

# **MBIO 3410 Molecular Biology- Fall term 2020**

**Instructor:** Dr. Damien Rivers; Tel: 204-474-6542 Email: [Damien.Rivers@umanitoba.ca](mailto:Damien.Rivers@umanitoba.ca)

**Lecture Time and Room:** 10:00 am - 11:15 am T/TH – Zoom meeting (see UMLearn for current link)

**Office Location and Hours:** Rm. 203 Buller by appointment. – Likely remote via zoom

**Lecture:** Course content will be delivered as pre-recorded lectures, supplementary videos, PowerPoint notes, written modules or a combination of these. Live remote Q&A lectures/discussions will also be scheduled with the assumption the students are up to date on any posted content. Students are expected to attend all scheduled live remote classes, and although this will not be the primary content delivery method, anything new that comes up in these sessions will be testable content. It is your responsibility to catch up on the missed live lecture material and notes. See calendar for schedule of remote lectures.

## **Note:**

- 1) Any emails must be sent to me from your university email account. Emails sent to me from an email account other than the University of Manitoba account will automatically be deleted.
- 2) 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), behavior 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. **EXAMS ARE NOT OPEN BOOK.** 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.

**Online policy:** We recognize that these are unusual circumstances, and that there are some adjustments needed when working virtually. At the same time, we do want to remind students that University policies, such as the Respectful Work and Learning Environment policy, still apply, as do basic expectations around how students will engage with each other, and with the University. This means that when participating in classes, online meetings, etc., students are expected to behave professionally, and follow the same basic norms as they would in person, such as being clothed, not being impaired, and participating respectfully. Essentially, if you wouldn't do it in an in-person class, don't do it in virtual setting.

**Textbook:** There is no required textbook, but Analysis of Genes and Genomes by R.J. Reese (2004) is a good resource and is listed as an optional book for the course. Students also greatly benefit from exploring the Science Library or text books you have used in other courses, such as Biochemistry books (e.g. Lehninger's Biochemistry) and Genetics texts (such as Russell's iGenetics), Karp's Cell and Molecular Biology text (recent editions) or "Genes" by B. Lewin (editions VI and beyond); all these books provide excellent background reading. Explore and actively learn. Students are expected to attend "zoom lectures", but they are just the beginning of understanding.

## **Course Description:**

**The overall goal** of the course is to introduce you to the major principles of molecular biology, as they apply to both prokaryotic and eukaryotic life. The **major** topics to be covered are listed below (note that the order may change and this is not an exhaustive list). Chapters refer to “Analysis of Genes and Genomes”; but keep in mind that additional material will be presented in the lectures and **you are responsible for everything that is covered in class!**

- I. Introduction to Nucleic Acids, review of their biochemistry and features relevant to understanding molecular genetics/biology. (Chapters 1 and 2)**  
Biochemistry of RNA and DNA; transcription/translation, genetic code, gel electrophoreses, topology; effect of pH, temperature and ionic strength on nucleic acids;
- II. Principles of DNA and RNA based technology. (Chapters 2, 3, 4, 5, parts of 7 and 9)**  
Restriction enzymes, Probes and Southern hybridization, physical mapping, RFLP and applications, DNA polymerases; PCR (RT-PCR and qRealTimePCR), DNA sequencing – Sanger, various “next gen sequencing” (Pyrosequencing, Illumina etc., massive paralleled sequencing), genome sequencing; metagenomics, transcriptomics, proteomics
- III. Recombination and mobile elements (last segment of Chapter 1)**  
Models for the recombination process. Relationship between recombination and genome maintenance (repair and gene conversion); site-specific recombination and mobile elements (insertion elements, transposons, retroelements);
- IV. Genes to Genome: Eukaryotic and Prokaryotic Chromosomes, Chromatin, Nucleosomes, Genes, Introns and Exons, mRNA processing, rRNA processing, repetitive DNA, mobile elements – group I and II introns, inteins; simple and complex multi-gene families, gene numbers and gene amplification, Genomes and "chromosomal landscapes";**
- V. Prokaryotic and Eukaryotic gene Expression (Chapter 1)**  
RNA polymerases; initiation, termination, and regulation of transcription; promoters and enhancers; transcription factors etc.; post transcriptional regulation strategies; riboswitches; mRNA surveillance; RNAi; introduction to PCR and RACE and footprinting;
- VI. Principles of gene manipulation technology. B. Cloning vectors; enzymes needed in biotechnology; expression vectors, reporter genes, and "suicide vectors"; RACE and DNA footprinting;, CRISPR**
- VII. Transgenesis: expression of foreign genes in prokaryotic and eukaryotic systems. (Chapters 11 and 12; if time permits)**  
Gene replacements, knock-outs and knock-downs.  
Genetic manipulation of yeast, plants and mammalian model systems.

## Evaluation:

Component	Date	Contribution to Final Grade	Feedback
Assignment #1 Prokaryotic ORFs	October 1 <sup>st</sup>	5%	On UMLearn
Mid-term exam # 1	October 13 <sup>th</sup>	15%	On UMLearn
Assignment # 2	October 29 <sup>th</sup>	5%	Marked and uploaded
Midterm exam #2 TBD	November 17 <sup>th</sup>	15%	On UMLearn
Final Assignment	December 11 <sup>th</sup>	20%	Marked and uploaded
Final exam	To be determined by Registrar's Office	40%	Final Grade

Please note that specific assignment instructions will be provided as appropriate.

The grades for the midterms and assignment #1 will be returned prior to the **voluntary withdrawal date** (November 23, 2020).

Letter grades are assigned taking into consideration the grade distribution in the class and the University of Manitoba's descriptors A<sup>+</sup> (Outstanding), A (Excellent), B<sup>+</sup> (Very Good), B (Good), C<sup>+</sup> (Satisfactory), C (Adequate), D (Marginal), F (Failure); see <http://umanitoba.ca/student/records/grades/686.html>

For this course, **a grade of 45% in the final exam is required to pass the class.** The grading scheme generally, but not always, is that used by the Rady College of Medicine

[https://umanitoba.ca/faculties/health\\_sciences/medicine/admissions/8847.html](https://umanitoba.ca/faculties/health_sciences/medicine/admissions/8847.html).

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% total, or <45% in final exam).

There are no deferred Midterm exams. If you miss an in-class exam, the marks automatically will be added to the final exam. Medical or other notes are not required for in-class tests. The **Final examination** will be comprehensive (i.e., cover 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 contact 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 as soon as possible for the date of the deferred exam.

As per University of Manitoba policies, students are not permitted to access any unauthorized materials during an examination. This includes but is not limited to books, notes, or any electronic device capable of wireless communication and/or storing information.