

Diversity of Plants and Microorganisms Syllabus

Department of Biology Biol 2004 Winter 2024

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people. Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)		
Name	Email	Office Hours
Dr. Alastair Simpson	Alastair.Simpson@Dal.Ca	Tuesday & Thursday 2:30-3:30 LSC B 5088
Dr. Arunika Gunawardena	Arunika.Gunawardena@dal.ca	Tuesday & Thursday 2:30-3:30 LSC B 6076 B
Lara Gibson	ldgibson@dal.ca	Friday 1:30- 3:30 LSC 5089 until March 1 Open Lab in LSC 5012 March 8- 29th

Course Description

Biology 2004 Introduces the main domains of plant, fungal and microbial life, based on modern phylogenetic taxonomy. Examines the diversity, structure, physiology and ecology of non – animal life forms. Reviews the origins of the main lineages of living things - Archaea, Eubacteria and Eukaryota, as well as the main groups of eukaryotes

Course Prerequisites: A grade of C+ or higher in BIOL 1010.03 or (BIOL 1020.03, or BIOA 1002.03 or BIOL 1030.03) and BIOL 1011.03 or (BIOL 1021.03, BIOA 1003.03, or BIOL 1031.03); or SCIE 1505.18.

Course Structure

Lectures:

- Biology 2004 will be delivered as synchronous In-person lectures.
- Lectures will occur In ROWE 1028, on Tuesday and Thursday from 1-2:30. The full schedule can be found In Table 1. Lectures start on January 9th.
- The microorganism lectures will be recorded but the plant lectures **WILL NOT** be recorded.
- Lecture exams will occur on March 1st from 6-8pm In ROWE 1028 for the Microorganism final, and the plant final will occur during the final exam period, April 11th- 23rd.
- If you miss the microorganism test, the make-up will be scheduled by the registrar during the final exam period of April 11th- 23rd.

Laboratory Sessions:

- Laboratory sessions occur weekly, starting on January 15th. The full schedule can be found In Table 1.
- Odd numbered lab sections will occur in LSC B 5009 (B01, B03, B05, B07, & B09) and
- Even numbered lab sections will occur In LSC B 5012 (B02, B04, B06, B08, & B10).

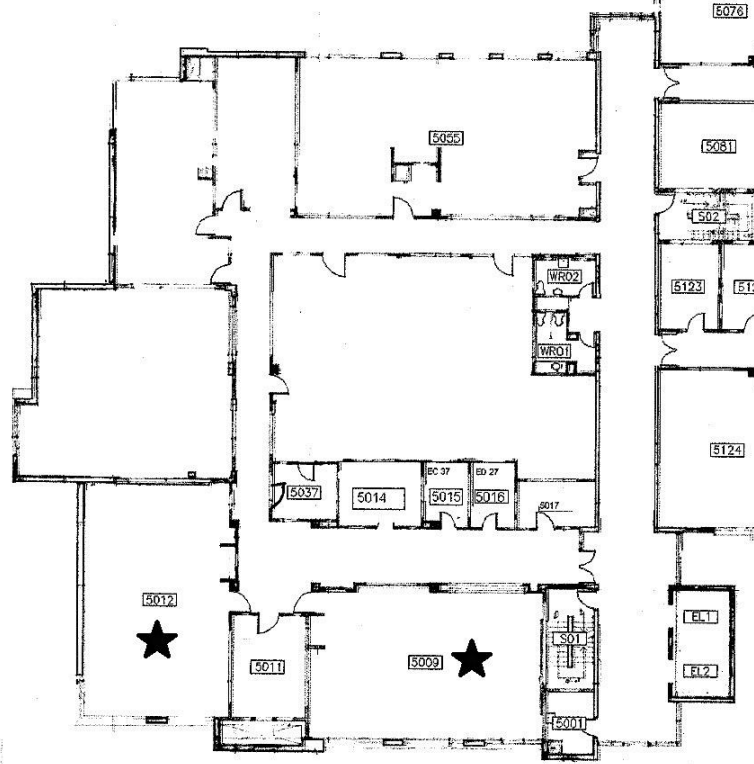


Figure 1: Partial Map of 5th floor of Life Sciences Building, Dalhousie University. The stars indicate the lab rooms. EL 1 & 2 are the elevators. LSC 5055 is the fifth floor lounge.

