

March 10, 2009

**Faculty Senate Curricular Affairs Committee
Four Hundred Sixty-Ninth Report**

Proposed Bachelor of Science Degree in Pharmaceutical Sciences

SECTION I

BACKGROUND INFORMATION

ABSTRACT

The College of Pharmacy has proposed a new 120-credit Bachelor of Science degree in Pharmaceutical Sciences. This four-year program will offer students a solid foundation in the basic sciences, broad exposure to the liberal arts, and expertise in one of several areas of specialization within the pharmaceutical sciences. The program is designed to provide educational and training experiences that will prepare students for careers in the pharmaceutical, consumer product and health care industries.

On February 23, 2009, after reviews by the Council of Deans, the Joint Strategic Policy Committee and the Budget Office, the Curricular Affairs Committee approved the proposal from the College of Pharmacy and the Department of Biomedical and Pharmaceutical Sciences to establish a new B. S. Program in Pharmaceutical Sciences.

BACKGROUND

The proposal for a B.S. degree in Pharmaceutical Sciences (BSPS) was originally approved by the faculty of the Department Biomedical and Pharmaceutical Sciences on May 1, 2008 by the College of Pharmacy faculty on May 9, 2008, and was subsequently submitted to the Council of Deans, the Joint Strategic Planning Committee, and the Budget Office in September 2008.

Budget Director Linda Barrett provided a Budget Impact Statement on October 31, 2008. Both the Joint Strategic Planning Committee (November 13, 2008) and the Council of Deans (December 17, 2008) endorsed the proposed BSPS degree and recommended approval to the CAC.

The proposal was first considered on January 29, 2009 and, after a number of questions were raised and issues resolved, the committee approved the revised proposal on February 23, 2009. This revised proposal approved on February 23 had been approved by the department and college faculty earlier in February.

Because the proposal does have costs associated with its implementation (See Appendix I) the Curricular Affairs Committee agreed to recommend to the Senate that the proposal be approved at the Class B level.

SECTION II

RECOMMENDATION

The Curricular Affairs Committee has reviewed the proposal and considered all of the comments forwarded to it by the various bodies. On February 23, 2009, the committee voted to recommend to the Faculty Senate that the proposed B. S. Degree in Pharmaceutical Sciences be approved at the Class B Level*. The proposal is in the format required by the Board of Governors for Higher Education. Note: the Department and College approved a revised proposal in February. The original approval dates are in parentheses.

Bachelor of Science Degree in Pharmaceutical Sciences (BSPS)

A. Program Information:

1. **Name of institution:** University of Rhode Island, Kingston Campus
2. **Name of department, division, school or college:** Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy
3. **Title of program and federal Classification of Instructional Programs:**

Bachelor of Science in Pharmaceutical Sciences (BSPS)
4. **Intended initiation date of program change and anticipated date for granting first degrees or certificates:** Academic year following approval with the first degrees granted four years thereafter.
5. **Intended location of program:** Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy, University of Rhode Island, Kingston, RI 02881
6. **Description of institutional review and approval process.**

	DATE APPROVED
Department of Biomedical and Pharmaceutical Sciences	2/06/09 (5/1/08)
College of Pharmacy	2/13/09 (5/9/08)
Faculty Senate Curricular Affairs Committee	2/23/09
Faculty Senate	
President of the University	

*8.85.30 Classification of Programs for which funding is required. When new programs are approved by the Faculty Senate, approval may be classified as follows: approval Class A will mean that the program is deemed to be of such merit as to justify the recommendation of the immediate allocation of funds for its implementation; approval Class B would recommend that proposed new programs compete for resources on an equal basis with all other University activities; approval Class C would recommend funding of the proposed new program should additional funds be made available to the University.

