



# BIOL\*3020 Population Genetics

Fall 2022

Section(s): 01

Department of Integrative Biology

Credit Weight: 0.50

Version 1.00 - September 02, 2022

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## 1 Course Details

### 1.1 Calendar Description

This course is designed to explore the concepts of random mating, inbreeding, random drift, population structure and selection as they relate to natural populations. The course also examines modern molecular population genetics and population genomics .

**Pre-Requisites:** MBG\*2040

### 1.2 Course Description

Population genetics is the study of the genetic compositions of populations. This course seeks to provide a thorough introduction to population genetics by examining the genetic composition of populations across the domains of life. With that as a basis, we will examine processes that give rise to the genetic composition of populations. These processes include reproduction, mutation, recombination, segregation, selection, dispersal and drift. Modern approaches to modeling the genetics of populations are introduced. In addition, we will learn about methods that are used to characterize genetic variation within populations.

### 1.3 Timetable

Lectures: MWF, 1230 - 1130, classroom RICH 2520

Tutorials (SSC 1304):

R, 1430 - 1520

R, 1530 - 1620

F, 1430 - 1520

F, 1530 - 1620

**NOTE:** The course will include a mix of in person and synchronous online lectures. Recordings of online lectures and PDF files of all lecture material will be available in CourseLink. Tutorial sessions will be held in person and will not be recorded. Further modifications are possible in case University COVID-19 policies change. Please see WebAdvisor and CourseLink for the latest information.

## 1.4 Final Exam

The final exam will be a take home exam. Students will have one week to complete the exam and submit it via the CourseLink Dropbox.

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## 2 Instructional Support

Lectures will be held in person in the designated room (RICH 2520) or via MS Teams. Check CourseLink for up to date information. Office hours are Fridays from 1230 h to 1330 h or by appointment, and will exclusively occur via MS Teams. The weekly tutorial sessions will be hosted by the GTA in the designated room (SSC 1304). In person lectures and tutorials will not be recorded.

### 2.1 Instructional Support Team

<b>Instructor:</b>	Teresa Crease Professor
<b>Email:</b>	tcrease@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x52723
<b>Office:</b>	virtual on MS Teams
<b>Office Hours:</b>	Office hours will be Fridays from 1230 to 1330 or by appointment, and will be held on MS Teams. Contact the instructor to schedule a meeting outside class time.

### 2.2 Teaching Assistants

<b>Teaching Assistant (GTA):</b>	Sophia Stoltz PhD candidate
<b>Email:</b>	sstoltz@uoguelph.ca
<b>Office:</b>	SSC 1304 during tutorial sessions
<b>Office Hours:</b>	The GTA will be available during the tutorial sessions in SSC 1304. Contact your GTA by email to schedule additional meetings if required.

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## 3 Learning Resources

### 3.1 Required Resources

**CourseLink (Website)**  
<https://courselink.uoguelph.ca/>

Lecture materials, published papers, assignments, student discussion.

### **Software programs (Software)**

Students will be required to download several free software programs for use in the assignments and take home final exam. Details of this software will be provided in CourseLink.

### **BIOL\*3020\_F22 (Other)**

An MS Team labelled BIOL\*3020\_F22 has been established for this course. It should be available in your Team account once classes begin. Please contact your instructor if you do not see this team listed.

All online meetings will be scheduled through this team. There is also a tab for easy access to lecture videos that are posted on MS Stream.

The URL for this team is: <https://teams.microsoft.com/l/team/19%3aWvK7-bGwXvwogXo2IxUOSa00KvR7V6TOel3XU-ndAxY1%40thread.tacv2/conversations?groupId=26c05c73-2ef2-4ab3-9f06-bb113a543968&tenantId=be62a12b-2cad-49a1-a5fa-85f4f3156a7d>

## **3.2 Recommended Resources**

### **Population Genetics M.B. Hamilton (2009) (Textbook)**

This textbook is on reserve at the library along with other textbooks in population genetics. The textbook is a very good resource for support on the topics in this course.

# **4 Learning Outcomes**

## **4.1 Course Learning Outcomes**

By the end of this course, you should be able to:

1. Develop a working knowledge of terminology, such as but not limited to allele, locus, haplotype, linkage disequilibrium, selection coefficient and absolute, relative and marginal fitness.
2. Apply basic models, such as one and two-locus selection, inbreeding, population structure, random genetic drift, and mutation to data to predict outcomes under specified conditions.
3. Apply and interpret statistical summaries of population genetic data, such as gene trees, mismatch distributions, fixation indices
4. Interpret published studies of natural and experimental populations of prokaryotic and

eukaryotic species in the context of terminology, models and statistical summaries

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## 5 Teaching and Learning Activities

The topics that will be covered in this course are listed below. Preparatory lecture materials for each topic will be posted in Courselink and will include videos and supplementary readings. Students are expected to review this material and be prepared to discuss it before attending the lecture sessions.

