Course Instructor: Richard Sparling  
Office: 414C Buller Bldg.  
Office phone: 204-474-8320  
Email address: Richard.Sparling@umanitoba.ca

****you MUST use your U of M e-mail to correspond with professors****

Class location: 111 Armes  
Office hours: MWF 1:30-2:30 PM (or by appointment)  
For making appointments, it is best to e-mail me, including the nature of the question(s) and a few suggestions about times available.

Lab Instructor: Dr. Chris Rathgeber  
Office: 419 Buller Bldg.  
Office phone: 204-474-9967  
Email address: Chris.Rathgeber@umanitoba.ca

**Course description:** The course will include an introduction to genomics approaches used for the analysis of microbial metabolism. Using these tools, the physiology of microbial cell envelope as well as microbial metabolism as related to ATP production, respiration, fermentation and carbon fixation will be discussed. May not be held with MBIO 3031 or the former MBIO 2100. Prerequisites: MBIO 2020 (MBIO 2021) (C); and one of MBIO 2370, MBIO 2371, CHEM 2370, CHEM 2371 (C); or consent of instructor.

**Textbooks and other required materials for the lectures:** Students are responsible for taking their own notes on the material presenting orally in class. They will have access to the PowerPoint slides that complement the lectures (available on the UM Learn page for this course). Brock Biology of Microorganisms 14th or 15th ed. is required as a general resource for background information for most of the topics discussed. A significant proportion of the figures used in the course will be taken from that book. Occasional topical documents and web-based information will be added to complement the information presented in class.
Topics:

1. **Microbial Genomics and ‘omics Tools**
   - a. Genome Sequencing and Annotation
   - b. Transcriptomics
   - c. Proteomics
   - d. Metabolomics
   - e. Introduction to Systems Biology (KEGG, BioCyc, etc.)

2. **Diversity of Microbial Metabolism**
   - a. Central Metabolism
   - b. Fermentation
   - c. Respiration, Electron Carriers and Proton Motor Force
   - d. Carbon Fixation
   - e. Nitrogen metabolism (catabolic and anabolic)

3. **Microbial Growth and Physiology**
   - a. Peptidoglycan, Lipopolysaccharide
   - b. Membranes and protein secretion
   - c. Bacterial Cell Division
   - d. Responding to the environment: Two Component Signal Transduction

4. **Putting it all together**
   - a. Microbial communities as holobionts
   - b. Introduction to synthetic biology
     - i. Directed evolution
     - ii. Minimal genomes and chassis organisms
     - iii. Designer pathways for novel products.

The order of topics will mainly be followed, but there will be some occasional deviation

**The primary learning outcomes expected are**
- To develop a vocabulary to discuss how various genomic and functional genomic tools can be used to understand the metabolic and ecological diversity of prokaryotic microorganisms.

- To learn various examples of the diversity of metabolic potentials available to microorganisms.

- To learn how microorganisms build-up their structure, and understand how elements of the structure affect antibiotic sensibility and resistance, as well as interaction to the outside world.

- To appreciate how the information above can be applied to understanding microbial communities.

- Using examples learned, to understand how information on genomics, metabolism and physiology can be used for industrial applications.
Evaluations:
Midterm,
-In class:
- Wednesday the 16th of October 2019
(on material covered until the 11th of October).
-Worth 20% of the final grade.

-A mix of true or false, multiple choice and short answer questions. Some questions will
measure recall of materials, some will require critical thinking about the material
presented and integration of various elements from different lectures.
Because the classroom is expected to be full, there will be 2 slightly different versions of
the mid-term.

There are NO deferred midterms. If you are not present to write the midterm, the final
exam, which is cumulative, shall count for 80% of your final grade.

Feedback from the midterm examination will be provided to the students at the beginning
of November, well prior to the VW date, 18th of November 2019.

Laboratory: 20% Including group work, project presentations and a final lab exam. See
the lab manual for group project due dates. A passing grade is required in the laboratory
component of the course to pass the course.

Final cumulative exam 60% December, scheduled by the Student Records Office. The
examination will consist of a mix of questions similar to that of the mid-term, plus several
longer answer questions. Some questions will measure recall of material, some will
require critical thinking about the material presented, and some questions will test
integration of various elements from different lectures.

The grades for the midterm will be returned prior to the voluntary withdrawal date.
Irrespective of the final numerical grade (midterm + lab grade + final exam) for this
course, a grade of 45% on the final exam, and a total lab mark of 50% are BOTH required
to pass the course.

Letter grades will only be assigned at the end of the term. Letter grades are assigned
taking into consideration the grade distribution in the class and the University of
Manitoba’s descriptors A+ (Outstanding), A (Excellent), B+ (Very Good), B (Good), C+
(Satisfactory), C (Adequate), D (Marginal), F (Failure)
see http://umanitoba.ca/student/records/grades/686.html
**Typical** low-numerical-boundaries for the letter grades:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A+</td>
<td>90%</td>
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<td>A</td>
<td>80%</td>
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<tr>
<td>B+</td>
<td>75%</td>
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<td>B</td>
<td>70%</td>
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<td>C+</td>
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<td>C</td>
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<td>F</td>
<td>&lt; 50%</td>
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The use of electronic devices (for example, cellphones, laptops, tablets) during exams is strictly forbidden. Richard Sparling holds copyright over the course materials, presentations and lectures which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without his permission. Course materials (both paper and digital) are for the participant’s private study and research, and may not be posted to social media platforms.

Students with learning accessibility issues are directed to Student Accessibility Services to facilitate the implementation of accommodations. Course instructors are willing to meet with Students to discuss the accommodations recommended by Student Accessibility Services.

**Academic dishonesty**: guidelines are stated in your calendar regarding University policy with respect to academic dishonesty (particularly plagiarism and cheating) and behaviour and absence from final exams. In cases of cheating during examinations, the test in question will be given a grade of 0% and the student will be reported to the appropriate authorities for disciplinary action. All work is to be completed independently unless otherwise specified. Please remember that group projects are subject to the rules of academic dishonesty and every group member must ensure that a group project adheres to the principles of academic integrity.

The Faculty of Science web page has detailed information which you must become familiar with. ([http://umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html](http://umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html)). Please read and follow these guidelines, and ask if you have any questions.