COURSE OUTLINE

BIOL 202

Genetics

3 **CREDITS**

PREPARED BY: Tara Stehelin, Biology Instructor
DATE: November 6, 2020

APPROVED BY: Joel Cubley, Chair, School of Science
DATE: November 6, 2020

BIOLOGY 202 Genetics

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OFFICE HOURS: Thurs 12:00 – 1:30
or by appointment
CLASSROOM: online or labs in A2805
TIME: Wednesdays (9:00 – 10:30) (online, synchronous)
Labs: Tuesdays (2:30 –5:00)

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 analysing genetic frequencies and basic methodology in conducting genetic experiments, as well as practise employing the scientific process.

PREREQUISITES

Successful completion of both Biology 101 and 102 or equivalent with a final grade of "C" or higher in both. Successful completion of one semester of a university-level first-year chemistry course.

EQUIVALENCY OR TRANSFERABILITY

Transfers to most universities in BC as a second-year introductory genetics course.
Please see the University Website for more information on transferability: https://www.yukonu.ca/admissions/transfer-credit

LEARNING OUTCOMES

Upon successful completion of the course, a student 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

Material will be presented in two 1.5 hr lectures and one 3 hr lab session per week. Attendance in the laboratory is mandatory. *Students must pass the lab and lecture portions of the course independently.*

Because of unusual circumstances of the **SARS Cov-2 pandemic** of 2019 and 2020, lectures will be delivered online. Students are greatly encouraged to attend lectures when they are delivered synchronously (during the lecture time) although lectures will be recorded and can be watched later. Labs will be delivered in face-to-face format, but with some added precautionary measures in place in the lab. Please follow all directions carefully. Students are expected to have access to a computer for best viewing of online lectures and activities. If this is not possible, please contact the university to make other arrangements.

ASSESSMENTS

Attendance

Students are expected to participate actively in laboratory exercises, including taking part in classroom discussions of results of lab activities and experiments. A portion of lab assignment marks will be related to a student's participation in classroom discussion and presentations.

Lab

Assignments are given during laboratory sessions and are outlined in the lab manual. Most assignments are based on results and discussions resulting from experiments.

Lecture

Two midterms will be given on lecture material throughout the semester and are worth 40%

of the total mark. The final examination with 25% of the final mark will be held at the end of the term and will cover material from the entire course, although it will focus mostly on the last portion of material.

EVALUATION

Lecture Material	**65%**
Midterms (2, 20% each)	40%
Final Exam	25%
Lab Material	**35%**
Lab Assignments	17.5%
Lab Quizzes (2) and participation in lab exercises	17.5%
Total	**100%**

REQUIRED TEXTBOOKS AND MATERIALS

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

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

Lab Manuals will be handed out during the lab in the form of three-hole punched pages. Students will be expected to read and understand scientific articles relating to course material.

ACADEMIC AND STUDENT CONDUCT

Information on academic standing and student rights and responsibilities can be found in the current Academic Regulations that are posted on the Student Services/ Admissions & Registration web page. (section 4.0 on Academic conduct) https://www.yukonu.ca/sites/default/files/policies/Academic%20Regulations_Effective%20Jul%201%202020%20-%20Dec%2031%202020.pdf

PLAGIARISM

Plagiarism is a serious academic offence. Plagiarism occurs when a student submits work for credit that includes the words, ideas, or data of others, without citing the source from which the material is taken. Plagiarism can be the deliberate use of a whole piece of work, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Students may use sources which are public domain or licensed under Creative Commons; however, academic documentation standards must still be followed. Except with explicit permission of the instructor, resubmitting work which has previously received credit is also considered plagiarism. Students who plagiarize material for assignments will receive a mark of zero (F) on the assignment and may fail the course. Plagiarism may also result in dismissal from a program of study or the University.

YUKON FIRST NATIONS CORE COMPETENCY

Yukon University recognizes that a greater understanding and awareness of Yukon First Nations history, culture and journey towards self-determination will help to build positive relationships among all Yukon citizens. As a result, to graduate from ANY Yukon University program, you will be required to achieve core competency in knowledge of Yukon First Nations. For details, please see www.yukonu.ca/yfnccr.

ACADEMIC ACCOMMODATION

Reasonable accommodations are available for students requiring an academic accommodation to fully participate in this class. 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. It is the student's responsibility to seek these accommodations. If a student requires an academic accommodation, they should contact the Learning Assistance Centre (LAC): lac@yukonu.ca.

TOPIC OUTLINE	(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
Sex-linked inheritance		
Sex Determination		
Errors in meiosis, chromosome alteration	4	
and genetic disorders		CH 6
Midterm I ****** FEB 10th ******		
Transmission Genetics		
Linkage and chromosome mapping	5	CH 7
Linkage maps		
Genetic Analysis – bacteria and bacteriophages	6	CH 8
Molecular Genetics		
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	7	CH 14
The Genetics of Cancer	8	CH 16
Recombination of genes	9	CH 17
Midterm II ******MARCH 9 ******		
Ethics and applications of genetic engineering	10	CH 19
Quantitative Genetics	11	CH 21
Evolutionary Genetics		
Population Genetics	12	CH 22
Human population genetics		

Last class April 12th *Final Exam* (April 14 - 28)

Lab TOPICS AND SCHEDULE

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	Introduction to *Drosophila* Creation (start) of crosses: a monohybrid cross, two dihybrid crosses, a sex-linked cross and a four-point cross for gene mapping
Lab 3	Continuation of Mendelian Genetics crosses, assessment of initial results Statistical analyses: the chi-square test
Lab 4	Transduction of phage DNA into bacterial DNA plasmids, use of restriction enzymes, amplification of this DNA, gel electrophoresis of results
Lab 5	**LAB QUIZ #1** Continuation of lab 5 (if needed) and beginning of *Streptomycin* mutations
Lab 6	Sequencing of mutant Gene Comparison of Mutant Gene to Wildtype Gene
Lab 7	DNA amplification using PCR demonstration or gene regulation operon fusion **Mendelian Genetics final lab report** – Mendelian crosses and Gene Mapping from a Four-Point Cross of *Drosophila due*
Lab 8	Population Genetics – activity TBA Variation in human genetics and the pedigree
Lab 9	Student Presentations **Lab Final Quiz**