

INDIANA UNIVERSITY EAST
Request for a New Concentration
under the B.A. in Natural Science and Mathematics Degree

Title of Proposed Concentration: Biochemistry

Proposed Date of Implementation: Spring 2009

I. Why is the program needed? (Rationale)

Biochemistry is the 'Chemistry of Life'. It is central to all areas of the Biological or Life Sciences. Biochemistry provides an understanding of every aspect of the structure and function of living things at the molecular level. Biochemistry offers the tremendous challenge of seeking to understand the most fundamental of life's processes at the molecular level, and to utilize this knowledge for the benefit of mankind.

There are close links between Biochemistry and other specific life sciences, such as Cell Biology, Genetics, Microbiology, Molecular Biology, Physiology and Pharmacology. In fact, in many cases the distinctions between these disciplines are becoming increasingly blurred. Biochemistry is a practical laboratory science that applies the molecular approaches of chemistry to the vast variety of biological systems. Biochemists work at all levels and with all types of biological organisms, ranging from biomolecules to man.

Who employs biochemists?

Biochemists work in many walks of life - in industry, hospitals, agriculture, research institutes, education and associated areas. There are many areas of everyday life as diverse as medical products and diagnostics, new food and its safety, crop improvement, cosmetics and forensic science that owe their development or even existence to biochemists

Industry

Pharmaceutical, food, brewing, biotechnology and agrochemical companies all need and employ biochemists to develop new products and to monitor the production, quality control and safety of existing ones.

Medicine

Hospitals, public health laboratories and medical research institutes, as well as the pharmaceutical industry, all require biochemists. Here they provide a variety of services, carrying out tests on blood, urine and other body fluids, alongside researching the underlying causes of disease and the methods of treatment.

Agriculture and the Environment

Biochemists and biotechnologists, who often have a biochemistry degree, working in

agriculture have been responsible for many developments, such as pest-resistant crops, improvements in crop yields and tomatoes that keep better. They also monitor the environment. Employers include seed companies, local government, the Civil Service and water authorities.

Education

All levels of education offer prospects for biochemists. The combination of biology and chemistry, along with the training in numerical and analytical skills that is given in any area of science, makes biochemistry ideal for teaching throughout the school age range. There are also opportunities for more advanced teaching, usually associated with research, in universities and colleges, and medical, dental and veterinary schools.

Away from Science

A science background can be an excellent starting point for many other careers. Biochemistry is a numerate subject that develops analytical thinking, creativity in problem solving, and the ability to handle large amounts of complex information - skills required in jobs in all walks of life including, for example, sales and marketing, accountancy and finance, journalism, and patent work.

II. List major topics or curriculum of the program.

The proposed curriculum includes the General Education, Distribution and Language requirements common to all concentrations under this degree. The Biochemistry Concentration includes 16 credits of relevant Biology courses and 13 hours of relevant Chemistry courses plus a 1 credit Capstone for a total of 30 credits.

III. List the major student outcomes (or set of performance-based standards) for the proposed program.

The Student Learning Outcomes are the same as those for the other science degrees, the BA in NSM with a Concentration in Biology, the BS in Biology and the BS in Biotechnology.

Students graduating from all Programs in Biology should be able to:

1. Demonstrate knowledge and the ability to integrate form, function, and organization within and across the disciplines of biological investigation.
2. Describe basic biological principles, apply these to experimental outcomes, and examine biological phenomena through observation and logical and critical thinking.
3. Apply key concepts, practices, and materials required for hypothesis-based, scientific research in biological sciences.
4. Demonstrate the ability to locate, evaluate, and use information effectively to develop scientific ideas and concepts and prepare oral and written scientific communication. (In accordance with the *Information Literacy Competency Standards for Higher Education*. American Library Association. 2006 <http://www.ala.org/acrl/ilcomstan.html>)

5. Evaluate the ethical and social implications of biology on humans and the environment, and personally demonstrate adherence to accepted standards of professional and ethical behavior.

IV. Explain how student outcomes will be assessed (course-embedded assessment, graduate follow-up, employer survey, standardized tests, etc.).

Assessment will follow the assessment plan for other NSM degrees and will consist of course-embedded assessment questions and problems in examinations, as well as writing assignments.

V. Describe the student population to be served.

The program will meet the needs of students who are interested in the areas where chemistry and biology intersect. Currently students with an interest in Biochemistry must choose a degree in either Biology or Biotechnology. Those degrees include specific biology courses which are not necessarily relevant to the field of Biochemistry.

VI. How does the program complement the campus or department mission?

This degree complements the other science degrees of the School of Natural Science and Mathematics by using existing courses and combining them in different ways. A Biochemistry concentration will attract additional students and increase enrollment in existing courses.

VII. Describe any relationship to existing programs within the IU system.

Supports existing Biology and Biotechnology degrees by attracting additional students to the required courses, facilitating scheduling.

VIII. List and indicate the resources required to implement the proposed program. Indicate sources, e.g. reallocation or any new resources such as personnel, library holdings, equipment, etc.

