UNIVERSITY OF SASKATCHEWAN

Department of Biology

COURSE SYLLABUS

Course title:	**BIOL 226 - From Genes to Genomics**		
Course code:	CRN 41861	Term:	Spring 2022 (Q2)
Course credits:	3.0	Delivery:	Lecture & Lab
Class session:	01	Start Date:	June 02 2022
Lecture room:	Thordvaldson 205A	Lab room:	Thordvalson G74A
Lecture time:	**MTWRF 9:00 to 11:20 am**	Lab time:	MTWRF 1:30 to 4.20pm
Website/notes:	via Canvas	Prerequisites	Biology 120.3 or 110.6

Calendar Description

Content ranges from Mendelian genetics to molecular biology. Examples from eukaryotic species, including humans, are emphasized. Topics include classical transmission genetics, cytogenetics, DNA structure and replication, gene function, mutation and repair, regulation, recombinant DNA technology, and structural, functional and comparative genomics.
Prerequisites: Biology 120.3 or 110.6

Learning Context

Lectures and laboratories for BIOL226 Q2 are fully face to face, conditional on the fluid public health situation. **You are reminded that masks are mandatory in all in door campus buildings until June 30, 2022**. Please refer to the most current Health and Safety Requirements at: *https://covid19.usask.ca/about/safety.php#Expectations*.

Course Overview

BIOL226 is an introduction to the basic genetics concepts that permeate several other fields in the biological sciences and is intended to prepare students for senior molecular biology and genetic courses. The course combines classical genetics with modern molecular analysis. The first half of the course focuses on Mendelian genetics as it relates to the Chromosomal Theory of Inheritance. Practical applications of classical genetics principles such as linkage and recombination in building genetic maps are explored. In the second half, we turn to understand the fundamental molecular processes (transcription and translation) that coordinate the flow of genetic information (the Central Dogma of Molecular Biology). We then move to investigate how the genome is transcriptionally regulated to yield variation at the level of the phenotype both genetically and epigenetically.

Note: The University of Saskatchewan Learning Charter is intended to define aspirations about the learning experience that the University aims to provide, and the roles to be played in realizing these aspirations by students, instructors and the institution. A copy of the Learning Charter can be found at:
http://www.usask.ca/university_secretary/LearningCharter.pdf

Learning Outcomes

By the completion of this course, students will be expected to:

1. Understand the basics of genetic analysis at the gene and genome levels.
2. Understand the functional organization of prokaryotic and eukaryotic genomes.
3. Understand gene expression and regulation mechanisms.
4. Be able to solve basic genetic problems.

Instructor information:

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Dr. Carvalho is a regular faculty member in the Department of Biology. He holds an MSc in molecular biology and a PhD in molecular genetics. Dr. Posso-Terranova is a laboratory coordinator for genetics courses in the Department of Biology. He holds a MSc in plant breeding and a PhD in evolutionary genetics.

Office Hours: Please note that all instructors have other commitments that may take them away from their office. Specific appointments can be set by email only.

Date	Lecture #	Topic and Griffiths text chapters
June 02 – Thu	1	TOPIC 1 - The fundamental principles of heredity (Chapters 2/3/6)
June 03 – Fri	2	TOPIC 2 - Chromosomal basis of Mendelism (Chapters 2/3/16/17)
June 06 – Mon	3	TOPIC 2 - Chromosomal basis of Mendelism (Chapters 2/3/16/17)
June 07 – Tue	4	TOPIC 3 - Extensions of Mendelian laws (Chapter 6)
June 08 – Wed	5	TOPIC 4 - Linkage and genetic mapping (Chapter 4)
June 09 – Thu	6	TOPIC 4 - Linkage and genetic mapping (Chapter 4)
June 10 – Fri	-	MIDTERM EXAM –
June 13 – Mon	7	TOPIC 5 - Transcription and translation (Chapters 8/9)
June 14 – Tue	8	TOPIC 5 - Transcription and translation (Chapters 8/9)
June 15 – Wed	9	TOPIC 5 - Transcription and translation (Chapters 8/9)
June 16 – Thu	10	TOPIC 6 - Gene isolation and manipulation (Chapter 10/11/5)
June 17 – Fri	11	TOPIC 7 - Regulation of gene expression in prokaryotes (Chapter 11)
June 20 – Mon	12	TOPIC 7- Regulation of gene expression in prokaryotes (Chapter 11)
June 21 – Tue	13	TOPIC 8 - Regulation of gene expression in eukaryotes (Chapter 12)
June 22 – Wed	14	TOPIC 9 - Epigenetic control of gene expression (Chapter 12)
June 23 – Thu		Exam period
June 24 – Fri		Exam period
June 27 – Mon		Exam period

Lecture Schedule (June 02 to June 22)

Please be aware that lectures are not recorded and there won't be make up lectures. Please plan to attend all lectures.

