

To: IPFW Senate

From: Ann Livschiz, Chair
Curriculum Review Subcommittee

Date: October 26, 2012

Re: Proposal for the Bachelor of Science in Physics, with a Concentration in
Biomedical Physics.

The Curriculum Review Subcommittee supports the proposal for the Bachelor of Science in Physics with a Concentration in Biomedical Physics, and finds that the proposal requires no Senate review.

Approving:

Ronald Duchovic

Craig Hill

Nancy Jackson

Il-Hee Kim

Myeong Hwan Kim

Joseph Khamalah (*ex officio*)

Ann Livschiz

Becky Salmon

Susan Skekloff

Lubomir Stanchev

Not Approving

Absent

Office of Academic Affairs Memorandum No. 01-1

December 19, 2001

Revised January 28, 2004

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OAA 01-1

Attachment A

TO: Deans, Division Directors and Department Chairs
FROM: Steven T. Sarratore (for the Curriculum Review Subcommittee)
Associate Vice Chancellor for Academic Programs
DATE: 6/1/2012
SUBJECT: Request for Comments

When the Curriculum Review Subcommittee receives a proposal, the Office of Academic Affairs distributes it, on behalf of the Subcommittee, to all deans and division directors and department chairs for comment.

The purpose of this memo is to solicit your comments on the proposal to Concentration in Biomedical Physics, which is enclosed.

The Subcommittee especially invites comments on (1) the rationale for the proposed program; (2) the use of IPFW resources; (3) the relationship among proposed and existing programs; and (4) other effects on IPFW and on IPFW's constituencies.

A comment sheet is enclosed.

For the Curriculum Review Subcommittee to conduct its review in a timely manner, it is essential that you reply to Steven T. Sarratore by 7/1/2012.

encs. Proposal Concentration in Biomedical Physics
Comment Sheet

Comment Sheet

Proposal: Concentration in Biomedical Physics

Name of Dean, Division Director, or Department Chair:

1. The rationale for the proposed program
2. The use of IPFW resources
3. The relationship among proposed and existing programs
4. Other effects on IPFW and on IPFW's constituencies
5. Other comment

The _____
Unit Name

- has no objections to the proposal.
- endorses the proposal.
- has minor objections to the proposal which can be dealt with through revision.
- has major objections to the proposal and recommends that the CRS postpone review.

Send comments to Steven T. Sarratore by 7/1/2012.

A&SCCD11-17A

**Proposal for a Concentration in Biomedical Physics
Indiana University - Purdue University Fort Wayne
April 6, 2012**

prepared by Mark F. Masters, Ph.D., Department of Physics

1. Name of proposed new program

Bachelor of Science in Physics with a concentration in Biomedical Physics

2. Title of degree to be conferred

Bachelor of Science

3. Field of study, department, and school involved

Biomedical Physics/Physics, Department of Physics, COAS

4. Objectives of the proposed program

There are several objectives for this concentration:

a. Physics has been demonstrated to be advantageous to students pursuing medicine as a degree. This program will be of value to students pursuing medical degrees by providing synthesizing courses that combine the knowledge from biology with the rigor and critical thinking of physics. The courses included in this concentration are the ones required for entrance to medical school.

b. Medical Physics is a rapidly growing advanced degree requiring a physics B.S. for entry. This degree would be helpful for the students choosing that career path.

c. Within physics, it is critical to provide students with more options than just simply physics as is recommended by the SPIN-UP report and our last program review. SPIN-UP was a National Science Foundation sponsored project that investigated qualities that make a successful, thriving physics department. (<http://www.aps.org/programs/education/undergrad/faculty/spinup/upload/SPIN-UP-Report.pdf>) In this project, it was found that having one or more concentrations is extremely beneficial to the physics program, helping to attract more majors.

d. The biomedical physics concentration is designed to be multidisciplinary. Multidisciplinary research is becoming more important in scientific fields. Multidisciplinary experiences are going to become more common and important for students and will provide students with an advantage.

5. Proposed date of initiation of the new program

Fall 2012 or as soon as possible.

