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| LSC Use Only No: | LSC Action-Date: | UWUCC USE Only No. | UWUCC Action-Date: | Senate Action Date: |
| | | 08-34 | App-11/18/08 | App-12/02/08 |

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

| | |
|---|--|
| Contact Person Dr. Narayanaswamy Bharathan/Dr. Carl Luciano | Email Address Bharathn@iup.edu |
| Proposing Department/Unit Biology | Phone 724-357-2584/357-2252 |

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

| | | |
|--|--|-----------------|
| 1. Course Proposals (check all that apply) | | |
| <input type="checkbox"/> New Course | <input type="checkbox"/> Course Prefix Change | |
| <input type="checkbox"/> Course Revision | <input type="checkbox"/> Course Number and/or Title Change | |
| <input type="checkbox"/> Course Deletion | <input type="checkbox"/> Catalog Description Change | |
| <hr/> | | |
| <i>Current Course prefix, number and full title</i> | <i>Proposed course prefix, number and full title, if changing</i> | |
| 2. Additional Course Designations: check if appropriate | | |
| <input type="checkbox"/> This course is also proposed as a Liberal Studies Course. | <input type="checkbox"/> Other: (e.g., Women's Studies, Pan-African) | |
| <input type="checkbox"/> This course is also proposed as an Honors College Course. | | |
| 3. Program Proposals | | |
| <input type="checkbox"/> New Degree Program | <input type="checkbox"/> Program Title Change | |
| <input type="checkbox"/> New Minor Program | <input checked="" type="checkbox"/> New Track Certificate | |
| <input type="checkbox"/> Catalog Description Change | <input type="checkbox"/> Program Revision | |
| <input type="checkbox"/> Other | | |
| <hr/> | | |
| <i>Current program name</i> | <i>Proposed program name, if changing</i> | |
| 4. Approvals | | |
| Department Curriculum Committee Chair(s) | <i>Sandra Dewell</i> | Date 8/18/08 |
| Department Chair(s) | <i>Almas</i> | 8/18/08 |
| College Curriculum Committee Chair | <i>[Signature]</i> | 10/08/08 |
| College Dean | <i>John D. Ed</i> | 10/15/08 |
| Director of Liberal Studies * | | |
| Director of Honors College * | | |
| Provost * | | |
| Additional signatures as appropriate: (include title) | | |
| UWUCC Co-Chairs | <i>Gail Sechrist</i> | 11/18/08 |

* where applicable

Received

OCT 15 2008

Part II. Description of Curriculum Change

1. Complete Catalog Description

Certificate in Cell and Molecular Biology

N. Bharathan: Coordinator

For students who wish to obtain specialized training in cell and molecular biology without electing the major track, the Department of Biology offers a 15-credit certificate program that consist of four-core courses and one elective course. Completion of the Certificate will help to prepare students for positions in the modern biotechnology workforce. Applications are available at 114 Weyandt Hall. For further information, call 724-357-2352.

| | | |
|--|-----|-----------|
| Certificate in Cell and Molecular Biology | | 15 |
| Core Courses: | | 12 |
| BIOL 410 Molecular Biology Topics | 3cr | |
| BIOL 405 Biology of the Cell | 3cr | |
| BIOL 401 Laboratory Methods in Biology/Biotechnology | 3cr | |
| BIOL 466 Principles of Virology | 3cr | |
| Elective Course (Choose <u>one</u> from among the following): | | 3 |
| BIOL 323 Introduction to Toxicology and Risk Assessment | 3cr | |
| BIOL 364 Immunology | 3cr | |
| BIOL 460 Fundamentals of Environmental Epidemiology | 3cr | |
| BIOL 481 Biology Special Topics | 3cr | |

2. Detailed Description

Rationale/Justification

The Department of Biology proposes a twelve-credit formal, well-defined curriculum to be called the Certificate in Cell and Molecular Biology (CCMB). The purpose of the proposed CCMB is to help train and produce a new generation of graduates with specialized skills needed to meet emerging career opportunities in the local, national, and global market for biotechnology in general, including drug discovery, gene analysis, agribusiness, sustainable energy, biomedical research and development and future innovations in biological system applications. The students electing the CCMB will take 12 credits of core Biology courses and a 3-credit upper-division elective course that will collectively help prepare the student for the biotechnology workplace at the regional, state or national level.

