A close up of a card

Description automatically generated

Course Syllabus – Winter 2025

Land Acknowledgment

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.

Calendar Description

Content ranges from Mendelian genetics to molecular biology to population genetics. Examples from eukaryotic species, including humans, are emphasized. Topics include classical transmission genetics, cytogenetics, transcriptional regulation, gene function, mutation, DNA repair, recombinant DNA technology and structural/ functional/comparative genomics.

Learning Context and Attendance Expectations

Lectures and laboratories for BIOL226 will be delivered 100% **in person** for the Winter 2025. **There will be no video recording of lectures available to students.** **There will also be no make up lectures or labs.** While attendance is not mandatory, students are expected to be present in all lectures and labs. Up to 3% of extra marks will be distributed based on participation *during lectures* using Poll Everywhere (see below).

Course Overview

BIOL226 is an introduction to the basic genetics concepts that permeate several fields in the biological and health sciences and is intended to prepare students for senior molecular biology and genetics courses. The course combines classical genetics with molecular and genomics 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 genetic linkage, pedigree analysis and recombination in building genetic maps are explored. In the second half, we turn to understand the fundamental molecular processes behind the Central Dogma of Molecular Biology that coordinate the flow of genetic information through biological polymers, the origin of mutations and how genomes are functionally organized. We then move to investigate how the genome is transcriptionally regulated to yield variation at the level of the phenotype both genetically and epigenetically. The course ends by addressing questions in population and evolutionary genetics.

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.

Learning Outcomes

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

1. Be able to explain the genetics laws governing heredity.
2. Be able to solve basic pedigree analysis questions.
3. Understand the basics of genetic analysis at the gene and genome levels.
4. Understand the functional organization of prokaryotic and eukaryotic genomes.
5. Understand basic principles of gene expression and gene regulation mechanisms.
6. Be able to solve basic questions on changes in allele and genotypic frequencies in populations.

Instructor information:

**Instructor: Carlos Carvalho**

Contact info:

Office: room 225 CSRB

Ph# 966-4436

Email: [carlos.carvalho@usask.ca](mailto:jose.andres@usask.ca)

**Lab Coordinator: Andres Posso-Terranova**

Contact info:

Office: room G77 THORV Building

Ph# 966-4431

Email: andres.posso@usask.ca

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

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.

Lecture Topics

A black background with text on it

Description automatically generated

Lecture Schedule (putative)