Course Materials- Required:

1. Slonczewski & Foster. 2017. Microbiology An Evolving Science. 5th edition. W.W. Norton & Company. Available as an E-book through the bookstore/ Willow link on brightspace.
2. Evert & Eichhorn. 2013. Raven Biology of Plants. Custom Edition. W.H. Freeman and Company. . Available as an E-book through the bookstore/ Willow link on brightspace.
3. Biology 2004 2018 Laboratory Manual. These will be available through the bookstore.
4. A lab coat is required. Dalhousie university policy states that all students will wear a lab coat when attending a laboratory session with potential hazards. Lab coats can be transported to and from lab in a plastic bag.
5. Supplementary course notes: There are supplementary course notes for parts of the microorganisms section. These will be made available to you on brightspace.

On course reserve at the Killiam Library:

- Two copies of Microbiology, An Evolving Science. 4th ed. One on 2 hr loan, one on 24 hr loan.
- Two copies of Microbiology, An Evolving Science. 3rd ed. On 24hr loan
- One copy of Raven Biology of Plants. 8th Ed. 2 hr loan.
- One copy of Introduction to Botany. 2 hr loan.

Table 1: Schedule of Lecture date, topic and laboratory topic for Winter term 2024. Please note, lecture topics may vary slightly by date but test dates are fixed. Lectures occur in ROWE 1028.

M indicates microorganism lecture, and P for plant lecture. Laboratory sessions occur on Monday, Tuesday, Wednesday and Thursday of each week.

Please Note: The Microorganism test will be held outside of class time on Friday March 1st, from 6-8 pm, in ROWE 1028. If you cannot attend you must contact Alastair or Lara.

Date		Lecture Topic	Laboratory Topic
Jan. 9 Jan. 11	M1 M2	Introduction to microorganisms: The prokaryote cell The prokaryote cell continued	No Labs
Jan. 16 Jan. 18	M3 M4	Metabolic diversity in prokaryotes Bacterial diversity 1	Introduction, Safety, Hands (1), Fungi (1) Techniques Practice Microscopes
Jan. 23 Jan. 25	M5 M6	Bacterial diversity 2 Bacterial diversity 3	Techniques Practice, Staining Spore Stains, Hands (2)
Jan. 30 Feb. 1	M7 M8	Archaea Introduction to microbial eukaryotes (cells and evolution)	Technique Practice Unknown Bacteria
Feb. 6 Feb. 8	M9 M10	Microbial eukaryotes diversity 1: Mostly microalgae Microbial eukaryotes diversity 2: Mostly protozoa	Fungi (2) Bacteriophage (1)
Feb. 13 Feb. 15	M11 M12	Fungi Macroalgae	Fungi (3) Bacteriophage (2)
Feb. 20 Feb. 22		Study Break: No Class Study Break: No Class	No Labs
Feb. 27 Feb. 29	P1 P2	Introduction to Plants Bryophytes (i)	Protists, Cyanobacteria, & algae
March 1		** Microorganism Test** Outside of class time: 6:00-8:00, ROWE 1028	
March 5 March 7	P3 P4	Bryophytes (ii), Seedless vascular plants (i) Seedless vascular plants (ii)	Bryophytes
March 12 March 14	P5 P6	Gymnosperms (i) Gymnosperms (ii)	Seedless Vascular Plants
March 19 March 21	P7 P8	Angiosperms (i) Angiosperms (ii)	Gymnosperms
March 26 March 28	P9 P10	Diversity of flowering plants (i) Diversity of flowering plants (ii)	Angiosperms
April 2 April 4	P11 P12	Primary plant body: roots, leaves, stems The private life of plants/ Programmed cell death in plants.	Plant Lab Exam

Table 2: Laboratory sessions for Diversity of Plants and Microorganism by lab section, indicating time and teaching staff.

Lab Section	Room	Day and Time	TA
B01	5009	Monday 2:35 pm- 5:25 pm	Jack
B02	5012	Monday 2:35 pm- 5:25 pm	Raja
B03	5009	Tuesday 10:05- 12:55	Patrick
B04	5012	Tuesday 10:05- 12:55	Dani
B05	5009	Tuesday 3:05- 5:55 pm	Wednesday
B06	5012	Tuesday 3:05- 5:55 pm	Kylie
B07	5009	Wednesday 2:35-5:25 pm	Makenna
B08	5012	Wednesday 2:35 pm- 5:25 pm	Alex
B11	5009	Thursday 10:05- 12:55	Lara
B09	5009	Thursday 3:05- 5:55 pm	Austyn
B10	5012	Thursday 3:05- 5:55 pm	Anna

Laboratory sessions are held weekly for 11 weeks of the term on the following dates: 1) January 15-18, 2) January 22-25, 3) January 29- February 1, 4) February 5- 8, 5) February 12-15, 6) February 26- 29, 7) March 4– 7, 8) March 11- 14, 9) March 18- 21, 10) March 25 – 28, 11) April 1- 4 (Plant Lab Exam).