6. A statement describing the relationship of the proposed program to the mission and scope of the campus

Department Mission: The relevant part of the Department of Physics Mission Statement is “producing well prepared graduates who are confident in their abilities and understanding of physics,” and “Physics Majors will gain a strong working knowledge of basic science and physics.”

The proposed concentration is clearly within this mission. Biophysics and medical physics are important fields within physics and the department believes that the students would benefit from a concentration that provides more specialization than the straight physics degree.

College Mission: "...the college provides students with a breadth of knowledge about the global environment and fosters an appreciation and respect for diversity. The College of Arts and Sciences equips students to think critically, communicate effectively, and develop creative solutions to future challenges."

This proposed concentration is directly related to the college mission statement, in particular, the breadth of knowledge and creative solutions to future challenges. It does so by providing a unique concentration that is of growing importance.

IPFW Mission: "We offer a broad range of high-quality undergraduate, graduate, and continuing education programs that meet regional needs ..."

The new medical school, the size of the health care industry in this region, the state's press for life sciences makes this concentration desirable. It broadens offerings within physics and provides students with more opportunities.

7. A statement describing the relationship of the proposed program to already existing programs at the campus.

There are no Biophysics or medical physics degrees at IPFW. There are departments of Physics and Biology. The proposed concentration, will offer students who are interested in biology and/or medicine with a wide range of opportunities while still concentrating heavily on physics to provide the analysis and technical skills.

8. A statement describing the relationship of this program to similar programs in other regional and Indiana post-secondary educational institutions.

The only other concentration in biophysics within Indiana (there are no degrees in biophysics) is at IUPUI. The program we outline here is very similar. However, IUPUI and IPFW serve different regions.

9. A statement describing cooperative endeavors explored and/or intended with other institutions particularly those located in the same geographic region.

There are no other institutions in our region (North East Indiana) and there is no one else with a biophysics program. IUPUI does offer a biophysics concentration which is similar in course distribution to this one. The biomedical physics program is a little unusual. Northeastern University in Boston has a biomedical physics program. However, there are certain philosophical underpinnings of physics which seem oddly absent from their program. Furthermore, it is a five year program (135 Credits too) which would be difficult for IPFW. The College of New Jersey has a biomedical physics track (as we propose) and closer to home, Wayne State has a B.S. In Biomedical Physics. The proposed program shares a great deal of overlap with these last two programs.

10. A statement indicating need for the concentration in terms of manpower supply and demand.

This concentration is intended to provide students with a different perspective to the life sciences and medical fields. Looking at Indiana long term occupational predictions there is predicted demand for science occupations exceeding annual replacement (in 2018) in general and in specific, we see greater demand for biophysicists, physical scientists, and medical scientists than are being produced in the state. This concentration can help meet the demand for these types of careers. (Based on data from <http://www.hoosierdata.in.gov>)

11. A statement describing resources over and above present levels required to initiate the program

With some creative scheduling and the design of courses such as mechanics so that sometimes it has a focus on biomechanics and at other times a straight mechanics approach, we can use courses for multiple concentrations. No additional resources are required to initiate the program. However, this may impact our ability to offer more physics electives or some general education courses.

A statement about library resources is attached. Librarian Florence Mugambi states that as the concentration grows, it may be necessary to improve the library's holdings. However, the library holdings already include some of the highest impact journals.

12. Proposed Curriculum

The proposed curriculum is similar to the current physics degree. However, some physics courses have been removed and courses from biology and chemistry are added.

Please see attached draft Bingo sheet for details.

Meeting IPFW General education requirements: 24 credit hours (some of the General Education Requirements are met by courses listed below such as MA 16500 meeting the Area I math requirements).

COAS Requirements: 11 credit hours.

