MBIO 4610 Eukaryotic Genetics **2017 (Fall)**

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Office hours: Tues and Wed 1 to 3 PM (NOT available Fridays)
Textbooks and other required materials: No text book, lab manuals, some course material on UMLearn.

Course description:
The course covers nuclear and organellar genomes, control of eukaryotic gene expression via transcriptional and translational mechanisms, mobile genetic elements, molecular genetics of genome rearrangements and oncogenesis (time permitting).

In the lab (Lab Coordinator: Dr. Rivers), a multipart experiment will be performed to generate and partially characterize mutations in the yeast, Saccharomyces. The *in vivo* system utilized will demonstrate concepts including transcriptional regulation, intron splicing, retrotransposition and organellar proteins encoded by nuclear genomes. The use of genetic databases to analyze experimental results will also be introduced. PCR analysis of students' mitochondrial DNA will also be performed.

Students are expected to attend all classes. **Some course material might be posted 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.**

Evaluation

Component	Date	Contribution to Final Grade	Feedback
Midterm exam (multiple choice, or long/short answers or mixed)	**Oct. 24th/2017**	25	Marked exam will be returned; comments will be posted on UMLearn.
Assignment	**Dec. 5th/2017**	10	Evaluated copies returned on the day of the final exam.
Lab	See lab manual	20	See lab manual
Final exam	To be determined by Registrar's Office	45	Final Grade

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 (**Nov. 15th/2017**).

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 <45% in final exam*).

Please note:

A passing final grade (D or above) in this course assumes that the student passed the final exam (> 50 %); also a final total grade (midterm, plus assignment, lab mark, 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. In addition a passing grade (>50%) has to be obtained for the laboratory component of this course in order to pass this course.

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. L**ate 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 December 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 with disabilities 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 (http://umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html). Please read and follow these guidelines, and ask if you have any questions.

Topics:

I. Basic methods in molecular genetics (some material to be posted on UMlearn)
A. Nucleic Acids, Gel electrophoresis, blotting and detection (Review*).
B. review* of: PCR, Sequencing Sanger (small scale) vs Next Generation Sequencing (large scale); DNAchips/micro arrays, RNAseq, Immunoprecipitation and ChIP;
C. Applied Bioinformatics
(NCBI blast; ORF finder, alignment, phylogeny, PHYRE)

II. Eukaryotic cells and their genes (brief overview)
A. Organellar genomes – in mitochondria and chloroplasts – structure, coding content
B. Nuclear genomes – overview of structure, coding and non-coding content

III. Eukaryotic gene expression
A. Transcription - RNA polymerases and basal promoters
B. Regulation of transcriptional initiation
C. RNA processing- splicing, polyadenylation
U2 and U12 spliceosomes
D. Alternative Splicing; Nested introns etc.
E. RNA editing
F. Translation and its regulation
G. RNA biology – "RNA world underpinning" gene expression.
Short-, long- and circular non-coding RNA molecules.
RNA interference (RNAi)

IV. Mobile genetic elements
A. Transposons (Class II)
B. Retrotransposons (Class I)

V. Current topics in Eukaryotic Molecular Genetics (time permitting)
Genome Editing (from meganucleases to CRISPR/cas9)

Ideas on the assignment (more details to be provided):

A paper – in the format of a mini review on a topic such as Gene therapy, RNAi, Oncogenes etc. 10 pages double spaced (font size 12; penalty if page number below 9 or above 10 pages)

OR Bioinformatics exercise – annotate a sequence and analysis the data with blast and Phyre2, MISTIC, CAPS, Sequence Logos etc. Provide a report on your findings.

OR Find a "tool" (method or computational methodology) – explain it in detail so that you can teach it to your class and note its relevance and importance to Euk. Genetics. (prepare ~ 15-20 power point slides and a short write up ~ 3 pages to explain your "tool") (AVOID BASIC "tools such as Southern, PCR, BLAST etc." – grade will reflect complexity of topic)