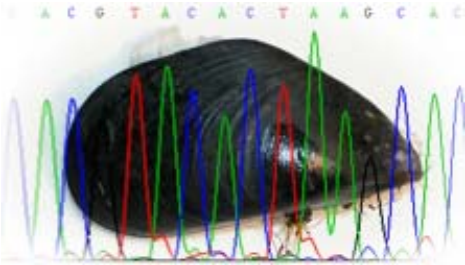


Marine Biotechnology and Bioinformatics



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Science Education Results

Bridging Cultures: From Laboratory to Classroom

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Cultural Dimensions

▶ Science and Schools

- ▶▶ Pre-service teachers with more authentic research experience are more likely to use inquiry-based teaching¹
- ▶▶ In the laboratory, resources and practices are continually negotiated and transformed in response to the situational context²
- ▶▶ In schools, science is treated as immutable fact²

1. Windshitl, M (Dec. 2002) *Science Education* 87:1:112-143

2. Barab, S “Doing Science at the Elbows of Scientists”, Bloomington, IN, CRLT

The Challenge

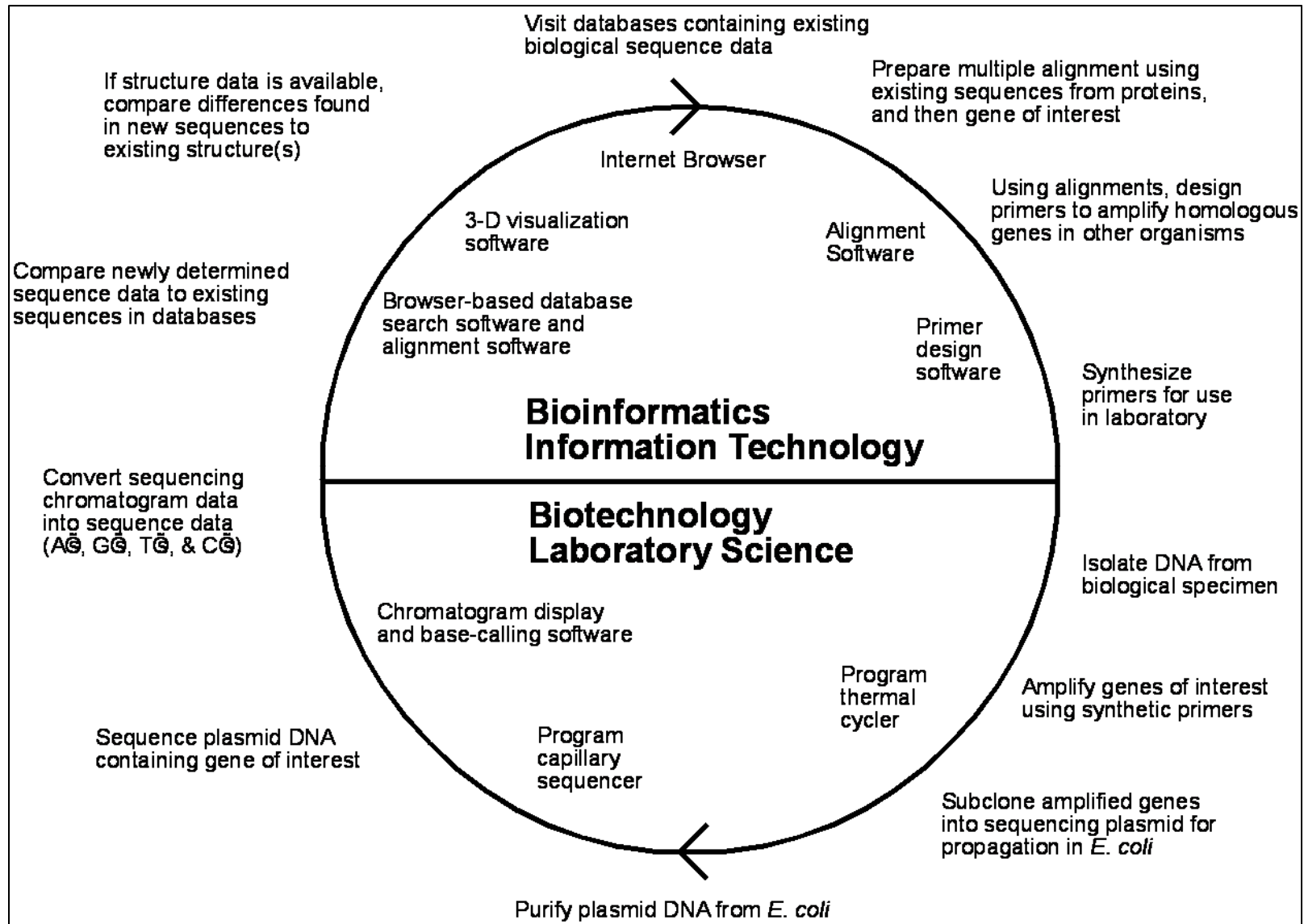
▶ To Bridge Cultures



- ▶▶ Immerse teachers in the scientists' world of biotechnology/bioinformatics
- ▶▶ Provide an opportunity for teachers to provide data in a current scientific investigation
- ▶▶ Provide opportunities for teachers to experience sustained scientific research

Study Methods

- ▶ Pre/Post surveys of attitudes, practices
- ▶ Pre/Post surveys of content knowledge
- ▶ Daily reflection on content, process
- ▶ Evaluator observations
- ▶ Interviews with scientists, teacher/participants
- ▶ “Free-write” - final reflections



Case Study - Participant #1

- ▶ Poly-scientist, highly motivated ESL teacher, not slowed despite personal health challenges, embraced practice/process of science/technology, reflected at length each day about how her experiences affected her perceptions of her students, returned second summer with two students for laboratory experience
- ▶ Strongly supported authentic science experience

Case Study - Participant #2

- ▶ Physical sciences background, no biology training since the 60s, sharp, eager to learn, incorporated content and perspectives into several classes, slow start, full assimilation, returned second summer to develop formal lesson plans
- ▶ Appreciated opportunity to participate in authentic science, wanted canned lab to get started

What did you like best today?

▶ Day 1

- ▶▶ "The lab - I've never used lab equipment before."
- ▶▶ "Review of micropipettes, centrifuges, gel loading."