Assessment

There are both lecture and lab assessments in this class.

55% of your grade results from two lecture tests, one which covers the Microorganism material (March 1st, 6:00-8:00 pm) and one which covers the Plant material (TBA: Scheduled by the Registrar during the regular exam period).

What to do if you cannot make the microorganism final test: You must contact either Alastair or Lara. The make-up test will be scheduled by the registrar during the final exam period, April 11th- 23rd.

The labs are worth 45% of your overall mark and will be assessed through both practical skills and written work.

All course assessments, weights and due dates are presented in Table 3, on the following page.

Table 3: Assessment component, value and due dates.

Evaluation Component	Weight (% of Final Grade)	Due Date
Lecture Test 1 Based on Microorganism material	27.5	March 1 st ROWE 1028 6-8 pm.
Lecture Test 2 Based on Plant material	27.5	To be scheduled by the registrar in the exam period: April 11- 23.
Microorganism Quizzes: Online Due by 11:50 pm on indicated date	2/ Quiz Total 8 marks	Micro Quiz 1: January 28 th Micro Quiz 2: February 4 th Micro Quiz 3: February 25 th Micro Quiz 4: March 3 rd
Slides:	0.25/ slide for a Total of 1.75 marks	Reference Gram stain: January 25 th Spore stain: January 25 th Negative stain: January 25 th Hand Gram stain 1: January 25 th Hand Gram stain 2: February 1 st Unknown Gram stain: February 1 st Pair of Fungi slides: February 15 th
Plates:	0.25/ plate for a Total of 1.75 marks	Hand Streak Plate: January 26 th Unknown EMB streak plate: February 2 nd Unknown Lawn plate: February 2 nd Bacteriophage Plate 1: February 9 th Bacteriophage Plate 2: February 16 th Bacteriophage Plate 3: February 16 th Fungi Subculture: February 16 th
Bacterial Unknowns *Completed as a group	2	Feb 6 th - 9 th the day after your lab by 5:30 pm
Bacteriophage	2	Friday February 25 th by 11:50 pm
Fungi Report *Completed as a group	4	No later than March 3 rd by 11:50 pm
Protists Assignment	3	No later than March 3 rd by 11:50 pm
Plant Quizzes: Online Due by 11:50 pm on indicated date	2/ quiz Total of 10 marks	Bryophyte Quiz: March 10 th SVP Quiz: March 17 th Inside Gymnosperm Quiz: March 24 th Outside Gymnosperms: March 31 st Angiosperm: March 31 st
Plant Worksheets	1/ worksheet for a Total of 2 marks	Worksheet 1: The day after your lab March 12-15 Worksheet 2: The day after your lab March 19-22
Plant Lab Exam	10.5	April 1 st – 4 th

Notes on particular assessments:

1) Online Lab Quizzes

The lab quizzes are POST lab quizzes, to be completed after the lab session. These can be found on Brightspace under the assessments, and then quiz link.

- Microorganism Quiz 1 covers lab 1 and lectures 1-4
- Microorganism Quiz 2 covers labs 2 & 3, and lectures 5-8
- Microorganism Quiz 3 covers lab 4 & 5 and lectures 9-12
- The plant quizzes will be based on the lab material from the previous week.

2) Both the **Bacterial Unknowns** and the **Fungi Report** will be completed in groups and everyone will receive the same mark. While you can divide the work to complete the physical tasks, you should review and edit the written work to ensure accurate identifications and well-presented answers.

3) **Plant worksheets.** You may complete this individually, in pairs, or as a group. If you choose to work with a partner or in a group all members of your group will receive the same grade.

3) Lab Exam

A lab exam will be held in the week of April 1st- 4th. Students are expected to write their lab exam in their registered lab section.