Laboratory Schedule

Each student is required to purchase an access code from the U of S campus bookstore for downloading the lab book- https://artsandscince.usask.ca/ebook.

Date	Lab	Lab Exercise	Key points	Assignments / Lab Quizzes
June 2	Through Canvas	Check essential information and general introduction in Canvas (Module 1)	Presentation of lab details and support, how to access the genetics simulator, assignment requirements and general information	-
June 3	In person: **lab # 1**	Laboratory # 1. Introduction to genetics and monohybrid crosses	-The different stages of a model organism (*Drosophila* melanogaster) -Phenotypic traits and male vs. female differentiation. -*Drosophila* genetics notation -Breeding experiment: Observation of P_1 and P_2 flies, score parentals	- Return assignment # 1 at the end of the laboratory session (physical copy or through Canvas)
June 7	In person: **lab # 2**	Laboratory # 2. *Drosophila* breeding experiment: F_1 generation and dihybrid crosses.	- Obtain and analyze simulated F_1 and F_2 data that illustrate segregation and assortment. - Propose a genetics model of inheritance for several traits -Breeding experiment: score and analyze F_1 flies	- Return assignment # 2 at the end of the laboratory session (physical copy or through Canvas)
June 8	In person: **lab # 3**	Laboratory # 3. *Drosophila* breeding experiment: (Sex-linked traits).	-Obtained simulated F_1 data that illustrate sex-linkage. - Propose a genetic model of inheritance for several traits - Analyze hypothetical crosses that illustrate a gene-interaction -Breeding experiment: Score F_1 parental flies and predict the F_2 outcome.	- Return assignment # 3 at the end of the laboratory session (physical copy or through Canvas)
June 10	In person: **lab # 4**	Laboratory # 4. Gene linkage and chromosome mapping.	- Obtain F_1 data that illustrates trihybrid and test-crosses. - Describe the difference between independent assortment and gene linkage - Map two genes on a chromosome - Analyze real-case data from a trihybrid cross to map three genes -Breeding experiment: score and analyze F_2 flies	- Return assignment # 4 at the end of the laboratory session (physical copy or through Canvas)
June 13	In person: **Lab quiz # 1**	-	-Please bring your own electronic device to take the lab quiz. -Laptop computer or larger tablets are recommended over cell phones.	- **Lab quiz # 1.** Room G74A, during lab session time. -Access through Canvas. Topics: Labs 1-4

June 14	In person: **lab # 5**	Laboratory # 5. *Drosophila* eye coloration: A combination of protein pigments	-Describe the *Drosophila's* protein-pigment differences. - Identify genes (enzymes) that are involved in the biosynthesis of protein pigments. - Recognize the epistatic interactions between pigmentation genes.	- Return assignment # 5 at the end of the laboratory session (physical copy or through Canvas)
June 15	In person: **lab # 6**	Laboratory # 6. The Chi-square (X^2) test: A statistical test for experiments.	- Propose a scientific hypothesis for a genetic cross. - Calculate a X^2 statistic value. - Use a calculated X^2 value to determine whether there is a statistically significant difference between hypotheses -Observation and analysis of chromatography plate	- Return assignment # 6 at the end of the laboratory session (physical copy or through Canvas)-
June 17	In person: **lab # 7**	Laboratory # 7. *Drosophila* class data review and PCR Genotyping	-Determine the genetics model of inheritance of four genes - Propose a scientific hypothesis and test it - Map three genes on a chromosome -Set up a PCR reaction for genotyping	- Return assignment # 7 at the end of the laboratory session (physical copy or through Canvas)-
June 20	In person: **lab # 8**	Laboratory # 8. DNA genotyping of *Drosophila* mutants: The white-1 locus (w) and gel electrophoresis	- Establish the link between genotype and the white-eyes phenotype in *Drosophila*. - Identify two common molecular genetics methods. - Perform a gel electrophoresis to identify *Drosophila* mutants. - Perform a simulated PCR test to differentiate DNA sequences.	- Return assignment # 8 at the end of the laboratory session (physical copy or through Canvas)-
June 22	In person: **Lab quiz # 2**	-	-Please bring your own electronic to take the lab quiz. -Laptop computer or larger tablets are recommended over cell phones.	- **Lab quiz # 2.** Room G74A, during lab session time. Access through Canvas. Topics: Labs 5-8

Resources

Textbook: 'Introduction to Genetic Analysis' – 12th edition. Griffiths et. al. 2020. The ebook license with Achieve® is available through the bookstore. Achieve is an online platform with several learning resource features (https://store.macmillanlearning.com/ca/digital/intro/achieve).

Electronic Resources: Students are encouraged to use Achieve® as a supplementary, not for marks, study questions.

