

Course Outline  
**BIOL361 Molecular Genetics and Genomics**  
Spring 2021, A01 (20410)

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Prerecorded Lectures: Typically drop weekly on Monday mornings (BrightSpace)

Discussion and question and answer sessions: Every second week on Thursday mornings (Zoom)

Quizzes: Every second week on Monday mornings (Live and timed on BrightSpace)

Office hours: By appointment, please inquire by eMail

***Course Description:***

Naturally occurring and induced genetic mutations leading to phenotypic variation within- and among-species in a diversity of eukaryotic taxa, including yeasts, plants and vertebrates. Regulation of transcription and translation (including small regulatory RNAs), protein-protein interactions, molecular mechanism of tumor formation, genome structure and mobile genetic elements, and functional genomics.

***Evaluation***

One hundred (100) marks in total:

There will be six quizzes each worth 15 mark; your worst quiz will be dropped and only the best five quizzes will be included for a total of 75 marks maximum. Quizzes are non-cumulative and will only cover the course material since the previous quiz. There will be no final exam.

There will be one bioinformatics/essay assignment worth 20 marks. Detailed assignment instructions will be handed out in early February. It will involve some web-based bioinformatic analyses, a literature search, and a two-page scientific essay.

There will be 5 marks for participating in course forums and Q&A sessions. We expect active participation (that is asking questions and giving answers) in the ‘Genetics and Genomics Discussion forum’ and participation in at least some Q&A live sessions.

***Notes on quizzes:***

Quizzes are designed for a duration of 20 minutes, but you will get an additional 20 minutes grace period during which you can still submit your quiz without any penalty (i.e. technically, you have 20 minutes per quiz, but practically you can use up to 40 minutes). The grace period is to accommodate any technical problems that may occur.

Quizzes are open-book exams, and you are allowed to use any course-based or other non-human resource during the exam, but you must not communicate with anyone during the exam, except the

instructor (who will be available on Zoom during the quizzes). Note that quizzes are timed and that you will not have sufficient time to learn the tested material during the exam.

There will be no deferred quizzes. If you miss a quiz without excuse, you will receive zero marks and it will be dropped as your worst quiz. If you miss more than one quiz without excuse, they will all be marked at zero and only one will be dropped from calculating your final grade. To be excused from a quiz, you must provide an excusable rationale to the instructor within a week of the quiz, but no doctor's notes are necessary during the pandemic. If you missed a quiz with excuse, the missed quiz will not be included in calculating your final grade and the quiz section will be based on your best four quizzes (if you missed one quiz with excuse) or based on your best three quizzes (if you missed two quizzes with excuse). A minimum of three quizzes must be included in calculating your final grade to complete the course.

### ***Statement***

Students must abide by academic regulations as set out in the university calendar. They must observe standards of scholarly integrity with regards to plagiarism and cheating. Please read the definitions, watch the tragi-comic video and look at the other information available at the following link

<https://www.uvic.ca/current-students/home/academics/academic-integrity/index.php>

### ***Grading scheme***

A+ (90%-100%), A (85-89.75%), A- (80-84.75%), B+ (77-79.75), B (73- 76.75%),  
B- (70-72.75%), C+ (65-69.75%), C (60-64.75%), D (50-59.75%), F (<50%)

### ***Resources***

Short summaries, pre-recorded lectures, and complete references of key papers will be uploaded to CourseSpaces. *Molecular Biology of the Cell* (the textbook for BIOL360) will be very useful but is not required.

### ***Course schedule***

#### Week 1 (Jan 11- 15)

Live: Mon. Jan 11, 9:00-9:45 AM: Course introduction (Zoom) [JE, RG, and SL]

Lectures: **Theme A: Phenotype to Genotype** - Qualitative and quantitative genetic loci: Sticklebacks with a no-pelvis phenotypes. [RG]

#### Week 2 (Jan 18 - 22)

Lectures: Mapping Pitx1: the transcription factor responsible for pelvis phenotypic variation. [RG]

Molecular basis of convergent evolution of hind-limb reduction in animals. [RG]

Live: Thu. Jan 21, 9:00-9:30 AM: Drop in discussion and Q&A (Zoom) [RG, JE, SL]

#### Week 3 (Jan 25 - 29)

Quiz 1: Mon. Jan 25; Open: 9:00 - 9:30 AM; Duration: 20 min (plus 20 min grace period).