7. Summary description:

This proposal details a four-year program of study that leads to a Bachelor of Science in the Pharmaceutical Sciences (BSPS). The program will offer students a solid foundation in the basic sciences, broad exposure to the liberal arts, and expertise in one of several areas of specialization within the pharmaceutical sciences. It is designed to provide educational and training experiences that will prepare students for careers in the pharmaceutical, consumer product and health care industries. Graduates of the BSPS program will be qualified to seek a diverse range of career options that include: research and development, manufacturing, product marketing, sales, testing, and administrative positions within the pharmaceutical industry; research and regulatory oversight careers within government agencies; and research and teaching positions in academia. As a prelude to many of these career opportunities, the program will prepare students for graduate studies in the expanding fields of pharmaceutical and biomedical sciences.

The first two years of the program are a modified version of our two-year pre-professional curriculum. It includes rigorous basic science requirements plus a broad exposure to the humanities, arts, and social sciences. The science component of the curriculum is consistent with the admissions requirements of most basic science graduate programs and professional schools. Courses offered in the third and fourth year will be drawn primarily from our existing curriculum, and will be taught by Department of Biomedical and Pharmaceutical Sciences (BPS) faculty. They reflect the strengths of the BPS faculty and provide solid, fundamental training in the pharmaceutical sciences. The fourth year curriculum also includes new BPS course offerings and selected electives from other departments on campus, such as the basic sciences and business. Students may also elect to obtain course credits for laboratory research performed under the guidance of a faculty mentor. These fourth year offerings will present students with the opportunity, under the supervision of the BSPS Program Advisor, to tailor their academic program to prepare them for the specific career paths that they choose. The 120-credit requirement for graduation provides education and training comparable to that offered by similar BSPS programs, and conforms to University credit requirements for four-year degree programs.

The initial enrollment in the BSPS program is expected to be 25 students. The existing University and BPS faculty (Table 2) is sufficient to fulfill the teaching requirements of this program. The majority of the courses in the BSPS curriculum are currently being taught. Nearly all of the facilities and capital equipment required are in place at the University. However, we do expect that the program will increase BPS faculty workload.

Graduates of this program are not eligible for licensure as pharmacists, and the program is not designed for students who plan to transfer into the Pharm.D. program.

8. Signature of President

Robert L. Carothers, President

9. Statement that no new or additional resources will be required:

Additional resources will be required as described below.

10. Name of Person(s) to contact during the review:

Name: Clinton Chichester, Ph.D.

Title: Professor and Department Chair

Telephone: 874-5034

E-Mail: chichester@uri.edu

11. Cooperative arrangements with other institutions/agencies: None

B. Rationale:

The pharmaceutical industry is a multi-billion dollar enterprise that has experienced tremendous growth over the last decade. This growth has created a widely recognized demand for qualified individuals with B.S. and graduate degrees in the pharmaceutical sciences. Graduates of these programs are sought after in order to meet the growing employment needs of the pharmaceutical and other consumer products industries, as well as those of government agencies and academia. Indeed, the Bureau of Labor Statistics predicts a substantial increase in job opportunities within the industry well into the next decade.

The primary BSPS program objective is to offer students a four year Bachelor of Science degree in the Pharmaceutical Sciences (BSPS). The BSPS curriculum is intended to provide students with a solid background in the basic and applied pharmaceutical sciences that can be employed in the development, manufacture and evaluation of pharmaceuticals and other biomedical products. The BSPS program will prepare students to fill positions in the pharmaceutical and biomedical industries, as well as government agencies, and academia. The program curriculum also includes the option for students to take business electives suitable for those who choose to enter the management or marketing side of the industry. BSPS graduates will be eligible to choose from a diverse set of careers that include: research and development, manufacturing, evaluation, management, marketing, and sales positions within the pharmaceutical industry; research and regulatory oversight functions of government agencies; and research and teaching positions in academia. In addition to offering graduates access to many of these career opportunities, the program will also prepare BSPS undergraduates for graduate studies at the M.S. and Ph.D. level in the expanding fields of pharmaceutical and biomedical sciences.