The proposed CCMB includes existing courses only and does not involve new courses. It does not require new resources or additional faculty. The proposed CCMB represents a novel way to package existing courses that makes them collectively more attractive to students. The Cell/Molecular diploma certification as well as an enhanced ability to compete for positions in the workforce will serve as incentives for students to enroll in the program and complete its requirements.

The core and elective courses in the proposed CCMB will provide students with sufficient content and practical experience to give them a competitive edge in seeking employment in the broad and growing biotechnology sector of the economy. Biotechnology is a dynamic industry that blurs traditional occupational and academic definitions and offers many opportunities for employment that do not always fit the stereotypical image of a biological research scientist. Biotechnology includes, but is not limited to, traditional bench science or clinical science. Often biotechnology in an industrial setting also involves production-level science or management, requiring additional skills such as teamwork, problem-solving and communication in addition to solid familiarity with underlying biology and techniques.

A Google search for “biotechnology jobs” in April, 2008 generated over a million hits. Not all of the sites that returned are relevant but the large number of hits illustrates the breadth of the biotechnology sector. One site “BioSpace Biotechnology and Pharmaceuticals News and Careers” (<http://careers.biospace.com/jobs/Public/JobSearchResult2>) offered a listing of available biotechnology jobs in the northeastern United States (“Pharm Country”). This list included familiar job titles such as research technician, research associate, immuno-toxicologist, lab assistant, biologist for anti-viral experiments and entry-level biochemist but also some less familiar ones including validation specialist, graphics technician and field service engineer for Pittsburgh Company that analyzes human genetic variation.

There are currently two B.S. degree programs related to the proposed CCMB at IUP. These two are the Chemistry-Biology interdisciplinary Biochemistry program and the Cell and Molecular Biology Track in Biology. The former program emphasizes physical sciences and allows few elective courses. The latter focuses on life sciences and has more opportunities for electives than Biochemistry. The proposed CPCMB falls between these two programs in that it does not emphasize physical sciences compared to Biochemistry but does not require a commitment to a degree track as does the Cell-Molecular Track. We expect the proposed CPCMB to fill a niche between the two existing programs.

The primary aim of the proposed CCMB is to use existing resources at IUP to better prepare students for the modern biotechnology workplace. Several lines of evidence indicate that a need exists for individuals with this sort of academic preparation.

One line of evidence indicates need at the regional level. The Pittsburgh Life Sciences Greenhouse (PLSG) {<http://www.pittsburghlifesciences.com/default.aspx>} is a consortium of Carnegie-Mellon University and the University of Pittsburgh allied with economic development groups, local governments and biotechnology trade organizations based in southwestern Pennsylvania. This initiative is funded by approximately \$30M each year derived from the Commonwealth’s share of the national tobacco settlement. The goal of the Greenhouse project is to foster the growth of the biotechnology industry in Pennsylvania’s southwestern region, with hospitals and universities in Pittsburgh acting together as a hub. Objective Four of the Life Science Greenhouse clearly articulates their emphasis on the region’s need for a trained workforce.

PLSG Objectives

PLSG’s founding strategic objectives are as follows:

Objective One: Nurture and develop entrepreneur-based bioscience enterprises as a primary way to build a stronger bioscience industry base in Pittsburgh.

Objective Two: Build capacity within the region's economic development organizations to help bioscience firms locate, expand, or start-up in Southwestern Pennsylvania.

Objective Three: Develop incentives and mechanisms to better link research to technology and commercialization within the Pittsburgh region.

Objective Four: Invest and develop the region's talent pool in the biosciences from entry-level to senior-level personnel.

Objective Five: Build research stature and reputation in core research areas that can position Pittsburgh for scientific leadership as well as clinical research and care.

The Commonwealth's Department of Economic and Community Development has described the size and importance of bioscience/biotechnology sector of Pennsylvania's economy on its web site (<http://www.newpa.com/default.aspx?id=63>). In addition, the site of the Commonwealth's Biosciences Enterprise Commitment articulates the need to support economic growth through biosciences (<http://www.newpa.com/default.aspx?id=64>) with an appropriately educated and skilled workforce. The proposed CPCMB thus meets a specialized statewide educational need in the area of biotechnology.

A second line of evidence indicates need at the national level. In the 2007-2008 Occupational Outlook Handbook from the United States Department of Labor, biotechnology employment prospects fall into the two occupational categories listed as "biological scientists" and "biomedical scientists". The Occupational Outlook Handbook predicts average growth in jobs for biological scientists for the forecast period from 2004-2014. The job outlook includes better opportunities for individuals with a master's or bachelor's degree than for those with a doctoral degree because individuals in the last group are expected to face stiff competition for available positions as independent researchers or university faculty. On the other hand, job opportunities for biomedical scientists are projected to grow much faster than the average during the same forecast period due to expansion of opportunities in health-related research, including drug discovery, drug testing, epidemiology and the analysis of disease-causing genes.

