School of Science

BIOL 202

Genetics

Term: Winter

Number of Credits: 3

Course Outline

INSTRUCTOR: Kate Chatfield-Reed, PhD
E-MAIL: kchatfieldreed@yukonu.ca
OFFICE: A2806
PHONE: (867) 456-8563
TIME/DATES: M/W 10:30 am – 12 pm (lectures) in A2202 T 2:30 pm – 5:30 pm (lab) in A2805
OFFICE HOURS: *anytime*, email me, but scheduled office hours are Mondays 1 pm – 3 pm.

COURSE DESCRIPTION

This core second-year biology course examines patterns of inheritance, genes, and gene functioning from DNA to phenotype. Mendelian patterns of inheritance and exceptions will be discussed and expanded on from introductory material in first-year Biology (Biology 101 and 102). Current topics in molecular techniques, transmission, stem cells, and ethics will also be discussed. Lab exercises will focus on basic quantitative techniques of analyzing genetic frequencies and basic methodology in conducting genetic experiments, as well as practice employing the scientific process.

COURSE REQUIREMENTS

Prerequisites: Successful completion of Biology 101 and 102 or equivalencies, with a final minimum grade of C in both. Successful completion of one semester of a university-level first-year chemistry course (e.g., CHEM 110)

EQUIVALENCY OR TRANSFERABILITY

This course transfers to most universities in BC as second-year introductory Genetics course. However, please be aware that receiving institutions determine final course transferability. Find further information here: https://www.yukonu.ca/admissions/transfer-credit

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to:

1. describe the processes and functions of mitosis and meiosis in transmitting DNA to other cells,
2. explain, with illustrative examples, Mendelian genetics and the exceptions to these patterns,
3. assess and describe the transmission of genes from parent to daughter cells and processes of molecular genetics such as DNA replication, transcription, and translation,
4. describe the principles of quantitative and population genetics used to describe evolution,
5. know and critically assess, genetic techniques such as recombination, cloning, and gene therapy used in modern genetics.

Lab learning outcome:

6. Students will be able to demonstrate lab techniques relating to quantitative genetics such as polymerase chain reactions, accurate predictions of phenotypic ratios and statistical assessments of results.

COURSE FORMAT

This course will be delivered with the following breakdown per week: three hours of lecture (in two 1.5-hour blocks), one three-hour lab, and zero hours of tutorial. Although it will vary from individual to individual, students should expect to spend 6 hours on course material outside of the classroom time (per week) on studying or completing assignments.

Delivery format

This course will be delivered in a face-to-face (in person) format. Students will be expected to access the YU online learning platform for additional material (Moodle). Labs can only be conducted in person.

EVALUATION

Assignments on lecture material	10 %
Lecture Quizzes (4)	30 %
Lab Quizzes (4)	15 %
Lab Assignments	20 %
Final Exam	25 %
Total	**100%**

Students are expected to read lab material before coming into the lab. There is no final exam for the laboratory portion of the course, instead there will be four lab quizzes during the semester.

Lecture quizzes and assignments are given during normally scheduled class time and take ~20 minutes to complete.

Lab assignments are handed out at the beginning of lab sessions and are to be completed once lab exercises are completed. They are due within one week unless otherwise announced. Late assignments may be deducted -5% of marks per day.

Students must pass the lab and lecture portions of the course independently.

COURSE WITHDRAWAL INFORMATION

The last date to withdraw without academic penalty is Mar. 7th, 2024. Refer to the YukonU website for other important dates.

TEXTBOOKS & LEARNING MATERIALS

Students are required to purchase a textbook; either as a hard copy from the YU bookstore, or an online eText access through the publisher (Pearson).

Essentials of Genetics, 2016 or newer, W. S. Klug, M. R. Cummings, C. A. Spencer and M. A. Palladino, 10th (or 9th) Edition, Pearson

With supplemental material (*not required*) from: Genetic Analysis an integrated approach, 3rd edition, M. F. Sanders and J. L. Bowman. 2019. Pearson.

Students will be expected to read and understand scientific articles relating to course material.

Lab Manuals will be handed out during the lab in the form of three-hole punched pages at least one week before the scheduled lab.

Students are required to wear a lab coat during lab sessions. These can be purchased from the YU Bookstore for $20. Students are also required to use disposable gloves and safety glasses on occasion. These are provided. Unless otherwise announced, students will be required to wear masks for COVID-19 precaution during labs. Students should bring a mask that is comfortable enough to wear for a 3-hour lab session.