Core Physics courses: 33 credit hours

PHYS 15200 – Mechanics 5 ch
 PHYS 25100 – Heat, Electricity and Optics 5 ch
 PHYS 31000 – Intermediate Mechanics 4 ch
 PHYS 32200 – Optics. 3 ch
 PHYS 34500 – Intermediate Laboratory 1 ch
 PHYS 31200 – Intermediate Electricity and Magnetism 3 ch
 PHYS 34200 – Modern Physics 3 ch
 PHYS 34300 – Modern Physics Laboratory 1 ch
 PHYS 51500 – Statistical Mechanics 3 ch
 PHYS 55000 – Quantum Mechanics 3 ch
 PHYS 57000 – Seminar – Biomedical Applications

Core Biology Courses: 12 credit hours

BIOL 11700 Ecology and Evolution 4 ch
 BIOL 11900 Functional Biology 4 ch
 BIOL 21800 Genetics 4 ch

Core Chemistry Courses: 18 credit hours

CHM 11500 General Chemistry 4 ch
 CHM 11600 General Chemistry II 4 ch
 CHM 26100 Organic Chemistry 3 ch
 CHM 26500 Organic Chemistry Laboratory 2 ch
 CHM 26200 Organic Chemistry II 3 ch
 CHM 26600 Organic Chemistry Laboratory II 2 ch

Core Math Courses: 18 credit hours

MA 16500 Calculus I 4 ch
 MA 16600 Calculus II 4 ch
 MA 26100 Calculus III 4 ch
 MA 35100 Linear Algebra 3 ch
 MA 36300 Differential Equations 3 ch

Total required courses 117 credit hours.

7 hours of electives from Biology, Chemistry, Radiography and Physics.

I have been in discussion about this concentration with Dr. Fen-Lei Chang, Dean and Director of Medical Education; Dr. Ann Obergfell, Dean of Health Sciences; Dr. Elliot Blumenthal, Advisor for Pre-Med; Dr. Frank Paladino, Chair of Biology; and Dr. Ronald Friedman, Chair of Chemistry. Some suggestions, such as the addition of a seminar from Dr. Chang have been integrated (he graciously has offered to help arrange such a seminar) into the program. Others, have been left to be fulfilled through the electives.

It is important to understand that in the physics department we require strong advising. The students map their progress with guidance every semester. Electives are not chosen lightly but with a particular goal for student learning in mind.

This program is designed to serve several purposes. One is pre-med. Another is medical physics. A third might be graduate school. It is not necessary that two students following different tracks will take exactly the same program. In fact, it would be silly if they did. Courses like Bio 527 Comparative Biomechanics would be valuable to the students and they would be encouraged to take such a class. Courses like Ethics can be fit within the general education framework and again, advising encourages students to take the course.

There are definite limits to the number of credit hours in this program. Furthermore, the philosophical underpinnings of physics are integrated within, and distributed across a series of courses, making it difficult to remove any more physics courses without the program becoming too physics "lite" to qualify as being a physics program. Finally, to be successful for entry into a medical physics graduate program, the students need to have a solid physics background afforded by these core physics courses.

**Walter E. Helmke Library
Indiana University-Purdue University Fort Wayne**

Resources in Support of Proposed Concentration in Biomedical Physics

January 10, 2012

This review provides an overview of the Helmke Library resources available to students and faculty in the proposed Biomedical Physics concentration.

The combined physical and electronic collection at the Helmke Library that covers the subject area of Biomedical Physics is satisfactory. However as the concentration grows, it will be essential to increase and strengthen the collection in order to build an excellent core collection that adequately supports the concentration. To augment resources available to IPFW students, staff and faculty, the library uses the Document Delivery Service to borrow materials from other libraries and institutions as well.

I. Monographic Materials (print and electronic)

Biophysics, Biomedical Physics, Medical Physics	75
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In addition general Physics has about 1900 titles in Helmke library IUCAT holdings, Biology has about 1600 titles and Chemistry has about 1900 titles.

II. Journals and Databases

Helmke Library offers a strong selection of databases and indexes providing access to full text journals, including the major databases of *Web of Science*, *Physical Review Online Archive (PROLA)*, *MathSciNet*, *SciFinder Scholar*, *Academic Search Premier*, *Conference Papers* and the *Wiley Online Library*. Additional broader subject coverage needed to support the needs of faculty and students is provided through other databases in Chemistry and Biology as applicable.

