BIOL 497 Aliphatic Biodegradation

Individual study
Spring 2018
3 credit hours

Instructor: Dr. Mary Beth Leigh
Office: 228 West Ridge Research Building (WRRB)
Phone: 474-6656, Email: mbleigh@alaska.edu

Course location
Primary research activities will take place in the Leigh microbiology research laboratory (Rm. 205 West Ridge Research Building).

Course overview
This course will provide a hands-on research experience in bioremediation research using microbiology and analytical chemistry methods. The project focuses on diesel fuel oil, which is an environmental contaminant affecting many locations in Alaska and around the world. The student will learn methods in microbiology and analytical chemistry and apply them to assess the potential for willow plants and nutrient additions to stimulate the biodegradation of diesel in contaminated soils. This includes a) experimental design of a replicated soil microcosm study b) quantifying the biodegradation of diesel in microcosms subjected to different treatments studies and c) performing 16S rRNA sequence analysis to examine the microbial community structure in the different treatments. The student will follow established protocols and work under the guidance of the instructor and a grad student to achieve the experimental aims, with additional help provided by lab technicians and other grad students. The data generated by the student may be included in a publication to be submitted to a peer-reviewed journal in collaboration with the instructor and grad student in the future. The student will also develop and present a poster at Undergraduate Research Day.

Course objectives
- Develop skills in experimental design, hypothesis testing and quantitative analyses
- Apply microbiological techniques including microcosm preparation, aseptic technique and molecular biology
- Perform analytical chemistry assays
- Learn methods for extraction and quantitative analysis of petroleum using gas chromatography and mass spectrometry
- Develop skills in maintaining a detailed lab notebook and electronic data files
- Develop scientific presentation skills by developing and presenting a poster
Course format:
This course will be a supervised independent research practicum. Hands-on training and guidance will be provided by the instructor as well as graduate students and lab technicians working in the Leigh lab. As familiarity with the techniques is attained, the student will work increasingly independently. Regular weekly research meetings with the instructor will be held to discuss research and course progress.

Course reading materials:
- **Scientific journal articles** – Most readings will be drawn from the primary scientific literature. Articles will be accessed electronically by student through online databases, with others provided through Dropbox.
- **Research Protocols** - Developed in the Leigh Lab
- **Textbooks** – There is no required text for this course. Several texts are suggested as resources when needed
  - Electronically available texts:
    - *Environmental Microbiology*, by Madsen.
    - *Microbial Diversity, 1st Ed.*, by Ogunseitan
    - *Environmental Microbiology, 2nd Ed.*, by Gerba et al.
  - Additional books available at the BioSciences Library, including:
    - *Brock Biology of Microorganisms, 14th Ed.*, by Madigan et al.
    - *Microbial Ecology*, by Barton
    - *Biocatalysis and Biodegradation*, by Wackett and Hershberger
    - *Environmental Microbiology, 2nd Ed.*, by Gerba et al.
    - *Microbe*, by Schaechter et al.
    - *Microbiology*, by Bauman

Course schedule

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<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
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<tbody>
<tr>
<td>DNA Extraction</td>
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<td>Chemical extractions</td>
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<td>GC/MS sample preparation</td>
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<td>GC/MS analyses</td>
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<td>Data analyses</td>
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<td>Poster preparation and presentation</td>
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**Deadlines:**
Poster draft – April 3
Final poster draft – April 10

**Assessment**
The course will be graded on a letter grade basis (A, B, C, D, F). Grading will be based on completion and quality of lab work, quality of lab notebook, data organization, data analyses, depth and breadth of technical understanding, and quality of the poster.

**Grading scheme:**

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<th>Grade</th>
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<td>Technical understanding</td>
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<td>Quality of lab work</td>
<td>10</td>
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<tr>
<td>Lab notebook &amp; data organization</td>
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<tr>
<td>Poster draft</td>
<td>10</td>
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<tr>
<td>Final poster</td>
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<td><strong>TOTAL</strong></td>
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**Students with disabilities**
UAF is committed to equal opportunity for all students. Students with even minor disabilities, students who are the first in their families to attempt a four-year college degree, or students whose incomes are low, have opportunities for tutorial and other forms of support from the office of Disability Services or the office of Student Support Services. If you need classroom accommodations or other support, please meet with me during office hours as soon as possible to let me know; and please make an appointment with the Office of Disability Services and Student Support Services, to enlist the appropriate support. I will collaborate to provide the appropriate accommodations and supports or services to assist you in meeting the goals of the course.