

Appendix II- TABLE 1: BSPS CURRICULUM

First Year Fall			Credits	First Year Spring			Credits
General Chemistry I	CHM 101	3	General Chemistry II	CHM 112	3		
General Chemistry Lab I	CHM 102	1	General Chemistry Lab II	CHM 114	1		
General Biology	BIO 101	4	Human Anatomy	BIO 121	4		
Communications	COM 100	3	Applied Calculus	MTH 141	4		
Elective	GenEd	3	Writing	WRT 106	3		
URI 101	URI 101	1	Elective	GenEd	3		
		15			18		
Second Year Fall			Credits	Second Year Spring			Credits
Organic Chemistry	CHM 227	3	Organic Chemistry	CHM 228	3		
Medical Microbiology	MIC 201	4	Organic Chemistry Lab	CHM 226	2		
Human Physiology	BIO 242	3	Introductory Biochemistry	BCH 311	3		
Physics	PHY 111	3	Introduction to Biostatistics	STA 308	3		
Physics Lab	PHY 185	1	Elective	GenEd	3		
Microeconomics	ECN 201	3	Elective	GenEd	3		
		17			17		
Third Year Fall			Credits	Third Year Spring			Credits
Principles of Pharmacology	BPS 321	2	Natural Products/Biotech. Drugs	BPS 445	3		
Intro. Medicinal Chemistry	BPS 313	2	Drug Metabolism & Pharm. Analysis	BPS 325	2		
Dosage Forms I/II/III	BPS 301/303/305	6	Formulation/Manufacturing Laboratory	BPS 443	2		
Statistical Methods in Research II	STA 412	3	Elective	BSPS elective	3		
Foundations of Human Disease I: Immunoinflammatory Disease	BPS 311	2	Elective	GenEd	3		
		15	Elective	GenEd	3		
					16		
Fourth Year Fall			Credits	Fourth Year Spring			Credits
General Pharmacology	BPS 487/587	3	Pharmacogenomics & Pharmacogenetics	BPS 442	3		
Pharmacoeconomic Analysis	PHP 580	3	Techniques in Medicinal Chemistry and Molecular Biology	BPS 451	4		
GMP's in Manufacture of Pharmaceutical Products	BPS 425	3	Physical Pharmacy/ BPS	BPS 405	3		
Elective	BSPS elective	3	Elective	BSPS elective	3		
Pharmacokinetics	BPS 503	3	Elective	BSPS elective	3		
		15			16		

APPENDIX III

TABLE 2. BIOMEDICAL AND PHARMACEUTICAL SCIENCES FACULTY

Name	Title	University	Core Courses
Fatemeh Akhlaghi, Ph.D.	Associate Professor	University of Sydney	BPS 403
Clinton Chichester, Ph.D.	Professor/Chair	University of Rhode Island	BPS 311, 321, 487
Bongsup Cho, Ph.D.	Professor	University of Illinois Medical Center	BPS 313, 325, 451, 325
Ruiteng Deng, Ph.D.	Assistant Professor	Ohio State University	BPS 442, 451
Roberta King, Ph.D.	Associate Professor	University of Iowa	BPS 313, 325, 451
Serpil Kislalioglu, Ph.D.	Professor	University of London	BPS 305, 443
Abraham Kovoov, Ph.D.	Assistant Professor	University of Washington	BPS 442, 451
Joan Lausier, Ph.D.	Associate Dean	University of Rhode Island	BPS 301, 305, 425
Keykavous Parang, Ph.D.	Associate Professor	University of Alberta	BPS 313, 445, 451
Robert Rodgers, Ph.D.	Professor	University of Oklahoma	BPS 321, 442, 487

APPENDIX IV
URI College of Pharmacy
Student Learning Outcomes BSPS Program

Concept: Critical Thinking and Problem Solving

Outcome #1: Utilize solid background in basic and pharmaceutical science to apply critical thinking and problem solving to assist in the development manufacture and evaluation of drugs.

Performance Criteria (characteristics, skills, knowledge, attitudes and/or values the student will exhibit)--- these will help in mapping course objectives):

- 1) Recognize a problem
- 2) Analyze a problem
- 3) Find and evaluate potential solutions
- 4) Choose optimal solution
- 5) Evaluate outcome

Concept: Interpersonal / Collaboration Skills

Outcome #2: Function effectively in groups to accomplish objectives.