The focus of the pharmaceutical industry is research leading to new and improved drug development. At the entry level, companies typically employ technicians or research associates who possess a B.S. degree. An important source of employees has been graduates of B.S. programs in the basic sciences such as chemistry, biology, biochemistry, and microbiology. However, these individuals have no direct training in the pharmaceutical sciences, and must gain this experience through on-the-job training. Until recently, another major source of new employees comprised graduates of B.S. pharmacy programs, individuals who are trained in the pharmaceutical sciences. However, B.S. pharmacy programs are being replaced by Pharm.D. programs that emphasize clinical science over the basic research and development aspects of the pharmaceutical science. Graduates of B.S. programs in pharmaceutical sciences will take the place of the diminishing pool of B.S. pharmacists, and provide the industry with versatile employees who have backgrounds in both basic and applied pharmaceutical science. Further, BSPS students that elect to specialize in the business side of industry in preparation for careers in management, product marketing, and sales, have an advantage over those individuals with no exposure to the pharmaceutical sciences.

Convincing evidence that justifies the creation of a BSPS program at URI include the results of a published survey of industry scientists, information gleaned from government and private websites, and the fact that several of the nation's top Colleges of Pharmacy have created BSPS programs in response to industry needs for qualified employees. It

also follows that new faculty will be required to teach pharmaceutical sciences at both the undergraduate and graduate levels.

A survey of members of the American Association of Pharmaceutical Scientists (AAPS) was published recently in the American Journal of Pharmaceutical Education¹. The survey results strongly indicate that scientists within the pharmaceutical industry recognize the merit of, and the need for, BSPS graduates. Many respondents pointed out that individuals with a BSPS degree are considered to be valuable employees by the pharmaceutical industry. Respondents with a pharmaceuticals and formulation backgrounds voiced the belief that Ph.D. level scientists with a B.S. in the pharmaceutical sciences understand the drug development process much better than Ph.D. level scientists with non-pharmacy related undergraduate degrees. Many respondents stated that BSPS programs should be delivered by Colleges of Pharmacy, but did not believe the licensure as a pharmacist was required. Currently, all BSPS programs are administered by Colleges of Pharmacy.

The survey also revealed a diversity of opinion amongst industry scientists with regard to the types of courses that BSPS programs might emphasize. Respondents appeared to be divided roughly into two groups: medicinal chemists and those involved in pharmaceuticals and formulation. The former promoted a curriculum that stresses the chemical and analytical areas of the discipline, while the latter expressed the need for courses addressing the pharmacologic and pharmaceutical aspects. We recognize the diversity of our faculty in both teaching and research to be a particular strength. The curriculum that we propose fully leverages this diversity, and will provide students with a firm grounding in both chemistry and biology, while also allowing them to focus in the areas of medicinal chemistry, pharmacology, and pharmaceuticals. In addition, unique opportunities are offered for students who elect to focus on the rapidly expanding fields of natural product and biotechnology drugs, as well as in the sales, management, and marketing aspects of the industry. The authors of the survey concluded that a B.S. degree in pharmaceutical sciences was a valuable commodity that will address industry employment demands, and that existing BSPS programs should be continued and new programs be created.

Further justification for creating a new BSPS program stems from an examination of several employment websites that was performed to gain an estimate of the employment opportunities available to BSPS graduates. These websites include: the Bureau of Labor Statistics; websearch.nytimes.com; hotjobs.com; payscale.com; and hirelifesciences.com. Using the key words, Bachelor of Science in Pharmaceutical Sciences, it became obvious that thousands of jobs are currently available for individuals who hold a B.S., M.S. or Ph.D. in the pharmaceutical sciences. The New York Times website was the easiest to evaluate, and yielded 7,178 hits. We examined a representative portion of these offerings, and while our evaluation was more qualitative than quantitative, we were left with a clear impression that many of these positions were suitable for BSPS graduates. The Bureau of Labor Statistics predicted that growth in the number of jobs deemed suitable for BSPS graduates will increase well into the next decade.