A screenshot of a computer

Description automatically generated

Laboratory Schedule

Each student is required to purchase an access code from the U of S campus bookstore for downloading the lab book: [https://shop.usask.ca/CourseSearch/?course[]=UOFS,202309,BIOL,BIOL226,01&](https://shop.usask.ca/CourseSearch/?course%5B%5D=UOFS,202309,BIOL,BIOL226,01&)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Date** | **Week** | **Lab** | **Lab Exercise** | **Key points** | **Assignments / Lab Quizzes** |
| **January 13-17** | 1 | **Remote Activity** | **Remote activity:** Check essential information and general introduction **in Canvas** | -Presentation of lab details and support, how to access the genetics simulator, assignment requirements - The Lab coordinator will set up the breeding experiment (P1 X P2). | - |
| **January 20-24** | 2 | lab # 1 | Laboratory # 1. Introduction to genetics and monohybrid crosses  **(In-person activity)** | -The different stages of a model organism (*Drosophila* melanogaster) -Phenotypic traits and male vs. female flies’ differentiation. -*Drosophila* genetics notation -Breeding experiment: Remove P1 and P2 flies, score parentals | - Return assignment # 1 at the end of the laboratory session (physical copy or through Canvas) |
| **January 27 – 31** | 3 | lab # 2 | Laboratory # 2. *Drosophila* breeding experiment: F1 generation and dihybrid crosses.  **(In-person activity)** | - Obtain and analyze F1 and F2 data that illustrate segregation and assortment. - Propose a genetics model of inheritance for several traits  -Breeding experiment: score and analyze F1 flies -Set up F1 x F1 cross to obtain F2 generation | - Return assignment # 2 at the end of the laboratory session (physical copy or through Canvas) |
| **February 3-7** | 4 | lab # 3 | Laboratory # 3. *Drosophila* breeding experiment: (Sex-linked traits).  **(In-person activity)** | -Obtained simulated F1 data that illustrate sex-linkage.  - Propose a genetic model of inheritance for several traits - Analyze hypothetical crosses that illustrate a gene-interaction -Breeding experiment: Remove F1 parental flies and predict F2 outcome. | - Return assignment # 3 at the end of the laboratory session (physical copy or through Canvas) |
| **February 10-14** | 5 | lab # 4 | Laboratory # 4. Gene linkage and chromosome mapping.  **(In-person activity)** | - Obtain F1 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 F2 flies | - Return assignment # 4 at the end of the laboratory session (physical copy or through Canvas) |
| **February 17-21** | 6 |  | Midterm break. No lab sessions this week. | | |
| **February 24 - 28** | 7 | lab # 5 | Laboratory # 5. *Drosophila* eye color: A combination of protein pigments  **(In-person activity)** | -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. | - **Lab quiz # 1.** Room G77, during lab session time. Access through Canvas. Topics: Labs 1-4  - Return assignment # 5 at the end of the laboratory session (physical copy or through Canvas) |
| **March 3-7** | 8 | lab # 6 | Laboratory # 6. The Chi-square (X2) test: A statistical test for experiments.  **(In-person activity)** | - Propose a scientific hypothesis for a genetic cross.  - Calculate a X2 statistic value.  - Use a calculated X2 value to determine whether there is a statistically significant difference between hypotheses | - Return assignment # 6 at the end of the laboratory session (physical copy or through Canvas)- |
| **March 10-14** | 9 | lab # 7 | Laboratory # 7. *Drosophila* class data review: hypotheses testing and gene mapping.  **(In-person activity)** | -Determine the genetics model of inheritance of four genes - Propose a scientific hypothesis (dihybrid cross) and statistically test its validity. - Map three genes on a chromosome | - Return assignment # 7 at the end of the laboratory session (physical copy or through Canvas)- |
| **March 17-21** | 10 | lab # 8 | Laboratory # 8. DNA genotyping of *Drosophila* mutants: The white-1 locus (w).  **(In-person activity)** | - Establish the link between genotype and the white-eyes phenotype in *Drosophila*. - Identify two common molecular genetics methods. - Perform a PCR test 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)- |
| **March 24 - 28** | 11 | lab # 9 | Laboratory # 9. Population genetics: Gene pool and allele frequencies.  **(In-person activity)** | - Describe the gene pool concept. -Estimate genotype and allele frequencies based on phenotypic data. | - Return assignment # 9 at the end of the laboratory session (physical copy or through Canvas)- |
| **March 31 - April 4** | 12 |  | Lab evaluation and lab quiz # 2.  **(In-person activity)** | - Lab evaluation and Lab quiz # 2 | **Lab quiz # 2.** Room G77, during lab session time. Access through Canvas. Topics: Labs 5-9 |

Resources

* Textbook: ‘Introduction to Genetic Analysis’ – 12th edition. Griffiths et. al. 2020. Purchase of the textbook is encouraged, not required. The ebook license with Achieve is available through the bookstore: (https://shop.usask.ca/CourseSearch/?course[]=UOFS,202501,BIOL,BIOL226,01&). Achieve is an online platform with several learning resource features. 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.
* Lecture notes (pptx files) and other online resources will be posted and accessible through the Canvas course page. Using Canvas students can also engage in course discussions about the course material and contact the instructors.
* Poll Everywhere®, a free web-based student response system that is accessed through an app downloaded to a cell phone or via a webpage. This tool will be used to gauge the understanding of concepts taught during lecture and quickly address gaps, encourage student engagement, and foster discussion.
* Achieve® online assignments. Students are requested to purchase a license for Achieve® (**course ID: uvepog).** A license for Achieve is included with purchase of the ebook. Assignments will be accessible in the window of time indicated in the schedule table above. **Assignments must be submitted exclusively online by the indicated deadlines**. Students have an unlimited number of attempts in answering Achieve questions. Once submitted, however, assignments cannot be retrieved and modified by the student. **Please note that no deadline extensions will be given**. To avoid last minute issues with internet access, please plan to submit your assignments at least a day in advance.