Lectures: Whole genome association genetics and human diseases: Clubfoot disease. [RG]

Whole genome association genetics and human diseases: Anemia, BCL11 and fetal hemoglobin (HbF). [RG]

Week 4 (Feb 01 - 05)

Lectures: Whole genome sequencing approaches. [RG]

Genome annotation approaches. [RG]

Live: Thu. Feb 04, 9:00-9:30 AM: Drop in discussion and Q&A (Zoom) [RG, JE, SL]

Week 5 (Feb 08 - 12)

Quiz 2: Mon. Feb 08; Open: 9:00 - 9:30 AM; Duration: 20 min (plus 20 min grace period).

Lectures: **Theme B: Genome Structure and Plasticity** - Transposable elements and their mode of jumping. [JE]

Transposable elements shape genomes and facilitate evolution. [JE]

Assignment hand-out.

Reading Break (Feb 15 - 19): no lectures

Week 6 (Feb 22 - 26)

Lectures: Gene and genome duplications. [JE]

**Theme C: Molecular Basis of Tumor Formation in Mammals and Plants** - Mammalian tumors and their cause: alterations of cancer critical genes. [JE]

Live: Thu. Feb 25, 9:00-9:30 AM: Drop in discussion and Q&A (Zoom) [JE, SL]

Week 7 (Mar 01 - 05)

Quiz 3: Mon. Mar 01; Open: 9:00 - 9:30 AM; Duration: 20 min (plus 20 min grace period).

Lectures: Genomics of mammalian tumor formation. [JE]

Introduction to plant tumor formation and the tumor inducing plasmid of *Agrobacterium tumefaciens*. [JE]

Week 8 (Mar 08 - 12)

Lectures: Molecular mechanisms of plant tumor formation. [JE]

Inter-kingdom lateral gene transfer and its use to create genetically modified plants. [JE]

Live: Thu. Mar 11, 9:00-9:30 AM: Drop in discussion and Q&A (Zoom) [JE, SL]

Week 9 (Mar 15 - 19)

Quiz 4: Mon. Mar 15; Open: 9:00 - 9:30 AM; Duration: 20 min (plus 20 min grace period).

Lectures: **Theme D: Non-protein-coding RNA's and the regulation of gene expression.** - The diverse functions of RNA's. [JE]

The discovery of small regulatory RNA's in *Caenorhabditis elegans*. [JE]

Assignment due: Thu. Mar 18, end of day.

Week 10 (Mar 22 - 26)

Lectures: Post-transcriptional regulation of gene expression via small interfering RNAs. [JE]  
siRNA and miRNA: Mechanisms of small RNA regulatory action. [JE]

Live: Thu. Mar 25, 9:00-9:30 AM: Drop in discussion and Q&A (Zoom) [JE, SL]

Week 11 (Mar 29 – Apr 1)

Quiz 5: Mon. Mar 29; Open: 9:00 - 9:30 AM; Duration: 20 min (plus 20 min grace period).

Lectures: RNA guided immunity in bacteria: CRISPR and Cas. [JE]

Genome editing using the CRISPR/Cas system. [JE]

Week 12 (Apr 06 – 09)

Easter Monday: no lecture

Lectures: Gene regulatory mechanisms involving long non-coding RNA: HOTAIR [JE]

Live: Thu. Apr 08, 9:00-9:30 AM: Drop in discussion and Q&A (Zoom) [JE, SL]

Week 13 (Apr 12)

Quiz 6: Mon. Apr 12; Open: 9:00 - 9:30 AM; Duration: 20 min (plus 20 min grace period).

*There will be **NO Final Exam***

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learning and working environment for all of its members ---