Another persuasive indicator of the pharmaceutical industry's need for BSPS graduates is the fact that several of the nation's leading Colleges of Pharmacy have created B.S. programs in the pharmaceutical sciences in order to address industry needs. The prominent institutions include: the University of Michigan, Purdue, Ohio State University, Philadelphia College of Pharmacy, SUNY Buffalo, and the University of Toledo. Regionally, the Massachusetts College of Pharmacy and Health Sciences, one of our chief competitors, now offers a Bachelor of Science degree in both Pharmaceutical Sciences and Pharmaceutical Marketing and Management. Clearly, if the URI College of Pharmacy is to remain competitive at both the regional and national levels, the

creation of BSPS program should be a top priority. We currently have the faculty talent and the resources to do so. The BSPS program we propose will be unique, will allow the URI College of Pharmacy to successfully compete for both in-state and out-of-state students, will offer our undergraduates new and interesting employment opportunities, and will place us in a leadership role within this emerging area of undergraduate education.

It might also be noted that a number of important pharmaceutical and biomedical companies are located both in and around the State of Rhode Island. Notably, the personnel needs of these companies offer significant employment opportunities for Rhode Island citizens with the appropriate academic credentials. The proposed BSPS program is designed to provide our graduates with the education and training sought by these companies. In addition, many BSPS faculty currently have contacts within the pharmaceutical and biomedical industries, both regionally and nationally. These relationships will advance the placement of BSPS graduates in industry. We also expect our faculty's relationships with the industry to grow as our graduates enter and compete successfully in the work force.

Until now, no external committee has been used in the development of this BSPS program proposal. During the next stage of program development, we plan to enlist the input of an external advisory committee for the purpose of refining and optimizing the program. This committee will include representatives of the pharmaceutical industry and faculty from existing BSPS programs. It is expected that this committee will address the present and future needs of the industry and how the program can be best structured to prepare our students to meet these needs.

C. Institutional Role:

The URI College of Pharmacy's mission has been consistent with that of the University mission, where emphasis is placed on ethical behavior, the promotion of critical thinking and independent learning, and the development of the knowledge base required for a professional career. Guided by this mission, the College of Pharmacy has earned a strong national reputation for educating professionals who move on to productive careers. A number of our graduates have had or continue to have an important impact on the profession of Pharmacy. Our graduates have shown their gratitude to the College in many ways, including the establishment of endowed professorships. The proposed BSPS program will extend the College's mission and increase our academic profile by addressing the pharmaceutical industry's needs for undergraduates trained in the pharmaceutical sciences. The BSPS program is compatible with a number of University programs, and will include existing courses already offered by the University in the basic sciences, business, and liberal arts disciplines. It will offer URI undergraduates new educational and career options.

D. Interinstitutional Considerations:

Currently, the only New England institution that offers a BSPS program is the Massachusetts College of Pharmacy, which is a private institution. While the objectives of this institution's program are similar to the proposed URI College of Pharmacy BSPS program, the curriculum differs somewhat in the nature of the upper level course requirements and the type of electives offered. These factors are unique to a faculty and an institution, and will determine the nature of the career options that students seek.

The proposed BSPS curriculum would make the University of Rhode Island the only public land-grant institution in New England to offer such a program. Accordingly, the program might be made available to students as part of the New England Board of

Higher Education Regional Student Program. To date, no cooperative arrangements have been made with other institutions. Nor are there any external affiliations required for the successful administration of this program.

The first two years of the proposed BPS curriculum are similar to most Biology and Chemistry programs offered by New England institutions. Therefore, the BPS program is expected to offer significant transfer options to both in-state and out-of-state institutions. One important example is the two-year biology program at CCRI. Since the first two years of the CCRI Biology and the BPS curriculum are similar, the BPS program creates an excellent opportunity for qualified CCRI graduates to transfer into the third year of a four-year Bachelor of Science program that will offer them significant and diverse career options.

E. Program Curriculum:

The BPS curriculum is comprised mainly of existing URI courses, together with new upper level courses to be taught by BPS faculty (Table 1). The 120 credits required for graduation is similar to the graduation requirements of the established BPS programs. The curriculum contains four distinct components. The first component consists of 28 credits of general education requirements that will provide broad exposure to the humanities, arts, and social sciences. The second component consists of 45 credits of basic science and mathematics courses that will deliver a firm foundation in the sciences, and satisfy admission requirements for most basic science graduate programs and professional schools. The third component is the BPS core requirement, consisting of 41 credits of new and existing BPS/PHP courses, which will offer students a strong, basic and applied understanding of the pharmaceutical sciences. The fourth component of 6 credits, comprising BPS electives, is drawn from upper level BPS courses and selected electives from other programs on campus, particularly those from the basic sciences and business. These courses will allow our students to tailor a program of study to suit their specific career goals.

