

DEPARTMENT OF INTEGRATIVE PHYSIOLOGY

SCIENCE EDUCATION INITIATIVE PROPOSAL

This proposal, the submission of which was unanimously endorsed by our faculty, provides a rationale for selecting the Department of Integrative Physiology as one of the participating departments in the Science Education Initiative.

Some History

The Department of Integrative Physiology (IPHY) was formed in 2003 when nine faculty in the former Department of Environmental, Population and Organismic Biology elected to transfer to the former Department of Kinesiology and Applied Physiology. The result was a new department with a mission that is described as: “Physiology is the field of biology that deals with function in living organisms. The Department of Integrative Physiology engages in and promotes the study of how genes, cells, tissues, and organisms function.” With this focus, it is the intent of the faculty to develop the premier pre-health major on the Boulder campus.

One of the first challenges for IPHY was to develop a curriculum for the new major. We decided on a two-phase approach. First, we agreed to combine some of the courses taught by the two sets of faculty into a within-department curriculum that comprised several *required courses* and a group of six *core courses* from which the students must complete at least three. We are now in our sixth semester of offering these undergraduate courses:

Required Courses

- Introduction to Integrative Physiology (IPHY 1010)
- Introduction to Statistics (IPHY 2800)
- Anatomy: Human (IPHY 3410) or Comparative Vertebrate (IPHY 3460)
- Physiology: Human (IPHY 3430) or Comparative (IPHY 3450)

Core Courses

- Cell Physiology (IPHY 3060)
- Immunology (IPHY 3600)
- Endocrinology (IPHY 4440)
- Biomechanics (IPHY 4540)
- Exercise Physiology (IPHY 4650)
- Neurophysiology (IPHY 4720)

The second phase, which we have just begun, is to evaluate the syllabi of these courses and prescribe the content that will be taught in each course. Our Curriculum Committee has been charged with this task. Because these are core courses, our expectation is that the content for each course will remain relatively fixed. This is particularly important for our required courses when multiple sections are taught.

In our lower-division courses, far too many of our students view their science education only as a means of obtaining grades and, ultimately, a degree. Too many of our students do not appreciate undergraduate science education as an opportunity to develop (a) knowledge that will serve them well in their future education and careers, and (b) thinking skills that are essential for success in

school and the working world. We deeply desire to change this aspect of the culture of science education in our Department, and our impression is that participation in the Science Education Initiative will enable us to do so.

Despite our presenting fundamental physiological knowledge in our lower-division courses, far too many of our students reach the upper division either without having retained the knowledge or having slipped backwards to naïve notions about key concepts in physiology. We recognize that this problem stems, in large part, from how we are teaching the lower-division courses. We appreciate that the Science Education Initiative will help us develop teaching methods that promote a deeper understanding of concepts in physiology, so that students retain knowledge, or least so that they are able to reconstruct the knowledge accurately when they need it.

Too many of our upper-division students who successfully retain fundamental knowledge from their lower-division courses fall short of our goals for applying that knowledge successfully in situations that require critical thinking, problem solving, and communication. We suspect that this problem stems from how we are teaching and testing students in the lower courses. We recognize that the objectives of the Science Education Initiative include promoting these advanced thinking skills in science.

Faculty Interest

In the recent survey of the climate in campus departments, IPHY was ranked third. In a briefing session with the organizers of the survey, they emphasized that one of the attributes of the more successful departments is the existence of a common goal shared by the faculty. In our Department, one of our common goals is to achieve excellence in undergraduate education. This goal was reaffirmed at our last Faculty Meeting (11/30/05) when, after a discussion of the extra work that would be involved by participating in the Initiative, the faculty unanimously recommended that the Department submit a proposal to participate in the Science Education Initiative.

At the Faculty Meeting, we also agreed on the following:

- Faculty will have a reduced teaching load in the semester that a course begins its evaluation and development.
- The involved faculty member will earn credit for curriculum development in the annual performance evaluation for the first semester that a course begins its evaluation and development.
- Faculty who subsequently teach a course once it has been through the process will be expected to reuse the developed teaching materials and methods. The Teaching Committee will monitor adherence to this policy.

We also expect that once a course has been developed, the instructor will experience an improvement in student evaluations that will have a positive impact on the individual's annual evaluation of teaching.

Proposed Plan

We propose that the courses to be evaluated and developed range from our introductory course through to the upper-division core courses:

<u>Course</u>	<u>Semester Taught</u>	<u>Number of Students</u>
Introduction to Integrative Physiology (1010)	Fall and Spring	400/semester
Statistics (2800)	Fall and Spring	150/semester
Human Anatomy (3410)	Fall	2 sections of 200 each
Human Physiology (3430)	Spring	2 sections of 200 each
Nutrition (3420)	Fall and Spring	2 sections of 250 each
Cell Physiology (3600)	Spring	150
Endocrinology (4440)	Fall	100
Biomechanics (4540)	Fall and Spring	100/semester
Exercise Physiology (4650)	Fall and Spring	100/semester
Neurophysiology (4720)	Fall and Spring	100/semester

The plan is not to include the low-enrollment courses (~30 students each) Comparative Vertebrate Anatomy (3460) and Comparative Physiology (3450) among the evaluated courses because the Science Education Initiative appears to be aimed at courses that enroll 100-400 students each. Rather, we expect that instructors of the low-enrollment courses will adopt appropriate strategies gleaned from lessons learned from the high-enrollment courses.

We suggest that the evaluation and development begin with four required courses and then examine the core courses:

- Year 1 Introduction to Integrative Physiology (Fall), Statistics (Spring)
- Year 2 Human Anatomy (Fall), Human Physiology (Spring)
- Year 3 Core courses (Cell Physiology through to Neurophysiology)
- Year 4 Elective course (Nutrition)

We recognize, of course, that the development and maintenance of each course will extend well beyond the initial semester in which the evaluation begins.

The Department comprises 32 faculty and 28 of them teach at least one undergraduate course. Inclusion of these 10 courses in the Initiative would involve 18 of the faculty and would, therefore, have a significant influence on the other courses that are taught in the Department (elective courses and graduate courses). This is a critical need as our courses expand to accommodate the increase in the size of our undergraduate population from ~500 majors in Fall, 2002 to 1220 in Fall, 2005.

One of the concerns expressed by faculty is the variety of academic backgrounds with which students enter our curriculum. We expect that participation in the Initiative will help us quantify these differences and adjust our teaching strategies to accommodate this diversity. This concern is particularly evident in three courses (1010, 3410, 3430) that include many students who are not majors in IPHY. For example, human anatomy (IPHY 3410) is also taken by many students who are preparing for a career in health-related professions, but are doing so by selecting other majors. Similarly, IPHY 3420 (Nutrition for Health and Performance) is a popular service course that teaches mostly non-majors important details about lifestyle and health. Furthermore, a key to the success of our undergraduate major is that students retain knowledge acquired in lower division courses through to participation in upper division courses. Consequently, another benefit for our curriculum would be that our core courses can begin from the learning goals that are established for the lower division courses.

The Department of Integrative Physiology is enthusiastic about participating in the Science Education Initiative, even though it will require a considerable amount of work by most of the faculty. Because of our commitment to undergraduate education and our desire to develop a nationally recognized curriculum, we welcome the opportunity to be involved in this endeavor.

December 8, 2005