Helmke Library's collection includes many of the prominent journals in these specialty areas. Based on Microsoft Academic Search and Journal Citation Reports (JCR) 2010 Science edition rankings these include:

Quarterly Reviews of Biophysics [electronic resource]
Biophysical Journal [electronic resource]
European Biophysics Journal with Biophysics Letters [electronic resource]
Annual Review of Biophysics and Biomolecular Structure [electronic resource]

III. Professional Support

The subject liaison librarian, Florence Mugambi, will continue to provide expert research advice and assistance to students and faculty. The liaison librarian can provide support through involvement in Blackboard-supported classes, individual research consultations, in-class instructional sessions on selecting and searching databases, or tailored course guides to guide students through particular research assignments. Librarians can also assist in doing cited

reference searches and help students and faculty take advantage of current awareness services offered by library databases or journals. However, in the future, it may be necessary to support library efforts to recruit a librarian with a strong science background.

124 CREDITS TOTAL

BIOL 21800 Genetics	4	
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IPFW GENERAL EDUCATION REQUIREMENTS

I. LING & NUM FOUNDATIONS

ENG W131	3	(C- or above)
COM 11400	3	(C- or above)
MA 16500	X	(C- or above)

II. NAT & PHYS SCIENCES (Max. of one in Major Discipline)

BIOL 11700	X	
CHM 11500	X	

III. THE IND CULT & SOC (Not in Major Discipline)

	3	
	3	

IV. HUMANISTIC THOUGHT (Not in Major Discipline)

	3	
	3	

V. CREATIVE & ARTISTIC EXPRESS (Not in Major Discipline)

	3	
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VI. INQUIRY & ANALYSIS (Not in Major Discipline)

	3	
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COAS REQUIREMENTS

WRITING

ENG W140 or W233	3	(C- or above)
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FOREIGN LANGUAGE (8)

	4	
	4	

MATH/STAT/CS (18)

MA 165	4	(C- or above)
MA 166	4	(C- or above)
MA 261	4	
MA 351	3	
MA 363	3	

BIOLOGY (12)

BIOL 11700 Ecology and Evolution	4	
BIOL 11900 Functional Bio	4	

Sample Four Year Plan for a Bachelor of Science in Physics with Biomedical Concentration

Freshman Fall

MA 16500 – Calculus I (4)
 PHYS 17000 – Freshman Seminar (1 – not req)
 COM 11400 – Communication (3)
 CHM 11500 – General Chemistry I (4)
 BIOL 11700 – Principles of Ecology and Evolution (4)

Total Credit Hours (16)[16]

Sophomore Fall

MA 26100 – Multivariate Calculus (4)
 PHYS 25100 – Heat, Electricity and Optics (5)
 BIOL 11900 – Principles of Structure and Function (4)
 CHM 26100+26500 – Organic Chemistry I (5)

Total Credit Hours (18)[50]

Junior Fall

MA 36300 – Differential Equations (3)
 General Education Area III (3)
 General Education Area V (3)
 Elective(3)
 COAS Req. ENG W140 (3)

Total Credit Hours (15)[80]

Senior Fall

COAS Req. Foreign Language (4)
 PHYS 55000 – Introduction to Quantum Mechanics (3)
 General Education Area IV (3)
 Elective (3)
 Elective (3)

Total Credit Hours (16)[112]

Freshman Spring

MA 16600 – Calculus II (4)
 PHYS 15200 – Mechanics (5)
 CHM 11600- General Chemistry II (4)
 ENG W131 – Elementary Composition (3)

Total Credit Hours (16) [32]

Sophomore Spring

MA 35100 – Linear Algebra (3)
 PHYS 34200 – Modern Physics (3)
 PHYS 34300 – Modern Physics Lab (1)
 PHYS 312 – Electricity and Magnetism I (3)
 CHM 26200+26600 – Organic Chemistry II (5)

Total Credit Hours (15)[65]

Junior Spring

PHYS 51500 – Statistical Mechanics (3)
 PHYS 32200 – Optics (3)
 PHYS 34500 – Optics Lab (1)
 BIOL 21800 – Genetics (3)
 General Education III (3)
 General Education IV (3)

Total Credit Hours (16)[96]

Senior Spring

PHYS 310 – Inter. Mech. (4)
 General Education VI (3)
 PHYS 37000 – Biomedical Seminar (2)
 COAS Req. Foreign Language (4)

Total Credit Hours (13)[125]