In a report published on August 14, 2003, The National Science Board, a policy arm of the National Science Foundation, pointed out the critical role of science and technology as engines of economic growth and national security. To forestall a projected deficit in the number of trained individuals for the American science and engineering workforce, the National Science Board recommended action by the federal government to direct substantial new resources to the support of students and institutions in order to improve success in the study of science and engineering. The 2001 Hart/Rudman Report sponsored by the United States Department of Defense summarized its conclusions pertaining to science education and training in a section entitled "Recapitalizing America's strengths in science and education". In this section of the report, the authors reached essentially the same conclusion as the National Science Board but also underscored the importance of teaching science as an inquiry- and discovery-based activity.

The 2001 Hart/Rudman Report sponsored by the United States Department of Defense summarized its conclusions pertaining to science education and training in a section entitled "Recapitalizing America's strengths in science and education". In this section of the report, the authors reached essentially the same conclusion as the National Science Board but also underscored the importance of teaching science as an inquiry- and discovery-based activity. Other reports over the last few years have emphasized the importance of integrating research with education and incorporating opportunities for hands-on activities into the curriculum.

Beyond the state and national level there are international opportunities in biotechnology as well. With globalization of economies, biotechnology is emerging as unifying sector that crosses national boundaries. The annual Bio International Convention (“Glitter Glitz and Glad-handing”) provides an illustration of the globalization of biotechnology. The 2007 event drew 22,366 attendees and exhibitors with approximately one-third from countries outside the U.S. This convention also hosted more than 300 domestic and international public officials including seven U.S. governors. This year’s June event in San Diego expects visitors from 65 countries with approximately 30% of all attendees from non-US nations. As a second illustration, a more scientifically oriented international biotechnology convention is scheduled for Dalian, China in October, sponsored by the International Union of Pure and Applied Chemistry. Three Nobel Laureates are scheduled to speak at this conference.

Taken together, these lines of evidence suggest the availability of jobs in the biotechnology sector over the next 5-10 years and a growing regional/national/international need for trained individuals to fill the expected positions. We expect students who complete the proposed CCMB to be very competitive for these positions.

The proposed CCMB aligns with the State System’s strategic direction by supporting two of the Core Areas identified in “Leading the Way” as framing PASSHE’s efforts through 2009. The proposed CCMB supports Core Area 1B “Enhance the quality of instruction, learning resources, and support services available to students” because the courses in the CCMB emphasize hands-on, active learning, which is an innovative, effective approach to teaching and learning (Strategy 1.B.1) and because the courses “infuse technology” (Strategy 1.B.6) via diverse applications. Finally, because students in the CCMB courses are required to take an active role in their own learning, through presentations, discussion and experimental design, the CCMB promotes “continuous student engagement in the educational experience” (Strategy 1.B.7).

The proposed CCMB also supports and aligns with strategies listed in Core Area 3. Commonwealth Service. It supports Strategy 3.A.1 because it aligns existing courses at IUP to support “workforce development needs” in the biotechnology sector. It also offer an opportunity for students to participate in an applied program in one of the “emerging disciplines of importance to the Commonwealth” as described in Strategy 3.A.3. Finally, the proposed CCMB supports Strategy 3.A.5 because it will encourage students to major in and graduate from a “science and technology” program.

The IUP 2007-2012 Strategic Plan lists Academic Excellence as its first goal for the university. The proposed CCMB aligns with Strategy A.2 “Offer new, high quality programs based on demand, faculty strengths, and resources.” The Certificate in Cell and Molecular Biology will provide more options to students interested in attending IUP and thus should aid Departmental recruiting efforts. Currently, ten of the 14 SSHE institutions including IUP offer an “option”, “track”, “concentration” or degree program in the biotechnology area, but none offer a stand-alone certificate unlinked to the undergraduate degree. Thus, the adoption of the CCMB Certificate Program will provide IUP students with additional flexibility to obtain credentials. The CCMB may also prove attractive to community college or non-traditional students who wish to pursue specialization or additional credentials.