Grading Scheme

There are four components in the marking scheme of the course: Midterm exam, Final exam, Laboratory assignments (n=9) and Lab quizzes (n=2). While there are no minimal marks required in these individual components **in order to successfully pass the course, students are required to attend labs, turn in laboratory assignments and take the lab quizzes**. Midterm and Final exam questions will be based on the material (posted notes) presented and discussed in lecture. Use the textbook and online material as reference for context when studying for these exams.

1) **Midterm Exam Value:** **25%** of final course grade. Date: February 5 from 10:30am to 11:20am at Thorv 271. Format: 40 multiple choice questions. Calculators are allowed. No phones, laptops, tablets or other material are allowed. The midterm exam covers all lectures up to the lecture 13 material (course topics 1,2,3 and 4 - Classical Genetics component).

2) **Final Exam Value: 40%** of final grade. Date: Consult the Final Exam Schedule to be released. Length: 3 hours Format: 100 multiple choice questions. The final exam covers the whole material delivered in the course (course topics 1 to 10; both Classical and Molecular Genetics). No phones, laptops, tablets or other material allowed.

3**)** **Achieve assignments: 5%** of final grade. Assignments for each topic will be posted and completed by the student online (https://iam.macmillanlearning.com/login?retURL=https://achieve.macmillanlearning.com/courses).

4) **Lab Component**: **30%** of final grade. A total of nine (9) 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.

Note: The lab component of BIOL226 is a requirement to pass BIOL226. Students are expected to attend labs and take both lab quizzes to pass the course. Students that have not completed the lab component (take both quizzes) will be assigned an INF (incomplete fail) mark for the course.

5) **Poll Everywhere Participation: +3% (Extra Marks)**

Poll Everywhere will be used during lectures to assess students’ understanding of the material. While participation in polls is not required and answers will not be marked, students who chose to participate can collect **up to 3%** of extra marks in the course, according to the total percentage of polls answered through the course. Students will have participation automatically registered by answering the poll during lecture, independently of whether their answer was correct or not. Students interested in participating are asked to have a laptop/tablet or a smart phone and pre register in the Poll Everywhere course account (<https://www.polleverywhere.com/home>). The BIOL226 Active Response URL is: PollEv.com/carloscarvalho. Please refer to IT Services to solve issues related to connectivity to your device (<https://students.usask.ca/centres/it-support-services.php>). **Participation marks will be taken exclusively through Poll Everywhere in class.** For participation marks to be collected, you must have answered the question **at the time it was presented and the system received it.** While issues with technology outside your control may prevent this from happening from time to time, **there will be no participation marks given after the poll is concluded irrespective of the reason. There will be no alternative assignment for extra marks provided**.

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://governance.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://governance.usask.ca/student-conduct-appeals/non-academic-misconduct.php) For more information on what academic integrity means for students see the Guides for Academic Conduct at:

<https://governance.usask.ca/governance/guidelines-for-academic-conduct.php#PrincipleIIHonestyandIntegrity>

Examinations through Access and Equity Services for Students (AES)

Students who have disabilities (learning, medical, physical, or mental health) are encouraged to register with Access and Equity Services (AES). Students who suspect they may have disabilities should contact AES for advice and referrals. In order to access AES programs and supports, students must follow AES policy and procedures. You must contact AES in advance to request special exam accommodations. **Changes in exam dates are not going to be considered as part of these accommodations**. If you miss an exam for a valid reason, you can apply for a make up (midterm) or deferred (final) exams. For more information, check <https://students.usask.ca/health/centres/access-equity-services.php> or contact AES at 966-7273 or [aes@usask.ca](mailto:aes@usask.ca).

