UNIVERSITY OF SASKATCHEWAN

Department of Biology

COURSE SYLLABUS

BIOL 226 - From Genes to Genomics

Course code:	CRN 22176	Term:	Winter (T2) 2019
Course credits:	3.0	Delivery:	Lecture & Lab
Class session:	01	Start Date:	January 04 2019
Lecture room:	BIOL 106	Lab room:	Thorvaldson G77
Lecture time:	MWF 10:30 to 12:30 am	Lab time:	MTWRF 1:30 to 4.20pm
Website/notes:	via Blackboard	Prerequisites	Biology 120.3 or 110.6

Course Description

This 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) and how our understanding of genetics and its uses have changed with the advent of recombinant DNA technology. We then move to investigate how the genome is transcriptionally regulated to yield genetic variation at the level of the phenotype. This leads us to our final topic in which the complexity of gene regulatory networks is illustrated in the process of embryonic development. This course 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.

Learning Outcomes

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

1. Understand the principles of inheritance.
2. Understand the functional organization of prokaryotic and eukaryotic genomes.
3. Understand gene expression and regulatory mechanisms.
4. Be able to solve simple genetic problems.

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

Lecture Topics

The lecture series are organized around the main topics below:

Part I

TOPIC 1 –	The Genetics Revolution	(Griffths Chp 1)
TOPIC 2 –	Fundamental Principles of Inheritance	(Griffths Chps 2, 3)
TOPIC 3 –	Chromosomal Basis of Mendelism	(Griffths Chp 3.3)
TOPIC 4 –	Extensions of Mendelian Laws	(Griffths Chp 6)
TOPIC 5 –	Linkage and Genetic Mapping	(Griffths Chp 4)

Part II

TOPIC 6 –	The Central Dogma of Molecular Biology	(Griffths Chps 8,9)
TOPIC 7 –	Gene isolation and Manipulation	(Griffths Chp 10)
TOPIC 8 –	Regulation of Gene Expression in Prokaryotes	Griffths Chp 11)
TOPIC 9 –	Regulation of Gene Expression in Eukaryotes	(Griffths Chp 12)
TOPIC 10 –	Epigenetic Control of Gene Expression	(Griffths Chp 12)
TOPIC 11 –	Genetic Control of Development	(Griffths Chp 13)

Please be aware that there won't be make up lectures. Lectures will not be recorded. Please plan to attend lectures. Lecture notes (PowerPoint files) will be made available on Paws prior to the lecture.

Working Schedule

lect. #	lecturer	date	topic
L1	Carvalho	F, Jan 4	Course Introduction
L2	Carvalho	M, Jan 7	The Genetic Revolution
L3	Carvalho	W, Jan 9	The Genetic Revolution
L4	Carvalho	F, Jan 11	Fundamental principles of heredity
L5	Carvalho	M, Jan 14	Fundamental principles of heredity
L6	Carvalho	W, Jan 16	Fundamental principles of heredity
L7	Carvalho	F, Jan 18	Fundamental principles of heredity
L8	Carvalho	M, Jan 21	Chromosomal basis of Mendelism
L9	Carvalho	W, Jan 23	Chromosomal basis of Mendelism
L10	Carvalho	F, Jan 205	Chromosomal basis of Mendelism
L11	Carvalho	M, Jan 28	Extensions of Mendelian laws
L12	Carvalho	W, Jan 30	Extensions of Mendelian laws
L13	Carvalho	F, Feb 01	Extensions of Mendelian laws
L14	Carvalho	M, Feb 04	Linkage and Genetic Mapping
L15	Carvalho	W, Feb 06	Linkage and Genetic Mapping
L16	Carvalho	F, Feb 08	Linkage and Genetic Mapping
L17	Carvalho	M, Feb 11	Linkage and Genetic Mapping
L18	Carvalho	W, Feb 13	Linkage and Genetic Mapping
		Friday 15 - MID TERM EXAM (Biol106 10:30 – 11:20)	
		Feb 18-22 - MID-TERM BREAK	
L19	Carvalho	M, Feb 25	Central Dogma
L20	Carvalho	W, Feb 27	Central Dogma
L21	Carvalho	F, Mar 1	Central Dogma
L22	Carvalho	M, Mar 4	Central Dogma
L23	Carvalho	W, Mar 6	Central Dogma