Credit Requirements

Credit requirements for the CCMB consist of four core courses (12 cr.) and one elective course (3 cr.) for a total of 15 cr. The proposed Program requires students to complete four core courses at the

advanced undergraduate (400) level and one elective chosen from a set of 3 additional 400-level and two 300-level courses. These advanced courses require a strong interdisciplinary science background and thus have prerequisites in organic chemistry, genetics, microbiology and biochemistry. The Core courses like Biology of the Cell BIOL 405 places an emphasis on the structure, function of a cell, cell products, and manipulation of biological information in the form of nucleic acids (DNA and RNA) and proteins. The laboratory course BIOL 401 offers practical experience with instrumentation, techniques in recombinant DNA technology, including tissue culture, production of transgenics, and purification and handling of nucleic acids. The Topics Course BIOL 410 and allows students to examine rapid developments and up-to-the-minute discoveries through an emphasis on current literature. The virology course BIOL 466 draws together threads from microbiology, genetics, cell biology and medicine to review mobile genetic elements and sub-cellular pathogens and present their use as vectors in genetic engineering applications. Collectively the core courses emphasize the role of nucleic acids, recombinant DNA technology and PCR analysis as unifying themes in modern biotechnology. The elective course builds on this theme but allows students to explore individual areas of interest or opportunity.

Lab components in BIOL 364, 401 and 405 have a strong student-centered emphasis on hands-on laboratory experience, consistent with departmental philosophy on science teaching. The laboratories offer the opportunity to gain or practice skills in teamwork, communication, experimental design and technology as well as the opportunity learn new scientific techniques.

Courses for the proposed CCMB are regular Biology Department courses currently listed in the undergraduate catalog. No new courses are proposed. Courses for the CCMB are currently taught in rotation by permanent IUP faculty in a face-to-face format. Thus, current faculty resources are both sufficient and well-suited for the proposed program.

Students electing the Certificate in Cell and Molecular Biology Program will take the following four core courses:

Core Courses (12 credits)

1: BIOL 405 Biology of the Cell

Prerequisites: BIOL 111, CHEM 231, or instructor permission

Introduces the cellular and modular mechanisms by which individual cells grow, receive and respond to internal and external signals, and move. Discusses the latest advances in the discipline; students will be expected to utilize current literature on their own as a means of building thinking skills. The student-centered laboratory portion emphasizes individual and group activities.

2. BIOL 401 Laboratory Methods in Biology and Biotechnology

2c-4l-3cr

Prerequisite: CHEM 351

Theory and practice in a number of major analytical and preparative techniques currently in use in physiology, molecular biology, and biotechnology.

3. BIOL 410 Molecular Biology Topics

3c-0l-3cr

Prerequisite: BIOL 263 or BIOC 301 or CHEM 351

Involves the study of biological phenomena in molecular terms. Focuses on recombinant DNA principles as they relate to prokaryotes and eukaryotes. Emphasizes the modern methods used in recombinant DNA technology.

4. BIOL 466 Principles of Virology

3c-0l-3cr

Prerequisite: BIOL 263 or equivalent course in Genetics, or CHEM 351 or equivalent course in Biochemistry, or instructor permission

Topics include structure, classification, assay, and transmission of viruses; methods used in the study of viruses; viral replication, gene expression, and gene regulation; host-viral interactions and sub-viral pathogens.

Free Elective (3 credits) Choose One

1: BIOL 323 Introduction to Toxicology and Risk Assessment

3c-0l-3cr

Prerequisites: BIOL 104 or 112; CHEM 102 or 112; or permission

A study of uptake, distribution, metabolism, and excretion of environmental chemicals; mechanisms of their toxicity; and their effects on major organ systems. Knowledge of these topics is applied to risk assessment procedures. (Also offered as ENVH 323; may not be taken for duplicate credit)

OR

2: BIOL 364 Immunology

Prerequisites: BIOL 250, CHEM 232, or instructor permission

Physical and chemical properties of antigens and antibodies; nature of antigen-antibody interactions; mechanism of antibody formation; and immune reaction and disease. Lab employs serological techniques.

OR

3: BIOL 460 Fundamentals of Environmental Epidemiology

3c-0l-3cr

Prerequisites: BIOL 104 or 112; MATH 216 or 217; or instructor permission

A study of the health consequences of involuntary exposure to harmful chemical and biological agents in the general environment. Disease etiology, occurrence, and intervention in human populations are examined through epidemiologic study using analytical methods and applications. (Also offered as ENVH 460; may not be taken for duplicate credit).

OR

4: BIOL 481 Special Topics

var-1-3cr

Prerequisite: As appropriate to course content

Course varies from semester to semester covering diverse topics in specific areas of biology.

