In 2006, faculty in Integrative Physiology (IPHY) unanimously agreed to participate in the Science Education Initiative (SEI) program.

### The original charge of the IPHY SEI program was three-fold:

1. To change the culture of science education in IPHY.
2. To help develop teaching methods that promote a deeper understanding of concepts in physiology so that students retain knowledge.
3. To promote critical thinking, problem solving, and communication skills in science.

Over the past five years, the Department and the Science Teaching Fellows (STFs) have been successfully reforming the IPHY curriculum to achieve these goals. In 2010, the SEI program in IPHY was recognized as a national model of successful course reform (Chan 2010).

In order to measure what students are actually learning, the STFs have systematically gathered data on students’ problem-solving skills, conceptual understanding, attitudes, and skills in the areas where faculty members have identified learning goals. By determining what students are actually learning, faculty are able to identify student misconceptions, to determine the impact of a new learning tool, or to appreciate the level of understanding students have at the beginning and end of the course.

### STFs have measured student learning in 6 IPHY courses using the following methods:

- In-depth interviews to reveal student understanding
- Analyzing exam results (particularly open-ended questions)
- Using validated assessment instruments at the beginning and end of the course
- Observing problem-solving in the particular course of interest
- Reviewing of suitable research literature
- Surveying current students and alumni

### Improve student learning

The IPHY SEI program has also assisted faculty in developing strategies that improve student learning and ensure that students reach the predetermined learning goals of the course.

While working with the STFs, IPHY faculty have:

- Added clickers (n=14 faculty members)
- Developed homework assignments (n=11)
- Assigned pre-class preparation assignments (n=5)
- Modified recitation/lab instruction (n=6)
- Added homework help sessions, class projects (n=4)

One tenure track faculty member, Pei-San Tsai, has introduced a new approach to clickers, called “thought questions,” which require students to defend their rationale to higher-level, open-ended questions. This new approach has been adopted by several IPHY faculty.

Based on the success of these pedagogical techniques, the majority of IPHY faculty plan to repeat the use of these instructional changes in the future or have already reused these changes (SEI Central Annual Report, 2010).

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**Faculty Workshops & Student Interviews**

### Changes in the culture of science education in IPHY

In an effort to change the culture of science education in IPHY, faculty workshop groups were developed for the required 100-level courses. These workshop groups are led by educational psychologists and are a mechanism by which faculty who teach similar courses can meet to decide on learning goals and assessments, and have a community to discuss the happenings of their course. The 24 teaching faculty members have had significant involvement with the SEI program through faculty workshop groups.

- **Statistics:** Ken Wright, Matt McQueen, Steve Hobbs, Marissa Ehringer, Monique Lebourgeois, and Bill Byrnes
- **Human Anatomy:** Chris Lowry, Ruth Heisler, and Leif Saul
- **Human Physiology I:** Steve Hobbs, Janet Casagrand, Bill Byrnes, Adam Hayes, and Ken Wright
- **Human Physiology II:** Bill Byrnes, Cindy Carey, and Heidi Bustomante
- **Human Physiology Labs:** Heidi Bustomante, Janet Casagrand, and Robert Hermanson
- **Neurophysiology:** Roger Enoka and Janet Casagrand
- **Cell Physiology:** Dave Allen and Franenny Bentley
- **Endocrinology:** Pei-San Tsai and David Norris
- **Immunology:** Monica Fleshner and Teresa Foely

The large percentage of faculty participation and acceptance of our SEI program has contributed significantly to our success. Outside of formal working groups, 87% of IPHY faculty report that the number of discussions around education and teaching have increased since the involvement with the SEI (SEI Central Annual Report, 2010).

To promote culture change among teaching assistants, all incoming IPHY graduate students are required to attend a two-day training session led by the STFs. The training session integrates active learning techniques with learning philosophies promoted by the SEI. Since 2009, 33 IPHY teaching assistants have been trained in active education. To ensure sustainability, an IPHY faculty member, Ruth Heisler, is involved in the development and implementation of these training sessions.

### Publications and presentations by the IPHY STFs

**Publications and manuscripts**


- **Posters**

### Background

**Publications & presentations by the IPHY STFs and faculty**

- **Faculty Working Groups**
  - Neurophysiology:
    - Ken Wright, Matt McQueen, Steve Hobbs, Marissa Ehringer, Monique Lebourgeois, and Bill Byrnes
  - Human Physiology:
    - Chris Lowry, Ruth Heisler, and Leif Saul
  - Human Physiology I:
    - Steve Hobbs, Janet Casagrand, Bill Byrnes, Adam Hayes, and Ken Wright
  - Human Physiology II:
    - Bill Byrnes, Cindy Carey, and Heidi Bustomante
  - Human Physiology Labs:
    - Heidi Bustomante, Janet Casagrand, and Robert Hermanson
  - Neurophysiology:
    - Roger Enoka and Janet Casagrand
  - Cell Physiology:
    - Dave Allen and Franenny Bentley
  - Endocrinology:
    - Pei-San Tsai and David Norris
  - Immunology:
    - Monica Fleshner and Teresa Foely

The IPHY learning goals can be found online at: www.colorado.edu/departments/integrative-physiology-learning.html

In 2010, the preliminary results of a survey developed by the STFs and completed by 325 IPHY students suggest that IPHY students find value in course-specific learning goals. More specifically, students most commonly use learning goals to help focus on the most important material for studying, to organize their notes, and as a tool to test their knowledge. Results from this survey will be used to develop an “instruction manual” that will help faculty understand how students perceive and use learning goals.

In order to measure what students are actually learning, the STFs have systematically gathered data on students’ problem-solving skills, conceptual understanding, attitudes, and skills in the areas where faculty members have identified learning goals. By determining what students are actually learning, faculty are able to identify student misconceptions, to determine the impact of a new learning tool, or to appreciate the level of understanding students have at the beginning and end of the course.

The SEI has provided me the knowledge and motivation to improve my teaching—much more than any other program offered by the university. Research faculty receive very little formal training in pedagogy when they are developing their mentor roles and that is very supportive of the SEI and would like to see it continue. —IPHY faculty member