Lecture sessions will allow students to ask questions about the lecture material and to participate in activities such as polls and quizzes.

### 5.1 Lecture

#### Topics:

#### Lecture Topics:

1. Genetic variation in natural populations
2. Quantifying genetic variation in natural populations.
3. The Hardy-Weinberg Theorem - 1-locus model, multiple alleles, sex linkage
4. Non-random mating - inbreeding, assortative and disassortative mating
5. The Hardy-Weinberg Theorem - 2-locus model, recombination and linkage disequilibrium
6. Genetic drift
7. Mutation and levels of genetic variation
8. Gene flow and population subdivision
9. Natural selection - 1-locus model
10. Natural selection - variable fitness models
11. Natural selection - 2-locus model
12. Detecting natural selection in natural populations
13. Molecular evolution and the Neutral Theory
14. Tests for detecting natural selection with molecular data
15. Quantitative genetics - heritability, selection on quantitative traits
16. Species and speciation

## 5.2 Tutorials

Problem sets will be provided that consist of questions to help direct your study of and practice with course material. The problems will be worked on and discussed in tutorial and serve as preparation for graded assignments and the final take home exam.

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# 6 Assessments

## 6.1 Marking Schemes & Distributions

The assessment of learning in this course will involve assignments requiring students to solve problems and/or analyze and interpret data, and complete a take-home final exam. There will be 4 assignments each worth 25%.

No makeup assignments will be provided for students who are not able to submit one. Requests for extension of assignment or exam deadlines must be submitted to the instructor **BEFORE the due date**. Only the **best 3 out of 4 assignments** will contribute to the final grade. The assignments will be worth a **total of 75%** of the final grade.

All assessments will be submitted via the Courselink Dropbox. Submissions will be evaluated using digital detection tools such as Turn It In to ensure academic integrity. Students will be able to evaluate their submissions with Turn It In in the Dropbox before final submission.

Name	Scheme A (%)	Scheme B (%)	Scheme C (%)	Scheme D (%)
Assignment #1	25	25	25	0
Assignment #2	25	25	0	25
Assignment #3	25	0	25	25
Assignment #4	0	25	25	25
Final Exam	25	25	25	25
Total	100	100	100	100

## 6.2 Assessment Details

### Assignment #1 (25%)

**Due:** Sun, Oct 16, 11:00 PM, Courselink Dropbox

**Learning Outcome:** 1, 2, 3, 4

Assignment 1 will be posted to Courelink on Saturday, **October 1** and must be submitted to the Courselink Dropbox by **2300 h Sunday, October 16**.

Students must complete the assignment individually. Working with other students or

getting assistance from anyone outside the course is considered to be Academic Misconduct.

#### **Assignment #2 (25%)**

**Due:** Sun, Oct 30, 11:00 PM, Courselink Dropbox

**Learning Outcome:** 1, 2, 3, 4

Assignment 2 will be posted to Courselink on **Saturday, October 22** and must be submitted to the Courselink Dropbox by **2300 h** on **Sunday, October 30**.

Students must complete the assignment individually. Working with other students or getting assistance from anyone outside the course is considered to be Academic Misconduct.

#### **Assignment #3 (25%)**

**Due:** Sun, Nov 13, 11:00 PM, Courselink Dropbox

**Learning Outcome:** 1, 2, 3, 4

Assignment 3 will be posted to Courselink on **Saturday, November 5** and must be submitted to the Courselink Dropbox by **2300 h** on **Sunday, November 13**.

Students must complete the assignment individually. Working with other students or getting assistance from anyone outside the course is considered to be Academic Misconduct.

#### **Assignment #4 (25%)**

**Due:** Sun, Nov 27, 11:00 PM, Courselink Dropbox

**Learning Outcome:** 1, 2, 3, 4

Assignment 4 will be posted to Courselink on **Saturday, November 19** and must be submitted to the Courselink Dropbox by **2300 h** on **Sunday, November 27**.

Students must complete the assignment individually. Working with other students or getting assistance from anyone outside the course is considered to be Academic Misconduct.