The lab exam will be two hours in duration and will cover all plant lab material. The lab exam will be an untimed station exam, consisting of identification, definitions and short answer questions. Students are expected know and spell the names of the taxa covered in the labs.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

The common grade scale defines achievement of each grade level as follows:

A- to A+: “Considerable evidence of original thinking; demonstrated outstanding capacity to analyze and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.”

B- to B+: “Evidence of grasp of subject matter, some evidence of critical capacity and analytical ability; reasonable understanding of relevant issues; evidence of familiarity with the literature”

C- to C+: “Evidence of some understanding of the subject matter, ability to develop solutions to simple problems; benefitting from his/ her university experience”

Note: As the Dalhousie common grade scale specifies grades as a whole number, we will consider the first decimal place when assigning grades and use standard rounding rules.

Course Policies

1) Lecture Recordings: It is not permissible to make video or audio recordings of the lectures. The PowerPoint slides of the lectures will be made available to you.

2) Absences: This class does not accept Student Declaration of Absence forms.

It is possible that at some point during the term you will have to miss some instructional time due to illness or other exceptional circumstances. It is your responsibility to contact us as soon as you know you will miss a lab or test.

For labs, the ideal situation would be to cover the material at a later lab session. However, it will not always be possible to accommodate requests to attend an alternate lab. The appropriate accommodation will be decided on a case-by-case basis.

In all cases you are responsible for the missed material, and if you attend another lab section your assignment due date does not change.

Make-up examinations will be scheduled to accommodate students who miss an exam through illness and other legitimate reasons. The make up for the microorganism will be scheduled by the registrar during the final exam period, April 11th- 23rd.

If you know of your absence prior to the exam or are ill on the day of the exam please contact Lara or the appropriate lecturer.

3) Assignments: All work submitted for credit must be completed independently, unless designated as a group project. Group work should be peer-reviewed prior to submission and all members of the group will be assigned the same grade.

4) Late Assignments: Please consult table 3 for the due dates for each assignment. Any assignments turned in after the due date/ time will be penalized at 10% per day.

5) Referencing: In your work, ANY and ALL statements that were not empirically derived for yourself as part of an experiment or study, for that assignment, must be credited to a source. When crediting other people's work please use the Name-Date system of the Council for Science Editors (CSE) style. There is a link to the style guide on the Brightspace page.

All sources should be collected into a list at the end of your work and presented in CSE style. Your source list should be in alphabetical order.

6) Academic Integrity & Artificial Intelligence: Our general policy is to allow you to use Artificial Intelligence (AI) assisted technology as tools, but know that we will never accept fully AI generated works for graded assignments.

If your assignment asks YOU to identify a plant, we are expecting you to make the identification, not the AI or human experts associated with iNaturalist.

For other AI technologies you will need to disclose that you have used the tool and you are responsible for any errors produced during the tools use. Because of this you should have a good idea of how the AI tool you are using works.

Please NOTE: The use of online assignment help tools (e.g., Chegg®) is considered cheating and is prohibited to use for the assignments in this course."

Learning Objectives

The biology department has created a curriculum map of the courses it offers. If you are interested in seeing the map, you can find it at: <https://biology.academics.cs.dal.ca/>

On that page if you click on the courses link, you will come to a list of all the courses offered by the biology department. Clicking on any of the individual classes, leads to a class page, with a map for the class, illustrating what classes are needed to take the class and what subsequent classes require the class of interest.

Below the map, you'll find a list of assumed learning outcomes, these are the skills and topics a student is expected to know at the start of the class. Following this list is a second list of student learning outcomes, these are the topics and skills a student is expected to learn during the class of interest.

The assumed learning outcomes, the list of skills and topics we expect you to be familiar with at the start of Biology 2004, include:

- Compare and contrast the fundamental features of mitosis and meiosis with emphasis on the movement of homologous chromosomes during these cellular reproductive processes.
- Create scientific questions, propose a written hypothesis as a tentative answer to that question and generate observable predictions consistent with that hypothesis in the context of a particular experiment.
- Demonstrate an understanding of molecular phylogenetics, including the concept of tracing the evolution history of genes (e.g. gene duplication, horizontal gene transfer).
- Describe the basic structure and function of organelles.
- Describe the components of photosynthesis and the main steps and products of each component.
- Describe the most basic similarities and differences between Bacteria, Archaea and Eukaryotes, and the evolutionary relationships between 'protists' and animals, plants and fungi.

