# Microbes, Metals, and Hands-On Education

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#### **Teaching Philosophy & Course Implementation**

- My goal as an educator is to teach my students the importance of microorganisms in environmental, ecological, and industrial processes while providing them a skill set that they can apply in the future.
- I aim to achieve these goals through:
  - Interactive lectures to ensure student comprehension
  - Data Incorporation and Research-Based Activities to Enhance Critical Thinking Skills
  - Collaborative Student Activities to Inspire Problem-Solving and Knowledge-based Learning
- I apply these goals in the courses I teach as I have:
  - Developed a hands-on lecture and lab course BIOL 4420 Microbial Biotechnology
  - Developed a graduate level lecture and lab course BIOL 6220 Advanced Sequencing Techniques
  - Integrated in class activities using news articles & new scientific articles in BIOL 3220 Microbiology

#### **Research Interests & Accomplishments**

- My lab's research incorporates environmental microbiology, microbial ecology, and geochemistry to address three central foci:
  - 1) Identifying the role of iron-oxidizing bacteria in the biocorrosion of steel structures (e.g. pipes, bridges, shipwrecks) in aquatic systems
- 2) Evaluating the effects of iron mat microbial communities in contaminant mobility and sequestration
- 3) Microbial interactions and their effects on coastal aquatic processes



Diverse research projects focus on Eastern North Carolina environmental issues such as microbial remediation of benzene in Town Creek (Greenville, NC), river herring conservation using environmental DNA in the Neuse, Tar, and Roanoke River systems, and exploring the microbiome of the *Pappy Lane Shipwreck* (Rodanthe, NC). Funding: NC Sea Grant, Army Corps of Engineers, NSF Chemical Oceanography, National Parks Service, Atlantic Marine Fisheries Commission

### Integration of Research in Classroom Education – Nanopore MinION Genome Sequencing CURE Project



- functions they can carry out to develop methods for enhancing or controlling their growth.
- projects.
- Microbiology.
- the biotechnology and research fields.



- Biogeosciences, Journal of Hazardous Materials, PLoS One, and Geobiology.
- awards.

A special thanks to Field lab members past and present, research collaborators, colleagues and students who wrote letters of support, all the students have have taken my courses (especially the BIOL 4420 students), and the Department of Biology for your overwhelming support. These successes truly are a team effort!





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Microbial Biotechnology (BIOL 4420) undergraduate students conduct an 8-week course-based undergraduate research (CURE) project in which they isolate a microbe, extract DNA, perform whole genome sequencing, assemble and annotate the genome, and identify what

• Sequencing is conducted in real-time by the class using the Nanopore MinION, cutting-edge sequencing technology, which is the size of a USB flash drive and is portable anywhere. TA support is provided by graduate students in the Field lab as this data supports their ongoing

Ultimately these genomes help us design methods to manipulate growth in the lab for biotechnological purposes and are from isolates critical to the Field Lab graduate student dissertations and theses, such as Garrison et al. 2019 in Applied and Environmental

This CURE provides students in the course hands-on experience in a variety of skills to put on their resume as they are pursuing jobs in

#### **Research & Student Successes in the Field Lab**

• The Field lab has had numerous research and student successes including 11 publications (half of which are student first author) in Applied and Environmental Microbiology, Frontiers in Microbiology, ISME Journal, Environmental Microbiology Reports, FEMS Microbiology Ecology, mBIO, Journal of Geophysical Research:

• Student research has been funded through national sources including Graduate Women in Science, Lerner-Gray Fund for Marine Research, and the American Society for Microbiology Undergraduate Research Fellowship as well as ECU sources such as the ECU Coastal Maritime Student Research Fellowships and URCA

• The publication by Price et al. 2020 about microbes associated with the Pappy Lane Shipwreck was featured in Popular Science, The Scientist, Inverse Magazine, *Chemical and Engineering News* and discussed in an interview on *Science Friday* with Ira Flatow.