#### **Final take home exam (25%)**

**Due:** Sun, Dec 11, 11:00 PM, Courselink Dropbox

**Learning Outcome:** 1, 2, 3, 4

The final exam will be a take home exam that covers material from the entire course. The exam will be available on Courselink on **Saturday, December 3** and must be submitted to the Courselink Dropbox by **2300 h** on **Sunday, December 11**. This exam will be comprehensive and involve solving numerical problems, and analyzing and interpreting population genetic data.

Students must complete this exam individually. Working with other students or getting assistance from anyone outside the course is considered to be Academic Misconduct.

## 6.3 Assignment Grading Scheme

Students will have one week to complete assignments (2 weeks for Assignment 1), which must be done individually. The assignments will consist of numerical problems similar to those discussed in lecture and tutorials, and/or analysis and interpretation of data.

There are 4 assignments each worth 25% of the final grade. Only the **best 3 out of 4 assignments** will contribute to the final grade. The total weight of the assignments is **75%** of the final grade.

## 6.4 Assessment Details

*Assignments:* Assignments will be available one week before they are due (2 weeks for Assignment 1). The assignments will allow students to analyze data using the concepts and models learned in lecture. **Students are expected to complete the assignments by themselves**, as these form a basis of individual assessment. Contravention of this policy is Academic Misconduct. Practice questions will be discussed during tutorial sessions and allow students to work together.

*Final Take home Exam:* Assigned readings, lectures, practice questions and assignments form the basis of the final take home exam. Students will be asked to apply the concepts and models they have learned in the course to population genetic data. **Students are expected to complete the final exam by themselves**, as it forms a basis of individual assessment. Contravention of this policy is Academic Misconduct.

## 6.5 Academic Consideration

Requests for deadline extensions must be received **BEFORE the deadline**. Without prior approval for a change of date/time by the course instructor, students will be assessed **a late penalty of 2 marks out of 25 per 24 h period**.

Extensions on the final exam **will not be approved beyond December 16**. Students who are not able to complete the final exam before December 16 must request a deferred privilege through their Program Counsellor.

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# 7 Course Statements

## 7.1 Campus Resources

The Academic Calendar is the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>

If you are concerned about any aspect of your academic program:

- make an appointment with a program counsellor in your degree program.  
<http://www.bsc.uoguelph.ca/index.shtml> or  
<https://www.uoguelph.ca/uaic/programcounsellors>

If you are struggling to succeed academically:

- There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist.  
<http://www.learningcommons.uoguelph.ca/>

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.  
<https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations.  
<http://www.uoguelph.ca/~ksomers/>

If you have a documented disability or think you may have a disability:

- Student Accessibility Services (SAS) can provide services and support for students with a documented learning or physical disability. They can also provide information about how to be tested for a learning disability. For more information, including how to register with the centre please see: [Accessibility Services](#)

## 7.2 Online Behaviour



Inappropriate online behaviour will not be tolerated. Examples of inappropriate online behaviour include:

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online
- Copying or presenting someone else's work as your own
- Adapting information from the Internet without using proper citations or references
- Buying or selling term papers or assignments
- Posting or selling course materials to course notes websites
- Having someone else complete your assignment or completing an assignment for/with another student
- Stating false claims about lost assignment submissions
- Threatening or harassing a student or instructor online
- Discriminating against fellow students, instructors and/or GTAs
- Using the course website to promote profit-driven products or services
- Attempting to compromise the security or functionality of the learning management system
- Sharing your user name and password
- Recording lectures without the permission of the instructor

### **7.3 Privacy Statement**

By enrolling in a course, unless explicitly stated and brought forward to their instructor, it is assumed that students agree to the possibility of being recorded during lecture, seminar or other "live" course activities, whether delivery is in-class or online/remote.

If a student prefers not to be distinguishable during a recording, they may:

- turn off their camera
- mute their microphone
- edit their name (e.g., initials only) upon entry to each session
- use the chat function to pose questions.

Students who express to their instructor that they, or a reference to their name or person, do not wish to be recorded may discuss possible alternatives or accommodations with their instructor.

## **8 Department of Integrative Biology Statements**

## 8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

## 8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. <http://www.learningcommons.uoguelph.ca/>
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

## 8.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. <https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. <http://www.selfregulationskills.ca/>

## 8.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University

officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar.

(<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml>)

## 8.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

# 9 University Statements

## 9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

## 9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

## 9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

## 9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## 9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website

<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website

<https://www.ridgetownc.com/services/accessibilityservices.cfm>

## 9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not

relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

## 9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

## 9.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

## 9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

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