ACADEMIC INTEGRITY

Students are expected to contribute toward a positive and supportive environment and are required to conduct themselves in a responsible manner. Academic misconduct includes all forms of academic dishonesty such as cheating, plagiarism, fabrication, fraud, deceit, using the work of others without their permission, aiding other students in committing academic offences, misrepresenting academic assignments prepared by others as one's own, or any other forms of academic dishonesty including falsification of any information on any Yukon University document.

Please refer to Academic Regulations & Procedures for further details about academic standing and student rights and responsibilities. https://www.yukonu.ca/policies/academic-regulations

ACADEMIC ACCOMMODATION

Reasonable accommodations are available for students requiring an academic accommodation to fully participate in this course. These accommodations are available for students with a documented disability, chronic condition or any other grounds specified in section 8.0 of the Yukon University Academic Regulations (available on the Yukon University website). It is the student's responsibility to seek these accommodations by contacting the Learning Assistance Centre (LAC): LearningAssistanceCentre@yukonu.ca.

TOPIC OUTLINE

UNIT TOPIC	WEEK	Chapter
Introduction	1	CH 1
Comparing Mitosis and Meiosis		CH 2
Basic Mendelian Genetics		CH 3
Monohybrid, dihybrid, and trihybrid crosses	2	
Human genetics: pedigrees		
Statistics, e.g. the chi-square test		
Exceptions to Mendel's Laws	3	CH 4
Quiz I ****** Jan 22nd ******		
Sex-linked inheritance		
Sex Determination	4	CH 5
Errors in meiosis, chromosome alteration	5	CH 6
and genetic disorders		
Transmission Genetics		
Linkage and chromosome mapping	6	CH 7
Linkage maps		
Quiz II ****** Feb 12th ******		
Genetic Analysis – bacteria and bacteriophages	7	CH 8

DNA organization		CH 11
Structure of DNA, replication of DNA, transcription, and translation of DNA to protein (students that have not taken BIOL 201 please ***read CH 9*** for review)		
Mutation of genes, DNA repair mechanisms	8	CH 14
Regulation of Gene Expression in Prokaryotes, CRISPR	9	CH 15
Regulation of Gene Expression in Eukaryotes	10	CH 16
Ethics and applications of genetic engineering		
Quiz III ***Mar 11th ***		
Genomics, Bioinformatics, Proteomics	11	CH 18
The Genetics of Cancer	12	CH 19
Quantitative Genetics, Population Genetics – *as time allows*	13	CH 20
Quiz IV ***Apr 3rd ***		
Review	14	

Last class April 10th, Final exam – April 18th at 9 am in A2202
https://www.yukonu.ca/programs/courses/biol-201

Lab Schedule and List of Topics – *Labs start in the second week of classes.*
Labs take place in Room A2805

Lab 1	Introduction to the lab, safety, working with live model organisms Review of mitosis and meiosis; making a squash of pea seedling roots (mitosis) and cricket testes (meiosis) Exercise on karyotyping chromosomes
Lab 2	**LAB QUIZ #1** Introduction to *Drosophila* Creation (start) of crosses: a monohybrid cross, two dihybrid crosses, a sex-linked cross and a 3-point cross for gene mapping
Lab 3	Continuation of crosses: a monohybrid cross, a dihybrid cross (two types), a sex-linked cross Start of comparison of two dihybrid crosses to demonstrate gene mapping
Lab 4	**LAB QUIZ #2** Continuation of Mendelian Genetics crosses, assessment of initial results Statistical analyses: the chi-square test Gene Mapping from a Four-Point Cross of Drosophila for final full lab report (due for lab 8)
Lab 5	Transduction of phage DNA into bacterial DNA plasmids, use of restriction enzymes, amplification of this DNA, gel electrophoresis of results
Lab 6	**LAB QUIZ #3**

	DNA extraction and digest using restriction enzymes
Lab 7	Continuation of DNA extraction and digest using restriction enzymes
Lab 8	DNA amplification using PCR **Mendelian Genetics final lab report** – Mendelian crosses and Gene Mapping from a Four-Point Cross of *Drosophila due*
Lab 9	**LAB QUIZ #4** Student Presentations