Performance Criteria:

- 1) Participate effectively and work cooperatively
- 2) Recognize, respect, and encourage diverse views
- 3) Recognize and manage conflict
- 4) Lead as the need arises to accomplish the group's objectives
- 5) Evaluate and motivate others to improve performance as necessary

Concept: Knowledge

Outcome #3: Demonstrate the body of knowledge that encompasses pharmaceutical sciences.

Performance Criteria:

- 1) Demonstrate appropriate depth and breadth of knowledge in the basic and pharmaceutical sciences.
- 2) Demonstrate mastery of integration of basic and pharmaceutical sciences.
- 3) Demonstrate application of knowledge in the resolution of basic science, research and development (R&D) and overall problems associated with pharmaceutical sciences.
- 4) Contribute to the development of knowledge

Concept: Self-Directed Learning

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Outcome #4: Demonstrate responsibility for own learning and professional competence.

Performance Criteria:

- 1) Independently acquire new knowledge and skills
- 2) Evaluate new information critically.
- 3) Incorporate new knowledge and recommendations into R&D and/or pharmaceutical sciences.
- 4) Develop and enhance skills to contribute to the development of new knowledge within the field of pharmaceutical science.

Concept: Professionalism and Ethics

Outcome #5: Demonstrate professional behavior throughout the pharmaceutical sciences curriculum.

Performance Criteria:

- 1) Recognize that the core of pharmaceutical industry is R&D.
- 2) Articulate ethical and legal principles that govern R&D in the United States and worldwide.
- 3) Maintain honesty, confidentiality, sensitivity and tolerance in professional interactions.
- 4) Interact in a respectful manner in all professional settings.
- 6) Assume personal responsibility for promoting professionalism in academia, government and/or industry.

Concept: Leadership

Outcome #6: Demonstrate leadership in professional and community activities and organizations.

Performance Criteria:

- 1) Develop and promote activities to help individuals and to improve academia, government and/or industry based community at large.
- 2) Develop, recognize and apply leadership skills
- 3) Encourage leadership in others

Concept: Communication

Outcome #7: Communicate effectively to diverse audiences

Performance Criteria:

- 1) Effectively communicate and work within academia, government and/or industry.

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2) Demonstrate the use of technology to communicate and work effectively with various audiences.

3) Write effectively in a style appropriate for clinical, scientific and administrative audiences in academia, government and/or industry.

Concept: Professional Involvement

Outcome #8: Present scientific findings at local, regional and national levels.

Performance Criteria:

1) Acceptance of an abstract at a local, regional and/or national level meeting.

2) Demonstrate the ability to communicate scientific findings to peers.

3) Integrate learned material from scientific meetings into academic, government or industry.

APPENDIX V

Assessing Student Outcomes – BSPS Program

Stating Outcomes and Assessments

Column A Outcomes Statements	Column B Direct/Indirect Method(s) of Assessment
<p>1. Utilize solid background in basic and pharmaceutical science to apply critical thinking and problem solving to assist in the development manufacture and evaluation of drugs:</p> <p>a. Students recognize problems b. Students analyze the problem c. Students reflect on the problem then find and evaluate potential solutions d. Students determine the optimal solution to given problem e. Students evaluate the outcome of their decision</p>	<p>Direct Assessment: Laboratory experiences where students work in small groups on problem-based assignments.</p>
<p>2. Function effectively in groups to accomplish objectives:</p> <p>a. Students participate effectively and work cooperatively. b. Students recognize, respect and encourage diverse views. c. Students recognize and manage conflict within the group. d. Students are able to provide leadership to accomplish objectives. e. Students are able to motivate and evaluate each other to improve performance and outcomes.</p>	<p>Direct Assessment: Students produce results in small groups to accomplish outlined objectives.</p> <p>Indirect Assessment: Students participate in survey and/or focus group designed to measure their success when working in small groups.</p>
<p>3. Students demonstrate a mastery of core subject areas including: biology, chemistry, biochemistry, pharmaceuticals, pharmacology and mathematics</p> <p>a. Students are able to demonstrate appropriate depth and breadth of knowledge in the basic and pharmaceutical sciences. b. Students can demonstrate mastery of integration of basic science and pharmaceutical sciences. c. Students can apply knowledge in the resolution of basic science, research and development (R&D) and overall problems associated with pharmaceutical sciences.</p>	<p>Direct Assessment: Students will take written examinations to assess their knowledge base in subject areas within pharmaceutical science. Earned minimum GPA in major.</p> <p>Indirect Assessment: Student self-assessment of basic and advanced pharmaceutical sciences competency using a survey tool. Survey of faculty advisors/teaching faculty to determine average course grades/grade spreads.</p>