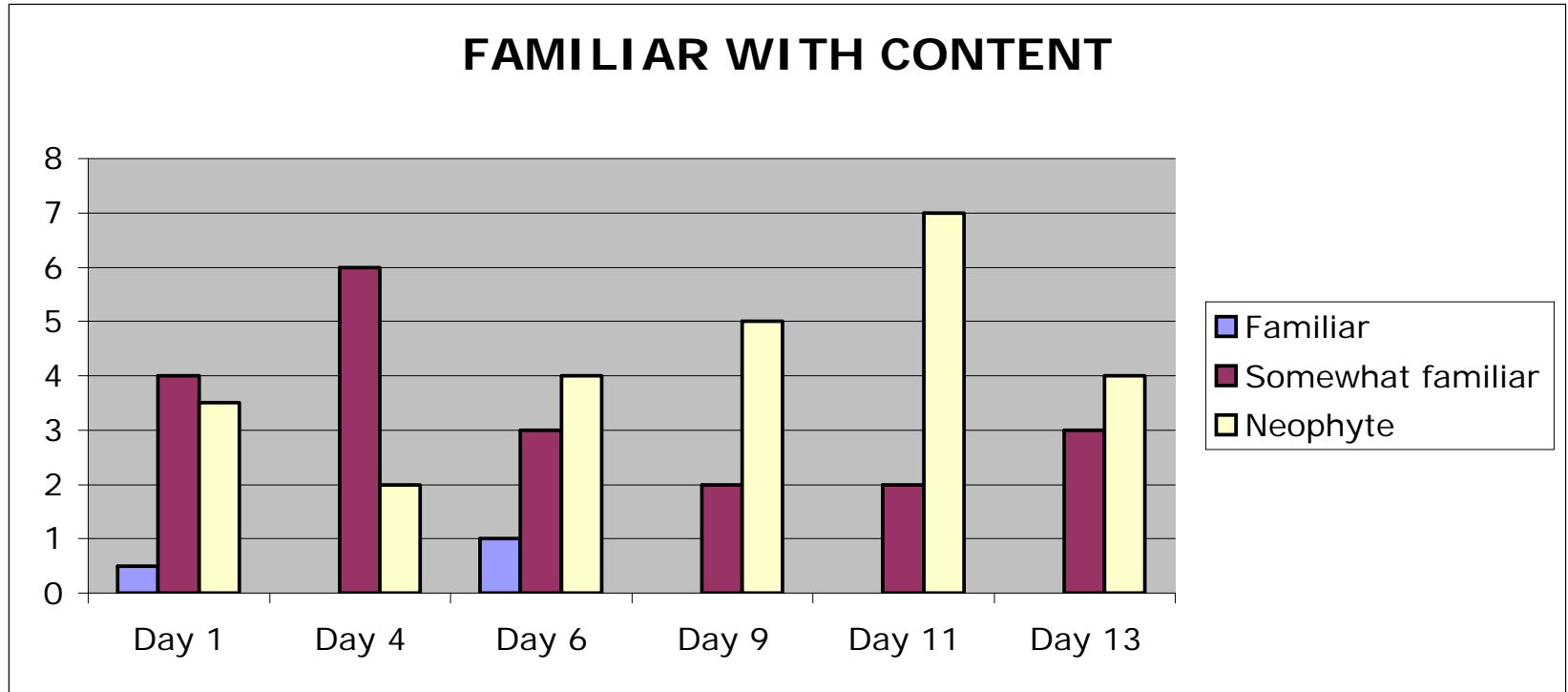
▶ Day 6

- ▶▶ "Seeing our results, even if they were marginal."
- ▶▶ "Using experimental design logic to select samples."

▶ Day 11

- ▶▶ "Everything - very mentally active day."
- ▶▶ "Looking for ECO RI and primers."

Daily Feedback Results



Teachers encountered new biotechnology content throughout the workshop.

Some Sample Results

- ▶ **Teachers accomplished their personal goals for the course, learned key biotechnology and bioinformatics content and techniques, and worked very hard.**
 - ▶ Learned about the newest research in biotech/ bioinformatics: 89% strongly agreed
 - ▶ Learned to extract DNA and amplify DNA using PCR: 78% strongly agreed
 - ▶ Learned to edit and manipulate DNA sequences: 100% strongly agreed
 - ▶ Accomplished personal goals for the course: 78% strongly agreed



Some Sample Results

- ▶ **Should we have picked a less novel experimental question?**
 - ▶ “Definitely not. Working through a real question was critical to learning [what] I wanted to learn ...”
 - ▶ “No, I liked the question because it is real science. We don’t always get results. I liked the problem solving (+3 others)”
 - ▶ “During the first week, I would have answered yes, but now I would say no. We were acting as researchers ... a precious and rare opportunity for teachers.”
 - ▶ “Yes! ...a [classroom] activity ... needs to have consistently good results.”

Lessons Learned About MBB



- ▶ MBB challenged teachers to embrace the culture of science.
- ▶ Teachers were surprised and pleased by how much they learned.
- ▶ Teachers incorporated new content/practices in their classes.

Cultures Bridged

- ▶ Teachers responded positively to:
 - ▶▶ Intense scientific and intellectual challenges
 - ▶▶ Embracing the culture of a research lab
 - ▶▶ Re-thinking their own teaching practices
 - ▶▶ Re-thinking their expectations for their students

- ▶ Scientists responded positively to:
 - ▶▶ Teachers' suggestions about pace and content
 - ▶▶ Teachers' need for basic content knowledge
 - ▶▶ Increased awareness of cultural dimensions