonstrate an awareness of diversity in the context of the pharmaceutical sciences, particularly with respect to cultural, biological, organizational, and human values differences.
7. Describe various careers in the pharmaceutical sciences, and be prepared to matriculate directly into the workforce or a graduate/professional program.

**Basis for Action**

In order to align with the vision of the new curriculum, we drafted new learning goals, placing particular emphasis on measurable outcomes in pharmaceutical science knowledge, problem-solving/critical thinking, information analysis, communication, professionalism, diversity awareness, and career preparation. A curricular map linking the learning goals to individual courses in the required curriculum is listed in Appendix 3 (pg. 37-38).
To measure our effectiveness in achieving these program learning goals, we will continue with ongoing assessment efforts. These include embedded exam questions, surveys, and rubric-based performance assessment. This work is currently being overseen by our Associate Dean for Assessment and Strategic Initiatives in collaboration with the BSPS Program Committee and our College’s Director of Undergraduate Studies.

**Comparative data**

With only 18 U.S. universities offering one, the BSPS major is relatively rare. As outlined in a recent review\(^6\) (included as Appendix 4, pgs. 39-55), BSPS programs are typically standalone like ours\(^7\) though some are used as a stepping stone (i.e., students complete two years of BSPS coursework and then can matriculate into a PharmD program). Most focus on only one of our proposed pathway areas; that is, the major is used either as pre-pharmacy training or as a laboratory research-focused program. Though graduates of any BSPS program technically would be prepared to pursue diverse post-baccalaureate options, our proposed curricular changes will shape our BSPS program as being highly unique, offering up-to-date, customized training and opportunities in both pre-clinical and laboratory-focused fields.

**Impact of the New BSPS Program**

We firmly believe that the revised BSPS program put forth herein will create a robust, highly unique degree offering at The Ohio State University. We have outlined a curriculum that increases our College’s teaching presence in front of our students over the entire 4-year program, offering innovative training opportunities in the process. We predict that this will result in an improved teaching and learning experience for everyone. However, we recognize that our revised program will impact our faculty, current (matriculated) students, and other campus units. We are monitoring these impacts, and in some cases, have developed appropriate strategies to remediate these issues, as detailed below.

**Impact on faculty/staff**

With respect to required courses, the revised program will double the College’s teaching load from 16 hours to 33 hours\(^8\). College administration is now actively planning for implementation and identifying internal and external resources to deliver the instruction. At the College’s most recent Executive Committee meeting (11/21/14), our administration agreed to commit resources for the hiring of associated faculty to assist with curricular delivery, if needed.

Another possible concern is how delivery of two separate curricula (i.e., the “old” and “new”) could be achieved without overloading faculty/staff. As planned, the new curriculum will be phased in roughly year-by-year from 2015-2018. During this time frame, we have developed a master schedule outlining when courses will go “on- and off-line” (Appendix 5A, pg. 57), and as

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\(^7\) We should point out that this review article erroneously states that students in our program can matriculate into our PharmD program after completing only 45 hours. This is not the case; students must have completed a full 4-year degree to matriculate into our PharmD program.

\(^8\) Because only a few new elective courses will be added to the course catalog in the next several years, we do not anticipate much effect on faculty/staff workload in that facet.
shown, there should be no need for dual-teaching of courses from the old and new curricula during this transition period.

Impact on current (matriculated) students

We recognize that this revision will have a significant impact on our current (matriculated) students, who will be held to the existing curriculum for their graduation requirements. To investigate this, we created course plans for each class year as the new curriculum unfolds over the next 3 years. Using the planned implementation timeline, we identified that the current BSPS sophomores, juniors, and seniors will be unaffected by the rollout; as such, they would follow the current course plan as dictated in Appendix 1C (pg. 18). However, the current BSPS freshmen will need schedule adaptations; that is, some of the upper-level required courses will be re-formulated and eliminated in their current form before these students can take them. In consultation with our Student Affairs staff, we have developed the following transition period vision and strategies:

1. Much like the quarter-to-semester conversion, none of our current students will be “harmed” in the curricular transition process.
2. With respect to required coursework, transition students will still be exposed to the same core pharmaceutical sciences content as the existing curriculum (see Table 3); however, the packaging of that content would differ. For example, instead of taking three individual basic pharmaceutical sciences courses (i.e., PHR4200-4400), students would now learn that content in the integrated pharmaceutical sciences course series (PHR4000, -10). We believe that the new curriculum will offer better training with more up-to-date content and reduced redundancy.
3. In some cases, content-equivalent courses between the curricula are not hour-equivalent. In the cases in which new equivalent courses are of a higher credit hour value than those in the old curriculum (Table 3), the overage hours will be applied to the students’ BSPS program elective requirements. This would likely equate to 5 credit hours counting towards the 10-hour requirement.
4. To ensure a smooth transition, our Student Affairs staff will work closely with students to communicate changes in the curriculum and alter students’ advising plans. Sample advising sheets for the affected freshman class are presented in Appendix 5B (pgs. 58-60).

Table 3: Required course equivalencies in the current and revised curricula during the transition period

<table>
<thead>
<tr>
<th>Current Curriculum</th>
<th>Revised Curriculum</th>
<th>Difference in Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedicinal Chem (PHR 4100, 3 cr hrs)</td>
<td>Biochemistry (PHR 3200, 5 cr hrs)</td>
<td>+2</td>
</tr>
<tr>
<td>Intro Med Chem (PHR 4200, 3 cr hrs)</td>
<td>Integrated Rx Sci 1 (PHR 4000, 5 cr hrs)</td>
<td>+3</td>
</tr>
<tr>
<td>Intro Pharmaceutics (PHR 4300, 2 cr hrs)</td>
<td>Integrated Rx Sci 2 (PHR 4010, 5 cr hrs)</td>
<td></td>
</tr>
<tr>
<td>Integrated Pharmacology (PHR 4400, 2 cr hrs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phr Dist. &amp; Healthcare Sys (PHR 4500, 3 cr hrs)</td>
<td>Drug Disc, Dev &amp; Deliv (PHR 2500, 3 cr hrs)</td>
<td></td>
</tr>
<tr>
<td>Pharm Sci Lab (PHR 4600, 2 cr hrs)</td>
<td>Pharm Sci Lab (PHR 4600, 2 cr hrs)</td>
<td>0</td>
</tr>
</tbody>
</table>

Overage hours to be applied to elective hours requirement 5

Impact on other campus units

We propose no changes in the amount of service science courses (i.e., General Chemistry, Biology, Organic Chemistry, Physics, etc.) that our students would take; as such, we do not anticipate issues with enrollment in these classes. However, some external courses may see increases in enrollment. All BSPS students would now take a biostatistics course (STAT2480). Additionally, the Healthcare Professions Pathway students would also be required to take
Microbiology (MICR4000) and Anatomy (ANATOMY2300 or EEOB2510). We have received concurrence from these units that these changes can be accommodated (included as Appendix 5C, pgs. 61-69).

With the GE coursework changes being proposed, this curricular revision will impact the foreign language departments in the College of Arts and Sciences. As discussed above, our revised curriculum would no longer require students to achieve a certain level of proficiency in a foreign language. However, data analysis of last year’s graduating BSPS class indicated only 18% of students actually took all 12 hours (100%) of the foreign language coursework (i.e., they placed into a higher course level or entered with AP credit). We do note that the revised curriculum would newly require two Arts and Sciences courses (Statistics, Microbiology, and Human Anatomy at 10 hours total), at least offsetting some of that College’s tuition dollars lost by the Foreign Language requirement changes.

Steps in proposal development, review, and/or approval

Over the past year, we worked extensively within the College of Pharmacy and with campus partners to develop this comprehensive BSPS program revision (with strong support from our Dean; letter of support included in Appendix 6A, pg. 71). These efforts included:

- December, 2013 – present: Meetings with key campus constituents to discuss the BSPS curricular revision, including:
  - Ms. Annette McMurry, Director of Admissions, College of Dentistry (12/4/13)
  - Dr. Linda Lord, Associate Dean for Student Affairs, College of Veterinary Medicine (1/8/14)
  - Dr. John Davis, Associate Dean for Medical Education, College of Medicine (1/16/14)
  - Drs. Steve Fink, Executive Associate Dean, and Bernadette Vankeerbergen, Program Manager, College of Arts and Sciences (9/4/14)
  - Dr. W. Randy Smith, Vice Provost for Academic Programs, Office of Academic Affairs (9/18/14)
  - University-Level Advisory Committee for General Education (ULAC-GE) Committee (11/24/14)

- January – May, 2014: The BSPS Curricular Revision Task Force, comprising faculty, staff, students, alumni, and industry partners (as listed in Appendix 6B, pgs. 72-73), worked to:
  - Analyze data, identifying strengths and weaknesses of the current BSPS program
    - Create a draft curricular proposal that:
      - Restructured the program’s framework, delivering more customized content that appeals to a broader base of students
      - Developed logical and manageable course plans that maximize student learning and skill acquisition
      - Distributed College of Pharmacy-based coursework over the entire four-year curriculum (instead of just the final two years)
      - Defined ancillary needs that would have a major impact on the students’ experience
- Gathered input from key stakeholders throughout the process, including presentations at:
  - Two faculty meetings (3/7/14, 5/2/14; minutes provided in Appendix 6C, pgs. 74-79)
  - The Dean’s Corporate Council meeting (5/16/14; minutes provided in Appendix 6C, pgs. 80-81)
  - Alumni Governing Board (10/16/14; minutes provided in Appendix 6C, pg. 84)

- August – November, 2014: The BSPS Curricular Implementation Team, comprising division chairs, assessment personnel, and Student Affairs staff (as listed in Appendix 6B, pgs. 72-73), worked to:
  - Adapt the curricular proposal where logistically necessary
  - Identify resources, including instructors and support staff, for program implementation
  - Update the faculty, staff, and students about the curricular revision, including:
    - Presentation of the draft proposal to faculty for discussion prior to vote (10/3/14; meeting minutes provided in Appendix 6C, pgs. 82-83)
    - Conducted College-wide town halls to gather feedback (10/14/14, 10/27/14)

- November 14, 2014: College of Pharmacy faculty unanimously voted to approve the new BSPS curriculum (meeting minutes provided in Appendix 6C, pgs. 85-86)

- November 20, 2014: College of Pharmacy’s Executive Committee decides on implementation timeline (meeting minutes provided in Appendix 6C, pgs. 87-88)

Resources

A letter from the College of Pharmacy’s Chief Administrative Officer (Mr. Erin Delffs) is included as Appendix 7 (pg. 89-90).
APPENDIX 1

Information about the current BSPS program at The Ohio State University

A. Graduation checklist showing course requirements (student advising form)…..pg. 15
B. Course list (student advising form)………………………………………………….pg. 16-17
C. Sample 4-year course plan (student advising form)…………………………pg. 18
D. University-approved GE plan……………………………………………………pg. 19
# BSPS Degree Requirements Checklist

## General Education (GE) Courses

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing (6)</td>
<td>1st Writing Course (3): ____________________</td>
</tr>
<tr>
<td></td>
<td>2nd Writing Course (3): ____________________</td>
</tr>
</tbody>
</table>

Note: Two courses in Global Studies and one course in Social Diversity are required. Classes can overlap with the Social Sciences and Arts and Humanities.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Language (12)</td>
<td>1101 (4): ____________________</td>
</tr>
<tr>
<td></td>
<td>1102 (4): ____________________</td>
</tr>
<tr>
<td></td>
<td>1103 (4): ____________________</td>
</tr>
</tbody>
</table>

## Arts and Humanities (12)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical Study (3):</td>
<td>1101 (4): ____________________</td>
</tr>
<tr>
<td>Arts (3):</td>
<td>1102 (4): ____________________</td>
</tr>
<tr>
<td>Literature (3):</td>
<td>1103 (4): ____________________</td>
</tr>
</tbody>
</table>

## Social Science (6)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Science 1 (3):</td>
<td>1101 (4): ____________________</td>
</tr>
<tr>
<td>Social Science 2 (3):</td>
<td>1102 (4): ____________________</td>
</tr>
</tbody>
</table>

## Core Math and Science Courses

### Biology

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 1113 (4)</td>
<td>1114 (4): ____________________</td>
</tr>
<tr>
<td>Biology 1114 (4)</td>
<td>1115 (5): ____________________</td>
</tr>
<tr>
<td>Math 1148 (4)</td>
<td>1149 (3): ____________________</td>
</tr>
<tr>
<td>Math 1150 (5)</td>
<td>1151 (5): ____________________</td>
</tr>
</tbody>
</table>

### Chemistry

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 1210 (5)</td>
<td>1220 (5): ____________________</td>
</tr>
<tr>
<td>Chemistry 2510 (4)</td>
<td>2520 (2): ____________________</td>
</tr>
<tr>
<td>Chemistry 2540 (2)</td>
<td>2550 (2): ____________________</td>
</tr>
</tbody>
</table>

### Math

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 1148 (4)</td>
<td>Physics 1200 or 1250 (5)</td>
</tr>
<tr>
<td>Math 1149 (3)</td>
<td>Physics 1201 or 1251 (5)</td>
</tr>
<tr>
<td>Math 1150 (5)</td>
<td>1151 (5): ____________________</td>
</tr>
</tbody>
</table>

### Physics

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 1200 or 1250 (5)</td>
<td>1201 or 1251 (5): ____________________</td>
</tr>
<tr>
<td>EEOB 2520 (3)</td>
<td>OR</td>
</tr>
<tr>
<td>Physiology 3101 (3) and</td>
<td>Physiology 3012 (3): ____________________</td>
</tr>
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</table>

## BSPS Required Courses

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacy 4100 (3)</td>
<td>4200 (3): ____________________</td>
</tr>
<tr>
<td>Pharmacy 4300 (2)</td>
<td>4400 (2): ____________________</td>
</tr>
<tr>
<td>Pharmacy 4500 (3)</td>
<td>4600 (2): ____________________</td>
</tr>
</tbody>
</table>

## BSPS Elective Courses (10 total hours)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacy 2000 (2)</td>
<td>4320 (2): ____________________</td>
</tr>
<tr>
<td>Pharmacy 4110 (2)</td>
<td>4330 (2): ____________________</td>
</tr>
<tr>
<td>Pharmacy 4120 (1)</td>
<td>4410 (2): ____________________</td>
</tr>
<tr>
<td>Pharmacy 4193 (*)</td>
<td>4420 (1): ____________________</td>
</tr>
<tr>
<td>Pharmacy 4194 (*)</td>
<td>4430 (1): ____________________</td>
</tr>
</tbody>
</table>

*Indicates that credit hours vary

## Free Elective Courses (to a total of at least 120 hours)

Non-remedial courses (i.e. classes below the level of a required course) at the 1100-level or above may be counted.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1101 (4): ____________________</td>
</tr>
<tr>
<td></td>
<td>1102 (4): ____________________</td>
</tr>
<tr>
<td></td>
<td>1103 (4): ____________________</td>
</tr>
</tbody>
</table>

Total: ______
BSPS Course List

BSPS Required Courses

All classes are REQUIRED for degreed completion:

Pharmacy 4100: (Biomedicinal Chemistry), 3 credit hours, Autumn Semester ONLY
   Prerequisites: Chemistry 2520 and enrollment in BSPS

Pharmacy 4200: (Introduction to Medicinal Chemistry), 3 credit hours, Spring Semester ONLY
   Prerequisites: Pharmacy 4100, Chemistry 2520, and enrollment in BSPS

Pharmacy 4300: (Introduction to Pharmaceutics), 2 credit hours, Autumn Semester ONLY
   Prerequisites: Physics 1201 or 1251, Chemistry 2520, Math 1151, EEOB 2520, enrollment in BSPS

Pharmacy 4400: (Integrated Pharmacology), 2 credit hours, Spring Semester ONLY
   Prerequisites: Pharmacy 4100 or equivalent, EEOB 2520

Pharmacy 4500: (Pharmaceutical Distribution and Health Care Systems), 3 credit hours, Spring Semester ONLY
   Prerequisites: Math 1151 and enrollment in BSPS

Pharmacy 4600: (Pharmaceutical Sciences Laboratory), 2 credit hours, Autumn and Spring Semester
   Prerequisites: Chemistry 2520, Pharmacy 4100 (or concurrent enrollment in Pharmacy 4100), enrollment in BSPS

BSPS Elective Courses

10 hours are REQUIRED, choose only from this list:

BUSADM 3601.01 and 3632.01: (Fisher College of Business, Health Care Industry Cluster Courses), 5 total credit hours,
   Autumn and Spring Semesters
   Prerequisites: Application for admission through Fisher College of Business
   Requirements: Completion of BOTH courses

Pharmacy 2000: (Addicting Drugs: Effects, Introductory Neurology and Regulation), 2 credit hours, Autumn Semester ONLY
   Prerequisites: None

Pharmacy 4110: (Intermediate Metabolism and Therapeutics), 2 credit hours, Spring Semester ONLY
   Prerequisites: Pharmacy 4100

Pharmacy 4120: (Problem Solving in Biomedicinal Chemistry), 1 credit hour, Spring Semester ONLY
   Prerequisites: Pharmacy 4100 and enrollment in BSPS

Pharmacy 4193: (Individual Studies in Pharmaceutical Sciences), credit hours vary, offered all semesters
   Prerequisites: 2.5 GPA, Sophomore standing, enrollment in BSPS, instructor permission
   Note: only 5 hours can count towards the 10 hour requirement

Pharmacy 4194: (Group Studies in Pharmaceutical Sciences), credit hours vary, offered all semesters
   Prerequisites: Enrollment in BSPS, permission of Instructor

Pharmacy 4320: (Drug Discovery and Development), 2 credit hours, Spring Semester ONLY
   Prerequisites: Chemistry 2520, Physics 1201 or 1251, Math 1151, EEOB 2520, Junior standing, enrollment in BSPS
BSPS Electives, Continued

10 hours are REQUIRED, choose only from this list:

**Pharmacy 4330:** (Basic Pharmacokinetics), 2 credit hours, Spring Semester ONLY
   Prerequisites: Math 1151

**Pharmacy 4410:** (Therapeutic Frontiers), 2 credit hours, Spring Semester ONLY
   Prerequisites: Enrollment in College of Pharmacy
   Recommended: Completion of Pharmacy 4400

**Pharmacy 4420:** (Concepts in Pharmacology I: Discovery of Drug Action), 1 credit hour, Autumn Semester ONLY
   Prerequisites: Pharmacy 4400, enrollment in BSPS

**Pharmacy 4430:** (Concepts in Pharmacology II), 1 credit hours, Spring Semester ONLY
   Prerequisites: Enrollment in BSPS

**Pharmacy 4510:** (Introduction to Pharmacy), 2 credit hours, Autumn Semester ONLY
   Prerequisites: None

**Pharmacy 4511H:** (Honors Introduction to Pharmacy), 3 credit hours, Spring Semester ONLY
   Prerequisites: Permission of Instructor
   Notes: Required for First-Year Early Admissions Pathway Students

**Pharmacy 4520:** (Principles of Therapeutics), 2 credit hours, Spring Semester ONLY
   Prerequisites: Pharmacy 4400 (or concurrent enrollment in Pharmacy 4400)

**Pharmacy 4998:** (Pharmaceutical Sciences General Undergraduate Research), credit hours vary, offered all semesters
   Prerequisites: Permission of Instructor
   Note: only 5 hours can count towards the 10 hour requirement

**Pharmacy 4999:** (Pharmaceutical Sciences Undergraduate Research Thesis), credit hours vary, offered all semesters
   Prerequisites: Permission of Instructor
   Note: only 5 hours can count towards the 10 hour requirement

**Pharmacy 5130:** (History of Pharmacy), 3 credit hours, Autumn Semester ONLY
   Prerequisites: Sophomore standing, enrollment in BSPS

**Pharmacy 5140:** (Professional Ethics), 1.5 credit hours, Spring Semester ONLY
   Prerequisites: Sophomore standing, enrollment in BSPS

**Pharmacy 5150:** (Basics of Pharmaconutrition), 3 credit hours, Autumn Semester ONLY
   Prerequisites: Senior standing, enrollment in BSPS

**Pharmacy 5160:** (Medical Applications of Radionuclides & Radiopharmaceuticals), 2 credit hours, Autumn Semester ONLY
   Prerequisites: Junior standing, enrollment in BSPS

**Pharmacy 5170:** (Introduction to Clinical and Translational Research), 2 credit hours, Autumn Semester ONLY
   Prerequisites: Pharmacy 4400, enrollment in BSPS

**Pharmacy 5180:** (Topics in International Pharmacy), 2 credit hours, Autumn Semester ONLY
   Prerequisites: None

**Pharmacy 5610:** (Success and Leadership in Pharmacy), 1.5 credit hours, Spring Semester ONLY
   Prerequisites: Enrollment in College of Pharmacy

**Pharmacy 5950:** (Seminar on Pharmacy Careers), 1 credit hour, Autumn Semester ONLY
   Prerequisites: Sophomore standing, enrollment in BSPS
Sample Plan:
The following represents a sample scheduling plan for BSPS students who entered the major as freshman beginning AU12 and beyond. We encourage students to plan their academic program early, review this plan with his or her academic advisor, and update the plan from time to time as conditions change.