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<p>d. Students contribute to the development of knowledge within pharmaceutical sciences.</p>	
<p>4. Demonstrate responsibility for own learning and professional competence in all aspects of pharmaceutical sciences:</p> <p>a. Students independently acquire new knowledge and skills.</p> <p>b. Students practice and evaluate new information and knowledge.</p> <p>c. Students incorporate new knowledge and recommendations into R&D.</p> <p>d. Students demonstrate appropriate knowledge required to the profession of pharmaceutical, bio-pharmaceutical and medical device manufacturing.</p> <p>e. Students demonstrate appropriate knowledge in cGLP and cGMP regulations and compliance.</p> <p>f. Students demonstrate appropriate knowledge in method development, optimization, troubleshooting, validation and transfer technology.</p> <p>g. Students demonstrate appropriate knowledge to work in the inter-disciplinary environment of R&D, analytical & process, manufacturing, validation and quality control.</p> <p>h. Students develop, enhance, and reflect upon their skills to contribute to the development of new knowledge within the field of pharmaceutical science.</p>	<p>Direct Assessment: Students will work independently with professors and will be responsible for writing up and presenting the results of this work.</p> <p>Indirect Assessment: Student self-assessment of professional competency using a survey tool.</p>
<p>5. Demonstrate professional behavior throughout the pharmaceutical sciences curriculum and explore post-graduation career options.</p> <p>a. Students recognize that the core of pharmaceutical industry is R&D.</p> <p>b. Students articulate ethical and legal principles that govern R&D in the United States and worldwide.</p> <p>c. Students practice and maintain honesty, confidentiality, sensitivity and tolerance in professional interactions.</p> <p>d. Students interact in a respectful manner in all professional settings.</p>	<p>Direct Assessment: Records will be kept of the number of students who choose to participate in elective courses, summer research/internship programs and degree minors. Information from Office of the Registrar on 4 and 4+ year graduation rates and rates of attrition will be examined.</p> <p>Indirect Assessment: Student will read and sign a code of conduct outlining behavioral expectations in the pharmaceutical science. Students will take an informal survey to gauge their level of interest in diverse</p>

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<p>e. Students assume personal responsibility for promoting professionalism in academia, government and/or industry.</p> <p>f. Students seek to combine their preparation in pharmaceutical science while exploring other interests (i.e. Student awareness of diverse career and higher education opportunities afforded by their degree).</p> <p>g. Students complete program and graduate in a timely manner (4 years).</p> <p>h. Students make post-graduation plans that may include: successful admittance to graduate, professional schools or successful pursuit of entry-level pharmaceutical sciences jobs in academia, government and/or industry.</p>	<p>career options found within pharmaceutical sciences.</p> <p>Development an electronic database of pharmaceutical and biotechnology companies that accept students from the program and evaluate yearly the fraction of graduating students that are placed in these institutions.</p>
<p>6. Demonstrate leadership in professional and community activities and organizations.</p> <p>a. Develop and promote activities to help individuals and to improve academia, government and/or industry based community at large.</p> <p>b. Develop, recognize and apply leadership skills</p> <p>c. Encourage leadership in others</p>	<p>Direct Assessment: Provide opportunities for students to join and lead pharmaceutical sciences related activities outside of standard coursework.</p>
<p>7. Prepare and present scientific findings at local, regional and national levels.</p> <p>a. Acceptance of an abstract at a local, regional and/or national level meeting.</p> <p>b. Demonstrate the ability to communicate scientific findings to peers.</p> <p>c. Integrate learned material from scientific meetings into academic, government or industry.</p> <p>d. Students develop an understanding of how to work in fast-paced timeline driven environment.</p>	<p>Direct Assessment: Posters presentations and/or participation at local, regional and/or national level meetings.</p> <p>Indirect Assessment: Faculty advisors will follow the progress of student participation in scientific meetings and guide students in meeting deadlines.</p>

Describe briefly how you developed the outcomes statements.