(See Appendix II)

The four main components of the curriculum include the following:

General Education Requirements:

BPS students must meet University and College of Pharmacy General Education Requirements in order to graduate. A number of specific courses listed as General Education Courses in the University Bulletin meet requirements in the following categories: communications, WRT 106, and COM 100 or HPR 118; mathematics, MTH 141; and social sciences, ECN 201 and one other approved 3 credit social science course. Students must also complete five 3 credit courses in three areas; fine arts and literature, letters, and foreign language or culture. These must include 6 credits from any of two areas and 3 credits from the third. The natural sciences general education requirement is satisfied by the basic BPS science requirements. All BPS freshmen must complete URI 101.

BPS Basic Science Requirements:

These required courses are drawn from several University programs. These courses provide a solid grounding in the basic sciences that support the upper level BPS courses and meet the admission requirements of most basic science graduate programs and professional degree programs. They include: CHM 101, General Chemistry I; CHM 102, General Chemistry Lab I; BIO 101, General Biology; CHM 112, General Chemistry

II; CHM 114, General Chemistry Lab II; BIO 121, Human Anatomy; CHM 227, Organic Chemistry I; MIC 201, Medical Microbiology; PHY 111, General Physics; PHY 185, Physics Lab I; CHM 228, Organic Chemistry II; CHM 226, Organic Chemistry Laboratory; BCH 311, Introductory Biochemistry.

BSPS Core Requirements:

BSPS Core requirements consist of 41 credits of new and existing BPS courses that will provide students with a fundamental understanding of the pharmaceutical sciences. The existing BPS courses include: BPS 321, Principles of Pharmacology; BPS 313, Introduction to Medicinal Chemistry; BPS 301/303/305, Dosage Forms I/II/III; BPS 311, Foundations of Human Disease I: Immunoinflammatory Disease; BPS 445, Natural Products/Biotechnical Drugs; BPS 325, Drug Metabolism and Pharmaceutical Analysis; BPS 403, Pharmacokinetics; BPS 425, GMP's in the Manufacture of Pharmaceutical Products; and PHP 580, Pharmacoeconomic Analysis. In addition, BPS 587, General Pharmacology, will be required. The remaining core requirements include two new laboratory courses: BPS 443, Manufacturing and Formulation Laboratory; and BPS 451, Techniques in Medicinal Chemistry and Molecular Biology. Two additional courses will be required: BPS 442, Pharmacogenomics; and BPS 503, Pharmacokinetics. BPS 405, Physical Pharmacy, will be a core requirement for those students specializing in Pharmaceutics but not for other BSPS students.

BSPS Electives:

BSPS students must complete a minimum of 6 credits of BSPS Electives. These courses will be chosen with the help of the Program Advisor from the following list of BPS, PHP, Basic Science, and Business courses. Up to six credits of these requirements may be met by completing BPS 497 and 498, Experimental Research, which involve laboratory research projects performed under the mentorship of individual BPS faculty members.

The following BPS courses qualify as BSPS Electives: BPS 352, Personal Cosmetics; BPS 530, Drug Metabolism; BPS 533, Medicinal Plants; BPS 535, Pharmaceutical Biotechnology; BPS 544, Forensic Toxicology; BPS 546, Advanced Toxicology; BPS 551; Chemistry of Natural Products, BPS 560; Fundamental of Cosmetic Science, and BPS 621 and 622, Manufacturing Pharmacy. PHP electives include: PHP 540, Principles, Methods and Applications of Epidemiology; PHP 550, Pharmacoepidemiology.

Certain BSPS electives have been selected in order to meet the needs of students who may chose careers in sales/marketing, internal pharmacy or production management. These include: PHP 503, Health Systems I; PHP 504, Health Systems II; PHP 580, Pharmacoeconomics; and PHP 680, Legal Environment of Health Administration. Additional electives in those disciplines may be taken by students with prior permission of the program advisor and/or department chair.

