



**UNIVERSITY OF
CALGARY**

DEPARTMENT OF BIOLOGICAL SCIENCES
COURSE OUTLINE

1. Course: BIOLOGY 315 - Quantitative Biology I

Lecture Section(s) L01 MWF 14:00-14:50 Room: ENE 243 Winter 2019

Lecture and Lab

Coordinator: Dr. Kyla Flanagan BI 266 403-220-7644 kmflanag@ucalgary.ca

D2L Course: BIOL 315 L01 - (WINTER 2019) – Quantitative Biology I (F2019BIOL315L01)

NOTE: Students must use their UofC account for all course correspondence,

Biological Sciences Department BI 186 403-220-3140 biosci@ucalgary.ca

2. Prerequisites: Biology 233 or 241

See section 3.5.C in the Faculty of Science section of the online Calendar
www.ucalgary.ca/pubs/calendar/current/sc-3-5.html

3. Grading: The University policy on grading and related matters is described sections [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Individual Work

Midterm Exam	20%	1 March @ 18:30 – 20:30 ICT 102
Lab Assignments	12%	
Final Exam (Cumulative)	30%	Scheduled by the Registrar
Quizzes	11%	
Final Portfolio (Individual component)	5%	
Peer Evaluations	2%	

Team Work¹

Quizzes	11%
Application Activities & Mini-lab assignments	4%
Final Portfolio (Team component)	5%

Each piece of work submitted by the student in the categories outline above will be assigned a percentage score. A student's grade is determined by marks for both individual and team work components (team quizzes, assignments, and final portfolio). The student's average percentage score for the various components listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade using the conversion scale provided below.

¹At the end of the term, each student will evaluate the contributions of the other members of his/her team (peer evaluation). All team members will get a "peer score" based on the final peer evaluation. The peer score for a student is the average rating of the student, divided by the overall average rating for all members of the team. This provides a way to evaluate the relative contributions of each team member to the team's work. Each student's total teamwork mark will be multiplied by his/her peer score to determine his/her final mark for the teamwork component of the course (20% of final grade).

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % required	95%	90%	85%	80%	75%	70%	65%	60%	55%	53%	50%

4. Missed Components of Term Work: The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.3](#) of the University Calendar

5. Scheduled out-of-class activities: 1 March 2019 @ 18:30 – 20:30 ICT 102

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. Course Materials: [Required]

1. *The Analysis of Biological Data, 2nd ed. (2014). Michael Whitlock and Dolph Schluter. Available at the Bookstore.*

Online Course Components: Some teamwork resources are provided by ITP Metrics, a University of Calgary-based system of secure web-based tools for forming teams and doing peer evaluations. These tools are free to all students and are not dependent on prior access.

- 7. Examination Policy:** Students will be able to use a non-programmable calculator for the midterm and final exams. Students should also read the Calendar, [Section G](#), on Examinations.

- 8. Writing across the curriculum statement:** In this course, the quality of the student's writing in laboratory assignments will be a factor in the evaluation of those assignments. See also [Section E.2](#) of the University Calendar.

9. HUMAN & LIVING ORGANISM STUDIES STATEMENTS:

Students will not participate as subjects or researchers in human studies.
See also Section E.5 of the University Calendar.

Studies in the Biological Sciences involve the use of living and dead organisms. Students taking laboratory- and field-based courses in these disciplines can expect involvement with and experimentation on such materials. Students perform dissections on dead or preserved organisms in some courses. In particular courses, students experiment on living organisms, their tissues, cells, or molecules. Sometimes field work requires students to collect a variety of living materials by many methods, including humane trapping.

All work on humans and other animals conforms to the Helsinki Declaration and to the regulations of the Canadian Council on Animal Care. The Department strives for the highest ethical standards consistent with stewardship of the environment for organisms whose use is not governed by statutory authority. Individuals contemplating taking courses or majoring in one of the fields of study offered by the Department of Biological Sciences should ensure that they have fully considered these issues before enrolling. Students are advised to discuss any concern they might have with the Undergraduate Program Director of the Department.

- 10.** Students are expected to be familiar with Section SC.4.1 of the University Calendar.