Students are required to purchase an access code from the U of S campus bookstore for downloading the lab manual (https://artsandscience.usask.ca/ebook).

Most lectures will be based on chapters of the Griffiths text listed above. In some cases, sections of chapters will be complemented with information from the Snustad text. Chapter links to the lectures will be announced in class. Copies of the textbook can be found in the Natural Sciences Library. The textbook should help students to prepare in advance for lecture and as a resource in studying for exams, it should not be used as a substitute for the lecture notes and attendance.

Grading Scheme

Evaluation of Student Performance

There are four components in the marking scheme of the course: Midterm exam, Final exam, laboratory assignments (n=8) and lab quizzes (n=2). There are no minimal marks required in these individual components in order to successfully pass the course.

Midterm and Final exam questions will be based on the material (posted notes) presented and discussed in lecture. Use the suggested textbooks and online material as reference for context when studying.

1) **Midterm Exam Value:** 30% of final course grade. Date: June 10 from 9am to 11am at Thorv205A. Format: 40 multiple choice questions. Calculators allowed. No phones, laptops, tablets or other material allowed. The midterm exam covers the first five lectures of the course.

2) **Final Exam Value:** 40% of final grade. Date: Consult the Final Exam Schedule. Length: 3 hours Format: 60 multiple choice questions. The final exam covers the material delivered in the lectures after the Midterm exam. No phones, laptops, tablets or other material allowed.

3) **Lab Component**: 30% of final grade. A total of eight (8) lab assignments (worth 10%) must be returned as physical copies (i.e., printed) or submitted online through Canvas, according to the lab schedule (deadlines). Two lab quizzes (20%) are based on the information provided in the briefings, video material, practical component, and laboratory manual. They will be performed in-person during the scheduled lab sessions and accessible through Canvas. Hence, **a laptop computer or larger tablet will be required for taking the quizzes**. The format includes multiple choice questions, fill in the blank, matching concepts, true/false, etc.

Copyright

Course materials are provided to you based on your registration in a class, and anything created by your professors and instructors is their intellectual property, unless materials are designated as open education resources. This includes exams, PowerPoint/PDF slides and other course notes. Additionally, other copyright-protected materials created by textbook publishers and authors may be provided to you based on license terms and educational exceptions in the Canadian Copyright Act (see http://laws-lois.justice.gc.ca/eng/acts/C-42/index.html). Before you copy or distribute others' copyright-protected materials, please ensure that your use of the materials is covered under the University's Fair Dealing Copyright Guidelines available at https://library.usask.ca/copyright/general-information/fair-dealing-guidelines.php. For example, posting others'

copyright-protected materials on the open web is not covered under the University's Fair Dealing Copyright Guidelines, and doing so requires permission from the copyright holder.

For more information about copyright, please visit https://library.usask.ca/copyright/index.phpwhere there is information for students available at https://library.usask.ca/copyright/students/rights.php, or contact the University's Copyright Coordinator at mailto:copyright.coordinator@usask.ca or 306-966-8817.

Academic Honesty

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students should read and be familiar with the Regulations on Academic Student Misconduct (https://secretariat.usask.ca/student-conduct-appeals/academic-misconduct.php) as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of Complaints and Appeals (https://secretariat.usask.ca/student-conduct-appeals/academic-misconduct.php#IXXIIAPPEALS)

For more information on what academic integrity means for students see the Academic Integrity section of the University Library Website at: https://library.usask.ca/academic-integrity#AboutAcademicIntegrity

You are encouraged to complete the Academic Integrity Tutorial to understand the fundamental values of academic integrity and how to be a responsible scholar and member of the USask community - https://library.usask.ca/academic-integrity.php#AcademicIntegrityTutorial. As part of the lab you are required to complete the first tutorial module.

Access and Equity Services (AES) for Students

Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals at any time. Those students who are registered with AES with mental health disabilities and who anticipate that they may have responses to certain course materials or topics, should discuss course content with their instructors prior to course add / drop dates. In order to access AES programs and supports, students must follow AES policy and procedures. For more information or advice, visit https://students.usask.ca/health/centres/access-equity-services.php, or contact AES at 306-966-7273 or aes@usask.ca.

Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

For information on AES services and remote learning please visit https://updates.usask.ca/info/current/accessibility.php#AccessandEquityServices

Treaty Acknowledgement

As we engage in Remote Teaching and Learning, we would like to acknowledge that the Saskatoon campus of the University of Saskatchewan is on Treaty Six Territory and the Homeland of the Métis. We pay our respect to the First Nation and Métis ancestors of this place and reaffirm our relationship with one another. We would also like to recognize that some may be attending this course from other traditional Indigenous lands. We ask that you take a moment to make your own Land Acknowledgement to the peoples of those lands. In doing so, we are actively participating in reconciliation as we navigate our time in this course, learning and supporting each other.