

DRAFT

Degree- Bachelor of Science in Biology with an Emphasis in Medical Imaging

Implementation- Fall, 2003

Justification

Medical imaging and diagnosis are crucial components of health care in any modern hospital facility. Highly educated and well-trained problem-solvers are required to aid in research, help develop new methodologies, and use and maintain existing high technology clinical equipment. There is a documented need for such trained professionals locally, and pressure from the local community to provide courses with a medical orientation.

The Emphasis in Medical Imaging prepares students for graduate or professional study in the medical sciences (medical imaging, medical physics, health physics, dosimetry, nuclear medicine, radiotherapy, oncology, biomedical engineering), or for immediate entry into professional positions in the clinical environment and in medical imaging R & D.

This unique combination of courses in biology and medical imaging allows students automatic entry to a Masters program in Medical Physics, which is required for board certification, or entry to medical school or graduate programs in the health sciences.

COMMON LOWER DIVISION

REQUIREMENTS (36 units):

(12 units of the following will be counted toward lower division
GE credits, 4 units in each of three different science disciplines)

1. Biology
 - BIOL 200 Principles of Organismal and Population Biology...4
 - BIOL 201* Principles of Cell and Molecular Biology.....4
 - BIOL 210 Human Anatomy and Physiology I4
 - BIOL 211 Human Anatomy and Physiology II.....4
2. Mathematics
 - MATH 150*Calculus I.....4
3. Chemistry
 - CHEM 121* General Chemistry I4
 - CHEM 122 General Chemistry II4
4. Physics
 - PHYS 200* General Physics I.....4
 - PHYS 201* General Physics II.....4

For Biology Students in Medical Imaging Emphasis:

UPPER DIVISION REQUIREMENTS (41-42 units):

1. Organic Chemistry and Biochemistry
 - CHEM 311 Organic Chemistry I3
 - CHEM 312 Organic Chemistry I Laboratory.....1
 - CHEM 318 Biological Chemistry.....3
2. Biology
 - BIOL 300 Cell Physiology.....4
 - BIOL 301 Microbiology4
 - BIOL 346* Scientific and Professional Ethics3
 - BIOL 400 Molecular Biology and Molecular Genetics4
3. Medical Imaging
 - PHYS/BIOL 416 Radiobiology and Radionuclides.....3
 - PHYS/BIOL*434 Introduction to Biomedical Imaging.....3
 - PHYS/BIOL 464 Biomedical Instrumentation.....4
4. Computing in Medical Imaging
 - BIOL 410 Computer Applications in Biomedical Fields3
 - BIOL 430* Research Design and Data Analysis.....3
5. Service Learning

A minimum of 2 units taken from the following:

BIOL/PHYS 493 Medical Imaging Internship 2-3

BIOL/PHYS 494 Independent Research2

BIOL/PHYS 497 Directed Study2

6. Capstone

BIOL/PHYS 499 Senior Capstone Colloquium 1

(Courses with * are double-counted toward LD/UD GE credits.)

ELECTIVES IN BIOLOGY AND PHYSICS (9-10 UNITS):

9-10 units chosen from upper division courses in Biology or Physics (such as PHYS/BIOL 315

Introduction to Biophysics, BIOL 332 Cancer and Society, PHYS 352 Digital Image Processing)

REQUIRED SUPPORTING AND OTHER GE COURSES (33 units):

ENGL 330 Writing in the Disciplines3

Title V Courses6

Other GE Courses in Categories A-E.....24

COURSE DESCRIPTIONS:

PHYS/BIOL 416 Radiobiology and Radionuclides (3)

Prerequisites: PHYS 201; BIOL 300

Nature and effects of ionizing radiation on biomolecular structures and living cells. Applied radiobiology and radionuclides. Genetic effects of ionizing radiation and methods of protection. Dosimetry.

PHYS/BIOL/COMP/HLTH 434. INTRODUCTION TO BIOMEDICAL IMAGING (3)

Two hours of lecture and two hours of lab activity per week, including two field trips per course.

Prerequisite: BIOL 210 or a non-calculus lower-division Physics course.

The course will present an overview of biomedical images and imaging systems. The fundamental concepts used in several imaging modalities (such as projection radiography, mammography, DEXA, computed tomography, ultrasonography and magnetic resonance imaging) will be examined: the emphasis will be on an intuitive and descriptive presentation of the main components of these systems. Image formation and reconstruction will be addressed. The resulting clinical images will be correlated with the underlying structure and function of the organs, and the diagnostic utility and limitations of the images will be considered.

Same as BIOL 434, COMP 434, HLTH 434.

GenEd-ID: B1, E

PHYS/BIOL 464 Biomedical Instrumentation (4)

Three hours of lecture and two hours of lab activity per week, including two field trips per course.

Prerequisite : BIOL/PHYS 434

The detection, acquisition, processing and display of diagnostic clinical images. The course will concentrate on the fundamentals of the design of the instruments and the use of appropriate reconstruction algorithms in (computed) radiography, (digital) fluoroscopy, computed tomography, ultrasound, magnetic resonance imaging and radionuclide imaging. The mathematics will be kept to a minimum. Activities will include image reconstruction examples, investigation of recent innovations, and two trips to local Radiology departments.

g. If any formal options, concentrations, or special emphases are planned under the proposed major, explain fully.

Students enrolled in the Medical Imaging Emphasis will be required to take BIOL 210 Human Anatomy and Physiology I and BIOL 211 Human Anatomy and Physiology II at the lower division, and not BIOL 202 Biostatistics.

They will need to take more upper-division courses and therefore less elective courses than in General Biology, to ensure their gaining sufficient knowledge and skills in the field of medical imaging. Specifically, they would be required to take BIOL 301 Microbiology instead of BIOL 302 Genetics and Evolution, specialized courses in Medical Imaging (PHYS/BIOL 416 Radiobiology and Radionuclides, PHYS/BIOL 434 Introduction to Biomedical Imaging and PHYS/BIOL 464 Biomedical Instrumentation), and both BIOL 410 Computer Applications in Biomedical Fields and BIOL 430 Research Design and Data Analysis.

On top of these essential knowledge and skill courses, students can choose their electives from any of the upper-division Biology or Physics courses.

(Summary of Total Units for Graduation with BS Degree in Biology

Common Lower Division Requirements

- a. General Biology and Pre-Professionals.....31
- b. Cell and Molecular Biology Emphasis.....31
- c. Medical Imaging Emphasis.....36

Upper Division Requirements

- a. General Biology and Pre-Professionals.....33
- b. Cell and Molecular Biology Emphasis.....41-42
- c. Medical Imaging Emphasis.....41-42

Electives in Biology

- a. General Biology and Pre-Professionals.....17
- b. Cell and Molecular Biology Emphasis.....11-12

Electives in Any Discipline

- a. General Biology and Pre-Professionals.....6
- b. Cell and Molecular Biology Emphasis.....3

Electives in Biology and/or Physics

- c. Medical Imaging.....9-10

Required Supporting and GE Courses.....33

Including ENGL 330.....3

American Institutions Requirement Courses.....6

Other GE Courses.....24

(Some courses are double-counted in majors and categories of GE which makes the total GE plus American Institutions Requirement course units to 54)

Total units.....120)