Reappraisal Of Grades:

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **15 days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a reassessment of the work if, and only if, the student has sufficient academic grounds. See sections I.1 and I.2 of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

11. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, Mental Health Services Website) and the Campus Mental Health Strategy website (Mental Health).
- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see www.ucalgary.ca/wellnesscentre or call 403-210-9355.
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to

someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at 403-220-2208 .

- d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K. Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points.
- f. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](#). Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head, Undergraduate of the Department of Biological Sciences, Heather Addy by email addy@ucalgary.ca or phone 403 220-6979. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See Section E.4 of the University Calendar.
- g. **Safewalk:** Campus Security will escort individuals day or night (See the Campus Safewalk website). Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see Legal Services website.
- i. **Student Union Information:** VP Academic, Phone: 403-220-3911 Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: 403-220-3913 Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: suvpaca@ucalgary.ca.
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

Department Approval _____ ORIGINAL SIGNED _____ Date _____

Associate Dean's Approval for
out of regular class-time activity: _____ ORIGINAL SIGNED _____ Date: _____

COURSE SYLLABUS

BIOLOGY 315 QUANTITATIVE BIOLOGY I

TEACHING ASSISTANTS: Contact information for TAs will be updated on D2L in the first week of lectures

OFFICE HOURS: Mon 9-10am, Wed 10-11am & Fri 3-4pm

Individual assistance is always available by appointment. I look forward to seeing you during student hours. Stop in! (office hours are really, really boring with no students)

EMAIL COMMUNICATION: I will be working hard to answer your emails within 24 hours (except on weekends)

OVERVIEW OF THE COURSE:

In this course you will learn:

- 1) many of the most important statistical tests used by biologists,
- 2) how to design an experiment,
- 3) how to apply the process of statistical inference to make statistical conclusions regarding experimental/observational data,
- 4) how to identify and justify the appropriate statistical test to apply given a biological research question or scenario,
- 5) how to perform and interpret statistical analyses on real data sets using the statistical computer program, R.

By necessity, this course involves a fair bit of math and computer programming. However, this is not a math or programming class—these are both tools to help us quantify the statistical significance of patterns and trends. I hope to convince you that statistics is not only useful, but really interesting as well. If you find the prospect of learning about statistics daunting, relax. I wouldn't try to teach you anything you couldn't handle. That doesn't mean the course will be easy (if it was easy, you'd be bored), but it does mean that you'll have a lot of opportunity to ask questions and get practice. I am going to do everything I can to help you understand this material, so that at the end, like many years' worth of students before you, you are glad you took the class and go away having learned a lot.

To make our time together as effective as possible, it is important that the lecture learning environment is one of mutual respect. I will do whatever I can to create and maintain that environment; my expectations of student conduct are outlined below:

- **Everyone has the right to learn as well as the responsibility to not deprive others of their right to learn.** Actions such as talking during instruction/lecturing, or using laptops and other electronic devices for non-class activities can be very distracting and affect others' learning. Please monitor your own behaviour during classes and restrict your use of laptops and other electronic devices to only those activities directly related to class to ensure that you do not distract others.
- **Please arrive at class on time.** Late arrivals and early departures can be disruptive and can result in you missing important information. I understand that there are special circumstances when you may have to arrive late or leave early; please make your arrival/departure as unobtrusive as possible and be sure to let your teammates know about your situation in advance of class.
- Please let me know right away if you are dealing with a problem or situation that is preventing you from performing at the level you want to be at in this class.
- Please treat your classmates, peer mentors and me with respect. There may be times when you are frustrated with something that is going on in the course and find it difficult to be patient. However, to maintain a respectful and constructive environment in this class, I ask that you are respectful of others in your words and actions.

What you can expect from me:

- I will treat all students with respect and do my best to make my expectations about how to succeed in this class clear.

- I will do my best to help your learning by designing clear assignments and assessments that provide you with timely feedback.
- I will start and end classes on time.
- I will be available outside of class time through office hours, appointments or email should you want to review concepts that are not clear, discuss study strategies, learn more about any topic or discuss concerns about any aspect of the course. Please note that I will aim to reply to emails within 24h, except on weekends.

