MBIO 3430 Molecular Evolution

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Office hours: Tues and Wed 1 to 3 PM

Textbooks and other required materials: No text book, course materials on UMLearn.

Course description:
MBIO3430 Molecular Evolution (Molecular evolution of biochemical processes, genomes, and phylogenetics, applications to medicine, biotechnology, anthropology, biology and history).
Prerequisite(s): one of MBIO 2020, (=MBIO 2110) (Molecular Biology 3410 highly recommended) Genetics I, Cell Biology or Biochemistry II.

Students are expected to attend all classes. Course material will be posted on UMLearn; however detailed explanations presented during lectures may not be available on UMLearn. Misuse of course material will result in the removal of all material from the course site. Ultimately this course is lecture based and it is the student’s responsibility to attend the lectures and take notes. The Instructor will not make his/her personal notes available to students.

<table>
<thead>
<tr>
<th>Evaluation Component</th>
<th>Date</th>
<th>Contribution to Final Grade</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm exam</td>
<td>Feb. 27\textsuperscript{th}/2020</td>
<td>30</td>
<td>Marked exam will be returned.</td>
</tr>
<tr>
<td>(multiple choice, or long/short answers or mixed)</td>
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<tr>
<td>Assignment</td>
<td>April 7\textsuperscript{th}/2020</td>
<td>10</td>
<td>Evaluated copies returned (UMlearn) on the day of the final exam.</td>
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<tr>
<td>Final exam</td>
<td>To be determined by Registrar’s Office</td>
<td>60</td>
<td>Final Grade</td>
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Please note that specific assignment instructions will be provided as appropriate.
The grades for the Midterm Exam will be returned prior to the voluntary withdrawal date (Mar. 18\textsuperscript{th}/2020).

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 (Adequate), D (Marginal), F (Failure); see http://umanitoba.ca/student/records/grades/686.html
The norm for this course with regards to conversion of % to letter grades is as follows: A+ (>90%), A (80-89.9%), B+ (75-79.9%), B (70-74.9%), C+ (65-69.9%), C (60.0-64.9%), D (50-59.9%), F (<50% , or <50% in final exam*).

Please note:

A passing final grade (D or above) in this course requires that the student passed the final exam (> 50 %); also a final total grade (midterm, plus assignment, plus final exam) of below 60 % is viewed as marginal (i.e. D) and a total grade below 50 % is a failure (F). There are no supplementary exams or assignments.

Note: No make-up midterms - missed work will be assigned 0 marks, unless documentable reasons can be provided, for the latter the final grade will be based on your final exam mark. Late assignments will NOT be accepted.

It is the student responsibility to provide documentation, if none is provided a grade of 0 will be recorded.

The Mid-term examination will be held during the regular scheduled class period. The Final examination will be comprehensive (i.e., covers all lectures), and will be scheduled by Student Records during the April examination period. Permission to write a deferred final exam is granted by your faculty - the instructor is not involved in this process. If it is necessary for you to write your final exam at an alternate date, you must visit your faculty office with appropriate documentation to request permission for a deferred exam. This is a strict university policy, and there are no exceptions. If a deferral is granted it is your responsibility to contact the instructor immediately for the date of the deferred exam, missing the deferred exam will result in a grade of F. All written answers will be graded based on quality of understanding, originality of thought, and clearness of presentation. Good writing skills certainly help! Electronic and mechanical devices are not permitted during the midterm or final exam.

Students requiring accommodations 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. 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:
https://www.sci.umanitoba.ca/undergraduate-students/academic-resources/academic-integrity-2/.

Please read and follow these guidelines, and ask if you have any questions.