lect. #	lecturer	date	topic
L24	Carvalho	F, Mar 8	Gene Isolation and Manipulation
L25	Carvalho	M, Mar 11	Gene Isolation and Manipulation
L26	Carvalho	W, Mar 13	Gene Expression in Prokaryotes
L27	Carvalho	F, Mar 15	Gene Expression in Prokaryotes
L28	Carvalho	M, Mar 18	Gene Expression in Eukaryotes
L29	Carvalho	W, Mar 20	Gene Expression in Eukaryotes
L30	Carvalho	F, Mar 22	Epigenetic Control of Gene Expression
L31	Carvalho	M, Mar 25	Doc. 'The Ghost in Our Genes'
L32	Carvalho	W, Mar 27	Genetic Control of Development
L33	Carvalho	F, Mar 29	Genetic Control of Development
L34	Carvalho	M, Apr 1	Genetic Control of Development
L35	Carvalho	W, Apr 3	Genetic Control of Development
L36	Carvalho	F, Apr 5	Review
Fina Exam – TBA			

Course Overview

The course consists of 50 minutes of lecture time, three times a week. Laboratories will be held in the mornings (Tuesdays and Thursdays), afternoons (Monday to Friday) and Wednesday evenings. Laboratory sections will be divided in introduction, protocol explanation and experiment parts. At the end of each experiment, a discussion will take place considering the data generated in the class. A laboratory exam will be administered. Laboratory experiments will not be tested in the midterm or final exams. More details will be made available in the first laboratory section.

Instructor and lab coordinator information:

Instructor: Dr. Carlos Carvalho
Contact info:
Office: room 220.5 CSRB
Ph# 966-4436
Email: carlos.carvalho@usask.ca

Lab Coordinator: Dr. Andres Posso-Terranova
Contact info:
Office: room G77 THORV Building
Ph# 966-4431
Email: andres.posso@usask.ca

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

Instructor Profiles & Other Information: 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.

Laboratory Section

Students are required to purchase an access code from the U of S campus book store for downloading the lab book- https://artsandscince.usask.ca/ebook. Access code can be purchased for 25$.

Date	Week	Lab	Lab Exercise	Key points
Jan 21 to 25	1	0	Lab presentation and introduction to genetics: *Drosophila melanogaster*	Safety information, schedule, grading scheme, Drosophila basic information
Jan 28 to Feb 1	2	1	*Drosophila* breeding experiment: Main Cross (four genes)	*Drosophila* traits observation, phenotype scoring and sexing
Feb 4 to Feb 8	3	2	*Drosophila* experiment: cross cayegory # 2. Set up F1 x F1 cross. Sex linkage	Understanding a dihybrid cross and interactions. Score F1 flies.
Fel 11 to Feb 15	4	3	*Drosophila* experiment: cross category # 3. Linkage and gene mapping. Score F2 progeny	F2 flies are emerging: scoring
Feb 18 to Feb 22	5		**Mid-Term break. No lab this week**	
Feb 25 to Mar 1	6	4	Thin layer chromatography of *Drosophila* eye pigments. Score F2 progeny	F2 flies are emerging: scoring
Mar 4 to Mar 8	7	5	Chi-square (X2) test: a statistical test for experiments (F1 *Drosophila* data analysis). Score F2 progeny	Last F2 flies scoring. Getting data for final analysis
Mar 11 to mar 15	8	6	Mendelian genetics: general remarks and *Drosophila* class data discussion	Use of class data (F2) for testing hypothesis and gene mapping
Mar 18 to Mar 22	9	7	PCR genotyping of *Drosophila* mutants: The white (w) locus.	Molecular genetics: Understanding the white mutation
Mar 25 to Mar 29	10	8	Gel electrophoresis of DNA fragments and laboratory review.	Differentiation of DNA fragments, Lab evaluation, solving exam-type exercises
Apr 1 to Apr 5	11		Final lab exam	Worth 25% of the bio226 course

Resources

Suggested Text:
Introduction to Genetic Analysis – 11th edition. Griffiths et. al. 2015.