A number of BSPS Electives have been selected in order to meet the needs of students that may be employed in the pharmaceutical industry in drug discovery. These include: AVS 365, Laboratory Animal Technology; BCH 312, Biochemistry Laboratory; BCH 401, Quantitative Cell Culture; BCH 437, Fundamentals of Molecular Biology; BCH 464, Biochemistry of Metabolic Disease; BCH 484, Physical Methods in Biochemistry; BCH 500, Principles and Techniques in Molecular Cloning; BCH 502, Techniques of Molecular Biology; BIO 352, General Genetics; BIO 432, Fundamentals of Molecular Biology; BIO 442, Mammalian Physiology; BIO 445, Endocrinology; BIO 446, Introduction to Cellular and Behavioral Neurobiology; BIO 453, Cell Biology; CHM 425, Advanced Organic Laboratory; CHM 427, Intermediate Organic Chemistry; CHM 521,

Advanced Organic Chemistry; CHM 642, 643, Graduate Seminar; CHM 691, Forensic Chemistry; CSC 582, Bioinformatics I. As new courses are developed throughout the college and the University, they will be evaluated for their appropriateness for inclusion as possible BSPS electives.

Students who elect to enter graduate programs in the basic sciences may choose courses appropriate to a particular discipline. All BSPS Electives must meet the approval of the Program Advisor. There are no requirements for certification or licensing associated with the BSPS degree.

****Five new courses will be created:***

BPS 405, Physical Pharmacy. A three-credit course which deals with the quantitative and theoretical principles of physical and chemical science as they are applied to pharmacy. This course integrates the factual knowledge and practical application through the development of broad principles such as solubility, stability, compatibility, dissolution, diffusion, interfacial tension, partitioning, and drug product design.

BPS 442, Pharmacogenomics & Pharmacogenetics. This three-credit course will examine drug effects and how these vary depending on the genetic makeup of the individual. The mechanisms whereby pharmaceuticals alter gene expression will be examined. Finally, the principles of gene therapy and protein pharmaceuticals will be presented.

BPS 443, Formulation and Manufacturing Laboratory. A two-credit course which focuses on the practical aspects of formulation and manufacturing of various drug products such as tablets, capsules, solutions, parenterals, suspensions, emulsions, creams, ointments, gels and suppositories.

BPS 451, Techniques in Medicinal Chemistry and Molecular Biology. A four-credit course with didactic and laboratory components focusing on the theory and practical application of chemical and analytical techniques in drug discovery and design. Students will receive hands on experience with techniques such as NMR, HPLC, LC/MS, solid-phase synthesis, combinatorial chemistry and biotransformation.

BPS 503, Pharmacokinetics. This course will present the principles of pharmacokinetics and pharmacodynamics, with specific emphasis on their application in the pharmaceutical sciences. The course will cover the foundations of each subject, followed by the derivation of the models commonly used to summarize plasma concentration and response data. Hands-on experience in basic pharmacokinetic and pharmacodynamic modeling will be emphasized.

*Pending approval by the Graduate Council

F. Faculty:

The current BPS faculty (Appendix III) is sufficient in number and expertise to deliver the BPS teaching component of the BSPS program. Existing University courses will be utilized during years one and two. For the third and fourth years of the curriculum, we will utilize current BPS, Pharm. D. curriculum, and graduate courses. Five new courses will also be created, including two new laboratory courses. Our full current complement of faculty positions is necessary in order to deliver this curriculum. The implementation of this curriculum is expected to increase BPS faculty workload significantly. Of particular need are faculty in the pharmaceuticals area. We have been searching for a replacement in pharmaceuticals manufacturing. While the latest search for this position was unsuccessful, it remains critical that an additional pharmaceuticals faculty member be hired, as there will be additional retirements in this area within the next six months, with other retirements soon to follow.