Student Support

**Academic Help – University Library**

Visit the [University Library](https://library.usask.ca/) and [Learning Hub](https://library.usask.ca/studentlearning/) to find supports for undergraduate and graduate students with first-year experience, study skills, learning strategies, research, writing, math and statistics. Students can attend [workshops](https://library.usask.ca/studentlearning/#Eventsandworkshops), access [online resources and research guides](https://libguides.usask.ca/), book [1-1 appointments](https://library.usask.ca/studentlearning/appts/index.php) or hire a [subject tutor](https://can01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fusask.tutorocean.com%2Fsearch%3Fpage%3D1%26sortBy%3DbestMatch%26subjectTutorsForHire%3Dtrue&data=05%7C01%7Cheather.ross%40usask.ca%7C38e4a8bb11ee4fe4bf8508db297677bc%7C24ab6cd0487e47229bc3da9c4232776c%7C0%7C0%7C638149361005497569%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=6Oebh53f1I5SsEYjHFtH%2B%2FCtlg%2Bs3azRDy2UMyTa6Rg%3D&reserved=0) through the [USask Tutoring Network](https://can01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fusask.tutorocean.com%2Fsearch%3Fpage%3D1%26sortBy%3DbestMatch%26subjectTutorsForHire%3Dtrue&data=05%7C01%7Cheather.ross%40usask.ca%7C38e4a8bb11ee4fe4bf8508db297677bc%7C24ab6cd0487e47229bc3da9c4232776c%7C0%7C0%7C638149361005497569%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=6Oebh53f1I5SsEYjHFtH%2B%2FCtlg%2Bs3azRDy2UMyTa6Rg%3D&reserved=0)

Connect with library staff through the [AskUs](https://library.usask.ca/askus/index.php) chat service or visit various [library locations](https://library.usask.ca/hours.php) on campus.

Enrolled in an online course? Explore the [Online Learning Readiness Tutorial](https://libguides.usask.ca/Online_Learning_Readiness_Tutorial).

**Teaching, Learning and Student Experience**

Teaching, Learning and Student Experience (TLSE) provides developmental and support services and programs to students and the university community. For more information, see the students’ website [http://students.usask.ca](http://students.usask.ca/).

**College Supports**

Students in Arts & Science are encouraged to contact the Undergraduate Student Office and/or the Trish Monture Centre for Success with any questions on how to choose a major; understand program requirements; choose courses; develop strategies to improve grades; understand university policies and procedures; overcome personal barriers; initiate pre-career inquiries; and identify career planning resources. Contact information is available at: (<http://artsandscience.usask.ca/undergraduate/advising/>)

**Financial Support**

Any student who faces unexpected 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>.

**Gordon Oakes Red Bear Student Centre**

The Gordon Oakes Red Bear Student Centre) is dedicated to supporting Indigenous 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 an intercultural gathering space that brings Indigenous and non-Indigenous students together to learn from, with and about one another in a respectful, inclusive, and safe environment. Visit <https://students.usask.ca/indigenous/index.php> or students are encouraged to visit the ASC’s website <https://students.usask.ca/indigenous/gorbsc.php>

**International Student and Study Abroad Centre**

The International Student and Study Abroad Centre (ISSAC) supports student success and facilitates international education experiences at USask and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange, and English as a Second Language students in their transition to the University of Saskatchewan and to life in Canada. ISSAC offers advising and support on matters that affect international students and their families and on matters related to studying abroad as University of Saskatchewan students. Visit <https://students.usask.ca/international/issac.php> for more information.