Support text:
Principles of Genetics – 6th Edition. Snustad and Simmons. 2012.

Most lectures will be based on chapters of the Griffiths listed above. In some cases, sections of chapters will be complemented with information from the Snustad. 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 lecture notes and attendance.

Electronic Resources
Lecture notes will be posted on Blackboard (Paws). Students must acquire a license to use *Sapling*® (saplinglearning.com) with their textbook or online separately. You are not required to purchase the textbook, but you are asked to purchase a Sapling® license in order to take the assignments for marks. On line assignments using the Sapling platform will account for 5% of the student's marks. More information about Sapling® will be given in lecture in the beginning of the course.

Grading Scheme

Evaluation of Student Performance

There are four components in the marking scheme of the course: Midterm exam, final exam, On-line question assignments (Sapling®) and lab marks (lab exam and weekly assignments). There are no minimal marks required in these individual components in order to successfully pass the course, however, the lab component is required. You must take the final lab exam in order to pass BIOL226.

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

1) Midterm Exam Value: 25% of final course grade. Date: Monday, February 18 at room 106 (Biology). Length: 50 minutes. Format: Closed book exam - 40 multiple choice questions. The midterm exam covers material dealing with from Part I topics as described above. Calculators are allowed. No phones, laptops, tablets or other material allowed.
2) Final Exam Value: 40% of final grade. Date: Consult the Final Exam Schedule. Length: 3 hours Format: 100 multiple choice questions. The final exam covers all lecture material delivered. No phones, laptops, tablets or other material allowed. Calculators (not on cell phones) are allowed.
3) Question Assignments: 5% of final grade. Out-of-class online question assignments will be announced in lecture and cover the material being delivered. Each assignment will be posted online through Sapling. Students will have a designated deadline to complete the assignments. Full completion of the exercises will grant full marks for the assignment, irrespective of the score (correct answers). Incomplete assignments past the deadline will receive zero marks. In total, online assignment will account for 5% of course marks. More details about how to use sapling will be given in the first lecture.
4) Lab Component: 30% of final course grade. Lab Exam: accounts for 25% and weekly lab assignments for 5%. For due dates, see Lab schedule above. The final lab exam consists of 50 multiple choice questions. For more information, please attend the first laboratory section of the course.

Required Components and Exam Scheduling

Student MUST complete all laboratory exercises and take the lab exam to pass the course. There is no minimum lab mark requirement. In case the laboratory requirement is not met, the final course mark will be a fail irrespective of performance in midterm and final exams. Students are expected to attend all scheduled laboratory practices. No make up labs will be offered. **The lab exam, midterm and final examinations must be written on the date scheduled**. Failure to take any exam(s) will result in a mark of 0 (zero) for the correspondent exam(s). Final course examinations may be scheduled at any time during the examination period; students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write a midterm or the lab exam through no fault of his or her own, for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. **Students who miss the final exam must contact the College and apply for a deferred final exam**. Deferred exams are scheduled by the undergraduate office and may utilize a different format than the regular exam, at the sole discretion of the instructor. Students are encouraged to review all University examination policies and procedures:

http://www.usask.ca/calendar/exams&grades/examregs/

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 can be found at: http://students.usask.ca/current/academics/grades/grading-system.php

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 (http://www.usask.ca/university_secretary/honesty/StudentAcademicMisconduct.pdf) as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of Complaints and Appeals (http://www.usask.ca/university_secretary/honesty/StudentNonAcademicMisconduct2012.pdf)

For more information on what academic integrity means for students see the Student Conduct & Appeals section of the University Secretary Website at:
http://www.usask.ca/university_secretary/pdf/dishonesty_info_sheet.pdf

Examinations through 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. It is the responsibility of the student to contact DSS in advance of exams. In order to access AES programs and support, students must follow AES policy and procedures. For more information, check https://students.usask.ca/health/centres/access-equity-services.php or contact AES at 966-7273 or aes@usask.ca.