(See Appendix III)

G. Students:

The initial BPS program size will be set at 25 students, with an eye on future expansion. The curriculum is designed to enhance the intellectual, social, and economic well being of BPS graduates. BPS graduates will gain access to wide variety of career options that address the employment needs of the pharmaceutical and health sciences community. We expect that the program will attract primarily new students with strong backgrounds in chemistry and the biological sciences. The program also has the potential to draw students from existing programs in the basic sciences. In addition, BPS graduates will be excellent candidates for URI graduate programs, such our BPS graduate program as well as those in Chemistry, Biology, Microbiology, and Biochemistry. We expect the applicant pool to be similar to that of our Pharm.D. program, in which students come primarily from Rhode Island, the rest of New England, New York, New Jersey and Pennsylvania. As with our current program, a small number of applications are expected to originate from many other areas of the country. Undergraduates enrolled in the BPS program should be eligible for scholarships and fellowships that are already available to the majority of University students, particularly those in the basic sciences.

To ensure that students accepted into the program have the potential and commitment to complete the program successfully, the admission requirements will be similar to those of our Pharm.D. program. These criteria are among the strictest at the University, and are proven to select those students who are focused on their professional goals and have the intellectual talent and motivation required to graduate and move on to successful careers. The admission criteria include a minimum secondary school GPA of 3.0 and combined SAT verbal and mathematics scores of 1300. Applicants must also demonstrate proficiency in prerequisite science and mathematics courses. A retention requirement of an overall GPA of 3.0 in science and mathematics courses will be established. Academic progress will be monitored by the Program Advisor and assessed at mid-semester and at the end of each semester.

H. Administration:

The BPS program will be administered by the Department of Biomedical and Pharmaceutical Sciences. Administrative oversight and advising responsibilities will be shared by the Department Chair and another faculty member who will serve as the Program Advisor. The administration of the BPS program is not expected to affect existing programs for which the Department of Biomedical and Pharmaceutical Sciences

and the College of Pharmacy are already responsible. No additional administrative costs will be required for the BSPS program.

I. Instructional Resources

The vast majority of courses in the proposed BSPS curriculum are already taught regularly by the Department of Biomedical and Pharmaceutical Sciences. Five new courses are proposed, and no additions to the faculty will be required to teach these new courses. The instructional resources are already in place at the University to deliver this new program. However, as pharmaceuticals faculty positions turn over due to anticipated retirements, these positions will need to be filled. In addition, there are three new pharmaceuticals courses that will have to be delivered, further underscoring the need for maintaining current pharmaceuticals faculty positions. In addition, we will need to retain our two INBRE faculty.

An increase in class size will occur in the following laboratory based courses: BIO 101, General Biology; CHM 102, General Chemistry Lab I; CHM 114, General Chemistry Lab II; BIO 121, Human Anatomy; and CHM 226, Organic Chemistry Laboratory. This increase in student number will be remedied by creating teaching assistant positions to be shared between departments. BPS 321, Principles of Pharmacology; BPS 313, Introduction to Medicinal Chemistry; and BPS 325, Drug Metabolism & Pharmaceutical Analysis, will also increase in class size. However, this can be accommodated by using a larger auditorium when teaching these courses. Additionally, class size in BPS 301, 303, 305, Dosage Forms I/II/III, will increase. If necessary, at some point the classes may be split in half, placing the pharmaceutical engineering students and BSPS students in separate sections from the Pharm.D. students.

J. Facilities and Capital Equipment:

Overall, the majority of the required facilities and capital equipment are already in place at the College of Pharmacy as components of our Pharm.D. program. The courses in the proposed program for the first- and second years are the same courses as those prescribed for the Pharm.D. program. The third- and fourth year classes are courses in the existing Pharm.D. program or are new courses to be taught by existing BPS faculty. This new program will be placing increased emphasis on laboratory skills and, in particular, those related to the pharmaceutical manufacturing process. We expect turnover in pharmaceuticals faculty as our current pharmaceuticals faculty retire. New pharmaceuticals equipment will also be needed as these faculty are hired. Excluding this equipment, all of the facilities and capital equipment are already in place at the University, and no additional resources will be required.