The concentration requires no additional resources since all courses are already regularly offered.

IX. Describe any innovative features of the program (e.g., involvement with local or regional agencies, offices, etc., cooperative efforts with other institutions, etc.).

The concentration makes use of existing courses by combining them in new ways..

BACHELOR OF ARTS IN NATURAL SCIENCE AND MATHEMATICS DEGREE

PROGRAM INFORMATION SHEET FOR STUDENTS

General Information:

The Bachelor of Arts in Natural Science and Mathematics Degree is designed for students who are interested in the flexibility and diversity of a liberal arts degree and the opportunity to pursue more extensive study in natural science and mathematics and the opportunity to develop one or more minors. The degree has multiple concentration options including Biology, Mathematics and Biochemistry. An Interdisciplinary Concentration allows you to design a specific course of study that meets your career goal. Examples include: science and criminal justice for forensics; science and business for pharmaceutical sales; science and politics for environmental careers.

The BA in Natural Science and Mathematics may not necessarily fulfill the requirements for graduate or professional schools. Students planning post-baccalaureate study should check the requirements of the specific program in which they are interested as early as possible.

All students planning to complete the requirements for the Bachelor of Arts in Natural Science and Mathematics Degree Program should complete the following as early as possible in their academic plan.

1. Skills review and all needed developmental courses.
2. Declaration of major form.
3. Meet with an NSM advisor and complete a 4 year academic plan. *The Interdisciplinary Track requires approval of the academic plan by the student's advisor, the NSM School Curriculum Committee, and NSM School dean.*

General Requirements for Graduation:

1. Declaration of major form on file.
2. Complete Institutional Program requirements (printed in the Bulletin).
3. Complete 30 credit hours of 200 level or higher courses at IU East.
4. Complete 15 credit hours of the concentration at IU East.
5. Complete the capstone requirement at IU East (students matriculating fall 1995 or later).
6. Complete 30 credit hours at the 300-400 level.
7. Complete 120 credit hours.

GPA Requirements for Graduation:

1. Minimum overall GPA of 2.3.
2. A grade of C or better in all courses taken for the concentration (see below).
3. Minimum GPA of 2.5 in the major.

Course Requirements for Graduation:

- **General Campus Requirements:** (14-17 cr.)
 - First Year Seminar EDUC-U100 (2 cr.) – [Not required for first year students entering IU East before Summer 2009 Semester.]
 - ENG W131 (3 cr.)
 - Any 2nd college writing course (3 cr.)
 - SPCH S121 (3 cr.)
 - Mathematics (3 cr.)
 - 100 level or higher (excluding M110, M117 and T courses).
 - Computer Literacy (0-3 cr.) (See NSM computer literacy policy)

- **Distribution Requirements:** (36 cr.) Courses used for general education or the concentration cannot be used as distribution credit.

Natural Science and Mathematics (12 cr.) must include courses from at least 2 different disciplines. One course must be a laboratory science. A second math course is required of students in non-math concentrations. Biology majors should take CHEM-C108 or CHEM-C106/126 to complete prerequisites for required Cellular and Molecular courses.

Anatomy	Chemistry	Physical
Anatomy and	Geology	Geography
Physiology	Mathematics	Physics
Astronomy	Microbiology	Physiology
Biology		

Humanities and Fine Arts (12 cr.) must include courses from at least two different disciplines.

Communication	History	Philosophy
English	Journalism	Religion
Fine Arts	Music	Speech
Foreign		Theater
Language		

Behavioral and Social Sciences (12 cr.) must include courses from at least two different disciplines.

Anthropology	Folklore	Psychology
Criminal	Human	Sociology
Justice	Geography	
Economics	Political	
	Science	

- **Foreign Language** -The first two semesters of a foreign language sequence or equivalent.
- **Natural Science and Mathematics Concentrations – 30* credits**

I. **BIOLOGY CONCENTRATION** (30* cr.)

- A. One course from each area plus one additional course from two of the following areas.
Evolution & diversity (B301, L 318, Z301);
Cellular & molecular (L211/213, L314, L315, L321, M310/315);
Ecological & environmental (L325, L333, Z468).
- B. Biology electives (200 level or above) to total 30 cr. chosen from those appropriate for biology majors.
- C. L452 (0-1 cr.) Capstone in Biology

II. **MATHEMATICS CONCENTRATION** (30* cr.)

Pre Calculus and Trigonometry are prerequisites for upper level courses. Credits from these courses may be used to satisfy the Mathematics General Education Requirement, but do not contribute to the credit hours in the concentration.

- A. The Calculus sequence, Math M215-216-311 (13 cr. hrs).
- B. Applications Courses (6 cr.) These courses are chosen from among Linear Algebra, Differential Equations, and Numerical Methods.
- C. Transition (6 cr.) Math M380 (History of Math) and M393 (Bridge to Abstract Math)

- D. One Course (3 cr.) at the Math M400 level.
- E. Mathematics electives (2-3 cr.) to total 30 cr. Must be 200 level or above. This can include certain computer science courses, but excludes Math K300.
- F. Capstone in Mathematics (0 cr.)

