Incubators: Building community networks and developing open educational resources to integrate bioinformatics into life sciences education

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NIBLSE Bioinformatics in Life Sciences Education

Network to Integrate Bioinformatics into Life Sciences Education

- NSF RCN-UBE to promote bioinformatics education in undergraduate life science education (more at **niblse.org**)
- Published bioinformatics core competencies recommended for undergraduate biologists
- Collecting learning resources and support materials to promote bioinformatics integration into biology education

Why improve learning resources?

To efficiently and effectively **integrate bioinformatics instruction into undergraduate life science curricula**, educators would benefit from open access, high-quality learning resources (LRs) for use in existing biology classes.

Many collections of bioinformatics learning resources are of limited value due to:

- Outdated or inferior materials
- Insufficient supporting documentation
- Uneven coverage of bioinformatics core competencies

How to improve learning resources?

Many educators draft learning resources for use in their own classroom but are generally hesitant to share them publicly. Furthermore, these are of limited use to potential adopters without supporting documentation, particularly with multidisciplinary content, such as bioinformatics. However, with further refinement, these **immature learning resources present an opportunity to contribute to more complete collections** of open access, high quality learning resources, particularly if supplemented with supporting materials to facilitate instruction by non-experts.

To nurture existing learning resources to maturity and currency, NIBLSE in partnership with QUBES has developed a community-based approach. **Collaborating in a small, short-lived, working group called an "Incubator," participants refine a learning resource** to improve its quality and usability across diverse life sciences classrooms.

QUBES The Power of Biology × Math × Community

- Project to incorporate quantitative approaches into undergraduate biology education.
- QUBESHub infrastructure facilitates online collaboration & publication (more at **qubeshub.org**)

The Incubator Process

Step 1. Select Learning Resources

- NIBLSE solicits resources to refine
- Resource reviewed using a standardized learning object review instrument (LORI):
  - Confirm that resource addresses NIBLSE core competencies
  - Identify potential improvements
- Review Committee prioritizes resources for incubation

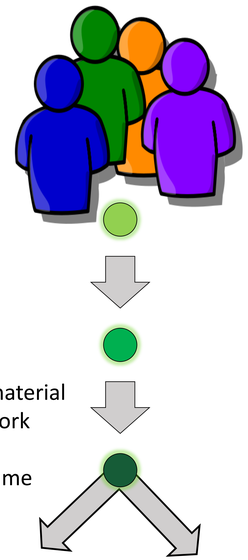
Step 2. Establish Incubator Goals

Managing editor from Review Committee and author(s) set specific goals & tasks

Step 3. Assemble Incubator Team

Composed with diverse pedagogical, bioinformatics, and biological expertise:

- Resource author(s)
- Managing editor
- Member(s) with scientific expertise
- Member(s) with novice perspective
- Assessment liaison (as appropriate)
- QUBES technical liaison

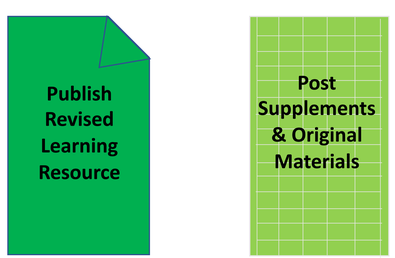


Step 4. Refine Resource Remotely

- Experienced educators and bioinformatics experts collaboratively refine learning resource & supporting material
- Incubator groups communicate and coordinate their work synchronously and asynchronously within QUBESHub
- Incubator team meets regularly over 4-8-week time frame
- Participants often implement a resource in their own classroom with team support

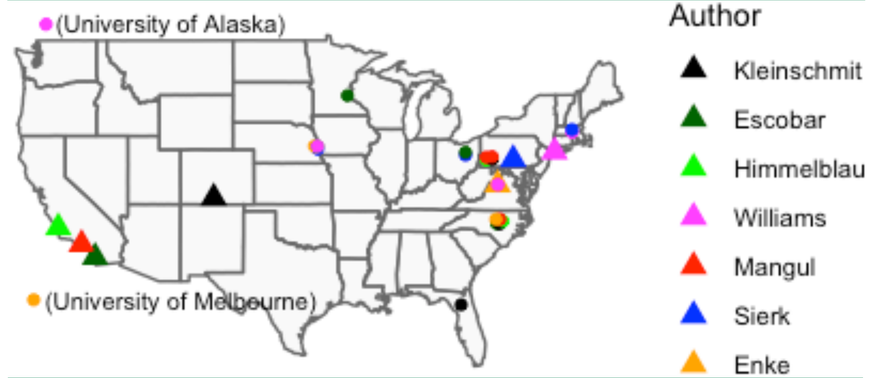
Step 5. Disseminate Final Products

- Incubator products are shared under a creative commons license
- Peer-reviewed publication of incubated learning resource is encouraged



Outcomes of Incubator Efforts

Incubators have connected bioinformatics educators across USA



Incubated learning resources have drawn significant interest

Resource Title	Views & Downloads
Bioinformatics: Investigating Sequence Similarity	1724 / 338
RNAseq Data Analysis Using Galaxy	828 / 102
CpG Islands as an Introduction to Bioinformatics	342 / 51
Using DNA Subway to Analyze Sequence Relationships	1349 / 134
Introduction to the UNIX Command Line	401 / 68
Needleman Wunsch Exercise	1078 / 917
Intro. to Command Line Coding & Genomics Analysis	575 / 136

Incubator Accomplishments

- **Fostered a network** of life science educators integrating bioinformatics into their courses and curriculum
- **Developed learning resources** to address NIBLSE Core Competencies
- **Customized outcomes** for individual learning resources & teaching context
- **Contributed to collections** of timely, high quality, open educational resources
- **Modeled best practices** for open educational resource development
- **Published resources** in peer-reviewed journals

Future Improvements

- Encourage more educators to share draft materials
- Promote greater participation in incubators

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