MBIO 3030 - Microbiology III (physiology and metabolism)

The course will include an introduction to microbial growth and genomics approaches used for the analysis of microbial physiology and metabolism. Using these tools, the physiology of microbial cell walls, transport, and motility, as well as microbial metabolism as related to ATP production, respiration, fermentation and carbon fixation will be discussed. Not to be held with MBIO 3031 or the former MBIO 2100 (60.210). Prerequisites: MBIO 2020 (MBIO 2021)(C); and one of MBIO 2370, MBIO 2371, CHEM 2370, CHEM 2371 (C).

Course Instructor: Richard Sparling
Office: 414C Buller Bldg. (not applicable this term)
Office phone: 204-474-8320 (leave a message, I may not frequently be in my office)
Email address: Richard.Sparling@umanitoba.ca (**most** reliable way to reach me this term)
Lab instructor: Chris Rathgeber (see lab manual for how to get in contact with him)

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

Students enrolled in this course must ensure they satisfy the following minimum technological requirements:

1. A computing device where one can create and edit documents,
2. An internet connection capable of streaming videos and downloading software, and
3. Access to a web-cam and microphone.

Class location: on-line through UM Learn

Lecture material will be available as powerpoints on the UM Learn MBIO 3030 website. New Pre-recorded lectures explaining the material of the powerpoints will be posted every Monday, Wednesday and Friday. Students are responsible for material in the powerpoints and pre-recorded lectures (i.e. what is written and what I say).

Scheduled Class Time in Aurora: MWF 12:30-13:20 (9th of Sept to 11th of Dec. 2020)
Class time use: (MW 12:30-13:20) will be used for lecture recap., questions and discussion via Zoom (link to be provided separately). **No** new class material will be presented live), "attendance" is optional, nevertheless these sessions will be recorded and up-loaded onto the UM Learn.
Fridays will be used for brief tests and midterms (see further instructions below).

For questions from individuals, it is best to e-mail me, including the nature of the question(s). I usually answer the same day (within 24 hours except on weekends).

Textbooks and other required materials for the lectures: Students are responsible for taking their own notes on the material presented orally in class. They will have access to the PowerPoint slides that complement the lectures and the prerecorded 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.

Lecture Topics:

1. **Microbial Functional 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
    (elements presented through some of the previous topics as well)
        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 out-comes 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 microorganism.

-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:

-All evaluations will be carried out through UM Learn.
-All evaluations must be completed in the allotted time (see below).
-To permit flexibility students can choose to write at any time between **9:00 and 21:00** on the days indicated below.

-To mitigate the temptation of academic dishonesty while providing you with start time flexibility:
-Students tests and midterm questions will be generated randomly from a bank of questions prepared for each specific test and exam (i.e not everyone will get the exact same questions, nor will they necessarily be in the same order).
-Once an answer or cluster of answers is submitted, you will not be permitted to go back and modify your answer.

All tests and exams are 'closed book'. The exams and tests, including the time allotment per question, were designed to make external materials and notes unnecessary to answer the questions successfully. However, if a question does require access to specific material during an exam, any materials that can be consulted during exams and quizzes will be indicated in advance of each test or quiz.

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2 Midterms,
-Each worth 15% 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. Duration 50 min.
Midterm 1, Friday the 2th of October

Midterm 2, Friday the 30th of October

There are NO deferred midterms. If you are not available to write a midterm within the time window provided, the value of the final exam, which is cumulative, will be increased accordingly.

Six 10 min tests: A brief (2-3 questions each) mix of true or false, multiple choice and short answer questions on the material since the previous test/midterm
Each worth 2.5 pts:
Test 1, 18th of September
Test 2, 25th of September
Test 3, 16th of October
Test 4, 23rd of October
Test 5, 20th of November
Test 6, 27th of November
You may 'skip' two of these tests: best 4 of the 6 tests will be used to calculate your grade. (These will also be good practice for using UM Learn for the larger value midterms!)

Final cumulative exam (2 hours) 40% 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.

Laboratory**: 20% Including group work, project presentations and a final lab exam. See the lab manual for group project due dates. A passing grade** (50%) **is required in the laboratory component of the course is required to pass the course.**

The grades for the tests and midterms up to and including the second midterm (30th of October) will be returned prior to the voluntary withdrawal date (23rd of November)

Irrespective of the final numerical grade (tests + midterms + 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:

A+	90%
A	80%
B+	75%
B	70%
C+	65%
C	57%
D	50%
F	< 50%

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 integrity and dishonesty: guidelines are stated in your calendar regarding University policy with respect to academic dishonesty (particularly plagiarism, impersonation and cheating), as well as 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). Please read and follow these guidelines, and ask if you have any questions.

The Faculty of Science has prepared a brief video out-lining issues regarding academic integrity in the context of on-line examinations, and the consequences of cheating: (7 min) https://youtu.be/Ok-lilm4SeE

***The content of this video is required viewing and is considered part of the course material for the purpose of evaluation in tests and exams.**