**YEAR 1:**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autumn</td>
<td>Math 1150</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Chemistry 1210</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Pharmacy 1100</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>GE/Electives*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>14</strong></td>
</tr>
<tr>
<td>Spring</td>
<td>Math 1151</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Chemistry 1220</td>
<td>5</td>
</tr>
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<td></td>
<td>GE/Electives*</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

**YEAR 2:**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autumn</td>
<td>Chemistry 2510</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Chemistry 2540</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Biology 1113</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>GE/Electives*</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>Spring</td>
<td>Chemistry 2520</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Chemistry 2550</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Biology 1114</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>GE/Electives*</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>16</strong></td>
</tr>
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</table>

**YEAR 3:**

<table>
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<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autumn</td>
<td>Physics 1200</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Pharmacy 4100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>EEOB 2520</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GE/Electives*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>14</strong></td>
</tr>
<tr>
<td>Spring</td>
<td>Physics 1201</td>
<td>5</td>
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<tr>
<td></td>
<td>Pharmacy 4200</td>
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</tr>
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<td>Pharmacy 4400</td>
<td>2</td>
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<td></td>
<td>Pharmacy 4500</td>
<td>3</td>
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<tr>
<td></td>
<td><strong>Total Hours</strong></td>
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**YEAR 4:**

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<th>Course</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>Autumn</td>
<td>Pharmacy 4300</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Pharmacy 4600**</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>GE/Electives*</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>Spring</td>
<td>Pharmacy 4600**</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>GE/Electives*</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

* “GE/Electives” include general education course, program electives and free electives, which should be scheduled as possible/as needed.

**Pharmacy 4600 is the Pharmacy Lab, which is offered BOTH Fall and Spring Semester. It only needs to be taken once, but it can be taken either semester.
<table>
<thead>
<tr>
<th>Course Type</th>
<th># of Courses</th>
<th>Hours/Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing</td>
<td>2</td>
<td>6</td>
<td>Level 1 (any decimalized version of English 1110)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Level 2 (2367 courses)</td>
</tr>
<tr>
<td>Literature</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Arts</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>2-3</td>
<td>10-12</td>
<td>Mathematics 1150 or Mathematics 1148 and 1149</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mathematics 1151</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>0</td>
<td>0</td>
<td>Skills developed in major requirements</td>
</tr>
<tr>
<td>Science</td>
<td>4</td>
<td>18</td>
<td>Biology 1113 and 1114 (4 hours each)</td>
</tr>
<tr>
<td>Biological</td>
<td></td>
<td></td>
<td>Chemistry 1210 and 1220 (5 hours each)</td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
<td>Courses include labs in each area</td>
</tr>
<tr>
<td>Historical Study</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Social Science</td>
<td>2</td>
<td>6</td>
<td>From two of three categories</td>
</tr>
<tr>
<td>Culture &amp; Ideas or Historical Study</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Open Options&lt;sup&gt;2&lt;/sup&gt;</td>
<td>2</td>
<td>10</td>
<td>Physics 1200 or 1250 and Physics 1201 or 1251</td>
</tr>
<tr>
<td>Language proficiency level</td>
<td>0-4</td>
<td>0-12</td>
<td>Note: proficiency required to 1103 level</td>
</tr>
<tr>
<td>Social Diversity in the US</td>
<td>1</td>
<td>0</td>
<td>Typically embedded in other requirements</td>
</tr>
<tr>
<td>Global Studies</td>
<td>2</td>
<td>0</td>
<td>Typically embedded in other requirements</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19-24</strong></td>
<td><strong>62-76</strong></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup>Social Science Categories
- Individuals and Groups
- Organizations and Polities
- Human, Natural, and Economic Resources

<sup>2</sup>Arts and Sciences Open Options Categories
- Another GE approved course (can be used for double major)
- Cross-Disciplinary seminar (x596 and x597 courses)
- Course approved for GE service-learning
- Course approved for GE education abroad (can fulfill up to 6 units)

Last edited: 08/09/13
APPENDIX 2

Information about the **revised** BSPS program being proposed

A. Courses of study for the Healthcare Professions and Drug Discovery and Development Pathways........................................................................................................pg. 21-29
B. Revised GE plan for the BSPS major..........................................................pg. 30
C. Draft student advising sheets for each pathway........................................pg. 31-36
## Courses of Study for the Revised BSPS Program:
The Healthcare Professions and Drug Discovery and Development Pathways

<table>
<thead>
<tr>
<th>Category</th>
<th>Course</th>
<th>Description</th>
<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>English</td>
<td><strong>English 1110: First-Year English Composition</strong> (3 hrs) (any decimalized version of English 1110 may be used)</td>
<td>Practice in the fundamentals of expository writing, as illustrated in the student's own writing &amp; in the essays of professional writers. <strong>Fulfills General Education first writing course requirement.</strong></td>
<td>Placement or prerequisite as determined by Department of English.</td>
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<tr>
<td>Pharmacy</td>
<td><strong>Pharmacy 2367.01: Introduction to Evidence-Based Medicine</strong> (3 hrs) OR <strong>Pharmacy 2367.02: Reading and Writing Pharmaceutical Sciences Literature</strong> (3 hrs)</td>
<td>This course provides the opportunity for students to explore how to use available evidence in health care. Students will engage in activities to enhance their skills in finding, evaluating, and using information to address health care problems from the perspective of the health care professional and the patient. Guidance on professional writing and experience applying evidence to patient care scenarios will be an integral part of the course. <strong>Recommended for Healthcare Professions Pathway students. Fulfills General Education Writing requirement.</strong></td>
<td>English 1110 or equivalent.</td>
</tr>
<tr>
<td>Social Science</td>
<td><strong>Social Science</strong>, selected from approved General Education list (6 hrs)</td>
<td>Students will select two courses, from two of three social science categories: Individuals and Groups, Organizations and Politics, or Human, Natural and Economic Resources. <strong>Fulfills General Education Social Science Requirement.</strong></td>
<td>Varies by course.</td>
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</table>

**BSPS Required General Education Courses**

- 8 courses
- 24 credit hours

(Note: Additional GE requirements fulfilled in core math and science coursework)
<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td><strong>BSPS Required General Education Courses (cont’d)</strong></td>
<td><strong>Arts and Humanities</strong>, selected from approved General Education list (12 hrs)</td>
<td>Students will select one course each from Historical Study, Arts, and Literature, plus one course from either Cultures and Ideas or Historical Study. <strong>Fulfills General Education Arts and Humanities requirement.</strong></td>
<td>Varies by course.</td>
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<tr>
<td></td>
<td><strong>Math 1151: Calculus I</strong> (5 hrs)</td>
<td>Differential and integral calculus of one real variable. <strong>Fulfills General Education Mathematics requirement.</strong></td>
<td>A grade of C- or above in 1148 and 1149, or in 1144, 1150, or Math Placement Level L.</td>
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<td></td>
<td><strong>Statistics 2480: Statistics for the Life Sciences</strong> (3 hrs)</td>
<td>Calculus-based introduction to the statistical analysis of biological data, including probability, common discrete and continuous distributions, experimental design, hypothesis testing, linear regression and correlation. <strong>Fulfills General Education Data Analysis requirement.</strong></td>
<td>Math 1131, 1151, 1156, 1161.XX, or 1181H, or equivalent, or permission of instructor.</td>
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<td></td>
<td><strong>Biology 1113: Biological Sciences: Energy Transfer and Development</strong> (4 hrs)</td>
<td>Exploration of biology and biological principles; evolution and the origin of life, cellular structure and functions, bioenergetics, and genetics. <strong>Fulfills General Education Science/Biological requirement.</strong></td>
<td>Math 1130, 1148, 1150 or above, or Math Placement Level L or M. Prereq. or concur: Chem 1110, 1210, 1610, or 1910H.</td>
</tr>
<tr>
<td></td>
<td><strong>Biology 1114: Biological Sciences: Form, Function, Diversity and Ecology</strong> (4 hrs)</td>
<td>Exploration of biology and biological principles; evolution and speciation, diversity in structure, function, behavior and ecology among prokaryotes and eukaryotes.</td>
<td>Math 1130, 1148, 1150 or above, or Math Placement Level L or M. Prereq. or concur: Chem 1110, 1210, 1610, or 1910H.</td>
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<tr>
<td></td>
<td><strong>Chemistry 1210: General Chemistry I</strong> (5 hrs)</td>
<td>First course for science majors, covering dimensional analysis, atomic structure, the mole, stoichiometry, chemical reactions, thermochemistry, electron configuration, bonding, molecular structure, gases, liquids, and solids. <strong>Fulfills General Education Science/Physical requirement.</strong></td>
<td>One unit of high school chemistry, and Math Placement Level L or M; or a grade of C- or above in Math 1130, 1131, 1148, 1150, or above.</td>
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<td></td>
<td><strong>Chemistry 1220: General Chemistry II</strong> (5 hrs)</td>
<td>Continuation of 1210 for science majors, covering solutions, kinetics, chemical equilibrium, solubility and ionic equilibria, qualitative analysis, thermodynamics, electrochemistry, descriptive chemistry, coordination compounds, and nuclear chemistry.</td>
<td>Chemistry 1210, 1215, 1250, 1610, 1910H, or 122, and Math Placement Level L or M; or a grade of C- or above in Math 1130, 1131, 1148, or 1150 or above.</td>
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<tr>
<td>Category</td>
<td>Course</td>
<td>Description</td>
<td>Prerequisites</td>
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<tr>
<td><strong>BSPS Required Core Math and Science Courses (cont’d)</strong></td>
<td><strong>Chemistry 2510: Organic Chemistry I (4 hrs)</strong></td>
<td>Introduction to structure, nomenclature, physical properties, preparation and reactions of alkanes, alkenes, alkynes, alcohols, ethers, epoxides, aldehydes and ketones. Other topics include stereochemistry, acids, bases, and reaction mechanisms.</td>
<td>Chemistry 1220, 1620 or 1920H.</td>
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<td></td>
<td><strong>Chemistry 2520: Organic Chemistry II (4 hrs)</strong></td>
<td>Continuation from 2510, including aromatic systems, carboxylic acids, carboxylic acid derivatives, amines, carbon-carbon bond-forming reactions, polymers, carbohydrates and amino acids.</td>
<td>Chemistry 2510, 2610 or 2910H.</td>
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<td></td>
<td><strong>Chemistry 2540: Organic Chemistry Laboratory I (2 hrs)</strong></td>
<td>Introduction to spectroscopic characterization, scientific writing, computational chemistry, and the laboratory techniques of organic chemistry, including synthesis, isolation, purification, and identification of organic compounds.</td>
<td>Chemistry 2510, 2610 or 2910H.</td>
</tr>
<tr>
<td></td>
<td><strong>Chemistry 2550: Organic Chemistry Laboratory II (2 hrs)</strong></td>
<td>Introduction to spectroscopic characterization, scientific writing, computational chemistry, and the laboratory techniques of organic chemistry, including synthesis, isolation, purification, and identification of organic compounds.</td>
<td>Chemistry 2540 or 2540H.</td>
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<tr>
<td></td>
<td><strong>Physics 1200: Mechanics, Kinematics, Fluids, Waves (5 hrs)</strong></td>
<td>Algebra-based introduction to classical physics: Newton’s laws, fluids, waves. <strong>Fulfills General Education Open Options.</strong></td>
<td>A grade of C- or above in Math 1148 or Math Placement Level M.</td>
</tr>
<tr>
<td></td>
<td><strong>Physics 1201: Electricity and Magnetism, Optics, Modern Physics (5 hrs)</strong></td>
<td>Algebra-based introduction to electricity and magnetism, simple optics, overview of modern physics including special relativity and quantum mechanics. <strong>Fulfills General Education Open Options.</strong></td>
<td>Physics 1200.</td>
</tr>
<tr>
<td></td>
<td><strong>EEOB 2520: Human Physiology (3 hrs)</strong></td>
<td>A survey of the human nervous system, sense organs, muscle function, circulation, respiration, digestion, metabolism, kidney functions, and reproduction.</td>
<td>3 credit hours in biological sciences.</td>
</tr>
<tr>
<td><strong>BSPS Required Pharmacy Courses</strong></td>
<td><strong>Pharmacy 1100: Pharmaceutical Sciences Survey (1 hr)</strong></td>
<td>Introduction to the University, strategies for student success, academic programs, opportunities in the pharmaceutical sciences and practice, and contemporary issues. (Not required for transfer students)</td>
<td>None.</td>
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<tr>
<td>Category</td>
<td>Course</td>
<td>Description</td>
<td>Prerequisites</td>
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<tr>
<td>Pharmacy 2100: Career Exploration in the Pharmaceutical Sciences (1 hr)</td>
<td>Oversees clinical- and research-based biomedical careers. Introduces roles and responsibilities, educational preparation, emerging trends, and opportunities in diverse career tracks (including Clinical Professions, Pharmaceutical Industry, Academia, Regulatory Affairs).</td>
<td>None.</td>
<td></td>
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<tr>
<td>Pharmacy 2500: Drug Discovery, Development and Delivery (3 hrs)</td>
<td>This course provides a comprehensive overview of the drug discovery, development, and delivery process within the U.S. healthcare system, exploring the roles of vested stakeholders (e.g., patients, pharmaceutical industry, providers, insurers, society, etc.) during a drug's &quot;bench to bedside&quot; development. Additionally discusses post-approval issues with respect to access, social impact, and safety.</td>
<td>None.</td>
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<tr>
<td>Pharmacy 3200: Biochemistry for the Pharmaceutical Sciences (5 hrs)</td>
<td>Fundamentals of biological chemistry for the study of the pharmaceutical sciences including molecular basis of structure, metabolism, genetic replication, transcription, and translation in humans. Ties to drug processes will be highlighted.</td>
<td>Chem 2520/2920H or concurrent enrollment in Chem 2520/2920H.</td>
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<tr>
<td>Pharmacy 3500: Ethics and Professionalism in the Pharmaceutical Sciences (2 hrs)</td>
<td>The course will develop core competencies in dealing with ethical issues in health care settings amidst a biologically, socially, and culturally diverse patient population. This will include a discussion of the ethical responsibilities and professional conduct of the pharmaceutical industry, including clinical drug trials and studies, research, and marketing and promotion. The course will also provide a discussion of basic principles of business ethics and proper ethic conduct in other health care industries.</td>
<td>Pharmacy 2500.</td>
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<td>Category</td>
<td>Course</td>
<td>Description</td>
<td>Prerequisites</td>
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<tr>
<td>BSPS Required Pharmacy Courses (cont’d)</td>
<td><strong>Pharmacy 4000:</strong> <em>Integrated Pharmaceutical Sciences I</em> (5 hrs)</td>
<td>First course in a two-course series. Principles governing the design, synthesis, delivery, action and use of drugs in disease treatment. Model disease pathophysiology and treatment will be investigated, discussing how biological differences can be targeted for therapeutic gain.</td>
<td>Pharmacy 3200, EEOB 2520, or concurrent enrollment in EEOB 2520.</td>
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<tr>
<td></td>
<td><strong>Pharmacy 4010:</strong> <em>Integrated Pharmaceutical Sciences II</em> (5 hrs)</td>
<td>Second course in a two-course series. Principles governing the design, synthesis, delivery, action and use of drugs in disease treatment. Model disease pathophysiology and treatment will be investigated, discussing how biological differences can be targeted for therapeutic gain.</td>
<td>Pharmacy 4000 and EEOB 2520.</td>
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<tr>
<td></td>
<td><strong>Pharmacy 4600:</strong> <em>Pharmaceutical Sciences Laboratory</em> (2 hrs)</td>
<td>Laboratory experience in isolation, synthesis, and evaluation of pharmaceutically relevant compounds.</td>
<td>Chemistry 2520, Pharmacy 3200 or concurrent enrollment in Pharmacy 3200. Enrollment in BSPS program or with permission of instructor.</td>
</tr>
<tr>
<td>Pathway-Specific Courses</td>
<td><strong>Micrbiio 4000:</strong> <em>Basic and Practical Microbiology</em> (4 hrs)</td>
<td>Provides an understanding of microorganisms and their interaction with the human experience. <strong>Required for the Healthcare Professions Pathway.</strong></td>
<td>3 credit hours in biology.</td>
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<tr>
<td></td>
<td><strong>Anatomy 2300.04:</strong> <em>Human Anatomy</em> (4 hrs)</td>
<td>Regional study of the basic structure and terminology associated with the human body supplemented with computer-assisted instruction. Laboratory inclues demonstrations on prosected human cadavers. <strong>Required for the Healthcare Professions Pathway.</strong></td>
<td>Enrollment in pre-AMP, AMP, pre-Opt, ExSci, Pre-Pharm, or Pre-Dent.</td>
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<tr>
<td>OR</td>
<td><strong>EEOB 2510:</strong> <em>Human Anatomy</em> (3 hrs)</td>
<td>An introduction to human anatomy; small mammal dissection. <strong>Required for the Healthcare Professions Pathway.</strong></td>
<td>3 sem cr hours in Biological Sciences.</td>
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<td></td>
<td><strong>Pharmacy 4610:</strong> <em>Instrumental Analysis and Experimental Techniques</em> (3 hrs)</td>
<td>Examination of the laboratory instrumentation and methods used in the drug discovery process. <strong>Required for the Drug Discovery &amp; Development Pathway.</strong></td>
<td>Pharmacy 3200.</td>
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<tr>
<td>Category</td>
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<tr>
<td>Pharmacy 2400: Addicting Drugs: Effects, Introductory Neurobiology, and Regulation (2 hrs)</td>
<td>Overview of effects, regulation, and mechanism of action of addicting drugs, with an introduction to function of the nervous system and how this function is altered by drugs.</td>
<td>None.</td>
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</tr>
<tr>
<td>Pharmacy 2510/H: Introduction to Pharmacy (2 hrs)</td>
<td>A survey of the profession of pharmacy, dealing with its history, educational requirements, organization, regulation, and current developments.</td>
<td>None.</td>
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<tr>
<td>Pharmacy 3400: Therapeutics Frontiers (2 hrs)</td>
<td>Discussion of recent development in one or more areas of pharmacology. Required group presentation.</td>
<td>Enrollment in the BSPS program, or permission of instructor. Completion of Pharmacy 4000 is recommended.</td>
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<tr>
<td>Pharmacy 3410: Science Communication and Engagement (1 hr)</td>
<td>With the Generation Rx Laboratory at the Center of Science and Industry (COSI), students will practice science communication as they create and lead live, hands-on experiments teaching basic drug science.</td>
<td>Jr. or Sr. standing, enrollment in the BSPS program, and permission of instructor. Repeatable to a maximum of 6 credit hours. This course is graded S/U.</td>
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<tr>
<td>Pharmacy 3510: Principles of Therapeutics (1.5 hrs)</td>
<td>Designed to provide knowledge about medication therapies and treatment guidelines for common illnesses affecting patients.</td>
<td>Pharmacy 4000 prerequisite or concurrent.</td>
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<tr>
<td>Pharmacy 4998: General Undergraduate Research (1-18 hrs)</td>
<td>Course credit earned by conducting research while enrolled as an undergraduate student.</td>
<td>Repeatable to a maximum of 60 credit hours or 12 completions. This course is graded S/U.</td>
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<tr>
<td>Pharmacy 4999: Undergraduate Research Thesis (1-18 hrs)</td>
<td>Culmination of undergraduate research in the form of written thesis.</td>
<td>Repeatable to a maximum of 60 credit hours or 12 completions. This course is graded S/U.</td>
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<tr>
<td>Pharmacy 5500: History of Pharmacy (3 hrs)</td>
<td>Evolution and development of the profession of pharmacy from antiquity to the present, with emphasis on its Anglo-American development since the 18th century.</td>
<td>Soph. standing in BSPS, or enrollment in PharmD program.</td>
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<tr>
<td>Pharmacy 5510: Basics of Pharmaconutrition (3 hrs)</td>
<td>Covers basic information on the effects of dietary factors on pharmaconutrition to be utilized as a foundation in solving patient-related cases in pharmacy practice.</td>
<td>Sr. standing in the BSPS program, or enrollment in the PharmD program.</td>
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<tr>
<td>Category</td>
<td>Course</td>
<td>Description</td>
<td>Prerequisites</td>
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<td></td>
<td><strong>Pharmacy 5520: Advanced Pharmaconutrition (2 hrs)</strong></td>
<td>Provides concepts needed by pharmacists necessary to include nutrition into their daily assessment of patients and integrate their findings into the therapeutic plan.</td>
<td>Pharmacy 5510 and enrollment in the PharmD program, or permission of instructor.</td>
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<td></td>
<td><strong>Pharmacy 5530: The Medical Applications of Radionuclides and Radiopharmaceuticals (2 hrs)</strong></td>
<td>A study of the theoretical and clinical aspects of the preparation, use, control, and handling of radionuclides and radiopharmaceuticals used in medicine.</td>
<td>Jr. standing, and enrollment in Pharmaceutical Science Plan, Allied Medical Profession Plan, or PharmD Plan; or permission of instructor.</td>
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<tr>
<td></td>
<td><strong>Pharmacy 5540: Introduction to Clinical and Translational Pharmacy Research (2 hrs)</strong></td>
<td>Introduction to conducting research in clinical pharmacy including research design issues and to ethical considerations. Faculty conducting research in various populations will discuss their research, followed by class discussion.</td>
<td>Pharmacy 4000, and enrollment in the PharmD or BSPS program. This course is graded S/U.</td>
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<tr>
<td></td>
<td><strong>Pharmacy 5550: Topics in International Pharmacy (2 hrs)</strong></td>
<td>Seminar on global pharmaceutical issues and international practices of pharmacy.</td>
<td>None. This course is graded S/U.</td>
</tr>
<tr>
<td>BSPS Pharmacy-Based Elective Courses (cont'd)</td>
<td><strong>Pharmacy 5560: Success &amp; Leadership in Pharmacy (1.5 hrs)</strong></td>
<td>Explore the meaning of success and leadership, attributes of successful leaders and what can be done to be a successful leader.</td>
<td>Enrollment in the College of Pharmacy, or permission of instructor. This course is graded S/U.</td>
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<tr>
<td></td>
<td><strong>Pharmacy 5570: Seminar on Pharmacy Careers (1 hr)</strong></td>
<td>Discussion and analysis of career pathways in clinical pharmacy and preparation of a career plan paper.</td>
<td>Soph. standing in the BSPS program, or enrollment in PharmD program.</td>
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<td></td>
<td><strong>Pharmacy 5580: Professional Ethics (1.5 hrs)</strong></td>
<td>The conceptual basis and content of pharmaceutical ethics; significance of codified ethics, interprofessionally considered; individual and group analysis of ethical issues; methods of encouraging compliance.</td>
<td>Soph. standing in the BSPS program, or enrollment in PharmD program.</td>
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<td></td>
<td><strong>Pharmacy 5798: International Healthcare Experience in Pharmacy (1 hr)</strong></td>
<td>Preparation for traveling abroad to a destination country. Students will be introduced to the culture, the history, and healthcare practice in destination country. Students will be evaluated upon their participation in individual class sessions, fulfillment of weekly assignments, and a group research project and presentation.</td>
<td>Permission of instructor. Repeatable to a maximum of 4 credit hours. This course is graded S/U.</td>
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<td>Category</td>
<td>Course</td>
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<tr>
<td>Pharmacy 4210: Problem Solving in Biomedical Chemistry (1 hr)</td>
<td>A course designed to use problem-based learning to promote understanding of biomedical concepts. Case studies will be assigned, allowing students to apply biochemical principles and communicate with their colleagues in the course. <strong>Satisfies Advanced Elective Requirement for Drug Discovery &amp; Development Pathway.</strong></td>
<td>Pharmacy 3200 and enrollment in the BSPS program.</td>
<td></td>
</tr>
<tr>
<td>Pharmacy 4420: Concepts in Pharmacology I: Discovery of Drug Action (1 hr)</td>
<td>Introduces students to pharmacological research and drug discovery through readings, discussions, and presentations. <strong>Satisfies Advanced Elective Requirement for Drug Discovery &amp; Development Pathway.</strong></td>
<td>Pharmacy 4000 and enrollment in the BSPS program; or permission of instructor.</td>
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</tr>
<tr>
<td>Pharmacy 4430: Concepts in Pharmacology II (1 hr)</td>
<td>Focuses on the pharmacology of G-protein-coupled receptors (GPCRs). GPCRs constitute a large and diverse family of proteins whose importance is underscored by the fact that at least one third of the currently marketed drugs target these proteins. <strong>Satisfies Advanced Elective Requirement for Drug Discovery &amp; Development Pathway.</strong></td>
<td>Enrollment in the BSPS program.</td>
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<tr>
<td>Pharmacy 4440: Pharmacology of Neurologic and Psychiatric Disorders (3 hrs)</td>
<td>This course is designed for pharmaceutical sciences majors, neuroscience majors or non-majors with a basic knowledge of biology. This course will serve as an introduction to principles of pharmacological therapy of neurologic and psychiatric diseases. <strong>Satisfies Advanced Elective Requirement for Drug Discovery &amp; Development Pathway.</strong></td>
<td>Neuroscience 3000 or Pharmacy 3200 or equivalent or permission of instructor.</td>
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<tr>
<td>Pharmacy 4460: Current Addiction Neurobiology Literature (1 hr)</td>
<td>Current research findings related to neurobiology of addiction are explained and interpreted. <strong>Satisfies Advanced Elective Requirement for Drug Discovery &amp; Development Pathway.</strong></td>
<td>Students should have some introductory knowledge of neurobiology. Permission of instructor is required.</td>
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</tr>
</tbody>
</table>
### Category Course Description Prerequisites

