

## COURSE SYLLABUS

COURSE TITLE:	BIOL 226: From Genes to Genomes		
COURSE CODE:	CRN 82713	TERM:	Fall 2019
COURSE CREDITS:	3.0	DELIVERY:	Lecture & Practicum (Lab)
CLASS SECTION:	01	START DATE:	September 4 <sup>th</sup> 2019
CLASS LOCATION:	Biology 106	LAB LOCATION:	Thorvaldson G77
CLASS TIME:	10:30 to 11:20 am (M,W,F)	LAB TIME:	See lab schedule
WEBSITE:	via Blackboard		

### Calendar Description

Content ranges from Mendelian genetics to computational procedures based on the complete genome. 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.

### Learning Outcomes

By the completion of this course, students will have a sound basic understanding of the principles of Mendelian and molecular genetics.

The student will:

1. Understand Mendel's first and second law of genetics and how they relate to cytogenetics.
2. Be able to predict the outcome of crosses and to carry out pedigree analysis.
3. Understand the principles of recombination and be able to map chromosomes
4. Recognize how expression of genetic information is related to phenotype
5. Be conversant with genomics and the application of genomic technologies.
6. Understand how genes behave in populations and how this mechanism contributes to evolutionary processes.

**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:

<https://teaching.usask.ca/documents/vptl/LearningCharter.pdf>

More information on the Academic Courses Policy on course delivery, examinations and assessment of student learning can be found at: <https://students.usask.ca/index.php> under "Academics."

### Course Overview

First, the course focus on Mendelian genetics (including modified Mendelian inheritance) and how it relates to the chromosomal theory of inheritance. This is followed by the study of genetic linkage, genetic recombination and their applications (i.e. genetic mapping). DNA mutation and repair are then studied, followed by chromosomal mutation and rearrangements. Then, based on the previous topics, the course focus on how recombinant DNA technology can be used to isolate and modify genes to provide research tools and practical applications.

Understanding gene expression leads to an exploration of gene regulation in plants and animals, and it is followed by the study of DNA sequencing technologies, comparative genomics and recent advances in genetics. Towards the end of the course, it explores the relation of genes and their different forms (i.e. alleles) at the population level and how this mechanism shapes the evolutionary history of living organisms.

The field of genetics represents a fundamental aspect of modern society. Genetics research has strengthened our understanding of human biology, crop and livestock production, medical and diseases treatment and environmental applications. This course is intended to provide an introduction to this fascinating field of science by studying basic genetics topics, principles and research methods in the context of the diversity in prokaryotic and eukaryotic life. The course consists of both lecture and laboratory components. Laboratories will be divided in an introduction, protocol explanation, and experimental part. At the end of each experiment, a discussion will take place considering the data generated in the class. The laboratory exercises will be composed of simple questions about the experiment performed and will be completed individually during the scheduled lab time.

### **Suggested order of topics**

The topics cover in class will include:

#### **Part 1. Introduction and transmission Genetics**

- The fundamental principles of heredity
- Mendelian genetics
- Molecular basis of Mendelian inheritance
- Extensions of Mendelian genetics (gene interactions)
- Linkage and recombination mapping

#### **Part 2. Molecular genetics: from DNA to phenotype**

- DNA structure and analysis
- DNA replication and recombination
- DNA organization in chromosomes
- Gene expression and regulation
- Recombinant DNA technology to genomics

#### **Part 3. Mutation, variation and evolution**

- Mutations and epigenetics
- Inheritance of complex traits: quantitative genetics
- Population genetics and selection

\*Disclaimer: This course outline is tentative and may be subjected to change\*

**Note: Last day to withdraw from Fall Term classes is Friday November 15, 2019.**

**Laboratory class information:**

During the lab sessions, students will perform the following activities:

1. *Drosophila melanogaster* controlled crosses
2. Phenotyping and scoring of parental, F<sub>1</sub> and F<sub>2</sub> generations
3. Chromatography and PCR assays
4. Concept problems

**Proposed Laboratory Schedule**

Date	Week	Lab	Lab Exercise
September 16-20	1	1	Lab presentation and introduction to genetics. <i>Drosophila melanogaster</i> breeding experiment: Set up main cross (P <sub>1</sub> X P <sub>2</sub> )
September 23-27	2	2	<i>Drosophila</i> experiment: Analysis of cross involving sex-linked traits. Check vials for adults, larvae, pupa
September 30 - October 4	3	3	<i>Drosophila</i> experiment: Analysis of cross involving gene linkage and gene mapping. Setup F <sub>1</sub> X F <sub>1</sub> cross
October 7-11	4	4	Thin layer chromatography of <i>Drosophila</i> eye pigments.
October 14-18	5		<i>No labs this week</i>
October 21-25	6	5	Chi-square (X <sup>2</sup> ) test: a statistical test for experiments (F <sub>1</sub> <i>Drosophila</i> data analysis). Score F <sub>2</sub> progeny
October 28 - November 1	7	6	Mendelian genetics: general remarks and <i>Drosophila</i> class data discussion - analysis
November 4-8	8	7	PCR genotyping of <i>Drosophila</i> mutants: The white (w) locus.
November 11-15	9		<i>Fall mid-term break</i>
November 18-22	10	8	Gel electrophoresis of DNA fragments and laboratory review.
Tuesday November 26-	11	-	Lab Final exam: November 26 at 7:00 - 9:00 PM. HLTH 1150

**Attendance Expectations for Laboratory Classes**

There are **no mandatory** components to this course, however, *students are expected to attend all scheduled classes*. Conceptual understanding of Genetics, like all science courses, requires students to actively engage and interact with colleagues. Students are expected **to attend all scheduled laboratories**. No make-up labs will be offered.