Topics:

Topics covered (please note topics may be covered in a different sequence as listed also topics maybe added as relevant new reports are published in the primary literature):

1. Introduction: Evolution of the HIV virus and the Bird Flu

   (i.e. Why should you care about Molecular Evolution?)
2. Molecular origins of life (Ideas and concepts)
   - From organic molecules to self-replicating systems
   - “Genetic takeover”; Ribozymes and the RNA world
   - Carl Woese and the three domains of life
   - “Universal tree of life”; Origin of the organelles;
   - The “first gene”: “exon theory” introns and exons; The “first cell”

Topics 1 and 2 make up about ~ 40% of the course

3. Introduction to phylogenetics (includes material covered by the Assignment)
   - Changes in nucleotide and amino acid sequences
   - Molecular data and phylogenetic trees (MEGA X)
   - *Molecular markers and application to evolutionary/ecological studies

4. Basic concepts of Evolution
   (Review of “Basic concepts of Evolution”)
   - Selection and “fitness”
   - The “modern synthesis” and the “Neutral theory of Evolution”
   - Micro and Macro Evolution
   - Evolution of antibiotic resistance in bacteria, [Evolution in the test tube (phages and bacteria), Human evolution [mitochondrial DNA and Y chromosomes plus “ancient” DNA (genomics) analysis];
   - Mechanisms of Speciation; EvoDevo: Gradualism vs punctuated evolution

5. Genomes and their Evolution
   - Repetitive/“selfish” DNA (Mobile elements)
   - Genome expansion by duplications
   - Exon shuffling and introns revisited; source of “new” genes
   - Species concept and speciation revisited: Molecular mechanisms
   - Concerted evolution (and Molecular Drive) within gene families

Key to success: Attend lectures, read assigned readings, keep your notes up to date (i.e. soon after a lecture review your notes and add comments, fill in details, organize and integrate the figures from handouts). Part of a University education is to learn how to take notes, organize
information, review information; expect to put certain concepts together yourself based on the material presented. Like any course in science dedicate at least a few hours a week for this course or you might find that scrambling your notes together before the exams results in poor performances.

Assignment Overview:

The assignment requires internet access to web-based resources, as the purpose is to introduce students to some basic bioinformatics tools that are currently available “online”. It requires some effort and patients. Many of these sites are user-friendly and will guide you through the various options available. The actual assignment will be posted on (or before) UM Learn Feb. 11th/2020 and is due 1 PM - April 7th/2020. Start on your assignment as soon as possible, as late penalties apply. There will be a 20% penalty for each day the report is late! No assignments will be accepted after April, 11th/2020.

You will need to get some basic (free) programs:

To get Started – download the following: “Build your basic tool box”

2. Genedoc [https://genedoc.software.informer.com/2.7/](https://genedoc.software.informer.com/2.7/)
4. MEGAX [http://megasoftware.net/](http://megasoftware.net/)

Bookmark the following:

5. PRALINE (protein alignment tool) [http://www.ibi.vu.nl/programs/pralinewww/](http://www.ibi.vu.nl/programs/pralinewww/)
For information:

If you experience depression, anxiety, or other health or stress related issues – you are not alone - please consider the following resources:

**Student Counselling Centre**  
474 University Centre  
University of Manitoba, Winnipeg, MB R3T 2N2 Canada  
Phone: 204 474-8592 Fax: 204 474-7558  

**CMHA Manitoba and Winnipeg**  
930 Portage Avenue, Winnipeg MB R3G 0P  
E-mail: office@cmhawpg.mb.ca  
[https://mbwpg.cmha.ca/mental-health-resources-for-winnipeg/](https://mbwpg.cmha.ca/mental-health-resources-for-winnipeg/)

**Klinic Community Health**  
870 Portage Avenue  
Winnipeg, MB, R3G 0P1  
Phone: (204) 784-4090  
Admin Fax: (204) 772-7998  
Medical Fax: (204) 784-4013  
[http://klinic.mb.ca](http://klinic.mb.ca)

**First Nations and Inuit Hope for Wellness Help Line**  
1-855-242-3310  
Counselling available in English and French - upon request, in Cree, Ojibway, and Inuktut  
Crisis Response Centre  
817 Bannatyne, Winnipeg; attend in person

**Jack.org**  
General information about student mental health, useful for sharing with friends and start the conversation!  
[https://jack.org/Home](https://jack.org/Home)  
Phone: 416-425-2494

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**Urgent Help**

**University Security Services (24 hs)** #555 (from MTS or Roger wireless)  
**On Campus Suicide Crisis Klinic (24 hs)** 4-(204) 986-6222  
**Adult Mobile Crisis Service** 204-940-1781  
**Crisis Stabilization Unit** 204-940-3633  
**Crisis services Canada** [http://www.crisisservicescanada.ca/en/](http://www.crisisservicescanada.ca/en/)