

Course Outline

BIOL361 Molecular Genetics and Genomics, Spring 2020

Instructor: Dr. Jürgen Ehling

Office: CUN159a. eMail: je@uvic.ca

Lectures: HSD A240. 8:30 – 9:50AM Monday and Thursday

Office hours: Tuesday 10:00-12:00AM or 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: Two ‘midterm’ exams, each worth 1/3 of the total marks, and a final exam (non-cumulative, covers only material after the second midterm) also worth 1/3 of the total marks.

There will be an optional assignment worth 10 %. For students who opt in, the weight of the midterms and final exam will be reduced to 30% each.

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%)

Notes

There will be deferred midterm exams scheduled outside lecture time within a week after the midterm for those providing proper documentation (e. g. doctors note). If you also miss the deferred midterm but provide a doctor’s note, your final mark will be calculated on the basis of the other completed components of the course, and you will not incur any penalty. You cannot miss both midterms.

Only pen and pencil will be permitted during any exam; no texts, no electronic devices. 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 refer to UVic Academic Calendar webpage below:

<http://web.uvic.ca/calendar2008/FACS/UnIn/UARe/PoAcI.html>

Resources

Lecture notes 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.

Lecture schedule

A Phenotype to Genotype

- Monday, Jan 6: Course introduction
Qualitative and quantitative genetic loci: Sticklebacks with a no-pelvis phenotypes
- Thursday, Jan 9: Mapping Pitx1: the transcription factor responsible for pelvis phenotypic variation.
- Monday, Jan 13: Molecular basis of convergent evolution of hind-limb reduction in animals.
- Thursday, Jan 16: Whole genome association genetics and human diseases: Clubfoot disease
- Monday, Jan 20: Whole genome association genetics and human diseases: Anemia, BCL11 and fetal hemoglobin (HbF)
- Thursday, Jan 23: Whole genome sequencing approaches and eukaryotic genome structure

B Genome Structure and Plasticity

- Monday, Jan 27: Transposable elements and their mode of jumping
- Thursday, Jan 30: ***MIDTERM 1***
- Monday, Feb 3: Transposable elements shape genomes and facilitate evolution I
- Thursday, Feb 6: Transposable elements shape genomes and facilitate evolution II
Optional Assignment hand-out.
- Monday, Feb. 10: Gene and genome duplications.

C) Molecular Basis of Tumor Formation in Mammals and Plants

- Thursday, Feb 13: Mammalian tumors and their cause: alterations of cancer critical genes
- Feb 17 - 21: *Reading Break*
- Monday, Feb 24: Genomics of mammalian tumor formation.
- Thursday, Feb 27: Introduction to plant tumors and their cause; the tumor inducing plasmid of *Agrobacterium tumefaciens*.
- Monday, Mar 2: Molecular mechanism of plant tumor formation.
- Thursday, Mar 5: Inter-kingdom lateral gene transfer and its use to create genetically modified plants
- Monday, Mar 9: ***MIDTERM 2***

D) Non-protein-coding RNA's and the regulation of gene expression.

- Thursday, Mar 12: The diverse functions of RNA's
- Monday, Mar 16: The discovery of small regulatory RNA's in *Caenorhabditis elegans*.

Thursday, Mar 19: Post-transcriptional regulation of gene expression via small interfering RNAs.

Monday, Mar 23: siRNA and miRNA: Mechanisms of small RNA regulatory action.

Optional ASSIGNMENT due

Thursday, Mar 26: Gene regulatory mechanisms involving long non-coding RNA: HOTAIR.

Monday, March 30: RNA guided immunity in bacteria: CRISPR and Cas.

Thursday, Apr 2: Genome editing using the CRISPR/Cas system.

Final exam during examination period (date to be determined)

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