## Instructors

### Dr. Christopher Todd

Office: 220.6 Collaborative Science Research Building (CSRB)

Phone: 306-966-4497

Email: chris.todd@usask.ca

### Lab Coordinator:

Dr. Andres Posso-Terranova

Office: room G77 THORV Building

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**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.

## Resource Material

**Textbook:** A customized edition of *Introduction to Genetic Analysis*. Griffiths et al. 11th Edition. Freeman, has been designed for use in Biol 226. It is available through the bookstore and includes Sapling Access.

## Downloads

These will be available as appropriate through the course Blackboard site. The only document that you are required to download and read is the course syllabus. **Please note that instructor's PowerPoint slides or lecture notes may be provided to you as a courtesy.** You are not required to download or print these slides/notes. While the instructor will endeavor to have the lecture PowerPoint slides/notes posted sometime in advance of the lecture, **this is not a guarantee.**

## Grading Scheme

Midterm exam	25%
Final exam	40%
Laboratory	30%
Sapling Assignments	5%
<b>Total</b>	<b>100%</b>

## Evaluation Components

### Midterm Exam:

**Value:** 25% of final course grade

**Date:** Date to be announced, during class period

**Length:** 50 minutes

**Format:** Multiple choice problems and questions

**Description:** Based on all lecture material prior to the exam date unless otherwise indicated. No phones, laptops, tablets or other material allowed.

**Final Exam:**

- Value:** 40% of final course grade  
**Date:** Consult Final Exam Schedule  
**Length:** 180 minutes (3 hours)  
**Format:** Multiple choice problems and questions  
**Description:** The exam is a comprehensive evaluation (i.e. cover all lectures and material). Material delivered since the midterm exam will be emphasized. No phones, laptops, tablets or other material allowed.

**Laboratory**

- Value:** 30% of final grade (20% lab exam and 10% assignment/concept problems)  
**Date:** see Laboratory Schedule  
**Format:** Multiple choice and short answer questions about the experiments and background of the laboratory experiments  
**Description:** The desired format and expectation for the lab reports will be presented in the lab period.

**Sapling Assignments**

- Value:** 5% of final grade  
**Date:** multiple online assignments  
**Format:** Completion of online assignments designed to increase comprehension.  
**Description:** More information on Sapling assignments will be provided in the lecture period.

**University of Saskatchewan Grading System**

Students in BIOL 226 are reminded that the University has established a grading system to be used in all of its courses. Information on literal descriptors for grading at the University of Saskatchewan (reproduced below) can be found at: <https://students.usask.ca/academics/grading/grading-system.php>

**Scheduling of Exams**

Students must bring their current University of Saskatchewan student card to all exams and be prepared to present it for verification purposes. Entry into certain campus buildings where exams may be held, also requires a valid student card.

It is forbidden for students to utilize in any way during an exam, any electronic device (e.g., cell phone, dictionary, palm pilot, translator, etc.). If calculators are permitted for an exam they must be a simple, non-programmable style.

Midterm and final examinations, and the lab exam, must be written on the date scheduled. Final examinations may be scheduled at any time during the examination period in December 2013; students should therefore avoid making prior travel, employment, or other commitments for this period.

In the event that a student is absent from the **midterm exam** through no fault of his/her own due to a medical emergency, death in the family, or other valid reasons, documentation must be provided explaining the absence, to assist in the determination of whether permission will be granted for the student to write a deferred mid-term exam. Students absent for the Mid-Term Lecture Exam **must advise their Instructor in person or by telephone (not by email) and initiate arrangements for writing a Deferred Mid-Term Exam, within 3 working days of the missed exam**, in order to avoid being assigned a grade of zero for the exam.

If a student is absent from the **final exam** through no fault of his or her own for medical or any other valid reason, **he/she must apply to the Dean's Office of the College in which he/she is registered for an opportunity to write a Deferred Final Exam, within 3 working days of the missed exam.** Documentation must also be provided to explain the absence from the final exam. Deferred exams may utilize a different format than the regular exam, at the sole discretion of the instructors.

Students are encouraged to review all examination policies and procedures:

<https://students.usask.ca/academics/exams.php>

### **Examinations with Access and Equity Services (AES)**

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](mailto: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.

### **Student Feedback**

Lab report feedback will usually be available within one week. Midterm and final exam grades will be communicated via the course Blackboard site and exams will be available for student review by appointment.

### **Integrity Defined (from the Office of the University Secretary)**

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>

## **Student Supports**

### **Student Learning Services**

Student Learning Services (SLS) offers assistance to U of S undergrad and graduate students. For information on specific services, please see the SLS web site <http://library.usask.ca/studentlearning/>.

### **Student and Enrolment Services Division**

The Student and Enrolment Services Division (SESD) focuses on providing developmental and support services and programs to students and the university community. For more information, see the students' web site <http://students.usask.ca>.

### **Financial Support**

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact Student Central (<https://students.usask.ca/student-central.php>).

### **Aboriginal Students' Centre**

The Aboriginal Students' Centre (ASC) is dedicated to supporting Aboriginal student academic and personal success. The centre offers personal, social, cultural and some academic supports to Métis, First Nations, and Inuit students. The centre is also dedicated to intercultural education, bringing Aboriginal and non-Aboriginal students together to learn from, with and about one another in a respectful, inclusive and safe environment. Students are encouraged to visit the ASC's Facebook page (<https://www.facebook.com/aboriginalstudentscentre/>) to learn more.

### **International Student and Study Abroad Centre**

The International Student and Study Abroad Centre (ISSAC) supports student success in their international education experiences at the U of S and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange and English as a Second Language students and their families in their transition to the U of S and Saskatoon. ISSAC offers advising and support on all matters that affect international students and their families and on all matters related to studying abroad. Please visit [students.usask.ca](http://students.usask.ca) for more information.

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