Our outcomes were designed to be appropriate for our scope and our offerings in pharmaceutical sciences. Emphasis was placed on outcomes that would ensure the long-term success of our students in academia, government, and/or industry.

Assessment Methods

- a. **Describe how the methods align with what and how students learn and with the kinds of inferences you want to make.**

We will engage in assessment that includes, examinations, lab reports, technical/scientific writing, and independent study. For affective and reflective outcomes, we will rely on self-reporting from students as an appropriate indirect method.

- b. **Describe how you determined the validity of these methods.**

Our outcomes are closely related to outcomes used in similar scientific disciplines including biological sciences, bio-engineering, and other technical/scientific based programs.

- c. **If you designed your own methods, describe how you determined your standards and criteria for scoring student work and how you determined the reliability of those standards and criteria.**

We have established our standards after careful consideration, discussion and examination of similar pharmaceutical science based programs and guidance of a survey published by the American Association of Pharmaceutical Science (AAPS). We will establish a scoring for student work.

Timetable

[Year]	Fall	Spring
Year One	Collect Evidence of Outcomes #1 and #2	Analyze results and propose changes for Outcomes #1 and #2
Year Two	Implement revisions for Outcomes #1 and #2 Collect Evidence of Outcomes	Analyze results and propose changes for Outcomes #3 and #4

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	for #3 and #4	
Year Three	Implement revisions for Outcomes #3 and #4 Collect Evidence of Outcome #5	Analyze results and propose changes for Outcome #5
Year Four	Implement revisions for Outcome #5 Begin cycle of Gen Ed Outcome #1	Analyze results and propose changes

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Specific New Course Outcomes:

Course: Pharmacogenetics and Pharmacogenomics:

Outcomes:

- A. To demonstrate appropriate depth and breadth of knowledge in pharmacogenetics, environmental factors, and genetic-environmental interactions.
- B. To demonstrate the appropriate application of the knowledge in drug discovery and development.
- C. To demonstrate the effective use of individuals and population-based approaches in designing therapeutic strategies and analyzing clinical outcomes.

Direct Assessment: Multiple written tests will be administered to assess the basic knowledge in Pharmacogenetics and Pharmacogenomics.

Indirect Assessment: Survey will be given to evaluate the awareness of analyzing issues related to drug development and therapy in critical and comprehensive manners.

Selected Courses: Formulation and Manufacturing Lab

Outcome:

A. Demonstrate the body of knowledge for an acceptable performance in the formulation laboratories and manufacturing environment in the pharmaceutical industry.

Direct Assessment/Indirect Assessment:

1. Demonstrate information on various dosage forms and legal aspects of formulation and manufacturing processes involved while incorporating drug substances into dosage forms
2. Demonstrate depth and breadth of knowledge in the preformulation studies; be able to integrate information gained in the physical pharmacy in understanding the physical chemical and chemical nature and precautions for handling of the of promising drug substances
3. Demonstrate information on the nature and biopharmaceutical characteristics of a drug substance in order to incorporate it in the most bioavailable dosage form
4. Demonstrate mastery of knowledge in the appropriate working principles needed to incorporate drug substances into dosage forms
5. Demonstrate sound knowledge about legal requirements for manufacturing of the dosage forms
6. Demonstrate knowledge to recognize and analyze possible problems that may occur in formulation and manufacturing of the dosage forms
7. Develop knowledge based skills to perform and analyze quality controls processes for various dosage forms

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8. Demonstrate application of knowledge to select appropriate packaging for the dosage forms and appropriate handling and quality controls for packaging materials and units.
9. Demonstrate knowledge to detect and analyze the stability problems that may occur in the dosage forms in order to effectively resolve related problems and to choose the optimal solution
10. Demonstrate knowledge of awareness in the formulation and manufacturing environments to contribute development of knowledge.