**Free Elective (does not count toward BSPS electives, but does count toward hours for graduation)**

**Pharmacy 2020: Job Search Preparation and Transition to Work (2 hrs)**

Practical techniques and skill development in conducting a job search, applying to graduate and professional programs, researching career information, and beginning a successful career search.

Rank 3 or 4, enrollment in the BSPS program. Repeatable to a maximum of 12 credit hours. This course is graded S/U.

### BACHELOR OF SCIENCE IN PHARMACEUTICAL SCIENCES: REQUIRED HOURS BY PATHWAY

<table>
<thead>
<tr>
<th>Healthcare Professions Pathway</th>
<th>Drug Discovery and Development Pathway</th>
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<tbody>
<tr>
<td>General Education Courses</td>
<td>General Education Courses</td>
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<tr>
<td>24 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td>Core Math and Science Courses</td>
<td>Core Math and Science Courses</td>
</tr>
<tr>
<td>51 hours</td>
<td>51 hours</td>
</tr>
<tr>
<td>Required Pharmacy Courses</td>
<td>Required Pharmacy Courses</td>
</tr>
<tr>
<td>24 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td>Pathway-Specific Courses</td>
<td>Pathway-Specific Courses</td>
</tr>
<tr>
<td>7-8 hours</td>
<td>3 hours</td>
</tr>
<tr>
<td>BSPS Elective Courses</td>
<td>BSPS Elective Courses</td>
</tr>
<tr>
<td>10 hours</td>
<td>15 hours (4 hours 'advanced')</td>
</tr>
<tr>
<td>Free Electives</td>
<td>Free Electives</td>
</tr>
<tr>
<td>As needed to reach 121 credit hours</td>
<td>As needed to reach 121 credit hours</td>
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</table>
### College of Pharmacy (PHR) Semester-based General Education (GE) Requirements

**PROPOSED**

<table>
<thead>
<tr>
<th>Course Type</th>
<th># of Courses</th>
<th>Hours/Units</th>
<th>Notes</th>
</tr>
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<tbody>
<tr>
<td>Writing</td>
<td>2</td>
<td>6</td>
<td>Level 1 (any decimalized version of English 1110)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Level 2 (2367 courses)</td>
</tr>
<tr>
<td>Literature</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Arts</td>
<td>1</td>
<td>3</td>
<td></td>
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<tr>
<td>Mathematics</td>
<td>1</td>
<td>5</td>
<td>Mathematics 1151</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>1</td>
<td>3</td>
<td>Statistics 2480</td>
</tr>
<tr>
<td>Science</td>
<td></td>
<td></td>
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<tr>
<td>Biological</td>
<td>4</td>
<td>9</td>
<td>Biology 1113 (4 hours)</td>
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<tr>
<td>Physical</td>
<td></td>
<td></td>
<td>Chemistry 1210 (5 hours)</td>
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<td></td>
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<td></td>
<td>Courses include labs in each area</td>
</tr>
<tr>
<td>Historical Study</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Social Science</td>
<td>2</td>
<td>6</td>
<td>From two of three categories¹</td>
</tr>
<tr>
<td>Culture &amp; Ideas or Historical Study</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Open Options²</td>
<td>2</td>
<td>10</td>
<td>Physics 1200 or 1250 and Physics 1201 or 1251</td>
</tr>
<tr>
<td>Language proficiency level</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Social Diversity in the US</td>
<td>1</td>
<td>0-3</td>
<td>Typically embedded in other requirements</td>
</tr>
<tr>
<td>Global Studies</td>
<td>2</td>
<td>0-6</td>
<td>Typically embedded in other requirements</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19</strong></td>
<td><strong>51-60</strong></td>
<td></td>
</tr>
</tbody>
</table>

¹Social Science Categories
Indians and Groups
Organizations and Polities
Human, Natural, and Economic Resources

²Arts and Sciences Open Options Categories
Another GE approved course (can be used for double major)
Cross-Disciplinary seminar (x596 and x597 courses)
Course approved for GE service-learning
Course approved for GE education abroad (can fulfill up to 6 units)

Last edited: 12/3/14
BSPS DEGREE REQUIREMENTS CHECKLIST

HEALTHCARE PROFESSIONS PATHWAY

General Education Requirements

Writing
☐ 1ST Writing Course (3): _________________________________
☐ Pharmacy 2367.02 (3): Reading & Writing Pharmaceutical Sciences Literature

Social Science
☐ 1ST Social Science (3): _________________________________
☐ 2ND Social Science (3): _________________________________

Arts & Humanities
☐ Historical Study (3): _________________________________
☐ Arts (3): _________________________________
☐ Literature (3): _________________________________
☐ Cultures & Ideas or Historical Study (3): _________________________________

Note: Two (2) courses in Global Studies and one (1) course in Social Diversity are required. Courses can overlap with Social Sciences and Arts & Humanities.

Core Math and Science Courses

Anatomy (Choose one course)
☐ Anatomy 2300.04 (4): Human Anatomy, OR
☐ EEOB2510 (3): Human Anatomy

Biology
☐ Biology 1113 (4): Biological Sciences: Energy Transfer and Development
☐ Biology 1114 (4): Biological Sciences: Form, Function, Diversity, and Ecology

Chemistry
☐ Chemistry 1210 (5): General Chemistry I
☐ Chemistry 1220 (5): General Chemistry II
☐ Chemistry 2510 (4): Organic Chemistry I
☐ Chemistry 2520 (4): Organic Chemistry II
☐ Chemistry 2540 (2): Organic Chemistry Laboratory I
☐ Chemistry 2550 (2): Organic Chemistry Laboratory II

Math
☐ Math 1151 (5): Calculus I

Microbiology
☐ Microbiology 4000 (4): Basic and Practical Microbiology

Physics
☐ Physics 1200 (5): Mechanics, Kinematics, Fluids, Waves
☐ Physics 1201 (5): E&M, Optics, Modern Physics

Physiology
☐ EEOB 2520 (3): Human Physiology

Statistics
☐ Statistics 2480 (3): Statistics for the Life Sciences
BSPS Required Courses
☐ Pharmacy 1100 (1): Pharmaceutical Sciences Survey
☐ Pharmacy 2100 (1): Career Exploration in Pharmaceutical Sciences
☐ Pharmacy 2500 (3): Drug Discovery, Development, and Delivery
☐ Pharmacy 3200 (5): Biochemistry for the Pharmaceutical Sciences
☐ Pharmacy 3500 (2): Ethics and Professionalism
☐ Pharmacy 4000 (5): Integrated Pharmaceutical Sciences 1
☐ Pharmacy 4010 (5): Integrated Pharmaceutical Sciences 2
☐ Pharmacy 4600 (2): Pharmaceutical Sciences Laboratory

BSPS Elective Courses
(10 credit hours required)
☐ Pharmacy 2400 (2): Addicting Drugs
☐ Pharmacy 2510 (2): Introduction to Pharmacy
☐ Pharmacy 3400 (2): Therapeutic Frontiers
☐ Pharmacy 3410 (1): Science Communication and Engagement
☐ Pharmacy 3510 (1.5): Principles of Therapeutics
☐ Pharmacy 4210 (2): Problem Solving in Biomedical Chemistry
☐ Pharmacy 4430 (2): Concepts in Pharmacology II: GPCRs
☐ Pharmacy 4440 (3): Pharmacology of Neurologic and Psychiatric Disorders
☐ Pharmacy 4460 (1): Contemporary Drug Addiction Literature
☐ Pharmacy 4998 (var.): General Undergraduate Research
☐ Pharmacy 4999 (var.): Undergraduate Research Thesis
☐ Pharmacy 5500 (3): History of Pharmacy
☐ Pharmacy 5510 (3): Basics of Pharmaconutrition
☐ Pharmacy 5520 (2): Advanced Pharmaconutrition
☐ Pharmacy 5530 (2): Medical Applications of Radionuclides and Radiopharm.
☐ Pharmacy 5540 (2): Intro to Clinical and Translational Pharmacy Research
☐ Pharmacy 5550 (2): Topics in International Pharmacy
☐ Pharmacy 5560 (1.5): Success and Leadership in Pharmacy
☐ Pharmacy 5570 (1): Seminar on Pharmacy Careers
☐ Pharmacy 5798 (1): International Healthcare Experience in Pharmacy

Free Electives (to an overall total of at least 121 credit hours)
☐ __________________________________________
☐ __________________________________________
☐ __________________________________________
☐ __________________________________________
The following represents a sample scheduling plan for BSPS students who entered the major as a freshman beginning AU15 and beyond. We encourage students to plan their academic program early, review this plan with his or her academic advisor, and update the plan from time to time as conditions change.

**YEAR 1:**

**Autumn**
- Math 1150 5
- Chemistry 1210 5
- Pharmacy 1100 1
- Pharmacy 2100 1
- GE/Electives* 3

**Total Hours** 15

**Spring**
- Math 1151 5
- Chemistry 1220 5
- English 1110.01 3
- GE/Electives* 3

**Total Hours** 16

**YEAR 2:**

**Autumn**
- Chemistry 2510 4
- Chemistry 2540 2
- Biology 1113 4
- Pharmacy 2500 3
- GE/Electives* 3

**Total Hours** 16

**Spring**
- Chemistry 2520 4
- Chemistry 2550 2
- Biology 1114 4
- EEOB 2520 3
- GE/Electives* 3

**Total Hours** 16

**YEAR 3:**

**Autumn**
- Physics 1200 5
- Pharmacy 3200 5
- Pharmacy 2367.01 3
- Statistics 2480 3

**Total Hours** 16

**Spring**
- Physics 1201 5
- Pharmacy 4000 5
- EEOB2510/Anat. 2300.04 3/4
- GE/Electives* 2

**Total Hours** 15/16

**YEAR 4:**

**Autumn**
- Pharmacy 4010 5
- Pharmacy 4600** 2
- GE/Electives* 6

**Total Hours** 13

**Spring**
- Pharmacy 3500 2
- Microbiology 4000 4
- GE/Electives* 7

**Total Hours** 13

* "GE/Electives" include general education course, program electives and free electives, which should be scheduled as possible/as needed.
**Pharmacy 4600 is offered both Autumn and Spring Semester. It only needs to be taken once, but it can be taken either semester.
# BSPS Degree Requirements Checklist

## Drug Discovery & Development Pathway

### General Education Requirements

**Writing**
- ☐ 1st Writing Course (3): ___________________________________________________________________
- ☐ Pharmacy 2367.02 (3): Reading & Writing Pharmaceutical Sciences Literature

**Social Science**
- ☐ 1st Social Science (3): __________________________________________
- ☐ 2nd Social Science (3): ________________________________________

**Arts & Humanities**
- ☐ Historical Study (3): ____________________________________________
- ☐ Arts (3): _____________________________________________________
- ☐ Literature (3): ________________________________________________
- ☐ Cultures & Ideas or Historical Study (3): ______________

*Note: Two (2) courses in Global Studies and one (1) course in Social Diversity are required. Courses can overlap with Social Sciences and Arts & Humanities.*

### Core Math and Science Courses

**Biology**
- ☐ Biology 1113 (4): Biological Sciences: Energy Transfer and Development
- ☐ Biology 1114 (4): Biological Sciences: Form, Function, Diversity, and Ecology

**Chemistry**
- ☐ Chemistry 1210 (5): General Chemistry I
- ☐ Chemistry 1220 (5): General Chemistry II
- ☐ Chemistry 2510 (4): Organic Chemistry I
- ☐ Chemistry 2520 (4): Organic Chemistry II
- ☐ Chemistry 2540 (2): Organic Chemistry Laboratory I
- ☐ Chemistry 2550 (2): Organic Chemistry Laboratory II

