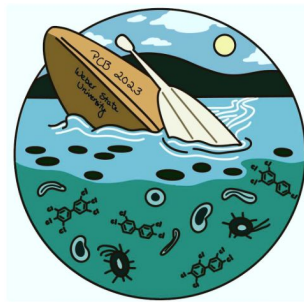


Microbial Ecology of PCB-Contaminated Sediments as part of a Course-based Undergraduate Research Experience (CRE)

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In collaboration with Demetrios Pagonis, Assistant Professor of Chemistry & Biochemistry
WSU, College of Science

Real-world research project with contributions from **8 MICR4800-Directed Research**, **56 MICR3154-Microbial Ecology**, and **5 CHEM3510-Environmental Chemistry students**, resulted in **student presentations** at WSU OUR symposia, UCUR, NCUR, UASAL, and ASM-Microbe during the **2023/2024 academic year**.



Polychlorinated biphenyls (PCBs)

are **persistent organic pollutants** that were banned by the EPA in 1979, which can cause **cancer, neurological, and developmental issues**. From 1933-1977, General Electric (GE) in Pittsfield, MA was a major producer of PCB waste, polluting the Housatonic River and downstream Woods Pond. Despite the passage of time and partial remediation by the EPA, PCBs **still persist** in Woods Pond today.

In **June 2023**, Dr. Twing traveled to her home town in MA to sample Woods Pond for PCBs and PCB-degrading microbes, collecting **4 mud samples** from a 1 mile area of the pond.

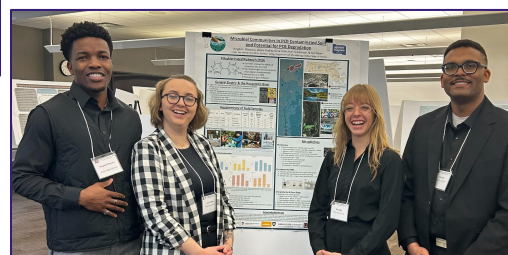
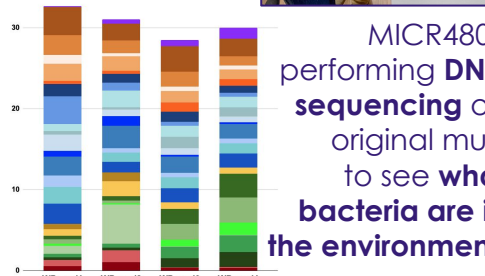


MICR4800 - Directed Research Students

funded by OUR/WSU Summer Research Fellows created **microcosms** (mini-incubations) and performed **DNA sequencing** from the mud samples



MICR4800 students making microcosms from mud. They have maintained 36 incubations under different conditions since 7/19/23 to see if they can **grow PCB-degrading bacteria** from mud samples

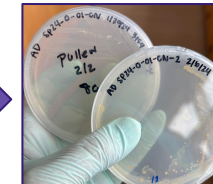


Presenting at Utah Academy of Sciences, Arts, and Letters, Spring 2024

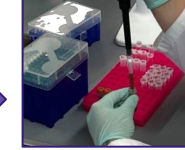
Microbial Ecology (MICR3154) CRE Students in groups of 3-4, followed the workflow below, generating real-world data and identifying PCB-tolerant and PCB-degrading bacteria. To date, **56 students** in this required course have contributed to this project



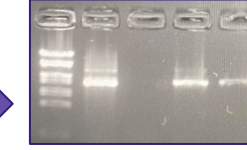
1. Selected a microcosm as inoculum



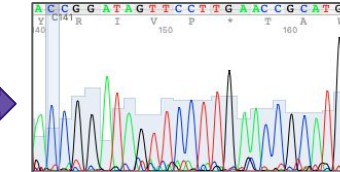
2. Isolated bacteria from microcosm on media with PCBs



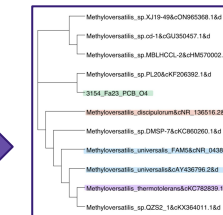
3. Extract DNA from isolated PCB-tolerant bacteria



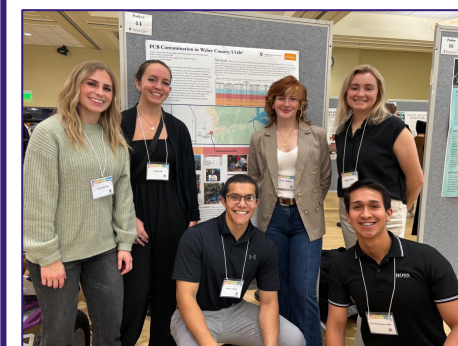
4. Polymerase chain reaction (PCR) and gel electrophoresis



