

**Theme: EPD: Challenges and best practices:
Running a research program primarily with
undergraduate students**

Abstract 2143

**A Metagenomic Exploration of Aquatic Life
in Jackson, TN Local Ponds**

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Keywords: Metagenomic, Data Science, Primarily undergraduate, HBCU

Lane College is a small, liberal arts, Historically Black College in Jackson, TN. The Division of Natural and Physical Sciences provides undergraduate research experiences for students majoring in biology, chemistry, computer science, mathematics, or physics. To increase inclusivity, all students within one of the five majors are encouraged to apply, regardless of GPA, classification, or previous research experience. This eight-week program features a bi-weekly professional development session and a symposium at the end of the program where students present their research findings. During the summer of 2023, seven biology students completed a metagenomics research study with the goal to explore the biodiversity of different local freshwater aquatic environments. The students collected water samples from four local ponds with metadata such as pH, temperature, dissolved oxygen, and GPS coordinates. Initial observations of aquatic life using microscopy and dichotomous keys were made. The DNA was extracted from the samples using ethanol precipitation followed by clean-up with the ZymoBIOMICS DNA Miniprep kit. DNA was amplified using the Nanopore Rapid PCR barcoding kit or the 16S PCR barcoding kit and sequenced with the Nanopore MinION Mk1C. DNA sequences were initially analyzed using the Nanopore Minnow and Epi2Me What's in My Pot Workflows. Each student explored the subsequent data to answer specific research questions about the biodiversity in each environment, such as the impact of pH, dissolved oxygen, whether the pond was static or free flowing, or the presence of different pathogenic or toxic microbes. Overall, they found that while there was some overlap, aquatic organisms varied in the ponds depending on whether the pond was static or free flowing, pH, dissolved oxygen, and location. Some of the students continued these research projects during the fall 2023 semester in the Biology Undergraduate Research course where they refined their research questions and analyzed the data using additional bioinformatics tools available on Galaxy.

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Abstract 2145

**From Proposal to Publication: Incorporating
Communication Snippets into a Full
Semester CURE**

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Keywords: CURE, Communication

Research has nine essential elements and to successfully engage undergraduates in CUREs or UREs, all nine elements should be incorporated. What a well-educated student should be able to do are: 1) Relevance. They should be able to articulate what basic, applied, or societal issues their research will address to lay and professional audiences. 2) Scientific Background. They should know relevant published background including the context and relevance of model systems chosen, unpublished preliminary work, and be able to use available informatics data, and indicate what gaps in knowledge their project will address. 3) Hypothesis Development. They should be able to develop and articulate a testable, falsifiable hypothesis making predictions their research will assess, identifying what they will measure to support or disprove their hypothesis. 4) Proposal. Research usually involves a proposal where how they will measure these things is described, along with appropriate independent and dependent variables and control experiments. 5) Experiments. Students should be able to design and conduct appropriate experiments including preparation of reagents. They should understand the concept of a control, and design controls into their experiments, indicating what each control signifies or measures. Their experiments may involve teamwork or collaboration with another research group. 6) Reproducibility. Students should be able to accurately record all necessary details of their experiments so that others can reproduce their work. Students should understand the difference between collecting replicates of data for given samples, and the need to reproduce the whole experiment. 7) Data analysis & Evidence-based conclusions. The student should be able to convert raw data to appropriate meta data, to perform the appropriate statistical analysis, and use graphical and tabular as well as visual representations of primary and meta data and parameters derived from appropriate mathematical models. They should be able to make evidence-based conclusions and relate them to the predictions made in the proposal, providing support or refutation for appropriate aspects of their hypothesis. 8) Presentation comes in many different formats, oral (everything from the brief elevator talk to a 30 minute seminar presentation), visual (posters), and written (a final report of the work to a draft of a manuscript to be submitted for publication). 9) Peer Review plays a critical role in the scientific process. They should be able to critically evaluate others' presentations and research proposals and make constructive comments. Scientists gain great benefit from engaging in peer review activities, and from