**Math**
- ☐ Math 1151 (5): Calculus I

**Physics**
- ☐ Physics 1200 (5): Mechanics, Kinematics, Fluids, Waves
- ☐ Physics 1201 (5): E&M, Optics, Modern Physics

**Physiology**
- ☐ EEOB 2520 (3): Human Physiology

**Statistics**
- ☐ Statistics 2480 (3): Statistics for the Life Sciences
BSPS Required Courses
☐ Pharmacy 1100 (1): Pharmaceutical Sciences Survey
☐ Pharmacy 2100 (1): Career Exploration in Pharmaceutical Sciences
☐ Pharmacy 2500 (3): Drug Discovery, Development, and Delivery
☐ Pharmacy 3200 (5): Biochemistry for the Pharmaceutical Sciences
☐ Pharmacy 3500 (2): Ethics and Professionalism
☐ Pharmacy 4000 (5): Integrated Pharmaceutical Sciences 1
☐ Pharmacy 4010 (5): Integrated Pharmaceutical Sciences 2
☐ Pharmacy 4600 (2): Pharmaceutical Sciences Laboratory
☐ Pharmacy 4610 (3): Instrumental Analysis & Experimental Techniques

BSPS Elective Courses

Advanced (4 credit hours required)
☐ Pharmacy 4210 (2): Problem Solving in Biomedicinal Chemistry
☐ Pharmacy 4430 (2): Concepts in Pharmacology II: GPCRs
☐ Pharmacy 4440 (3): Pharmacology of Neurologic and Psychiatric Disorders
☐ Pharmacy 4460 (1): Contemporary Drug Addiction Literature

Basic (11 credit hours required)
☐ Pharmacy 2400 (2): Addicting Drugs
☐ Pharmacy 2510 (2): Introduction to Pharmacy
☐ Pharmacy 3400 (2): Therapeutic Frontiers
☐ Pharmacy 3410 (1): Science Communication and Engagement
☐ Pharmacy 3510 (1.5): Principles of Therapeutics
☐ Pharmacy 4998 (var.): General Undergraduate Research
☐ Pharmacy 4999 (var.): Undergraduate Research Thesis
☐ Pharmacy 5500 (3): History of Pharmacy
☐ Pharmacy 5510 (3): Basics of Pharmaconutrition
☐ Pharmacy 5520 (2): Advanced Pharmaconutrition
☐ Pharmacy 5530 (2): Medical Applications of Radionuclides and Radiopharm.
☐ Pharmacy 5540 (2): Intro to Clinical and Translational Pharmacy Research
☐ Pharmacy 5550 (2): Topics in International Pharmacy
☐ Pharmacy 5560 (1.5): Success and Leadership in Pharmacy
☐ Pharmacy 5570 (1): Seminar on Pharmacy Careers
☐ Pharmacy 5798 (1): International Healthcare Experience in Pharmacy

Free Electives (to an overall total of at least 121 credit hours)
☐ _______________________________________________________
☐ _______________________________________________________
☐ _______________________________________________________
☐ _______________________________________________________
**BSPS SAMPLE SCHEDULING PLAN**

**DRUG DISCOVERY & DEVELOPMENT PATHWAY**

The following represents a sample scheduling plan for BSPS students who entered the major as a freshman beginning AU15 and beyond. We encourage students to plan their academic program early, review this plan with his or her academic advisor, and update the plan from time to time as conditions change.

### YEAR 1:

**Autumn**
- Math 1150 5
- Chemistry 1210 5
- Pharmacy 1100 1
- Pharmacy 2100 1
- GE/Electives* 3

**Total Hours 15**

**Spring**
- Math 1151 5
- Chemistry 1220 5
- English 1110.01 3
- GE/Electives* 3

**Total Hours 16**

### YEAR 2:

**Autumn**
- Chemistry 2510 4
- Chemistry 2540 2
- Biology 1113 4
- Pharmacy 2500 3
- GE/Electives* 3

**Total Hours 16**

**Spring**
- Chemistry 2520 4
- Chemistry 2550 2
- Biology 1114 4
- EEOB 2520 3
- GE/Electives* 3

**Total Hours 16**

### YEAR 3:

**Autumn**
- Physics 1200 5
- Pharmacy 3200 5
- Pharmacy 2367.02 3
- Statistics 2480 3

**Total Hours 16**

**Spring**
- Physics 1201 5
- Pharmacy 4000 5
- Pharmacy 4600** 2
- GE/Electives* 3

**Total Hours 15**

### YEAR 4:

**Autumn**
- Pharmacy 4010 5
- Pharmacy 4610 3
- Advanced elective 2
- GE/Electives* 4

**Total Hours 14**

**Spring**
- Pharmacy 3500 2
- Advanced elective 2
- GE/Electives* 10

**Total Hours 14**

* "GE/Electives“ include general education course, program electives and free electives, which should be scheduled as possible/as needed.

**Pharmacy 4600 is offered both Autumn and Spring Semester. It only needs to be taken once, but it can be taken either semester.**
APPENDIX 3

Revised program learning goals with associated curricular map (pg. 38)
Curricular Mapping of Revised Program Learning Goals to Required PHR Coursework

Learning Goals

A. Students will demonstrate an understanding of the essential content of the pharmaceutical sciences and their interrelationship within the context of healthcare and the drug discovery and development process.
B. Students will apply practical and critical-thinking skills to solve complex problems.
C. Students will acquire, assess, and evaluate information.
D. Students will effectively communicate scientific content and concepts, both verbally and in written form.
E. Students will understand professionalism while appreciating ethics, cultural awareness, and teamwork in all aspects of performance.
F. Students will demonstrate an awareness of diversity in the context of the pharmaceutical sciences, particularly with respect to cultural, biological, organizational, and human values differences.
G. Students will describe various careers in the pharmaceutical sciences, and be prepared to matriculate directly into the workforce or a graduate/professional program.

Key to Learning Goal Levels

1. The outcome is INTRODUCED. It may not be a central focus of the course, but at least some element related to this outcome is a topic of the content of the course. Students may be asked to know something about this outcome by the end of the course.
2. The outcome is REINFORCED. It is among the focal points of the course. Students may be asked to apply this outcome by the end of the course.
3. The outcome is EMPHASIZED. It is a central focal point of the course. Students may be asked to do something related to this outcome by the end of the course.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Learning Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHR1100</td>
<td>Pharmaceutical Sciences Survey</td>
<td>A 1 B 1 C 1 D 2</td>
</tr>
<tr>
<td>PHR2100</td>
<td>Career Exploration in Pharmaceutical Sciences</td>
<td>A 1 B 1 C 1 D 3</td>
</tr>
<tr>
<td>PHR2367.01</td>
<td>Introduction to Evidence-Based Medicine</td>
<td>A 1 B 3 C 3 D 1</td>
</tr>
<tr>
<td>PHR2367.02</td>
<td>Reading and Writing Pharmaceutical Sciences Literature</td>
<td>A 1 B 3 C 3 D 1</td>
</tr>
<tr>
<td>PHR2500</td>
<td>Healthcare Delivery</td>
<td>A 2 B 1 C 2 D 1 E 1 F 1 G 1</td>
</tr>
<tr>
<td>PHR3200</td>
<td>Biochemistry for the Pharmaceutical Sciences</td>
<td>A 2 B 2 C 1 D 1</td>
</tr>
<tr>
<td>PHR3500</td>
<td>Ethics and Professionalism in the Pharmaceutical Sciences</td>
<td>A 2 B 2 C 2 D 3 E 3 F 3 G 3</td>
</tr>
<tr>
<td>PHR4000</td>
<td>Integrated Pharmaceutical Sciences I</td>
<td>A 2 B 2 C 2 D 2 E 2 F 2 G 2</td>
</tr>
<tr>
<td>PHR4010</td>
<td>Integrated Pharmaceutical Sciences II</td>
<td>A 3 B 3 C 3 D 2 E 2 F 2 G 2</td>
</tr>
<tr>
<td>PHR4600</td>
<td>Pharmaceutical Sciences Laboratory</td>
<td>A 2 B 3 C 3 D 3 E 3 F 3 G 3</td>
</tr>
<tr>
<td>PHR4610</td>
<td>Instrumental Analysis and Experimental Techniques</td>
<td>A 2 B 3 C 3 D 3 E 3 F 3 G 3</td>
</tr>
</tbody>
</table>

 superscript 1 Students may choose EITHER writing course (2367.01 or 2367.02) with hours counting toward the GE writing requirement.

 superscript 2 Only required for students in the Drug Discovery and Development Pathway.
APPENDIX 4

Comparative data of sample BSPS programs (pg. 40-55)
Article

Availability, Uniqueness and Perceived Value of Bachelor of Science in Pharmaceutical Sciences (BSPS) Programs in the United States

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2 Pharmaceutical and Administrative Sciences Department, University of Charleston School of Pharmacy, 2300 MacCorkle Ave S.E., Charleston, WV 25304, USA; E-mails: davidlatif@ucwv.edu (D.A.L.); mareadodd@ucwv.edu (M.D.)

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Abstract: We describe the uniqueness of the Bachelor of Science in Pharmaceutical Sciences (BSPS) degree and the factors that contribute to this uniqueness. A total of 18 colleges and schools that offer a BSPS were identified in the literature and compared. A review of the current literature and university websites was conducted in order to compare and contrast the different BSPS programs. BSPS program directors’ perceptions were evaluated through a 14-item online survey instrument. Of the 16 programs surveyed, seven (43.8%) responded to the survey. The respondents agreed that most of the BSPS graduates are placed (from the highest to the lowest) at pharmacy school, postgraduate education and in the pharmaceutical industry. This is a timely review of coursework, program lengths and job opportunities for graduates of the BSPS. Currently, the BSPS programs have yet to receive a large amount of attention, but the importance in pharmaceutical education cannot be denied.

Keywords: Bachelor of Science in Pharmaceutical Sciences; Bachelor of Science in Pharmacy; Doctor of Pharmacy degree; pharmaceutical education; pharmacy curriculum; Accreditation Council for Pharmacy Education
1. Introduction

The first Bachelor of Science in Pharmaceutical Sciences (BSPS) degree program in the USA was initiated in 1962 at the University at Buffalo School of Pharmacy and Pharmaceutical Sciences [1]. Since then, 18 BSPS programs in the USA have come about, with the most recent program initiated in 2010 at the University of Rhode Island College of Pharmacy [2].

According to the Ohio State University College of Pharmacy, “the BSPS program provides students with a general education curriculum, classes in core sciences and foundational courses in the pharmaceutical sciences. It is a 4-year, non-licensure, undergraduate bachelor’s degree program” [3]. Students who pursue a BSPS degree today are typically interested in areas of drug discovery, drug delivery, drug action and the manufacturing and marketing of pharmaceuticals. Upon graduating with the BSPS, students are not eligible to become licensed pharmacists. The BSPS curriculum helps in honing the requisite skills needed to develop and evaluate drug products through research in a variety of biotechnology and pharmaceutical facilities. Graduates typically work in the pharmaceutical industry or pursue higher education in areas related to pharmaceuticals, such as pharmacy [4]. The Accreditation Council for Pharmacy Education (ACPE) is the national agency for the accreditation of professional degree programs in pharmacy. Since the BSPS degree programs are not considered professional degrees, they are not accredited by the ACPE. The objectives of this study are two-fold: To distinguish the BSPS program from the PharmD and BSPharm programs by describing the educational and vocational characteristics for the BSPS programs in the USA (curriculum comparisons, job opportunities and satisfaction); to ascertain the program directors’ perceptions regarding the BSPS programs that they operate. To accomplish these objectives, program directors were surveyed, and the available literature was assessed on the BSPS degrees offered by colleges in the USA.

Comparisons between BSPharm, BSPS and PharmD

In July 1992, the ACPE mandated that all applicants entering the field of pharmacy had to obtain a Doctor of Pharmacy (PharmD) degree in order to become a licensed pharmacist [5]. As the switch from the BSPharm to PharmD was made, the Bachelor of Science in Pharmaceutical Sciences (BSPS) degree evolved from the previous BSPharm curriculum. The BSPS may be mistakenly equated as the former BSPharm degree or the PharmD degree. June 30, 2005 marked the official expiration of the ACPE standards for the baccalaureate degree (BS) in Pharmacy. During the 2004/05 academic year Purdue, Wayne State, St. Louis, St. John’s, Albany, Ohio Northern and Utah were the remaining schools that conferred BSPharm degrees prior to the expiration (Melinda D. Colon, AACP email, June 17, 2013). The transition to the new policy was completed when the last Bachelor of Science (BS) in Pharmacy degree candidates graduated in 2005 at Ohio Northern University [6]. Current practicing pharmacists in the USA have either a PharmD or BSPharm degree. Today, students must graduate from a PharmD program and successfully complete the licensure process in order to become a practicing pharmacist. Currently, there are no BS in Pharmacy degree programs in the United States, because most of the BSPharm programs morphed into PharmD or what we now know as the BSPS [4].

In order to better understand the difference between the PharmD, the BSPharm and the BSPS degree, an introspection of the history and required curriculum for each of these degrees is required. In
the 1950s, basic sciences became an integral part of the education of pharmacists. At that time, practicing pharmacists played a role in influencing the curriculum being taught. The central attention of pharmacy practice was on the medications the pharmacist was dispensing; hence, the focus of education followed the focus of practice. The foundation of the curriculum was pharmaceutics, pharmacology and medicinal chemistry. Research also became an important component in the education of pharmacists [7].

In the past, there had been a component of apprenticeship or interning that taught the pharmacist much needed practical skills of the profession, standardized nationally by the National Association of Boards of Pharmacy. The PharmD degree evolved from the idea that a pharmacist needed both basic science knowledge and specialized patient care skills in order to become a well-rounded practicing pharmacist [3]. Yet, in its early years, clinical pharmacy was an educational experiment that led to increasing diversity rather than standardization in the clerkship experiences in various states. The American Council on Pharmaceutical Education (ACPE) began to promote the concept that clinical clerkships within the curriculum should be utilized to satisfy state and national internship requirements. With the advent of pharmaceutical care, changes in education and training became necessary for pharmacists to gain the skills needed for this evolving practice role [8]. Pharmaceutical care moved the emphasis from medications to the patient, along with the patient’s drug therapy that directly affects their health [8].

Relative to Doctor of Pharmacy degree programs, the BSPS is currently offered at 18 colleges and universities in the United States. Information on the BSPS programs is available from the American Association of Pharmaceutical Scientists (AAPS) website and is presented in Table 1.

<table>
<thead>
<tr>
<th>Name of University</th>
<th>Type of School or Department</th>
<th>Name of Program</th>
<th>Standalone or entry level to PharmD program</th>
<th>Number of Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albany College of Pharmacy and Health Sciences [9]</td>
<td>Pharmacy and Health Sciences</td>
<td>BSPS</td>
<td>Standalone</td>
<td>133 h</td>
</tr>
<tr>
<td>Campbell University [10]</td>
<td>College of Pharmacy and Health Sciences</td>
<td>BSPS</td>
<td>Standalone Prior to entering the BSPS, 64 h are to be completed.</td>
<td>131.5–133.5 h</td>
</tr>
<tr>
<td>Cleveland State University [11]</td>
<td>College of Sciences and Health Professions</td>
<td>BSPS (three tracks under the BSPS Program) -Pharmaceutical -Medicinal and Biological Chemistry Pharmacy Administration</td>
<td>Standalone</td>
<td>128 h</td>
</tr>
</tbody>
</table>
Table 1. Cont.

<table>
<thead>
<tr>
<th>Name of University</th>
<th>Type of School or Department</th>
<th>Name of Program</th>
<th>Standalone or entry level to PharmD program</th>
<th>Number of Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elizabeth City State [12]</td>
<td>Department of Pharmacy and Health Professions</td>
<td>BSPS</td>
<td>Standalone</td>
<td>128 h</td>
</tr>
<tr>
<td>Fairleigh Dickinson University [13,14]</td>
<td>School of Natural Science</td>
<td>-BS/MS(^6) Chemistry w/ Pharmaceutical Chemistry concentration -BS in Mathematics with Pharmaceutical Biostatistics concentration</td>
<td>5 years program that awards both degrees Standalone</td>
<td>128 h for BS 151 h for MS</td>
</tr>
<tr>
<td>Massachusetts College of Pharmacy and Health Sciences University [15,16]</td>
<td>School of Pharmacy</td>
<td>-BSPS -BSPharmacology and Toxicology</td>
<td>Standalone Standalone</td>
<td>127 h 129 h</td>
</tr>
<tr>
<td>Michigan Technological University [17]</td>
<td>Department of Pharmacy</td>
<td>Pharmaceutical Chemistry</td>
<td>Standalone</td>
<td>128 h</td>
</tr>
<tr>
<td>Pittsburg State University [18]</td>
<td>College of Arts and Sciences</td>
<td>BS in Chemistry with Emphasis in Pharmaceutical Chemistry</td>
<td>Standalone</td>
<td>124 h</td>
</tr>
<tr>
<td>Purdue University [19]</td>
<td>College of Pharmacy</td>
<td>BSPS</td>
<td>Standalone</td>
<td>128 h</td>
</tr>
<tr>
<td>South Dakota State University [20] *</td>
<td>College of Pharmacy</td>
<td>BSPS</td>
<td>Awarded the BSPS degree after completing the first two years of pharmacy school</td>
<td>90 h</td>
</tr>
<tr>
<td>Ohio State University [3]</td>
<td>College of Pharmacy</td>
<td>BSPS</td>
<td>Standalone Complete 45 h before admission to PharmD program</td>
<td>108–120 h</td>
</tr>
<tr>
<td>University at Buffalo [1]</td>
<td>School of Pharmacy and Pharmaceutical Sciences</td>
<td>-BSPS -BS Pharmacology and Toxicology</td>
<td>Standalone MS in 5 years in conjunction with BS</td>
<td>120 h 120 h</td>
</tr>
<tr>
<td>University of California, Davis [21]</td>
<td>Department of Chemistry</td>
<td>BS Pharmaceutical Chemistry</td>
<td>Standalone</td>
<td>180 h</td>
</tr>
<tr>
<td>University of California, Irvine [22]</td>
<td>College of Health Sciences</td>
<td>BSPS</td>
<td>Standalone</td>
<td>180 h</td>
</tr>
<tr>
<td>University of Connecticut [23]</td>
<td>School of Pharmacy</td>
<td>BS Pharmacy Studies</td>
<td>Awarded after the completion of two years of pre-pharmacy and the first two years of the pharmacy study in the professional program</td>
<td>137 h</td>
</tr>
<tr>
<td>Name of University</td>
<td>Type of School or Department</td>
<td>Name of Program</td>
<td>Standalone or entry level to PharmD program</td>
<td>Number of Credit Hours</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------------------</td>
<td>----------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>University of Delaware [24]</td>
<td>Collaboration with Thomas Jefferson University School of Pharmacy</td>
<td>BS Biological Science/Pharmaceutical Sciences</td>
<td>First 3 years at UD; Fourth year is 1st year at TJU PharmD program</td>
<td>132 h</td>
</tr>
<tr>
<td>University of Georgia [25]</td>
<td>College of Pharmacy</td>
<td>Pharmaceutical and Biomedical Sciences</td>
<td>Standalone</td>
<td>120 h</td>
</tr>
<tr>
<td>University of Houston [26]</td>
<td>College of Pharmacy</td>
<td>BSPS</td>
<td>Standalone</td>
<td>120 h</td>
</tr>
<tr>
<td>University of Michigan [27]</td>
<td>College of Pharmacy</td>
<td>BSPS</td>
<td>Standalone Admitted to Pharmacy School after               122</td>
<td></td>
</tr>
<tr>
<td>University of Mississippi [28]</td>
<td>School of Pharmacy</td>
<td>BSPS</td>
<td>Required for PharmD admission</td>
<td>113 h</td>
</tr>
<tr>
<td>University of North Carolina–Chapel Hill [29]</td>
<td>College of Pharmacy</td>
<td>BSPS</td>
<td>BSPS program is the P1–P3 years of the PharmD Program</td>
<td></td>
</tr>
<tr>
<td>University of Rhode Island [2]</td>
<td>College of Pharmacy</td>
<td>BSPS</td>
<td>Standalone</td>
<td>120 h</td>
</tr>
<tr>
<td>University of the Sciences in Philadelphia [30]</td>
<td>Science</td>
<td>-BSPS, -BS Pharmacology and Toxicology</td>
<td>Standalone</td>
<td>132 h</td>
</tr>
<tr>
<td>University of Toledo [31]</td>
<td>College of Pharmacy</td>
<td>BSPS</td>
<td>Standalone</td>
<td>132 h</td>
</tr>
<tr>
<td>University of Wisconsin–Madison [32]</td>
<td>School of Pharmacy</td>
<td>BS Pharmacology and Toxicology</td>
<td>Standalone</td>
<td>120 h</td>
</tr>
<tr>
<td>West Chester University of Pennsylvania [33]</td>
<td>College of Arts and Sciences</td>
<td>Pharmaceutical Product Development</td>
<td>Standalone</td>
<td>120 h</td>
</tr>
<tr>
<td>Western Illinois University [34,35]</td>
<td>Department of Chemistry</td>
<td>BS Chemistry with Pharmacy concentration</td>
<td>Standalone</td>
<td>120 h</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Name of University</th>
<th>Type of School or Department</th>
<th>Name of Program</th>
<th>Standalone or entry level to PharmD program</th>
<th>Number of Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilkes University [36] ^</td>
<td>College of Science and Engineering</td>
<td>BA in Chemistry with a concentration in Pharmaceutical Science</td>
<td>Standalone</td>
<td>120 h</td>
</tr>
<tr>
<td>York College [37]</td>
<td>Arts and Sciences, Chemistry</td>
<td>BSPS</td>
<td>Standalone</td>
<td>120 h (76–84, plus General education )</td>
</tr>
</tbody>
</table>

*: There is no standalone program for the BSPS: once the student successfully completes the first two years of the professional pharmacy curriculum (P1 and P2), the student will be awarded the BSPS; ^: University of Houston and Wilkes University discontinued their programs in 2013; #: BS/MS: Bachelor of Science/Master of Science; ¯: A program of courses in the arts and sciences that students needs to complete successfully before they start taking the classes for their major.

