Conference on Introductory Physics for the Life Sciences (IPLS)

Robert C. Hilborn
AAPT

AAPT Summer Meeting
July 28, 2014

Support from
National Science Foundation
American Association of Physics Teachers

Conference Planning Group

Eric Brewe – Florida International U.
Juan Burciaga – Mt. Holyoke College
Catherine Crouch – Swarthmore
Paul Gueye – Hampton University
Bob Hilborn – AAPT – Chair
Dawn Meredith – U. of New Hampshire
Tom O'Kuma – Lee College
Wendell Potter – U. of California - Davis
Mark Reeves – George Washington U.
Patricia Soto – Creighton University

Stephanie Chasteen – U. of Colorado-Boulder – External Evaluator

Outline

I. Motivations for the conference

II. Key components of the conference

III. Tentative recommendations from the conference

IV. Further information

Why have a conference on IPLS?

- Changes in undergraduate biology education
  - Bio2010
  - *Vision and Change in Undergraduate Biology Education*
  - Revised Medical College Admission Test – MCAT^{2015}
- Increasing overlap between physics and biology
- Changes in physics education
  - IPLS last reviewed in 1975 and then only cursorily
  - physics education research
- External demands for accountability – learning goals and objectives and their measurement

The Conference

- March 14-16, 2014

- Arlington, VA
- About 170 participants (about 10% biologists)
- Four-year and Two-Year College Faculty

- Keynote speaker: Susan Singer, Director, Division of Undergraduate Education, NSF

The Conference Program

www.compadre.org/ipls/

Schedule

Presenters' slides

Participants' Syllabi (searchable)

Links to other resources

Participants' posters

Plenaries

Case Studies

Working Group Sessions

Plenaries

- Energy changes at the molecular level
- The new MCAT
- Teaching physics to biology students in biology courses (by a biologist)
- Nexus/Physics
- IPLS Labs
- Case Studies of IPLS Courses

More Plenaries

- Course Transformation and Learning Goals
- Views from biology
- Mathematics and IPLS courses
- Course Transformation Revisited – Carl Wieman

Case Studies

- U. of New Hampshire
- U. of Maryland – College Park
- University of Michigan
- Rockhurst University

Working Group Sessions

- Course Transformation and Learning Goals – deciding on what I want students to be able to do at the end of the course
- Strategies and Resources for IPLS Course Transformation
- Take-home Ideas from the Plenaries
- Formulating Recommendations for the Physics Community about IPLS Courses

Observations

- Many flavors of IPLS courses and their audiences – local situations matter
- No “canon” for IPLS courses
- Everyone agreed that a watered-down physics for engineers and majors course was not useful for life science students
- Biology students want to learn those aspects of physics that help them understand living systems

More Observations

- As we change content in IPLS courses, we should not forget about interactive engagement pedagoy
- Susan Singer: reformed (interactive engagement) IPLS courses can serve as excellent models for future biology teachers

Preliminary Guidelines and Recommendations

- Take biologists to lunch
- Topic areas for IPLS courses to include
  - Transport processes
    - Diffusion
    - Osmosis
    - Thermal
  - Electrical currents across cell membranes
  - Fluids
  - Feedback and control

More recommendations

- Other crucial topics
  - Waves – sound and light
  - Nuclear radioactivity
  - Thermal physics from a statistical point of view with a focus on molecular processes
  - Some human body physics (talk to your local physiologist)

More recommendations

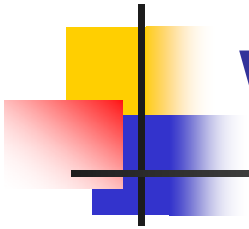
- Need for complete sets of IPLS course materials
- Resources for training faculty and TAs who will be teaching IPLS for the first time
- Modules and webinars on IPLS topics
- Open access publication (like CBE Life Sciences Education) for IPLS papers

More recommendations

- Centralized and curated resources for IPLS labs (including learning objectives and assessment tools)
- Encourage colleges and universities to provide internal funding for IPLS course reforms
- Online information about what works and what doesn’t for IPLS courses

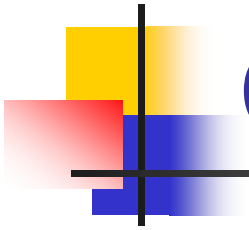
Unanswered Questions

- Can the physics community agree on a common core of topics for IPLS?
- Will upper-level life science courses build on what is learned in an IPLS course?
- What are the possibilities for integrated introductory science courses (e.g. chemistry and physics) for life science students?



What remains to be done?

- Conference Report
- Resources – comPadre and elsewhere
  - Biologically authentic examples
  - Homework problems tailored to IPLS
  - IPLS Conceptual Inventories?
  - Nationally normed exams?
- www.comPadre.org/IPLS/



Questions and Comments