K. Financial Considerations:

Because the Department of Biomedical and Pharmaceutical Sciences is an independent academic unit, it already has its own budget, and there are no initiation costs. The program will be administered by the department chair and one additional faculty member within the department. Revenue estimates, expenditure estimates and the total budget for the first four years are shown in the BSPS program budget, **Appendix I**. We estimate that the first class will contain 25 students. This is expected to increase to a class size of 50 students. Tuition is estimated to increase at a rate of 3 percent per year.

No new BPS faculty will be needed to deliver this curriculum. The department will not, however, be able to implement this new program without maintaining its full current complement of faculty positions. We expect significant turnover in pharmaceuticals faculty, and these faculty will need to be replaced, particularly as strong emphasis is placed in pharmaceuticals research and development. We also have two pharmacology/toxicology

faculty that are partially supported by the INBRE grant, which supports the development of biomedical research in Rhode Island. These two individuals will be important contributors to the new BSPS program. These professors are in the process of transitioning to tenure track positions, and will be relied upon to help implement and deliver the new BSPS curriculum. Therefore, there will be no unanticipated budgetary requirements for the hiring of additional faculty.

There are two new laboratory courses associated with the curriculum that will need additional supplies and teaching assistant resources. The new formulation/manufacturing laboratory will also need to be equipped. Currently, we have no functioning manufacturing equipment. However, it is imperative that students gain hands-on experience using modern pharmaceutical manufacturing equipment. We anticipate approximately \$300,000 in expenses in order to outfit this laboratory. It is estimated that the laboratory supplies needed would be approximately \$2,500 per student per year. We propose that these additional costs be borne by a professional fee charged to the students in the third and fourth years of the program. In addition, three additional TA's will be required. Two of these TA's will be utilized by the Chemistry department to deliver extra chemistry labs to be taken by the BSPS students, and one will be utilized by the Biology department to deliver extra biology labs to be taken by the BSPS students. There will be a minor readjustment of Pharmacy TA duties in order to deliver two additional, upper division BSPS laboratories.

L. Evaluation:

The Department of Biomedical and Pharmaceutical Sciences will use several performance measures to evaluate and review the BSPS program and implement appropriate revisions. First, the curriculum will be evaluated initially by the College of Pharmacy Curriculum Committee, which includes representatives from both College departments, Biomedical and Pharmaceutical Sciences and Pharmacy Practice. Additionally, we have a policy of ongoing program evaluation and curriculum revision.

The overall program will be evaluated after the first cycle by an assessment committee, run under the auspices of the College Director of Strategic Planning. The evaluation will include criteria similar to that used to assess our Pharm.D. program.

In addition, an external advisory committee will be convened in order to evaluate the program. This committee will be drawn from representatives of the pharmaceutical industry and faculty from existing BSPS programs at other institutions, and will evaluate program structure, organization and goals, administrative function, teaching, staffing and outcomes. This external advisory committee will lend strength to the BSPS program and should be a valuable assessment tool.

Finally, we will implement a feedback survey designed to examine student's strengths and weaknesses following graduation. This will allow for uniform preparation of students as they enter different aspects of the pharmaceutical sciences workforce.

We have developed a series of learning outcomes and assessment guidelines which can be reviewed in **Appendix IV** and **Appendix V**.

References:

1. Pharmaceutical Research and Manufacturers of America (PhRMA) Website, www.phrma.org.
2. Bureau of Labor Statistics Website, www.bls.gov/oco/cg/cgs009.htm.

3. Broedel-Zaugg K, Kisor D, Sullivan D. L. Evaluating the Pharmaceutical Industry's Need for Graduates with a Bachelor of Science Degree in Pharmaceutical Sciences. *Am J Pharm Educ.* 2003; 67(1): article 14.
4. New York Times Website, key words: Bachelor of Science in Pharmaceutical Sciences

<http://websearch.nytimes.com/jobs>

APPENDICES

Appendix I - Budget

Appendix II - Curriculum

Appendix III - Faculty

Appendix IV - Learning Outcomes

Appendix V - Assessment Guidelines