FAU FLC
Proposed Site Structure

I. **Infusing Undergraduate Research in Natural Science/Microbiology/MCB 3020RI.**

a. **Citation**: Shortlidge, E., Bangera, G., and Brownell, S. Each to Their Own CURE: Faculty Who Teach Course-Based Undergraduate Research Experiences Report Why You Too Should Teach a CURE. Journal of Microbiology and Biology Education. 2017 May 26; 18(2): 18.2.29. doi: https://doi.org/10.1128/jmbe.v1812.1260 PMID: 28656071The perspectives of 61 faculty who teach CURE was analyzed. Reported or perceived tangible outcomes are significantly higher for those Faculty who develop their own CURES compared to those who implement predeveloped national CURES. Intangible outcomes were same for both groups of faculty.

b. **Citation:** Lo SM and Le BD (2021) Student Outcomes Frome a Large-Enrollment Introductory Course-Based Undergarduate Research Experience on Soil Microbiome. Front. Microbiol. 12:589487. doi: 10.3389/fmicb.2021.589487
Article discusses and measures student outcome pre and post CURE and presents actual authentic research model that spans skill-building (applications and analysis) to intensive (evaluation and deductions) research engagement in a soil microbiome course. It employs standard CURE design elements viz

- Scientific practices - students collect and analyze data to draw conclusions
- Collaborations - Students work in teams
- Analysis - Students critique and include previous data
- Discovery (new knowledge/data created) and Relevance (topic of scientific merit)

c. **Citation**: Genné-Bacon, E. A., & Bascom-Slack, C. A. (2018). The PARE Project: A Short Course-Based Research Project for National Surveillance of Antibiotic-Resistant Microbes in Environmental Samples. *Journal of Microbiology & Biology Education*, *19*(3). https://doi.org/10.1128/jmbe.v19i3.1603
PARE is a straightforward 4-lab session exercise that spans discovery to math and data interpretation which includes elements of exposure, skill-building and intensive research activities. Topical and relevant subject matter. Students feel a part of an important process…understanding the complex phenomenon of origins and emergence of antibiotic resistance. Ready-made CURE package covering all the SLOs and assessment. Easy to adopt and integrate into any microbiology course. Levels of engagement spans exposure to skill building to intensive research involvement in medium to large classrooms. PARE can be modified to any level by faculty.

II. Research-Based Course Activities

a. General Microbiology is taught every semester and averages 100 – 200 enrollment depending on the semester. The CURE as I currently designed it, will be available to 50 students on a first come first serve basis. The students will self-select and have the option of signing into the regular General Microbiology or the research intensive (RI) General Microbiology (MCB 3020R). Of the 23 topics (chapters), all the students will stay participate in regular 18 core chapters of the course that establish the fundamentals of the ultrastructure, metabolism, mathematics/physiology, genetics and evolution of the cellular and acellular members of the microbial world. Scholars in the RI subsection will have the option to skip 5 of the application chapters to delve into authentic research. Through-out the course, the process of science and critical thinking are emphasized (example the thought process and research that disproved spontaneous generation theory; how to apply Koch's postulates in COVID-19 and G-5 misinformation, etc). For the RI scholars, the targeted outcome is a synthesis and presentation at the OURI, or preferably a submission to journal. The specific course activities for the RI cohort will span:

- **Exposure** – I introduce the subject of antibiotic resistance and known mechanisms in class. Students study texts and learning materials on McGraw Hill Connect
- **Knowledge** – Scholars read, critique and extract relevant information from published articles.
  They receive key words and are trained to identify (find) relevant articles (5-10) on the subject and read and identify gaps.
- **Formulate questions**: How does resistance evolve?. What role does the environment play if any? Is there a difference between spread and emergence of antibiotic resistance? What specific environ factors could promote emergence of resistance?

- **Plan of action/Skill building**: Each student team is guided/allowed to design a sound experiment to determine prevalence of resistance traits in the environment of their choice. They will weight the role of replications and the nature of their control(s). Sampling and sample collection protocols to protect data integrity. Predict and hypothesize (based on knowledge) the trend and profile they will find. Several lab skills in microbiology and biotech are acquired.
- **Critical thinking/ Analysis - Intensive**: Collate data and analyze. Compute serial dilution ratios and log growth of bacteria Critical thinking in computing and analyzing data
- Determine trends and explain why. Distinguish between emergence and spread of antibiotic resistance. Deduce any significance and or overall implication of their finding to curbing drug resistance. How will my study inform better public and environmental health policy? They will review literature on various interventions to curb emergence of new resistance and identify knowledge gaps and write up a report and
- Science communication during write-up, class presentation, poster production and or publication present

III. Assessing Undergraduate Research and Inquiry Activities

- Knowledge: Critical review of relevant literature, hypothesis and clarity of objective (5 - 10%). Team product graded with a rubric.
- Experimental design and execution(10%): Sound question(s), testable hypothesis,
- Actual Lab skill and experimentation (10%): Lab notes, microbiology/ molecular bio (skills) data collation
- Analysis, Synthesis and Write-up / presentation or submission to a journal (10%)

IV. Additional Resources

a. Faculty Resources

i. **https://asm.org/Browse-By-Audience/Higher-Education-Educator**

The ASM has a wide range of unparalleled support for CURE and all aspects of the scholarship of teaching.

The ASM Conference for Undergraduate Educators (AMSCUE) provides a solid support and network

Iii The peer reviewed journal of Microbiology and Biology Educations publishes best practices and resources for all life science education. https://journals.asm.org/journal/jmbe

a. Student Resources

Career resources, Research guidelines and networks and useful webinars. https://asm.org/Browse-By-Audience/Undergraduate-Student

V. Contact Dr. Nwadiuto Esiobu (nesiobu@fau.edu) for additional information about this course/discipline area.