2. Methods

The study proposal was approved by the University of Charleston Institutional Review Board. Articles related to BSPS programs for pharmacists were identified via searches of the databases PubMed (provided through the National Library of Medicine and National Institutes of Health (NIH) and International Pharmaceutical Abstracts (IPA) [provided from Ovid Technologies, Inc. (OVID)] OVID from inception to January, 2013. Search terms included: BSPS programs, pharmacy education and dual PharmD/MS. In addition, an Internet search was performed to identify articles in the lay press related to this topic. Searches of the World Wide Web were conducted with the browser Internet Explorer 8.0 and Google Chrome using the advanced search options of Google. The keywords selected for entry into the query box of the browser included the search terms: “BSPS”, “Bachelor of Science in Pharmaceutical Sciences” and “degree programs in Pharmaceutical Sciences.” Programs at USA colleges and universities were compared regarding the percentage of surveyed programs that include specific pharmacy-related courses within their BSPS curricula.

Next, we conducted a survey to evaluate BSPS program directors’ perceptions regarding obtaining the BSPS. Using the American Association of Pharmaceutical Sciences (AAPS) website, 18 universities that offered BSPS degree were identified. A 14-item survey instrument was developed by the authors based on a thorough literature review. (The complete survey instrument is available from the corresponding author upon request). The primary focus of the survey questions pertains to program characteristics and include the types of institutions, curriculum, students’ age and the number of students admitted each year. Other parts of the survey pertain to graduates’ career directions upon completing the BSPS program. An e-mail invitation with a link to the online survey instrument was sent to all 16 BSPS program directors. The list of e-mail addresses for the directors was obtained from their college’s websites. Two BSPS programs were not included in the survey, because they did not have a director for the BSPS program. The BSPS program directors were invited up to 2 times via e-mail. SPSS 16 [38] was used as the software for the analysis.
3. Results

Searches of PubMed and IPA yielded 10 documents, and Google searches retrieved 61 websites related to BSPS programs in the USA. Results are summarized in Tables 1–4 and are described in greater detail below.

3.1. Findings from the Survey

Table 1 is a list of 18 schools in the United States that offer the BSPS degree. A survey was sent out to those schools with a response rate of 7/16 (43.7%). A close look at the courses offered by the BSPS programs is presented in Table 2. It is shown that biochemistry is offered in all of the programs (100%), while other frequently offered courses are pharmacokinetics and physiology (85.7%) and notable courses are biopharmaceutics/pharmaceutics, medicinal chemistry and quantitative chemistry, which were also offered (71.4%). On the other hand, courses, such as clinical pharmacy, pharmacy administration and immunology, are least likely to be offered (28.5%).

Table 2. BSPS curriculum content.

<table>
<thead>
<tr>
<th>What courses do you cover in your program curriculum?</th>
<th>Frequency (Percentage of programs that include the course)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>7 (100.0)</td>
</tr>
<tr>
<td>Pharmacokinetics</td>
<td>6 (85.7)</td>
</tr>
<tr>
<td>Physiology</td>
<td>6 (85.7)</td>
</tr>
<tr>
<td>Biopharmaceutics/Pharmaceutics</td>
<td>5 (71.4)</td>
</tr>
<tr>
<td>Medicinal Chemistry</td>
<td>5 (71.4)</td>
</tr>
<tr>
<td>Quantitative Chemistry</td>
<td>5 (71.4)</td>
</tr>
<tr>
<td>Drug Development</td>
<td>4 (57.1)</td>
</tr>
<tr>
<td>Biostatistics</td>
<td>4 (57.1)</td>
</tr>
<tr>
<td>Microbiology</td>
<td>4 (57.1)</td>
</tr>
<tr>
<td>Anatomy</td>
<td>3 (42.8)</td>
</tr>
<tr>
<td>Clinical Pharmacy</td>
<td>2 (28.5)</td>
</tr>
<tr>
<td>Pharmacy Administration</td>
<td>2 (28.5)</td>
</tr>
<tr>
<td>Immunology</td>
<td>2 (28.5)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (28.5)</td>
</tr>
</tbody>
</table>

A comparison of the characteristics of USA schools and colleges responding to the BSPS survey shows that the majority (71.4%) are public universities and (57.1%) have a pharmacy school, but only (14.2%) of those with a pharmacy school have the BS in Pharmaceutical Science degree as a prerequisite to enter the PharmD program. (Table 3) While only (71.4%) reported that less than 20 students from the BSPS program are admitted to the PharmD program each year, 42.8% reported that student enrollment in the BSPS programs has stayed the same compared to the past five years. Approximately 43% of the schools reported that they have offered the BSPS program for “5–10” years. 85.7% reported the average yearly salary for BSPS graduates going into the workforce upon graduation as between $40,000–$59,999. Two of the schools identified a specialization within their BSPS program.
Although there are jobs after graduation for those students with a BSPS degree, they may choose to pursue a career in pharmacy. Table 4 also shows that the respondents ranked the job placement for the BSPS graduates (from highest to lowest) pharmacy school, postgraduate education and pharmaceutical industry.

**Table 3.** Characteristics of USA institutions who responded to the BSPS survey.

<table>
<thead>
<tr>
<th>Characteristics of USA institutions</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is your University private or public?</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>2 (28.5)</td>
</tr>
<tr>
<td>Public</td>
<td>5 (71.4)</td>
</tr>
<tr>
<td>Does your University have a pharmacy school?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4 (57.1)</td>
</tr>
<tr>
<td>No</td>
<td>3 (42.8)</td>
</tr>
<tr>
<td>If yes, is the BSPS degree a pre-requisite to enter the PharmD program at your University?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>No</td>
<td>5 (71.4)</td>
</tr>
<tr>
<td>No Response</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>How many students are admitted to the program each year?</td>
<td></td>
</tr>
<tr>
<td>Less than 20</td>
<td>5 (71.4)</td>
</tr>
<tr>
<td>20–39</td>
<td>0.0</td>
</tr>
<tr>
<td>40–59</td>
<td>0.0</td>
</tr>
<tr>
<td>60–80</td>
<td>14.2</td>
</tr>
<tr>
<td>More than 80</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>What is the average age of the students when they graduate the program?</td>
<td></td>
</tr>
<tr>
<td>20–25</td>
<td>7 (100.0)</td>
</tr>
<tr>
<td>26–30</td>
<td>0.0</td>
</tr>
<tr>
<td>31–35</td>
<td>0.0</td>
</tr>
<tr>
<td>Over 35</td>
<td>0.0</td>
</tr>
<tr>
<td>How long has the BSPS degree been offered at your school?</td>
<td></td>
</tr>
<tr>
<td>Less than 5 years</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>5–10 years</td>
<td>3 (42.8)</td>
</tr>
<tr>
<td>11–15 years</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>More than 15 years</td>
<td>2 (28.5)</td>
</tr>
<tr>
<td>Does the program require a capstone project, internship, or anything beyond the didactic courses?</td>
<td></td>
</tr>
<tr>
<td>Yes, capstone</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>Yes, internship</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>Yes, other</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>No</td>
<td>4 (57.1)</td>
</tr>
<tr>
<td>What is the student enrollment trend at your program now compared to the past 5 years and explain why?</td>
<td></td>
</tr>
<tr>
<td>More students apply now</td>
<td>2 (28.5)</td>
</tr>
<tr>
<td>Less students apply now</td>
<td>2 (28.5)</td>
</tr>
<tr>
<td>Student enrollment has stayed the same</td>
<td>3 (42.8)</td>
</tr>
</tbody>
</table>
Table 3. Cont.

<table>
<thead>
<tr>
<th>What do you believe is the average yearly salary of a BSPS graduate who goes straight into the workforce upon graduation?</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $40,000</td>
<td>1 (14.2)</td>
</tr>
<tr>
<td>$40,000–$59,999</td>
<td>6 (85.7)</td>
</tr>
<tr>
<td>$60,000–$79,999</td>
<td>0.0</td>
</tr>
<tr>
<td>$80,000–$100,000</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Does your program offers any concentration/specializations in the BSPS?

<table>
<thead>
<tr>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
</tr>
</tbody>
</table>

If yes, how many concentrations, specializations, do you offer and what are they?

<table>
<thead>
<tr>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
</tr>
<tr>
<td>Two</td>
</tr>
<tr>
<td>Three</td>
</tr>
<tr>
<td>Four</td>
</tr>
<tr>
<td>Five</td>
</tr>
<tr>
<td>No Response</td>
</tr>
</tbody>
</table>

Table 4. Career paths for (BSPS) program graduates.

<table>
<thead>
<tr>
<th>In your estimation, what percentage of students proceeds to each level upon graduating from the program?</th>
<th>0–24% 25%–49% 50%–75% Greater than 75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-graduate Education</td>
<td>4 1 1 1</td>
</tr>
<tr>
<td>Pharmacy School</td>
<td>1 3 1 2</td>
</tr>
<tr>
<td>Pharmaceutical Industry</td>
<td>5 1 0 0</td>
</tr>
</tbody>
</table>

4. Discussion

The significance of this investigation is that it is the first study to describe the uniqueness of the BSPS program, including its curriculum, graduation patterns and career paths, and to explore BSPS program director perceptions regarding their programs.

The first goal was to review the literature related to BSPS programs in the United States and to describe the uniqueness of the BSPS program when compared to PharmD and BSPharm programs. Although there are a limited number of schools in the United States that offer a Bachelor of Science in Pharmaceutical Sciences, each school has its own variations in the curriculum they offer. As described previously, BSPS programs focus on preparing students for career opportunities that differ from the PharmD. This degree is also used as a stepping stone for multiple professional programs, including pharmacy, dentistry, medicine and law [19,31].

4.1. Findings from the Literature Review

It is important to note that the core components for the former five-year BSPharm are very comparable to the current pre-pharmacy curriculum for the PharmD degree, as well as the pre-professional division of the BSPS degree. The former five-year BSPharm degree required two years of pre-pharmacy
coursework similar to the current requirements for the PharmD and the BSPS programs. According to the University of Toledo website, once admitted to the BSPS program and after completing the two-year pre-professional coursework, there will be an additional two years of professional coursework. These two years will consist of the following courses: Medicinal Chemistry I and II, Physical Chemistry I and II, Pharmacology I, II and III, Microbiology and Immunology, Pharmaceutics I and II, Chemotherapy and Immunotherapy, Biopharmaceutics and Pharmacokinetics, Professional Practice Development I and II, Human Interaction in Healthcare, Drug Therapy I and II, Healthcare Administration and internship [31]. This particular program differs from the other BSPS programs, as there may be an option to select a specialized track within the BSPS program [31].

The first two professional years of curriculum in the BSPS program are very similar to the first two professional years of the BSPharm program. The third and fourth professional years in the BSPS program focus the curriculum on the track chosen by the student. For example, if the medicinal and biological track is chosen, the student’s fourth professional year would be focused on targeted drug design, advances in drug design, medicinal biotechnology lab, new drug development and biochemistry of disease. However, in the BSPharm program, fourth and fifth year students’ curriculum focused more on therapeutic and pharmacology classes [31].

4.2. Curriculum Comparisons among BSPS Program

Like other Bachelor of Science degree programs, the BSPS is a four-year undergraduate degree, but instead of focusing only on biology and/or chemistry, these programs have an emphasis on pharmaceutical sciences. For most BSPS degree programs, the first two years of studies focus on basic sciences and liberal arts, including general chemistry, organic chemistry, calculus and English composition. The third and fourth year classes describe each program’s unique characteristics. Close to one-half of the BSPS programs are not offered by a school or college of pharmacy. However, the majority that offer the BSPS programs are affiliated with their respective pharmacy schools. The University of California at Irvine, York College and Cleveland State University are examples of standalone programs that are not affiliated with a school of pharmacy [11,22,37].

The University of Toledo has four tracks within its BSPS program, including Medicinal and Biological Chemistry (MBC), Pharmaceutics (PHAR), Pharmacology/Toxicology (PTOX) and Pharmacy Administration (PHAM). The third and fourth year curriculum will vary depending on which track the student chooses to take [31]. The University of Michigan also has four majors within their BSPS degree: Pharmaceutics, Pharmacognosy, Pharmaceutical Analytical Chemistry and Pharmacology [27]. Purdue University has two options for its students to engage in research, the first with the Department of Medicinal Chemistry and Molecular Pharmacology (MCMP) and the second with the Department of Industrial and Physical Pharmacy (IPPH) [19]. Moreover, Cleveland State University has three tracks within the BSPS program: Pharmaceutical Chemistry and Analysis; Medicinal and Biological Chemistry; and Pharmacy Administration.

The remaining schools reviewed for their BSPS degree included Ohio State University, University at Buffalo, Campbell University, Massachusetts College of Pharmacy and Health Sciences, Albany College of Pharmacy and Health Sciences, University of the Sciences in Philadelphia, University of California at Irvine, South Dakota State University, York College, University of Rhode Island,
University of North Carolina, Chapel Hill, University of Houston, University of Delaware, Elizabeth City State University, University of Georgia, University of Connecticut and The University of Mississippi. These have only one track for all students. Students’ classes may vary depending on electives chosen. One unique quality about the University of Mississippi is that it requires the completion of the BSPS program as a prerequisite for entry into their PharmD program [28]. Some universities, such as the University of Mississippi, award a bachelor of science in pharmaceutical sciences (BSPS) degree as a part of the seven-year PharmD program after the completion of the first four years [28]. However, this does not mean that all students in the BSPS program are interested in being admitted into the school of pharmacy [4]. South Dakota State University and the University of North Carolina, Chapel Hill, offer a BSPS degree, but only in conjunction with the PharmD program. The BSPS provides a solid foundation in pharmaceutical sciences, which then leads into the PharmD degree (See Table 1) [20,29].

The University of Michigan, Albany College of Pharmacy and Health Sciences and the University at Buffalo all offer combined programs, which allow students to receive the BSPS, along with a master’s degree [1,9,38]. The joint program at the University of Michigan is the BSPS with a Master’s in Pharmaceutical Engineering, which can be completed in five years [39]. The University at Buffalo allows students to graduate in less than six years with a dual Bachelor of Science/Master of Science in pharmaceutical sciences [1].

Wilkes University, West Chester University of Pennsylvania, Michigan Technological University, Pittsburg State University, Fairleigh Dickinson University, University of Wisconsin Madison, University of California, Davis, and Western Illinois University all offer a BS in Chemistry with a concentration in Pharmacy or a BS in Pharmaceutical Chemistry [13,17,18,32–36,40]. Moreover, Fairleigh Dickinson University offers a BS in Mathematics with a Pharmaceutical Biostatistics Concentration [35].

4.3. Job Opportunities for BSPS

Graduates with pharmaceutical science degrees are employed for entry-level positions in the pharmaceutical and cosmetics industries, government and specialty laboratories and biotechnology companies. Specific positions exist in product development, research, production/manufacturing, quality control/quality assurance, technical services, regulatory affairs and packaging of products. Most pharmaceutical industries employ graduates with pharmaceutical science degrees with knowledge in drug design, pharmacogenomics, drug information and biotechnology, among others [5]. Most schools offering the BSPS program have ties within the major pharmaceutical industries. For instance, the BSPS program at Massachusetts College of Pharmacy and Health Science University works closely with the New England biotechnology and pharmaceutical companies [15]. Another area also in high demand for BSPS graduates is regulatory agencies, such as the Food and Drug Administration (FDA). Job opportunities at the FDA include drug evaluation and research, pharmaceutical compliance in good manufacturing practices (GMP), research on new drug safety and clinical trials [41]. This somewhat corroborates the survey results from Table 4, which gauges the perceptions of program directors for the progression of students beyond the BSPS program.

Graduates with a BSPharm degree work in community pharmacies, hospitals and the pharmaceutical industry. When comparing specific practice settings for graduates of the BSPharm, 90% practice in
community pharmacies and hospital practice, while only 4.2% work in the pharmaceutical industry [42]. On the other hand, BSPS graduates work primarily in the pharmaceutical industry. Alumni from the BSPS program at the University at Buffalo completed a survey, which revealed that approximately 90% of students pursue and are employed in the pharmaceutical industry, while 10% pursue graduate studies [1].

4.4. Job Satisfaction among BSPharm, PharmD and BSPS Practitioners

During the early implementation from the BSPharm to PharmD, most BS pharmacists were more likely to practice at community pharmacies, while PharmDs were practicing in teaching, research and management positions. PharmD graduates spend less time in a dispensing role than BSPharm pharmacists [42]. In 2006, a drug topics online survey was conducted with respondents from BSPharm, PharmD and non-traditional PharmD programs. In community practice, most of the reporting pharmacists believed that the BSPharm degree was sufficient to fulfill the job description and demands [43]. Regarding the mandatory movement from BSPharm to PharmD, the online results of the survey showed that 88% thought the BSPharm was sufficient for dispensing roles in a pharmacy [43]. In continuation, there have also been reports about more job satisfaction, especially with people who went back for their non-traditional PharmD. These pharmacists were able to acquire higher level positions, to receive more clinical roles, to add to the prestige of being called doctor and had a higher salary [42]. Of the BSPharm pharmacists who made the commitment to earn a non-traditional PharmD, 92% said “the tassel was worth the hassle” [42]. In regards to the community pharmacy, as the proportion of BSPharm pharmacists continues to decline, it will be interesting to see how the trends with job satisfaction will change among PharmDs in community pharmacy practice [42]. Currently, pharmacists may also work in hospitals, with disease management, consulting, academia, long-term care, pharmaceutical industry, mail service, managed care and government, each with varying requirements for pharmaceutical care skills [44,45].