Academic Integrity:

Each student in this course is expected to abide by the University of Calgary Code of Academic Conduct. You are encouraged to study together and to discuss information and concepts covered in class and assigned readings with other students, but all individual work that you submit in this course for academic credit must be your own work. In the case of team assignments, all members of the team are responsible for the honesty and integrity of the document.

Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. All work submitted for this class (whether as a draft or for final grading) is held to the strictest standards for intellectual honesty. A single offence may lead to a grade of zero for the assignment involved, disciplinary probation, suspension or expulsion. The Faculty of Science follows a zero-tolerance policy regarding dishonesty. In addition to reading the sections of the University Calendar under "Student Misconduct", I will assume that you have read and understand the information posted on the Dept. of Biological Sciences' webpage dealing with academic honesty: https://bio.ucalgary.ca/undergraduate/current_students/academic_honesty. In particular, be sure that you understand what constitutes plagiarism—test yourself by taking the on-line quiz.

TEAM BASED LEARNING:

In this class, we will be using a Team Based Learning (TBL) approach. In this process, you will spend many classes working in teams applying what you've learned from the textbook and from lectures. Teams in TBL are different than the kind of group work you may have done in other classes: the instructor forms the teams (as described below) which work together throughout the term to complete course assignments and quizzes; team members also evaluate each other's contributions to the group throughout the term. Before your team tackles an assignment, TBL uses short quizzes to make sure you've got the basics from the required readings. They're not ordinary quizzes, though: you take the quiz both individually and as a team, and you get immediate feedback, so the quizzes function as learning tools. I will do some lecturing but a lot of our class time will be spent on applying what we've learned. Here are the basics:

1. We will be forming teams in the first week of class. Research show that *diverse* teams function the best and produce the best outcomes. So it's my job to make the teams as diverse as possible. To help with this I will be using ITP Metrics to divide you into teams of 4-5 students based on previous courses you've taken, your major/year, work experience, and other factors that will help us form successful teams. These may feel like big teams at first, but research shows that teams of 4-7 individuals work best. As the term progresses, I am sure you will appreciate having the diversity of ideas and perspectives that come with a team of this size. Additionally, I will be putting measures in place (Team Contract, Peer Evaluation) to ensure there is individual accountability to the team.

2. For each module in the course, you will be assigned a reading that you are expected to complete before the start of the module; I prepare a Reading Guide with Module Outcomes for all assigned readings to help you focus on the most important points in the assigned readings. At the beginning of the Module, you will individually take a short (~10-15 questions) multiple choice test called an "Individual Readiness Assessment Test" (iRAT) to see how well you've understood the concepts in the assigned reading. In calculating your final grade, *I will not count your lowest individual quiz score for the term.*

Quizzes missed without documentation (see 8 below) will be awarded a mark of zero. Missed quizzes may not be written at a later time.

3. Immediately after taking the iRAT, you will take the *same* test with your team. This is called a "Team Readiness Assessment Test" (tRAT). For the group test, you'll use a special "scratch-off" answer sheet that immediately tells you whether you have the correct answer for full marks. If your team doesn't choose the correct answer on the first try, you make a second choice for partial credit. If it takes you three tries to get the correct answer, you again earn partial credit

for the item. As for the iRATs, tRAT quizzes missed without a valid excuse will be awarded a mark of zero; missed quizzes may not be written at a later time.

4. When you've finished the tRAT, your team provides written feedback to me as to which concepts are still unclear or for which you would like more information.

5. I'll use the individual and team scores, as well as, the written feedback to determine what material needs to be discussed and clarified. The next class (or two) will be spent exploring the most difficult aspects of that module. I'll also incorporate any supplemental information that you'll need to complete the in-class team application activities that involve application of what you learned in the readings.