- Describe the phenomenon of (primary) endosymbiosis and its role in the origins of mitochondria and plastids (chloroplasts).
- Know basic features of the major groups of fungi, including structure, growth and life cycles
- Know the life cycles of major plant groups.
- Observe diversity of form, as well as key shared structures, across a range of cell and organism types.
- Recall basic chemical concepts: bonding, formulas, concentration, the principle of balancing chemical equations.
- Recall basic mathematical concepts and techniques: logarithms, exponentials, solving simple algebraic equations, slopes and intercepts, graphing and interpreting simple graphs
- Understand the features that allowed transition from aquatic to terrestrial environments.
- Use and know when to make use of common biological research tools such as compound microscopes, gel electrophoresis units, pipettors and micropipettors, bioinformatics tools, and enzyme assays.
- Describe the basic structure and function of biological membranes.
- Describe the different macromolecules.
- Describe the major plant cell, tissue and organ types.
- Recall how cells produce and utilize ATP.

The student learning outcomes, the list of skills and topics we expect you to learn during Biology 2004, include:

- Apply standard microbiological techniques (streak plates, bacteriophage plaque assays)
- Arrange plant specimens into the correct phyla
- Assess the credibility of source material
- Be able to use a dichotomous key to identify gymnosperms
- Collect and prepare a fungal sample for identification
- Compare reproductive structures, dominance, spore type, and vascular tissue between plant phyla (including ovary position and raceme type)
- Describe the diversity of some major groups of prokaryotes: focus on Proteobacteria; Gram-positives; Cyanobacteria.
- Describe the four major plant groups
- Describe the microbial food web (in the ocean): dominance and role of Bacteria; bacterivory and microbial predation; mixotrophy; viruses
- Explain the differences between the three major groups of macroalgae (reds, greens, browns), triphasic life cycle of red algae and complex thallus organization in some brown algae
- Explain the key features of the major plant lineages (Non-vascular land plants, seedless vascular plants, gymnosperms, angiosperms, monocotyledons, eudicotyledons)
- Familiarity with diagnostic bacterial identification (catalase test, differential media, antibiotic susceptibility)
- Identify algal groups based on pigmentation
- Learn and apply aseptic techniques to culture work and sterile transfers
- Prepare a formal lab report on a select topic

- Construct scientific drawings with scale bars
- Contrast generational dominance, spore type, dependence on water, independence from water, and reproduction between the four major plant lineages.
- Describe the Archaea: Shared features with Eukaryotes; Thermophily and Methanogenesis.
- Describe the bacterial species 'concept', phylogenetic tree of prokaryotes (including the role of gene transfer)
- Describe Fungal diversity: nature of hyphae; basic differences between zygomycetes, ascomycetes, and basidiomycetes; Mycorrhizae
- Describe the Nitrogen cycle from a microbial perspective (examples of anaerobic respiration, lithotrophy, nitrogen fixation)
- Describe the plastid diversity in eukaryotes, including primary vs secondary endosymbiosis
- Determine a testable question and alternate hypotheses
- Explain the importance of plants to humans and other organisms (oxygen production, crops, primary producers)
- Prepare slides for use with a compound microscope (wet mounts, Gram stains, bacterial spore stains, and fungal hyphae culture slides)
- Understand structures and functions of major components of, and replication of, prokaryotic cells
- Use a compound microscope with Kohler illumination, including immersion oil
- Contrast plant life cycles between phyla (Hepatophyta, Anthoceroophyta, Bryophyta, Lycopodiophyta, Pteridophyta, Cycadophyta, Ginkgophyta, Coniferophyta, Genetophyta, Anthophyta)
- Contrast the benefits and challenges of moving onto land
- Contrast the tissue arrangement of roots and stems between monocots and dicots
- Describe the different types of pollinators, seed dispersal methods, inflorescences, and flowers.
- Describe the importance and diversity of vascular plants and success of terrestrial plant life
- Describe the primary plant body (Root, Shoots and flowers)
- Describe the protist cells and some major groups of Protists; focus on Haptophytes, Diatoms, Apicomplexan parasites, Ciliates, Cellular slime molds (including life/sexual cycles for the latter four)
- Differentiate between the different classifications of fruits
- Differentiate between the different germination types
- Explain the environmental factors which limit bryophyte and seedless vascular plant distribution
- Give examples of Fermentation, Anaerobic respiration, Lithotrophy, and Anoxygenic photosynthesis (vs oxygenic photosynthesis)
- Relate evolutionary adaptations to plant development and reproduction

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.