While there is ample information available on job satisfaction with graduates with BSPharm and PharmD, no such studies were identified for the graduates with BSPS. The information available so far is from schools and employers as tools to increase interest in the degree and career field. Further research is needed to determine job satisfaction among BSPS graduates.

4.5. Salary and Compensation

Although the demand for pharmacists with BSPharm or PharmD has moderated in recent years, it is still a field that commands a high income. According to the Bureau of Labor Statistics, the median annual salary for pharmacists in May, 2010, was $111,570 [46]. They also project a 25% increase in pharmacy employment between 2010 and 2020 [46]. Graduates from BSPS programs are equally in high demand. The minimum commitment of six years to receive a PharmD, the limited number of BSPS programs available and the explosion in the field of biotechnology and pharmacogenomics has significantly paved the way for the demand of graduates with degrees in pharmaceutical sciences [4]. According to the Bureau of Labor Statistics, the median annual wages of wage and salary for drug manufacturing and sales in May, 2010, was $56,620 [47]. The Bureau of Labor Statistics also ranks pharmaceutical manufacturing amongst one of the fastest growing industries. A 16% increase in job outlook for drug manufacturing and sales is expected from 2010 to 2020 [47]. On the other hand, according to a 2011 survey conducted by AAPS, the average annual salary for BSPS graduates in the
pharmaceutical industry was $99,200, while the average starting salary for individuals beginning their career in 2011 was $84,500 [48].

The second goal of this study was to identify the perceptions of BSPS program directors. Our findings suggest that individuals with a BSPS degree are more likely to pursue further education by entering into a PharmD program or other post-graduate education. In correlation with this finding, respondents to our survey believe that having a BSPS degree better prepared students for the PharmD program than those with another basic science degree. When looking at the curriculum of each individual program, we also found that courses, such as biochemistry, biopharmaceutics/pharmaceutics, pharmacokinetics, medicinal chemistry and quantitative chemistry, are more likely to be incorporated, due to the fact that a BSPS degree often focuses on preparing graduates to work in the pharmaceutical industry. Although, the evidence of our finding shows that a large portion proceed into pharmacy, the article by Broedel-Zaugg et al. indicates that there is a demand for qualified personnel with a BSPS degree in the pharmaceutical industry for drug development [4]. We cannot comment on the qualification of a BSPS degree in preparing graduates to work in the pharmaceutical industry, nor can we draw a conclusion on how many will pursue that route. There has not been a study like ours, and we hope our findings will suggest further research regarding standardization of BSPS curricula and expanded roles for such graduates. We also support a dialogue concerning whether permitting BSPS graduates in future standardized programs to perform basic dispensing skills in community and hospital settings might potentially redistribute the pharmacy workforce in a manner that cost-effectively enhances patient access to pharmaceutical care services, much as physician assistants and nurse practitioners have extended physician resources.

This study has at least one limitation. As it was a self-administered email survey, there is the potential for non-response bias. Repeated contacts were used to try to limit non-response bias. The relatively low response rate of around 44 percent is a limitation of the study in that those who responded may be systematically different than those who did not respond on variables of interest. Despite this limitation, we maintain that these results can provide useful insight into the availability, uniqueness and perceived value of the BSPS programs in the United States.

5. Conclusion

In conclusion, the BSPS is a versatile degree that prepares students to pursue a Master’s, PhD and even a PharmD. Graduates with this degree generally will work directly or indirectly within the pharmaceutical industry. Their field of work is determined by their educational background and career interests. The BSPS, the former BSPharm and PharmD all have some similar courses required for graduation or as pre-professional requirements. All degrees listed above allow students to have a solid science foundation. All the BSPS programs assessed are affiliated with USA universities. The BSPS will not qualify a graduate to work as a licensed pharmacist, but serves as the most relative degree that prepares students to receive a PharmD and/or work in the pharmaceutical industry. Currently, the BSPS programs have yet to receive a large amount of attention, but the importance in pharmaceutical education cannot be denied.
Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

We sincerely thank the following individuals for their contributions to the literature review reported in this paper: Gagan Kaushal and John Bowman.

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APPENDIX 5

Implementation issues

A. Timeline for revised curricular implementation........................................pg. 57
B. Advising sheets for matriculated students during transition period..............pg. 58-60
C. Email concurrence from other units regarding Anatomy, Microbiology, and Statistics requirements (pertinent sections highlighted)........................................pg. 61-69
<table>
<thead>
<tr>
<th>Current Curriculum</th>
<th>Revised Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedicinal Chem (PHR 4100)</td>
<td></td>
</tr>
<tr>
<td>Intro Pharmaceutics (PHR 4300)</td>
<td></td>
</tr>
<tr>
<td>Career Exploration in Rx Sciences (PHR 2100)</td>
<td></td>
</tr>
<tr>
<td>Rx Sciences Lab (PHR 4600)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Autumn 2015</th>
<th>Spring 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey (PHR 1100)</td>
<td>Intro Med Chem (PHR 4200)</td>
</tr>
<tr>
<td>Career Exploration in Rx Sciences (PHR 2100)</td>
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The following is a degree requirements checklist for BSPS students who entered the major as a freshman beginning AU14.

General Education Requirements

Writing
☐ 1ST Writing Course (3): _________________________________
☐ 2nd Writing Course (3): _________________________________

Foreign Language
☐ 1101 (4): _________________________________
☐ 1102 (4): _________________________________
☐ 1103 (4): _________________________________

Social Science
☐ 1ST Social Science (3): ___________________________________
☐ 2nd Social Science (3):_____________________

Arts & Humanities
☐ Historical Study (3):______________________________________
☐ Arts (3):_________________________________________
☐ Literature (3):_________________________________________
☐ Cultures & Ideas or Historical Study (3):_____________________

Note: Two (2) courses in Global Studies and one (1) course in Social Diversity are required. Courses can overlap with Social Sciences and Arts & Humanities.

Core Math and Science Courses

Biology
☐ Biology 1113 (4): Biological Sciences: Energy Transfer and Development
☐ Biology 1114 (4): Biological Sciences: Form, Function, Diversity, and Ecology

Chemistry
☐ Chemistry 1210 (5): General Chemistry I
☐ Chemistry 1220 (5): General Chemistry II
☐ Chemistry 2510 (4): Organic Chemistry I
☐ Chemistry 2520 (4): Organic Chemistry II
☐ Chemistry 2540 (2): Organic Chemistry Laboratory I
☐ Chemistry 2550 (2): Organic Chemistry Laboratory II

Math
☐ Math 1151 (5): Calculus I

Physics
☐ Physics 1200 (5): Mechanics, Kinematics, Fluids, Waves
☐ Physics 1201 (5): E&M, Optics, Modern Physics

Physiology
☐ EEOB 2520 (3): Human Physiology
BSPS Required Courses
☐ Pharmacy 1100 (1): Pharmaceutical Sciences Survey
☐ Pharmacy 2500 (3): Drug Discovery, Development, and Delivery
☐ Pharmacy 3200 (5): Biochemistry for the Pharmaceutical Sciences
☐ Pharmacy 4000 (5): Integrated Pharmaceutical Sciences 1
☐ Pharmacy 4600 (2): Pharmaceutical Sciences Laboratory

BSPS Elective Courses
(10 credit hours required)
☐ Pharmacy 2400 (2): Addicting Drugs
☐ Pharmacy 2510 (2): Introduction to Pharmacy
☐ Pharmacy 3400 (2): Therapeutic Frontiers
☐ Pharmacy 3410 (1): Science Communication and Engagement
☐ Pharmacy 3510 (1.5): Principles of Therapeutics
☐ Pharmacy 4998 (var.): General Undergraduate Research
☐ Pharmacy 4999 (var.): Undergraduate Research Thesis
☐ Pharmacy 5140 (1.5): Professional Ethics
☐ Pharmacy 5500 (3): History of Pharmacy
☐ Pharmacy 5510 (3): Basics of Pharmaconutrition
☐ Pharmacy 5520 (2): Advanced Pharmaconutrition
☐ Pharmacy 5530 (2): Medical Applications of Radionuclides and Radiopharm.
☐ Pharmacy 5540 (2): Intro to Clinical and Translational Pharmacy Research
☐ Pharmacy 5550 (2): Topics in International Pharmacy
☐ Pharmacy 5560 (1.5): Success and Leadership in Pharmacy
☐ Pharmacy 5570 (1): Seminar on Pharmacy Careers
☐ Pharmacy 5798 (1): International Healthcare Experience in Pharmacy

Free Electives (to an overall total of at least 120 hours)
☐ __________________________________________
☐ __________________________________________
☐ __________________________________________
☐ __________________________________________
BSPS Sample Scheduling Plan

Sample Plan:
The following represents a sample scheduling plan for BSPS students who entered the major as a freshman beginning AU14. We encourage students to plan their academic program early, review this plan with his or her academic advisor, and update the plan from time to time as conditions change.

YEAR 1:

Autumn
Math 1150  5  
Chemistry 1210  5 
Pharmacy 1100  1 
GE/Electives*  3 
Total Hours  14

Spring
Math 1151  5  
Chemistry 1220  5 
GE/Electives*  6 
Total Hours  16

YEAR 2:

Autumn
Chemistry 2510  4  
Chemistry 2540  2  
Biology 1113  4 
GE/Electives*  5 
Total Hours  15

Spring
Chemistry 2520  4  
Chemistry 2550  2  
Biology 1114  4 
GE/Electives*  6 
Total Hours  16

YEAR 3:

Autumn
Physics 1200  5  
EEOB 2520  3  
Pharmacy 3200  5  
Pharmacy 2500  3 
Total Hours  16

Spring
Physics 1201  5  
Pharmacy 4000  5  
GE/Electives*  5 
Total Hours  15

YEAR 4:

Autumn
GE/Electives*  12 
Total Hours  14

Spring
Pharmacy 4600**  2 
GE/Electives*  12 
Total Hours  14

* “GE/Electives” include general education course, program electives and free electives, which should be scheduled as possible/as needed.
**Pharmacy 4600 is offered both Autumn and Spring Semester. It only needs to be taken once, but it can be taken either semester.
Hi Nicole,

I definitely agree that your students can complete Anat 2300.04 and we will make the room for them – do you need anything on official letterhead?

And we definitely need to chat. What is your schedule for the week of January 5? For example, I am available on Monday, January 5 except from 12:30PM-2:30PM.

Jennifer

******************************************************************************
Jennifer M. Burgoon, PhD
Assistant Professor - Clinical
Director of Undergraduate Education
Community Outreach Coordinator
Division of Anatomy
College of Medicine
The Ohio State University
279 Hamilton Hall
1645 Neil Avenue
Columbus, OH 43210
614-366-8066 (o)
jennifer.burgoon@osumc.edu
******************************************************************************

Hi Jennifer,
Thanks so much for getting back to me! I don’t think that we have spoken before, but yes, let’s get together to chat. I teach on Mondays and Thursdays next semester, but I’m generally free on the other days of the week. Let me know what works for you.

To answer your questions:

1. Our students would be coded “Pharmacy-Pharmaceutical Sciences”. There shouldn’t be a pre-pharmacy designation.
2. With the revised curriculum, students would have some flexibility in their final two years to take Anatomy. In the sample course plan, we have them taking it during the spring semester of their 3rd year, but technically they could take it either semester. This would all begin in the 2017-18 school year.
I’m currently preparing the curricular revision proposal that will go to OAA, and I would like to include a concurrence statement from you about this matter. Would that be okay?

Thanks again for your help here!
Nicole

Nicole Cartwright Kwiek, Ph.D.
Clinical Assistant Professor
Director of Undergraduate Studies
Co-Director, The Generation Rx Initiative
Ohio State University College of Pharmacy
500 W. 12th Avenue | 442 Parks Hall
Columbus, OH 43210
Phone: 614-688-5951

From: Burgoon, Jennifer [mailto:Jennifer.Burgoon@osumc.edu]
Sent: Monday, December 15, 2014 3:51 PM
To: Kwiek, Nicole
Cc: McHugh, Kirk; Whitmer, Mark; Barton, Melody
Subject: RE: BSPS program changes and Anatomy coursework

Hi Nicole,

My name is Jennifer Burgoon and I am the Director of Undergraduate Education for the Division of Anatomy. Have we spoken before over the phone regarding a registration issue??

Looking over the information you provided below, we should be able to accommodate an additional 10-15 students, but no more. Are your students coded pre-pharmacy? We will need to take a look at how your students are coded so that we can ensure seats are reserved for your students, most likely in the Anat 2300.04 section.

We are currently looking at ways to address our waitlists, with the first change being that we will offer Anat 2300 for the first time during the summer – this upcoming Summer 2015 semester (64 seats). What semester do you foresee your students completing Anat 2300.04?

We should get together and chat sometime soon about the curricular needs of your students, in terms of anatomy, especially as we work to address our waitlist issues. Let’s set up a meeting for the Spring 2015 semester. Please let me know a time that would be best to meet.

Thanks,
Jennifer

*****************************************************************************
Jennifer M. Burgoon, PhD
Assistant Professor - Clinical
Director of Undergraduate Education
Community Outreach Coordinator
Hi Nicole,

I appreciate your inquiring about this in advance, and at this point I think we will be able to accommodate the additional students. During Spring Semester, I generally have a waitlist for many of the seven labs by the time registration windows open for sophomores and freshman. However, if pharmacy undergrads are advised to take anatomy as juniors or seniors, and they register promptly, I don't foresee them having trouble getting into the class. EEOB 2510 is also offered during Summer Semester, and for the past few years I've had 70-80 students when the course capacity is 100 so there are some extra spots there. You may have checked this out already, but EEOB 2510 is not offered during Autumn Semester. Finally, the department is in the initial/planning stages of renovating a second lab classroom, and if that pans out, it will be possible to increase the number of lab sections offered during Spring Semester.

I will notify you if anything above changes dramatically. Let me know if you have any other questions.

Cheers,
Leslie

On Dec 16, 2014, at 2:46 PM, Kwiek, Nicole <kwiek.1@osu.edu> wrote:

Hi Dr. Jackson,
My name is Nicole Kwiek, and I am the Director of Undergraduate Studies within the College of Pharmacy. We are currently revising our undergraduate BS in Pharmaceutical Sciences (BSPS) curriculum, proposing that students have the opportunity to complete the degree through one of two new program tracks (Healthcare Professions and Drug Discovery/Development). With this revision, we would like to require our Healthcare Professions track students to take an Anatomy course (we are proposing that they can choose between EEOB2510 or Anatomy2300).

What would this mean in terms of numbers and timing? The new curriculum will ideally go into effect during the 2015-16 school year for the incoming freshmen. With our proposed advising plan, these students would take EEOB2510 in their third year (2017-18; however, there is flexibility in the students’ final two years to do so). Currently, about 70% of our roughly 110 students/year are already taking Anatomy as an elective in order to fulfill prereqs for professional school. We predict that about 80% of incoming students will select the Healthcare Professions track; as such, we would expect about 10-15 additional students to be enrolled in your class during the 2017-18 school year and thereafter.

Can you please confirm that this increase in enrollment is okay from your standpoint?
If you would like to discuss this further, please don’t hesitate to ask. If there is someone else to whom I should ask this question, please let me know that too.

Thank you so much!
Nicole

Nicole Cartwright Kwiek, Ph.D.
Clinical Assistant Professor
Director of Undergraduate Studies
Co-Director, The Generation Rx Initiative
Ohio State University College of Pharmacy
500 W. 12th Avenue | 442 Parks Hall
Columbus, OH 43210
Phone: 614-688-5951
Hi Nicole,

I am glad to let you know that I'll be happy to have pharmaceutical sciences undergraduate students in the Microbiology 4000 course in the future. Since your program’s new requirement increases the student flow into Mb 4000 only marginally, we may not need to add an extra lab section. This means, from logistical point of view, we are perfectly fine with the accommodation of new students.

On a different note, we offer two lecture sessions of the course. The one at 11:30am on MWF is always in demand and fills up quickly. However, the MWF session at 4:05 pm usually has many open seats because of the larger lecture hall we get.

I communicated your email message to our departmental chairperson and he has agreed with the decision as well.

Please do not hesitate to contact if I can offer further assistance.

Regards,

Madhura

---

Hi Nicole,

My name is Nicole Kwiek, and I am the Director of Undergraduate Studies within the College of Pharmacy. We are currently revising our undergraduate BS in Pharmaceutical Sciences (BSPS) curriculum, proposing that students have the opportunity to complete the degree through one of two new program tracks (Healthcare Professions and Drug Discovery/Development). With this revision, we would like to require our Healthcare Professions track students to take Microbiology 4000. (Note: currently, about 70% of our roughly 110 students/year are already taking your class as an elective in order to fulfill prereqs for professional school.)

What would this mean in terms of numbers and timing? The new curriculum will ideally go into effect during the 2015-16 school year for the incoming freshmen. With our proposed advising plan,
these students would take your class in their fourth year (2018-19). We predict that about 80% of incoming students will select the Healthcare Professions track; as such, we would expect about 10-15 additional students to be enrolled in your class during the 2018-19 school year and thereafter.

Can you please confirm that this is okay from your standpoint? If you would like to discuss this further, please don’t hesitate to ask.

Thank you so much!
Nicole

Nicole Cartwright Kwiek, Ph.D.
Clinical Assistant Professor
Director of Undergraduate Studies
Co-Director, The Generation Rx Initiative
Ohio State University College of Pharmacy
500 W. 12th Avenue | 442 Parks Hall
Columbus, OH 43210
Phone: 614-688-5951
Nicole;

Going forward, we plan to offer 2480 both autumn and spring semesters. We should be able to accommodate BSPS students without any problem.

Bill Notz

---

Hi Jean,

Thank you for getting back to me! To answer your questions:

1. Yes, STAT2480 would be ideal, but STAT2450 is a fine replacement. We would accept either course to satisfy this requirement.

2. We have some time to plan as these students wouldn’t be required to start taking either of these courses until 2017-18.

3. I am finishing the curricular revision proposal that will go to OAA. Once we are in agreement, I’d like to include Dr. Notz’s concurrence statement in the proposal, if that’s okay. So, please feel free to ask me any questions that you have.

Thanks so much!

Nicole

Nicole Cartwright Kwiek, Ph.D.
Clinical Assistant Professor
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Phone: 614-688-5951

---

Thank you so much for sharing this information so we can better serve the students who need
statistics classes.

Dennis Pearl is now longer at OSU. I am copying Dr. Bill Notz who is the Vice Chair of Undergraduate Studies. When will the students be notified of this new requirement? I ask because there has been an increase in demand for STAT 2480 for this spring semester. STAT 2450 has been offered in the fall and STAT 2480 has only been offered in the spring. The material in these classes is very similar, with STAT 2480 using primarily bio-sciences examples. Will Stat 2450 be an acceptable option if students need to take the class in the fall?

Although I am confident that we can handle an increase in enrollment of 30-40 students per year, Dr. Notz oversees all of our course offerings and I’m sure he will be in touch and may have additional questions.

Thanks for being proactive, so we can be prepared.