** Must include at least 20 cr. at the 200 - 400 level. No more than 6 cr. of individualized study may be used.*

III. Biochemistry Concentration (30 cr.)

- A. Biology Courses(16 cr. hrs).
 - BIOL L211, Molecular Biology (3 cr.)
 - BIOL L213, Molecular biology Laboratory (2 cr.)
 - BIOL M310, Microbiology (3 cr.)
 - BIOL M315, Microbiology Laboratory (2 cr.)
- B. Chemistry Courses (13 cr.)
 - CHEM C341, Organic Chemistry Lecture I. (3 cr.)
 - CHEM C342, Organic Chemistry Lecture II (3cr.)
 - CHEM C343, Organic Chem. Lab I (2 cr.)
 - CHEM C344, Organic Chem. Lab II (2 cr.)
 - CHEM-C483, Biological Chemistry (3 cr.).

- C. Capstone (1 cr.)

IV. INTERDISCIPLINARY CONCENTRATION (30 cr.)

A minimum of 16 cr. in Natural Science and Mathematics courses with additional courses to create a well-defined concentration. At least 20 cr. must be at the 200 level or higher. All interdisciplinary programs must be approved by the student's advisor, the NSM division curriculum committee, and the NSM School dean. Students should meet with their advisor early and plan their entire 4 year program.

Electives - additional courses as needed to total 120 credits

INDIANA UNIVERSITY EAST
DIVISION OF NATURAL SCIENCE AND MATHEMATICS
B.A. in Natural Science and Mathematics (120 cr.)
Advising Check List

Name _____ Date _____

Advisor _____

III. Biochemistry Concentration (120 cr.)

Skills Review Test completed	Y	N	NR
Developmental Courses completed	Y	N	NR

1. General Campus Requirements: (14-17 cr.) Yr/sem Grade Credit

First Year Seminar EDUC-U100 (2 cr.)*	_____	_____	_____
English ENG-W131 (3 cr.)	_____	_____	_____
Any 2nd Writing Course (3 cr.) ENG-W132, W231 ...	_____	_____	_____
Speech SPCH-S121 (3 cr.)	_____	_____	_____
Computer Literacy** (0-3 cr.)	_____	_____	_____
Mathematics (3 cr.):100 level or higher (excluding M110, M117 and "T" courses; recommended M125 and M126)	_____	_____	_____

* Not required for first year students entering IU East before Summer 2009 semester.
** See NSM computer literacy policy

2. Distribution: (36 cr.) *Courses used for general education cannot also be used here*
Arts and Humanities** (12 cr.) *(May include foreign language.)*

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Social and Behavioral Sciences*** (12 cr.)

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Natural Science and Mathematics (12 cr.) *(Courses used for the major may not be used here.)*

MATH-K300 Statistical techniques	_____	_____	3
MATH-M215 Calculus	_____	_____	5
Introductory Biology (e.g. – L107)	_____	_____	3-5
_____	_____	_____	_____

*** Must include courses from at least two different disciplines.

3. Foreign Language -The first two semesters of a foreign language sequence or equivalent.

_____	_____	_____	_____
_____	_____	_____	_____

4. BIOCHEMISTRY Concentration (30 cr.)

A. Biology

<u>Course #</u>	<u>Course name</u>	<u>Yr/sem</u>	<u>Grade</u>	<u>Credit</u>
MICR-M310	Microbiology	_____	_____	<u>3</u>
MICR-M315	Microbiology Lab	_____	_____	<u>2</u>
BIOL-L211	Molecular Biology	_____	_____	<u>3</u>
BIOL-L213	Molecular Biology Lab	_____	_____	<u>2</u>
BIOL-L315	Cell Biology	_____	_____	<u>4</u>
BIOL-T305	Adv. Biotechnology Lab	_____	_____	<u>2</u>

B. Chemistry

<u>Course #</u>	<u>Course name</u>	<u>Yr/sem</u>	<u>Grade</u>	<u>Credit</u>
CHEM-C341	Organic Chemistry I	_____	_____	<u>3</u>
CHEM-C343	Organic Chemistry I Lab	_____	_____	<u>2</u>
CHEM-C342	Organic Chemistry II	_____	_____	<u>3</u>
CHEM-C 344	Organic Chemistry II Lab	_____	_____	<u>2</u>
CHEM-C483	Biological Chemistry	_____	_____	<u>3</u>

C. Capstone _____ 1

The above (A + B+ C) should total 30 cr. and must include at least 20 cr. at the 200 - 400 level. No more than 6 cr. of individualized study may be used.

5. General Electives to total 120 cr.

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

6. Graduation Requirements

30 cr. in 300 level courses or above.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

30 cr.(200 level or above) at IUE Y N
15 cr. in concentration at IUE Y N

Overall GPA (min. 2.3) _____
Biology GPA (min. 2.5) _____
Sci./Math GPA (min. 2.0) _____

7. Total Credits _____