MICR 222: Microbes in Action

Semester Two 18 points

Course overview

Microbes are ubiquitous and dominate the biosphere, but our understanding of the full contribution microbes and their communities make to life on Earth is hindered by our lack of ability (imagination) to culture microbes from the environment. In MICR 222 you will study microbes in the environment and learn of new technologies used to study microbes at a community level. The course will focus on gaining an appreciation of the vast metabolic potential of bacteria and how this has been harnessed and put to work in biotechnology and agriculture.

Learning outcomes

- Be able to demonstrate an in-depth knowledge of microbiology in preparation for advanced laboratory skills in 300-level and in graduate papers
- Display a practical knowledge of fundamental and applied microbiology, with the ability to assimilate complex information on a spectrum of interdisciplinary topics and to use this knowledge for applications in the workplace
- Develop an ability to communicate ideas about science

Lecture course overview

MICR 222 is a 32-lecture course, lectures will cover the following areas:

Module 1: Microbial Evolution and Ecology *(Sergio Morales)*

1. Molecules, Origins of Life and Evolution.
2. Microbial Diversity: What drives it and how can we measure it.
3. Bacterial Species Concept.
4. Bacterial Physiology and Microbial Ecology.
5. Microbial Community Genetics, Metabolic Potential and how can we study them

Module 2: Microbial Evolution and Biogeochemical Cycles *(Sergio Morales)*

6. Development of Microbial Communities.
7. Microbial-Animal Interactions.
8. Oceans: Marine Microbes as Mediators of Global Cycles.
9. A Living Bioreactor -The Symbiotic Rumen Microbiome.
10. More than just Dirt - How Soils and Microbes Sustain the Earths Biosphere

Module 3: Water Microbiology and Public Health *(Judith Bateup)*

11. The Freshwater Environment
12. The Marine Environment
13. Waterborne Pathogens
14. Providing a Safe Drinking Water Supply
15. Measuring Water Quality

Module 4: Putting Microbes to Work in the Environment *(Daniel Pletzer)*

16. Microbial Life in Biofilms.
17. Microbes and Biofouling.
18. Microbes to Clean the Environment.
19. Microbial Design for Bioremediation

Module 5: Putting Microbes to Work in Biotechnology *(Daniel Pletzer)*

20. Microbes as Biocontrol and Biological Warfare.
21. Microbes to Produce Recombinant Proteins.
22. Antibiotics Produced by Bacteria.
23. Microbes in Food and Industrial Microbiology.
24. Probiotics (lecture given by John Hale)

Module 6: Plant-Microbe Interactions *(Clive Ronson)*

25. The Plant Microbiome and its Effects on Plant Growth – Biological Control in the Rhizosphere.
26. The Plant Microbiome and its Effects on Plant Growth – The Phyllosphere and Ice-nucleating Bacteria.
27. The Rhizobium-Legume Symbiosis: Nodulation.
28. The Rhizobium-Legume Symbiosis: Nitrogen Fixation.
29. Mycorrhizae.
30. Plant-Pathogen Interactions: Innate Immunity.
31. Plant-Pathogen Interactions: Gene-for-Gene Resistance.
32. *Agrobacterium* – Nature's Genetic Engineer.

Lab course overview

The MICR 222 laboratory course has been designed to complement the lecture course. In the 7 labs you will:

- Look at microbes as part of bacterial communities and the microbial interactions that can occur
- See the impact of microbes in the nitrogen cycle, and the critical role they play in nitrogen recycling
- Look at how microbes cope with extreme environments including extreme heat, salinity, UV light and pH
- Setup your own Winogradsky column and see what happens to the bacterial populations over the course of the labs
- Explore the impact of microbes in the dairy industry – what microbes do you find associated with milk, how they affect quality of the milk you drink and how they can be harnessed to make different cheeses
- Visit local industries to see microbes in action

Assessment

1. Lecture test (10%)
2. Laboratory test (10%)
3. Laboratory assignment on nitrogen cycle (10%)
4. A 3-hr final exam (70%)

Textbooks

Essential text:

Prescott's Microbiology by J. Willey, K. Sherwood and D. wood, 11th edition, 2020 OR Wiley, Sherwood and Woolverton, 10th edition, 2017, McGraw-Hill Publishers.

This textbook is available in the library, both as a printed copy Close Reserve and as an eBook.

Teaching staff

- Dr Judith Bateup (Convenor)
- Professor Clive Ronson
- Dr Sergio Morales
- Dr Daniel Pletzer
- Guest Lecturer from industry

Workload expectations

An 18 point paper has a minimum expectation of 14 hours per week per paper. This is made up of formal contact times (lectures, tutorials, laboratories etc.) and independent study (studying, revision, assignments, reading etc.).
This course comprise 32 lectures (50 minutes each), and 7 laboratory sessions (up to 4 hours each). A guide to workload expectations is;

- Lecture preparation, reading and review — 1.5 hours per lecture
- Lecture attendance — 32 hours
- Laboratory preparation — 1 hour per lab
- Laboratory attendance — 28 hours
- Lecture test preparation — 10 hours
- Laboratory test preparation — 10 hours
- Laboratory assignment — 10 hours
- Final examination preparation — 40 hours

Responsibilities of students

- Students are responsible for making themselves aware of all University rules and regulations pertaining to their rights and responsibilities as students and to the degree in which they are enrolled.
- Students shall be deemed to have received any information:
  - provided in scheduled classes, regardless of attendance;
  - sent to their student email address;
  - made available via Blackboard or other University-approved learning management systems.
- Students are expected to be aware of all information related to a paper that is made available to them, and, in a timely manner, to raise with staff any questions or concerns relating to this information.
- Students are expected to be aware of, and to act in accordance with, the University's Academic Integrity Policy.

Academic integrity and academic misconduct

Academic integrity means being honest in your studying and assessments. It is the basis for ethical decision-making and behaviour in an academic context. Academic integrity is informed by the values of honesty, trust, responsibility, fairness, respect and courage. Students are expected to be aware of, and act in accordance with, the University's Academic Integrity Policy.

Academic Misconduct, such as plagiarism or cheating, is a breach of Academic Integrity and is taken very seriously by the University. Types of misconduct include plagiarism, copying, unauthorised collaboration, taking unauthorised material into a test or exam, impersonation, and assisting someone else's misconduct. A more extensive list of the types of academic misconduct and associated processes and penalties is available in the University's Student Academic Misconduct Procedures.

It is your responsibility to be aware of and use acceptable academic practices when completing your assessments. To access the information in the Academic Integrity Policy and learn more, please visit the University's Academic Integrity website at www.otago.ac.nz/study/academicintegrity or ask at the Student Learning Centre or Library. If you have any questions, ask your lecturer.

- Academic Integrity Policy (www.otago.ac.nz/administration/policies/otago116838.html)
- Student Academic Misconduct Procedures (http://www.otago.ac.nz/administration/policies/otago116850.html)