Jean

Jean A. Scott
Undergraduate Program Coordinator
The Ohio State University
Department of Statistics
408A Cockins Hall
1958 Neil Avenue
Columbus, OH 43210
614-688-5913
614-292-2096 (fax)
jscott@stat.osu.edu

Hi Dennis and Jean,

My name is Nicole Kwiek, and I am the Director of Undergraduate Studies within the College of Pharmacy. We are currently revising our undergraduate BS in Pharmaceutical Sciences (BSPS) curriculum, and with this revision, we would like to require all of our students to take a statistics course (preferably STAT2480, though we would technically accept any course). As a point of reference, currently ~70% of our roughly 110 students/year already take a statistics class as an elective in order to fulfill prereqs for professional school.

What would this mean in terms of numbers and timing? The new curriculum will ideally go into effect during the 2015-16 school year for the incoming freshmen. With our proposed advising plan, these students would take your class in their third year (2017-18). As such, we would expect about 30-40 additional students to be enrolled in any of your statistics courses during the 2017-18 school year and thereafter.
Can you please confirm that this increase in enrollment is okay from your standpoint? If you would like to discuss this further, please don’t hesitate to ask.

Thank you so much!
Nicole

Nicole Cartwright Kwiek, Ph.D.
Clinical Assistant Professor
Director of Undergraduate Studies
Co-Director, The Generation Rx Initiative
Ohio State University College of Pharmacy
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Columbus, OH 43210
Phone: 614-688-5951
APPENDIX 6

Steps in development

A. Letter of support from Dr. Henry Mann, the Dean of the College of Pharmacy...pg. 71
B. Rosters of faculty, staff, students, and partners involved in curricular revision....pg. 72-73
C. Meeting minutes (pertinent sections highlighted) from:
   1. Presentation of the Task Force’s ongoing work to College of Pharmacy faculty
      (3/7/14)........................................................................................................pg. 74-75
   2. Presentation of the Task Force’s findings to College faculty (5/2/14)....pg. 76-79
   3. Discussion of the Task Force’s findings with the Dean’s Corporate Council
      (5/16/14)......................................................................................................pg. 80-81
   4. Presentation of the curricular revision proposal to College faculty
      (10/3/14)......................................................................................................pg. 82-83
   5. Discussion of the curricular revision with the College’s Alumni Governing Board
      (10/16/14)......................................................................................................pg. 84
   6. Presentation of the revised curricular proposal to College faculty and vote results
      (11/14/14)......................................................................................................pg. 85-86
   7. Discussion with the College’s Executive Committee about the implementation
      timeline (11/20/14)....................................................................................pg. 87-88
December 3, 2014

Council on Academic Affairs
c/o Office of Academic Affairs
203 Bricker Hall
190 North Oval Mall
The Ohio State University
CAMPUS

Dear Council on Academic Affairs Members:

I am pleased to submit for your review a proposal for revision of the Bachelor of Science in Pharmaceutical Sciences (BSPS) program. The BSPS program has been very successful in attracting highly qualified students since it was first approved in 1996. In addition, the program has been well received by students and grown in size and scope. Over the past year, this program has been analyzed by the BSPS task force led by Dr. Nicole Kwiek. The task force sought input from multiple sources including graduates of the program. Their analysis has led us to the proposal for revision as described in the attached documents.

The revised program will provide students with more contact in the College of Pharmacy as well as greater choice in course selection. The changes in the program infrastructure will provide a Health Professions Pathway that better meets the perceived needs for the majority of students in the program. The strong emphasis on research preparation that was envisioned in the original program will still be met by The Drug Discovery and Development Pathway. We believe these changes will provide graduates who are even more competitive for professional and graduate school placement.

The College of Pharmacy at The Ohio State University is one of a very few schools who offer an undergraduate curriculum in the pharmaceutical sciences. The growth of this program and the success of placement for our graduates demonstrate the quality of the BSPS program. We believe we have the resources and the capability to further enhance an already successful program. We appreciate your consideration of the proposal, which I very strongly endorse.

Sincerely,

[Signature]

Henry J. Mann, Pharm.D., FCCP, FCCM, FASHP
Dean and Professor
College of Pharmacy
Roster of the BSPS Curricular Revision Task Force

• Nicole Kwiek, PhD (Chair)
  Director of Undergraduate Studies
  Clinical Assistant Professor of Pharmacology

• Cynthia Carnes, PharmD, PhD
  Associate Dean for Graduate Studies and Research
  Professor of Pharmacology, Pharmacy Practice and Administration

• Katherine Kelley, PhD
  Associate Dean for Assessment and Strategic Initiatives
  Associate Professor of Clinical Pharmacy, Pharmacy Practice and Administration

• Jim McAuley, PhD, RPh
  Associate Dean for Academic Affairs
  Professor, Pharmacy Practice and Administration
  Director of Teaching and Learning

• Ken Hale, RPh, PhD
  Clinical Professor, Pharmacy Practice and Administration
  At the time: Assistant Dean of Professional and External Affairs

• Jim Coyle, PharmD
  Professor Emeritus, Pharmacy Practice and Administration
  Currently leading the PharmD curriculum revision

• Jim Fuchs, PhD
  Associate Professor, Medicinal Chemistry and Pharmacognosy

• Mitch Phelps, PhD
  Assistant Professor, Pharmaceutics and Pharmaceutical Chemistry

• Lane Wallace, PhD
  Professor and Chair, Pharmacology

• Kelly Burke
  College Registrar, Student Affairs

• Kelly Crum
  Academic Counselor & Staff Assistant, Student Affairs

• Nikki Herbert
  Graduate Programs Coordinator

• Tara McCarron
  Career Advisor, Student Affairs

• Mary Higginbotham
  Program Assistant, Assessment

• Sarah Jones (BSPS student at the time, current PharmD student)

• Nira Kadakia (BSPS alumnus, current PharmD student)
• Moriah Locklear (BSPS student at the time, current PhD student)
• Michael Messina (BSPS student at the time, now an alumnus)
• Eric Place (BSPS alumnus, current PharmD student)
• Samantha Tucci (BSPS alumnus, scientist at Boehringer Ingelheim Research Institute)
• Ryan Jackson (Scientist at Boehringer Ingelheim Research Institute)
• Steve Loborec (Pharmacist at Wexner Medical Center)

**Roster of the BSPS Curricular Implementation Team**

• Nicole Kwiek (Chair)
  Clinical Assistant Professor, Pharmacology
  Director of Undergraduate Studies

• Daren Knoell, PharmD
  Professor and Chair, Pharmacy Practice and Administration

• Tom Schmittgen, PhD
  Professor and Chair, Pharmaceutics and Pharmaceutical Chemistry

• Lane Wallace, PhD
  Professor and Chair, Pharmacology

• Karl Werbovetz, PhD
  Professor and Chair, Medicinal Chemistry and Pharmacognosy

• Kelly Burke
  College Registrar, Student Affairs

• Kelly Crum
  Academic Counselor & Staff Assistant, Student Affairs

• Mary Higginbotham
  Program Assistant, Assessment

• Victoria Williams
  Current BSPS student
The Ohio State University
College of Pharmacy

Faculty Meeting Minutes

March 7, 2014

Attending: Dean Mann (Chair), Beatty, Bennett D, Brueggemeier, Carcache de Blanco, Carnes, Casper, Chen, Coyle, Delffs, Detwiler, Dula, Emptage, Frank, Fuchs, Haas-Gehres, Hoyt D, Hoyt K, Kelley, Kinghorn, Knoell, Kwiek, Legg, Li C, McAuley, Mehta, Mirtallo, Nahata, Phelps, Pruchnicki, Rakotondraibe, Schmittgen, Spiers, Tjarks, Wallace, Werbovetz, Whetstone, Yalowich, Young, Zhao


Guest: Michael Boehm, Vice Provost for Academic & Strategic Planning

1. Announcements:

➢ Dean Mann announced the promotion and tenure approvals for 2014 for Dr. Werner Tjarks, Dr. Mitch Phelps, Dr. Stuart Beatty, Dr. Eric Bachelder, Dr. Bella Mehta and Mr. Jay Mirtallo.

➢ Dean Mann announced that the College’s E-news is now being sent out regularly. He asked that anyone with announcements they’d like to be added to the E-news to please contact Laura Wise-Blau.

➢ Dr. McAuley updated the faculty on the University Senate meeting held March 6, 2014. Faculty compensation and benefits will be extending the COTA benefit, currently offered to students, to the staff and faculty. Additionally, the senate heard an update from the Health Plan Oversight committee on the current status and plans for moving forward in this “unparalleled time of complexity” for health plans.

➢ Kathy Kelley announced that the annual Pharmacy Ball is being held on April 11th and tickets are currently available. She also reported to the faculty that the students will be holding a silent auction March 18 and 19, 2014.

➢ Dr. Brueggemeier reported to the group on the AFPE Gateway Research Scholarship for Undergraduate and/or Pharmacy Pre-Professional Degree Students. This scholarship provides a one-year award of $5,000 supporting the student’s participation in a faculty-mentored research project. Each institution can only submit two applications. Deadline for submission is March 31, 2014. Coordination for the College will be going through Dean Carnes’ office. More information can be found at http://www.afpenet.org/.
Dean Carnes announced that the annual College Research Day is being held April 2, 2014. The deadline for abstract submission has been extended to March 10, 2014.

Dr. Kwiek reported that applications for the Pills, Potions and Poisons summer program are now open.

2. Dean Mann presented the minutes from the February 14, 2014 faculty meeting for approval. Subsequent to a motion by Dr. Knoell seconded by Dr. Kinghorn, these minutes were unanimously approved.

3. Michael Boehm, Vice Provost for Academic and Strategic Planning spoke to the faculty about the University’s strategic planning process and its impact on each College.

4. Kristin Casper presented the revisions to the Academic Standing Guidelines which were up for faculty action. The faculty would like to move to strike the student Pharmacy Council approval and would like this to be a majority vote of faculty only with student input. Vote was taken and it was unanimously approved.

5. Dr. Kwiek reported to the faculty on the Bachelor of Science in Pharmaceutical Sciences (BSPS) curricular revision. The current curriculum consists of six core courses for the four year undergraduate degree, with the majority of the Pharmacy classes being taken in the final two years. A committee of faculty, staff and students has been formed to review and revise the current curriculum with many goals in mind, some of which include: increasing enrollment and e-learning options; strengthening the honors program; efficiently tie to the PharmD program; expanding active learning and adding more lab technique instruction; adding a pharmacy technician certification program. The timeline for these revisions is to submit the plan to Dean Mann by the end of the summer (June-August), present to the faculty for approval by the Fall 2014, followed by submission to the University for approval, with implementation by the Fall of 2015.

6. Dean Mann presented the faculty with the second APhA video: Innovation & Knowledge Transfer, which will be shown at both the AACP and APhA annual meetings and posted to the College’s website.

Respectfully Submitted,

Rori Taylor
Executive Assistant to the Dean

(Approved by the faculty, May 2, 2014)
The Ohio State University
College of Pharmacy

Faculty Meeting Minutes

May 2, 2014


Absent: Dean Weber; Professors Ainslie, Bachelder, M.Bennett, Brueggemeier, Cable, Casper, Delffs, Drew, Elton, Emptage, Frank, Gooden, Haas-Gehres, Hall, Kessl, Kinghorn, Kvartskhelia, R.Lee, Legg, T.Li, Liu, Mirtallo, Nahata, Pai, Phelps, Pruchnicki, Spiers, Sweeney, Szeinbach, Young, Zhao.

1. Announcements:

- Dean Mann reminded the faculty that Faculty Activity Statements (covering June 2013 through May 2014) are due by May 15th, and annual reports are due by June 1st.

- Dean Mann announced that Dr. James McAuley was selected by our PharmD students to receive the 2014 Miriam Balshone Memorial Award for Distinguished Teaching, and Dr. Nicole Kwiek was selected by our BSPS students to receive the 2014 BSPS Distinguished Teaching Award.

- Dean Kelley announced that a proposal to move our next ACPE accreditation site visit to 2017 (as opposed to 2016) has been verbally approved, with final approval to be determined at their Board meeting in June.

- Dr. Schmittgen announced that three faculty candidates in the Division of Pharmaceutics and Pharmaceutical Chemistry will be interviewing during the month of May. He asked the faculty to support this process by attending the candidates' seminars (announcements to follow).

- Dean Carnes noted recent successful grant applications by Dr. Nam Lee, Dr. Ching-Shih Chen, Dr. Mamuka Kvartskhelia, and Dr. Robert Lee.
Dean Carnes reminded that faculty that conflict of interest forms must be completed annually and that external consulting forms must be completed as applicable.

Dr. Chenglong Li provided an update relating to the data analytics discovery theme. He is a member of the University advisory team. An interim leader for this initiative is being identified. Fifty to sixty faculty members are expected to be recruited over the next two to three years, with approximately half working in the data analytic core group and half within academic units. Dean Carnes added that the second discovery theme (emerging and re-emerging diseases) RFP deadline is May 30th. A drug discovery and development proposal is being constructed and will be circulated within the College soon. Related planning meetings and partnership discussions will follow.

Dean Hale announced that the College's annual Alumni Awards Banquet will be held the evening of May 9th at the Blackwell Inn. This year's honorees include Richard Demers, Elizabeth Kudlacz, Mary Piascik, Joseph Borowitz, Carol Braun, James Coyle, and Thad Franz. He encouraged faculty to attend (contact Tanya McDay for complimentary registration).

Dr. Knoell introduced a new assistant professor (research track) in the Division of Pharmacy Practice and Administration, Ming Poi, PharmD, PhD. Dr. Poi is an oncology specialist with experience in the Clinical Trials Unit at the James Cancer Hospital and Solove Research Institute.

Dean Carnes introduced Dr. Marjorie Neidecker, who has a new split appointment between the Colleges of Nursing and Pharmacy. She will direct the new Master's program in applied clinical and pre-clinical research.

Dean Mann noted that the recent Pharmacy Ball was very successful and encouraged faculty to attend this event in the future.

2. Dean Hale presented the March 7, 2014 faculty meeting minutes for approval. Subsequent to a motion by Drs. Wallace and Schmittgen, these minutes were unanimously approved without revision.

3. Dean Hale called for nominations to serve on the 2014-15 Committee on Committees. The following faculty members were nominated: Drs. Beatty, Fuchs, K. Hoyt, Kvartskhelia, Kwiek, N. Lee, McAuley, Phelps, Rodis, and Tjarks. Dean Kelley will generate an electronic ballot to determine the membership of this group (the five faculty members receiving the most votes). The individual receiving the most votes will serve as Chair.
4. Dr. McAuley provided an update from University Senate. This included a meeting with Provost Joe Steinmetz on March 27th during which the following top challenges relating to the “state of academic affairs” were discussed: affordability and access to higher education; functioning under an unprecedented level of public scrutiny; maintaining a robust research program in an era of tight budgets; and examining the ways we evaluate faculty. On April 17th, Carol Whitacre (Vice President for Research) provided a “state of research” message including: information from a recent publication in *Science* detailing the benefits to students, the State of Ohio and the US from research done at OSU; a summary of industry collaborations (approximately half relating to health and wellness); and international research programs (including opportunities through the new Gateway office in Brazil).

5. Dean Kelley provided an update on strategic planning. She defined the intended structure of these plans, to include core goals, strategic focus areas, and implementation initiatives. Examples of the use of this heuristic were provided. She reviewed a summary of progress in the College’s planning process including: data gathering through internal and external SWOT analyses; a faculty retreat in December; formulation of a writing group; construction of mission, vision and value statements; small group working sessions; generation of draft focus areas and implementation initiatives; and brown bag discussion sessions relating to teaching & learning and outreach & engagement. She outlined the writing process and the composition of the writing group. A draft plan (with top-level strategic focus areas and implementation initiatives) will be presented at the faculty meeting in June, toward the goal of submitting an approved plan to Academic Affairs by June 30th. This plan will serve as a foundation for more detailed action plans to be developed by various units (i.e., Divisions, program committees, administrative units).

6. Dr. Kwiek outlined draft proposals relating to Bachelor of Science in the Pharmaceutical Sciences (BSPS) curricular revisions. She reviewed the current BSPS curriculum, including the core required classes. College faculty currently deliver 15 credit hours of required coursework (mostly in the third and fourth years). A need to capitalize on the unique and appealing context of the program, enhance face time with College faculty, add Honors-level courses, and resolve redundancy with PharmD courses was discussed. The composition of the BSPS Curriculum Revision Committee was described, with faculty members from each Division and representatives from student affairs, assessment, the student body, and external partners. This group was charged to design a new curriculum; an implementation team will later be established. Dr. Kwiek described the process being observed by the committee. Proposals for a “Clinical Sciences Pathway” as well as a “Drug Discovery and Development Pathway” were
detailed, including draft sample course plans for each. Proposed revisions would result in expansion of pharmacy delivery of required coursework to 33 and 35 hours, respectively. Proposed ancillaries include the development of new elective courses relating to common drugs, pharmacy technician certification examination preparation, a laboratory techniques primer, and pharmacogenomics. Additional Honors-level courses are also proposed, as well as a pharmaceutical sciences minor. Proposals will be finalized during the summer, with presentation to the faculty for approval in the fall. The goal is to phase-in the new curriculum beginning fall semester 2015.

7. Dr. Coyle provided an update on PharmD curricular change. He reviewed the structure for curricular change, including an associated Task Force, Steering Team, Director of Curricular Change Planning and Implementation, and Associate Dean for Curriculum and Assessment. Members of the Task Force and Steering Team were listed, including Dr. Teresa Johnson from the University Center for Advancement of Teaching. A revised timeline was described, with a program-level plan to be presented for faculty approval by June 2015. Course-level planning for the P-1 year is to be completed by July 2016, and the new curriculum will be phased-in beginning with P-1 coursework in the fall semester of 2016. Dr. Coyle announced special programming to be conducted during June, with invited guests from the UNC Eshelman School of Pharmacy and the University Michigan. Presentations will highlight recent curricular change initiatives at these institutions.

Respectfully Submitted,

Kenneth M. Hale
Assistant Dean

(Approved by the faculty June 6, 2014)
Minutes
College of Pharmacy
Dean’s Corporate Council Spring Meeting
Friday, May 16, 2014

Present
Council: Anne Burns, Harold Godwin, John Long, Rob Mains, Marcia Nusgart, Max Peoples, Bill Sheridan, Mark Sirgo, Andy Vick & Al Vrable


Guests: Bence Boelcskevy (OSU Drug Development Institute)

The meeting was called to order at 8:30 a.m. by Council Chairman, John Long. Mr. Long gave a brief overview of the agenda for the meeting. Minutes from the October 25, 2013 meeting were approved. Two new council members were introduced, Max Peoples and Andy Vick.

College of Pharmacy Update
Dr. Mann updated the Council on the College for this past academic year. The College is currently still going through the strategic planning process and a curriculum update. The College had 131 students graduate with their PharmD on May 4, 119 students graduated with their BSPS in 2013-2014 (69 of those with honors), 10 students obtained an MS degree and 8 students obtained a PhD degree in 2013-2014. Overall enrollment for the College in 2013-2014 was just over 1,000. The graduate program however has seen a slight decrease. The College’s NAPLEX and MPJE for 2014 were both at 100% pass rate.

The College’s faculty has increased from 58 to 67 in the last year. Dr. Mann would like to see the faculty increase to over 100. Working with the University and the new Discovery Themes initiative will help to fund more faculty for the College. The College is also working with the Medical Center and Dr. Wolfgang Sadee to help incorporate Pharmacogenomics.