5. DNA sequence analysis to find out who isolated bacteria is



6. Construction of phylogenetic trees to see evolutionary relatedness of isolated bacteria to known bacteria



MICR3154 students presenting at the Fall 2023 OUR Symposium, most of whom had no previous research or presentation experience

Data generated by MICR3154 students:

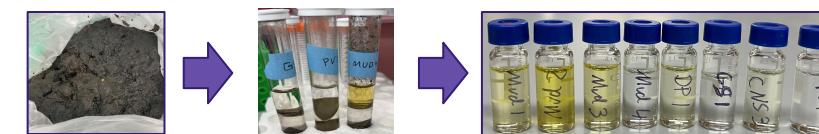
- Isolation of 49 PCB-tolerant and PCB-degrading bacteria, from 12 different genera
- Discovery of at least **1 novel species**
- Database of known PCB-degrading bacteria, to be incorporated into a **review paper**
- Identification of potential PCB-contaminated **sites in UT** for future study
- **8 research posters**, presented at OUR Symposium

Interdisciplinary Collaboration of Microbiology and Chemistry CRE Students

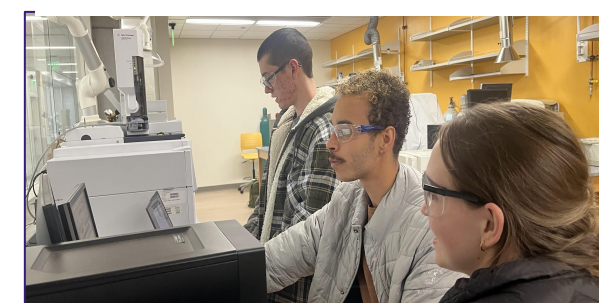
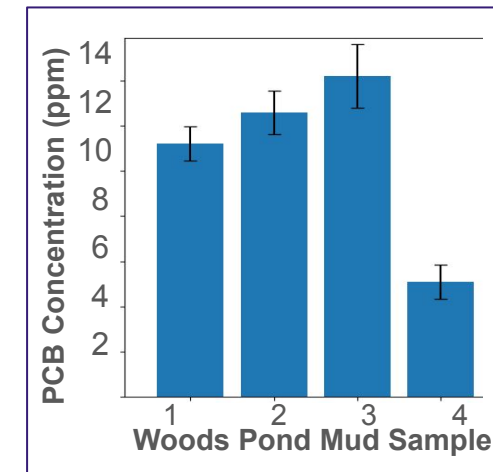
MICR3154 and CHEM3510 students collaborate to **measure PCB quantities and types** of PCBs in Woods Pond mud samples in Fall 2023 using gas chromatography-mass spectroscopy (**GC-MS**)



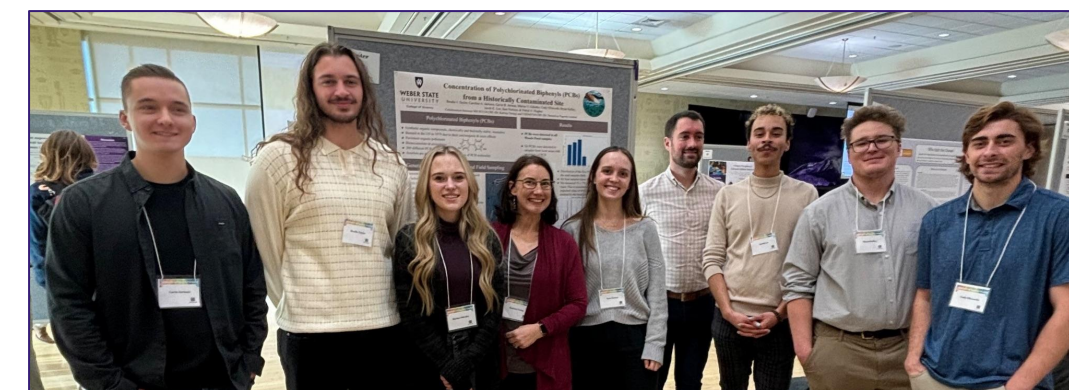
MICR3154 students preparing mud samples for chemical analyses



Total PCBs in the mud samples ranged from **5-14 ppm**. EPA level for regulatory action is 50 ppm.



CHEM3510 students analyzing samples on GC-MS



Students from MICR3154 & CHEM3510 presenting at the Fall 2023 OUR Symposium, with Drs. Twing & Pagonis

This research was funded by RSPG, OUR, WSU Summer Research Fellows, and OUR-CRE grants. Thank you Karen Mann, Leigh Komperda, Demetrios Pagonis, Dept. of Microbiology and College of Science. Sincere thank you to all MICR4800, MICR3154, and CHEM3510 students that contributed to this research.



In a single academic year, this project has generated data for a review paper, multiple manuscripts, and a NSF proposal, all while giving ~70 students hands on, interdisciplinary research experience