Restrictions and Sequencing

The proposed program is not likely to be a viable option for students outside CNSM due to the number of pre-requisite requirements in chemistry and biology for CCMB Core and Elective courses. Practically speaking, only students who are majors in Biochemistry, Biology, Chemistry or Natural Sciences are likely to participate in the program. Biology majors in the Cell and Molecular Biology track will not be eligible for the proposed CCMB. The proposed CCMB may also be an attractive option for

part-time students or non-traditional students. If lab facilities are available, the courses could be taught at a branch campus or an off-campus location such as Monroeville or Harrisburg.

Core and elective courses are taught in a regular rotation such that students can complete the program requirements in 2 years. Ideally, students would complete the requirements in the order shown in the Complete Catalog Description but this may not be possible for all students.

Part III. Implementation

1. Effect on students in the program

Although some students will elect participation in the propose CCMB we otherwise anticipate little effect on students currently enrolled in Biology programs.

2. Faculty resources

Since no new courses or sections are proposed, faculty resources are adequate for the proposed program.

3. Other resources

With the exception of library resources, all other resources are adequate for the proposed program. Library resources now available at IUP are inadequate for the current programs as well as the proposed program. Students in the traditional program currently utilize inter-library loan, travel to libraries at Pitt or Penn State to obtain materials unavailable from the IUP library or obtain additional materials from faculty collections. Students in the proposed program will utilize the same strategies.

4. Number of students

We do not expect a significant change in the number of students in the department as a result of this program.

5. Implementation date

In order to allow students to take advantage of the program we would like to implement it at the earliest possible date in spring, 2009.

Part IV. Periodic Assessment

We plan a two-pronged method of evaluation of the program that will include both direct and indirect assessment tools.

Direct

We will monitor the quality of projects and presentations in core courses, for example-journal article presentations in BIOL 466 Virology.

We will maintain a database of articles published by students in the program and conference presentations made by CCMB students.

Indirect

We will conduct focus group interviews with students in the program and use their input to make appropriate changes in the program, as needed.

We will conduct transcript analysis for the core and elective courses in the program.
Departmental and program review data (5 year)

Graduating seniors will be asked to complete student perception surveys at the time of application for graduation. Information on these senior surveys will be used to make appropriate changes in the program, as needed.

We will also maintain a database on job placement for students who graduate from the program.

Part V. Course Proposals

None

Part VI. Letters of Support or Acknowledgement

Sharon Aikins

From: "Susan Boser" <sboser@iup.edu>
To: "Gail S. Sechrist" <gailsech@iup.edu>; "Todd Potts" <potts@iup.edu>; "Scott Edward Mensch" <s.e.mensch@iup.edu>; "Sharon Aikins" <SAIKINS@iup.edu>; "Sally McCombie" <smccomb@iup.edu>; "Russell Peterson" <rpeterso@iup.edu>; "Muhammad Numan" <mznuman@iup.edu>; "Mary Anne Hannibal" <hannibal@iup.edu>; "Mary Sadler" <Mary.Sadler@iup.edu>; "John A. Lewis" <J.A.Lewis@iup.edu>; "Kevin L Turner" <kevin.turner@iup.edu>; "Jack Scandrett" <John.Scandrett@iup.edu>; "Chauna Craig" <CCraig@iup.edu>; "Carly Carranza" <carlycgc@iup.edu>
Sent: Wednesday, November 19, 2008 11:28 AM
Subject: Re: Bio Certificate

Hi, all,

I checked as well on this end and this is correct. If a major already exists, approval is not needed.

Susan

~~~~~  
 Susan Boser, Ph.D.  
 Indiana University of Pennsylvania  
 Interim Associate Provost for Academic Programs and Planning

----- Original Message -----

**From:** Gail S. Sechrist  
**To:** Todd Potts ; Scott Edward Mensch ; Sharon Aikins ; Sally McCombie ; Russell Peterson ; Muhammad Numan ; Mary Anne Hannibal ; Mary Sadler ; John A. Lewis ; Kevin L Turner ; Jack Scandrett ; Chauna Craig ; Carly Carranza  
**Cc:** Susan Boser  
**Sent:** Wednesday, November 19, 2008 9:32 AM  
**Subject:** Bio Certificate

UWUCC,

In response to the UWUCC concern about whether the Certificate needed PASSHE approval first, Ola forwarded me an email from Nick Kolb saying that it did not. The college would like to get it approved this fall so I am going to place it on the agenda.  
 Gail