The College’s Outreach and Engagement continues to be strong with programs like the Generation Rx initiative, the Massive Open Online Courses (MOOC) which has over 64,000 students enrolled, and Partner for Promotion. The College also continues to build its relations and agreements with schools in Taiwan, Honduras and London.

The College of Pharmacy’s priorities for 2014-2015 being outlined through the current strategic planning process include faculty recruitment, curriculum enhancements, working with the University’s Discovery Themes and the College’s graduate program. Implementation of a new Masters in Applied Clinical and Preclinical Research (MACPR), as well as collaboration between the Colleges of Pharmacy, Nursing, Medicine and Veterinary Medicine are being focused on at this time for the graduate program.

Update on the “But for Ohio State” Campaign
Thomas Dauber, the College of Pharmacy’s Chief Advancement Officer, updated the Council on the University’s / College’s Advancement report on the “But for Ohio State” Campaign which was launched in 2009. The College has just passed the $15M mark. The College’s overall goal in this campaign is $20M. The giving from College alumni has quadrupled since the start of the campaign. Council member and campaign chair Mark Sirgo also spoke to the council on behalf of the campaign urging them to support and commit to the College in any way possible.

Pharmacy Practice and Administration Division Strategic Goals
Dr. Daren Knoell, Division Chair for the College of Pharmacy’s Pharmacy Practice and Administration Division presented to the Council the Division’s strategic goals and vision. A task force was established in the Division in 2013 to head up the strategic planning process. One of the emphasis areas for the Division is integration of the OSU Wexner Medical Center’s Department of Pharmacy and the College of Pharmacy to the fullest extent possible beginning with
leadership. The Division is also currently heavily invested in the curricular revision going on throughout the College, with a focus on transitioning from traditional lectures to an applied learning model.

The Pharmacy Practice and Administration Division currently consists of 13 auxiliary full or part-time faculty, 11 regular clinical track faculty, 5 tenure track faculty, 1 research track faculty member, 3 emeritus faculty and 2 secretarial support staff. A number of training programs fall under the direction of the PPAD division including the Master’s in Health Systems Pharmacy Administration, PGY1 (Ambulatory and Community), PGY2 (Ambulatory, Community, Hospice), Fellowships (Pediatrics) and Ph.D. (College wide Translation Science Program). Research within PPAD at this time includes 64 peer reviewed articles, $911,000 as PI and $713,325 as co-PI or co-I, 52 invited presentations, 1 editor-in-chief, and 11 editorial boards.

PPAD also has many opportunities both current and in the future to expand upon including: the establishment of financially sustainable clinical partnerships; capitalizing on growth areas such as Transitions in Care, the ITIO/OSUWMC, and Partner for Promotion; establishing community partners in Transitions in Care; and establishing practice models for the real world. PPAD is also helping to grow the Experiential program which is currently providing up to 200,000 IPPE hours a year, 195,000 APPE hours a year, and 30% of the professional curriculum. A major emphasis is being placed on having our students be the “face of the College” through their experiences with preceptors, our alumni and the public and becoming an indispensable component of patient care.

**Working Lunch**  
Presentation given by Dr. Nicole Kwiek, Clinical Assistant Professor & Director of Educational Outreach

**Optimizing the BSPS Curriculum for Career Customization**  
Dr. Kwiek reported to the Council on the Bachelor of Science in Pharmaceutical Sciences (BSPS) curricular revision that is currently underway in the College. The current curriculum consist of six core courses for the four year undergraduate degree, with a majority of the Pharmacy classes being taken in the final two years. A committee of faculty, staff and students has been formed to review and revise the current curriculum with many goals in mind, some of which include: increasing enrollment and e-learning options; strengthening the honors program; efficiently tie to the PharmD program; expanding active learning and adding more lab technique instruction; adding a pharmacy technician certification program. The committee would like to pursue two different frontiers for the program as well, with clinical and research based options available once you’re part of the program. The timeline for these revisions is to submit the plan to Dean Mann by the end of summer 2014, present to the faculty for approval by the fall 2014, followed by submission to the University for approval, with implementation by the fall of 2015.

**Next Steps in OSU Drug Discovery**  
Bence Boelcskey, Deputy Director of the Drug Development Institute (DDI) with the Comprehensive Cancer Center, presented to the Council the purpose and mission of the DDI. The Institute, formed two and a half years ago by the CCC, is formally chartered by the Board of Trustees. The DDI’s process is to start with an early discovery concept, work with the Fisher College of Business to develop a formal business assessment, develop a plan formal development plan through Phase I. If early work determines the idea is a viable one, then seek a co-development partnership with pharma and/or other outside resources. Note that while the DDI works secure co-development partnerships with OSU, it also works to include performing additional development work at OSU. Out-licensing is not the preferred option as this course generates the least financial return to the University. Operationally, pharmaceutical project management is a core service that the DDI provides with 4 continuing projects, 1 already co-partnered with pharma, 6 new projects in development and 2 in consideration (13 projects for 2015). The DDI’s recommended budget has been approved for 2015. Next steps for the DDI are to garner an internal investment of $4-6M, drive 10 projects to their next milestones in 2015, roll-out their online project management system (PRISM), expand (3) R & D areas of strength as Areas of Excellence and ensure successful execution of industry sponsored research support.

Next Meeting  
The next meeting of the Dean’s Corporate Council is set for Friday, October 17, 2014.  
The meeting was adjourned at 1:30 p.m.

Respectfully submitted,  
Rori Taylor-Goldsmith
The Ohio State University
College of Pharmacy
Faculty Meeting Minutes
October 3, 2014

Attending: Dean Mann (Chair), Barnette, Brackett, Carcache de Blanco, Carnes, Chen, Coyle, Coss, Dong, Downing, Fuchs, Haas-Gehres, Hale, Hall, Hoyt D, Hoyt K, Kelley, Kinghorn, Knoell, Kwiek, Lee, N, Li T, McAuley, Mirtallo, Nahata, Neidecker, Rakotondraibe, Rodis, Schmittgen, Tjarks, Werbovetz, Whetstone, Yalowich, Zhao


1. Announcements:

- Dean Mann reported to the faculty that he has recently visited Jinn and Dianne Wu, owners of Xenobiotics Laboratories, Inc. Xenobiotics has just been acquired by WuXi PharmaTech and Dr. Wu will continue in an executive position with the company. He also reported that Dr. Qi-Dong You, Dean of the School of Pharmacy and Dr. Boyang Yu, Dean of the Graduate School, both of China Pharmaceutical University, visited the College September 23-24, 2014. They are interested in establishing a relationship with OSU and the Dean plans expects we will make a visit to CPU within the next year.

- Dr. Carnes announced that the College’s first Distinguished Lecturer for the 2014-2015 year will be Dr. Deanna Kroetz on October 22nd.

- Dr. Knoell announced four new PPAD faculty members: Dr. Debra Barnette, Dr. Alexia Sevin, Dr. Ming Poi and Dr. Przemyslaw Radwanski and one new staff member Sue Kratko.

- Pharmacy student Melinda Domingo announced to the faculty that the 17th Annual College Chili Cook-off is being held on October 25, 2014 from 3:00-7:00 p.m. at the 4H Building.

2. Dean Mann presented the minutes from the September 11, 2014 faculty meeting for approval. These minutes were unanimously approved.

3. Dr. McAuley informed the faculty that he will be vacating his position as University Senator for the College due to his new administrative appointment. Dale Hoyt will be stepping into the position of senator and a new alternate senator will need to be elected. Dr. Kelley nominated Dr. Cari Brackett for this post and Dr. Kwiek nominated Dr. Kari Hoyt. Dr. Kelley will be sending out information on voting for the two nominated candidates in the coming week.
4. Dr. Nicole Kwiek presented the BSPS Curricular Proposal to the faculty. A BSPS Curricular Change Task Force worked from January – May to draft the new proposal, stemming from a growing trend of 80-85% of the students in recent years wanting to pursue clinical careers as opposed to the initial thought of these students pursuing research degrees. The BSPS Curricular Change Implementation Working Group has been working since August to make the new proposed curriculum achievable. In the new proposal the BSPS program will move to a more customized degree with a Drug Discovery pathway and a Pre-Clinical pathway allowing new opportunities for students. Dr. Kwiek presented the new proposed courses and gained feedback from the faculty to make any revisions before presenting it at the November meeting for a vote of approval.

5. Dr. James Coyle and Dr. James McAuley presented the Vision Statement, Guiding Principles, and Goals and Ability Outcomes for the PharmD Curricular Change with revisions made from suggestions at the September 11, 2014 faculty meeting. The faculty affirmed the proposed vision statement. A program level plan will be brought before the faculty at the December 5, 2014 meeting.

6. Dr. Jennifer Rodis reported to the faculty on the Medication Therapy Management (MTM) in Federally Qualified Health Centers (FQHC) plan for improving outcomes for the estimated 15% (some 46 million people) in the U.S. that are high-risk, high-cost, and medically complex patients. This is a new two year phased project with a potential for five years that Dr. Rodis is leading. It is a statewide effort supported by the Ohio Department of Health and the Centers for Disease Control and all Colleges of Pharmacy in Ohio. The purpose of the project is to advance MTM provided by pharmacists to patients cared for in FQHCs and improve chronic disease outcomes for Ohioans.

Respectfully Submitted,

Rori Taylor-Goldsmith
Executive Assistant to the Dean

(Approved by the faculty… date)
President Barb Ague called the meeting to order at 9:40am.

Secretary Kim McDevitt presented the minutes from the February 20, 2014 meeting. On Sherrin/Love motion the minutes from the meeting were approved. The minutes were distributed to each Board member.

OSU Alumni Association Report: Director of Alumni Societies, Craig Little was unable to report.

College Update: Dean Henry Mann has been here a year now and has gotten a good feel for understanding the breadth of the College of Pharmacy at Ohio State. There is a lot to be proud and he notes that the college is one of the broadest colleges in the country with the BSPS, PharmD, MS, PhD and residencies. He reports that the student enrollment trends remain about the same. He is concerned that the average debt for the PharmD graduate is $150,000. We must pay attention to this. The graduate school program’s med chem and Pharmacognosy were fortunate to gain a partner with the Cancer Center but there still needs development in the Translational Sciences. Our MS in Health Systems Pharmacy is the best known in the country. There is a lot of opportunity for growth in the BSPS program. This program will be undergoing a complete revision with Dr. Nicole Kwiek overseeing this transition. They plan to increase the number of courses taught by the college and increase more specialization with two tracks. A research track and a clinical track for health sciences. The PharmD program continues to take about 125 students a year but with seven Colleges of Pharmacy in Ohio now Ohio State needs to answer the questions “Why does a student want to come to Ohio State?” and “Why does an employer want a graduate from The Ohio State University College of Pharmacy over anyone from another College of Pharmacy?” We need to continue to train the best pharmacists in the country and be confident that our program develops a strong skill set. To stay relevant the college needs to adjust the curriculum to go with the times. The curriculum revision should be completed by 2016. The job search has been difficult for many graduates and getting into a residency program even more challenging. Not giving the student the advantage of getting into a residency program must change for our students. With the major curriculum changes coming over the next three years in three separate programs the college will be busy. Another area of focus is to increase the number of faculty. The biggest opportunity is with the Discovery Themes focused on Data Analytics. They have proposed an addition of four more faculty positions. The college needs to lead a zone for drug discovery and development. Dean Mann has a new organizational structure for the college. He is looking to increase Pharmacy research awards. Overall the College is “doing well but not at the top of the game yet.”

Strategic Plan/Curriculum Report: Katherine Kelley reported on the update of the inclusive process initiated in the autumn of 2013 to revise the curriculum. A broad group of people who value excellence in innovation and knowledge are involved in this group. The strategic plan defines a limited number of broad directions for the next 3 to 5 years. They are working on ten initiatives with 4 core goals: Teaching and Learning, Research and Innovation, Outreach and Engagement and Resource Stewardship. This is a time of vast curricular changes. They are changing the MS Health System Pharmacy program, the BSPS program and the PharmD program. Students will have what they need to hit the ground running when they graduate from the Ohio State University.

Office of Advancement Report: Director of Advancement, Tom Dauber is excited to work with Dean Mann to reach the College’s goal of $20M for the But for Ohio State Campaign. Currently $16 million has been raised towards that goal. (See dashboard sheet in packet). He asks the Board to reach out to alumni of the College for help in making this a successful campaign.

The meeting was adjourned at 2:50p.m.

Respectfully submitted,
Kim McDevitt, RPh., Secretary
The Ohio State University  
College of Pharmacy  

Faculty Meeting Minutes  
November 14, 2014  

Attending: Dean Mann, Dean Kelley (Chair), Barnette, Brackett, Carcache de Blanco, Carnes, Casper, Chen, Coyle, Detwiler, Dong, Dula, Emptage, Fuchs, Haas-Gehres, Hoyt D, Hu, Knoell, Kwiek, Lee N, Lee R, Li C, Li T, McAuley, Mehta, Nahata, Neidecker, Poi, Prucknicki, Radwonski, Rakotondraibe, Rodis, Sevin, Singrey, Spiers, Sullivan, Weber, Werbovetz, Whetstone, Yalowich, Zhao  

Absent: Barnes, Beatty, Bennett D, Bennett M, Brueggemeier, Coss, Delffs, Downing, Drew, Elton, Frank, Hale, Hall, Harrison, Hoyt K, Johnston, Kessl, Kinghorn, Kuperberg, Kvaratskhelia, Legg, Mandell, Mirtallo, Orozco, Pai, Phelps, Sweaney, Szeinbach, Tjarks  

Guest: President Michael Drake, Provost Joe Steinmetz, College staff  

1. Dr. Carnes presented the minutes from the October 3, 2014 faculty meeting for approval. The minutes were unanimously approved.  

2. Dr. Nicole Kwiek presented the revised BSPS Curricular Proposal to the faculty with suggested changes made from faculty feedback received at the October 3, 2014 faculty meeting. The changes that were made include: Integrated Pharmaceutical Sciences course series will now include pharmacokinetics content; an extra credit hour has been added to the Instrumental Analysis and Techniques class; Biochemistry will now be taken in the Fall of the third year; the “Clinical Science Pathway” will now be called the “Healthcare Professions Pathway.” A quorum of faculty unanimously approved the proposal. Dr. Kwiek also presented the proposed pharmaceutical sciences minor. A quorum of faculty also unanimously approved this proposal.  

3. Dr. Dale Hoyt, new College senate representative gave an update from the October 30, 2014 senate meeting. The senate is encouraging the university community to check its website for updates and meeting information http://senate.osu.edu. This site also links to the board of trustees site. The senate approved a fall semester break at the last meeting to begin October 2015. Dr. Hoyt will be using email more often to communicate senate business with the College and asks that everyone please email him any questions they have. He also announced that Dr. Cari Brackett has been chosen as the new senate alternate for the College.  

4. Dr. Kelley presented the plan for the Pattern of Administration (POA) revision and approval. There have been three brown bag lunch sessions scheduled in November to familiarize the faculty with Appendix I (Guidelines for faculty duties and responsibilities), Appendix II (Appointments, promotion and tenure), Appendix III (Mission, scope and jurisdiction of standing committees), and Appendix IV (Guidelines for the establishment and review of College centers). The full POA revisions will be presented at the December Faculty Meeting and a vote on approval will occur at the January 2015 Faculty Meeting.
5. The new University President, Dr. Michael Drake, and University Provost, Dr. Joseph Steinmetz joined the faculty meeting to engage with the faculty and staff for a brief presentation followed by a question and answer session.

Respectfully Submitted,

Rori Taylor-Goldsmith
Executive Assistant to the Dean

(Approved by the faculty December 5, 2014)
Executive Committee Meeting Agenda  
Thursday, November 20, 2014  
11:30a.m. – 1:30 p.m., Room 250 Parks Hall

1. Announcements

- Dr Carnes announced the first two hiring authorizations from the Discovery Themes in Data Analytics have been received. A computational biologist and a translational genomicist are authorized for the first year of funding through this mechanism. The Department of Veterinary Biosciences in the College of Veterinary Medicine will be a partner on the translational genomicist position. Formal training is required for search committees for these positions. The Executive Committee suggests a standing search committee with college-wide representation and a representative from veterinary medicine.

2. Dr Nahata provided an update on the Institute of Therapeutic Innovations and Outcomes. Eight years ago Medical Mutual of Ohio asked Dr Nahata for help with benefits choice because they wanted input from a college of pharmacy for the purposes of design of Medicare plans. Pharmacists provide a valuable perspective with respect to drug benefits design. Subsequently the Institute was formed with a focus on patient care education and research, and the OSU Health Plan committed $200,000 /year for 3 years to further this mission. The University of Arizona was also working on a similar type of project and legal agreements were signed between the two institutions; the current contract is for $1.1 million per year for 3 years to provide medication management services to Medicare enrollees. The project has grown its staff from one to 30 in the first year and occupies the space in the southwest corner of Parks Hall. The venture is completely externally funded including rent for space, all staff, and the software operating system. Pharmacists and pharmacy interns are currently providing 400 comprehensive medication reviews/week to Medicare patients; most patients are over the age of 70 who take 13-15 medications. The business model is successful employing 22 interns who also are benefiting educationally. Research proposals are under development and new clients are also being pursued. Space is sufficient for now, but further growth will require moving the enterprise outside of College space.

3. Dr Kwiek presented two potential implementation timelines for the new BSPS curriculum. Three and four-year total implementation timelines were discussed. The plans overall are smooth and require no overlap of teaching
old and new curricula in the same semester. Transition plans for students have also been clearly mapped out under both timeline scenarios. Pros and cons were presented for both options in terms of benefits to student and faculty and increased revenue. One important consideration moving forward is assessing which courses need to be offered more than one time per year to handle the enrollment while meeting course and program goals. The College will explore the need for lecturers to help with the implementation now. The Executive Committee expressed support for the three-year timeline.

4. Dr Knoell presented the credentials for Dr. Katherine Fitz for a no-salary associated faculty appointment (Clinical Assistant Professor). She is currently teaching with Dr Hale in the Introduction to Pharmacy 4511H. In addition she has had a long standing connection to our students through student organizations and other service. The appointment was unanimously approved.

5. Mr. Joe Orozco updated the committee on a policy to secure the building on weekends. This policy will be developed more fully in the coming months.

6. Dr Kelley presented several updates on the Pattern of Administration (POA) revision process. The following timeline for revision was approved by OAA. There will be a discussion of the revisions at the December 5, 2014 faculty meeting followed by a vote to approve the changes at the January 9, 2015 meeting. Three open forums were held the week of November 24, 2014 to also facilitate discussion of the changes. Drs Carnes and Kelley received clarification from OAA on the requirements for Appendix I, Faculty Duties and Responsibilities. The University now requires that unit POAs include delineation of faculty efforts in terms of percent effort for teaching research and service.

Respectfully submitted,
Katherine Kelley
APPENDIX 7

Statement of Resources from the College of Pharmacy’s Chief Administrative Officer,

Mr. Erin Delffs (pg. 90)
December 12, 2014

Nicole Cartwright Kwiek, Ph.D.
Clinical Assistant Professor
Director of Undergraduate Studies

Dear Dr. Kwiek,

I am providing this letter to indicate support for the proposed changes in the BSPS program. The college has capacity for the near term for the increased teaching and facilities needs identified in the proposal. In the longer term, additional teaching capacity will be garnered through already planned and budgeted faculty hires. The program will also provide additional revenue which will be adequate to cover lecturing and lab needs. Overall, the changes will provide a positive financial impact to the college and ultimately to the university.

Sincerely,

Erin W. Delffs, MBA
Chief Administrative Officer
College of Pharmacy