6. The final aspect of a module will be the *Team Application Activities*. These application activities are the most critical part of the course because they will involve real problems and applications of the material that I expect you to be able to do by the end of the module/course. During these activities, you will work with your teammates to bring all you've learned in the module together to solve a problem. My goal for you in this course is that you should be able **to do something** with the material you learn. These activities should help you achieve this and also allow you to see how I will examine your ability to apply the material on a midterm and/or final exam. All the teams will be working on the same problem and I will likely be asking teams to defend their answers in a class discussion. Some of the application activities, or parts of application activities will be graded (4% of final grade); however, the purpose of grading the activities is to provide you with feedback and show you how I would mark on a Midterm or Final exam, not to be a high-stakes assessment of your understanding (like an exam). So don't sweat the grading aspect of these activities too much!

7. The team nature of this class requires you to be in class and to do your part as a member of your Team. Quizzes missed without a valid excuse (medical or family emergency) will be awarded a mark of zero. Missed quizzes may not be written at a later time. The nature of team assignments is such that you can't do them individually, so you can't make them up. In addition, attendance at all labs is required for this course.

8. If you should miss a class quiz, team activity, lab assignment or the midterm exam for medical reasons, you will need to provide documentation (eg. a completed Physician/Counselor Statement form, which can be downloaded from: http://www.ucalgary.ca/UofC/departments/UHS/PDFs/deferred_exam_form.pdf, **or** a statutory declaration: <https://www.ucalgary.ca/registrar/files/registrar/university-of-calgary-statutory-declaration-coursework-and-examinations.pdf>). You must provide documentation to me **within 48 hours** from the date that you missed the lab, class or midterm.

9. If you are having issues in your team, please don't hesitate to come and talk to me or the Peer Mentors. Little problems can turn into big problems if not addressed. We are happy to facilitate a discussion with your team to help resolve issues.

Other grade components in the Course include:

1. **Lab Assignments:** Lab assignments will focus primarily on your ability to use R to statistically analyze biological problems. These assignments are to be completed **INDIVIDUALLY**. Academic misconduct on these assignments is taken very seriously. I will provide a detailed guide as to how I would like you to structure your answers for these assignments. These assignments will be submitted via a Dropbox on D2L. If you choose to submit your lab assignment *1 day late* (without appropriate documentation), you will be eligible for *80% of the total marks on the assignment*. If you choose to submit your assignment *2 days late*, you will be eligible for *50% of the total marks on the assignment*. If you choose to submit your assignment *more than 3 days late*, you will receive feedback on your assignment, but will be eligible for *0 points*.

2. **Midterm & Final exams:** The midterm exam and final exams will be a combination of multiple choice and short-answer format and will consist mainly of the same types of questions as the team application activities and quizzes completed during the term. Exam questions will be based on lectures, assigned readings, and lab material. The final exam will be cumulative. Both the midterm and final exam will include material covered in readings, lectures, application activities and labs.

Tentative BIOL 315 Schedule Winter 2019

Module	Reading	Date	Class	Lab	Lab Assignments	
Introduction to the course	Handouts	Jan 11	Statistics and why we need them & introduction to TBL & get into teams	No Lab	NO ASSIGNMENT	
		14	Introduction to the course & practice RAT	Lab 1: Skills 1-2	NO ASSIGNMENT	
1: Descriptive Statistics and Estimating with Uncertainty	Ch. 1, 3, 4	16	Module 1: iRAT and tRAT Quiz	Orientation to the lab and R		
		18	Module 1: Populations, Variables and Samples & Mini-Team Activity #1	Lab 2: Skills 3-5 Summary Statistics & Random Sampling		
		21	Module 1: Descriptive Statistics & Mini-Team Activity #2			
		23	Module 1: Sampling distributions & Estimating with uncertainty			
2: Hypothesis Testing & Statistical Inference & Experimental Design	Ch. 6 & 14 Interleaves 3, 5, 6	25	Module 1: Team Application Activity #1 & Module Wrap-up	Lab 3: Skills 6-9 Graphing in R	1: Summary Statistics & Graphing in R (2%) DUE: Feb 8 @ 4:30 pm	
		Feb 28	Module 2: iRAT and tRAT Quiz			
3: Proportions and Frequencies	pp. 179-185, 191-193, 203-223, 245-255	30	Module 2: Hypothesis testing, Inferential statistics, errors of inference	Lab 4: Skills 10-14 Sample distributions, error, and the CLT	Team mini-assignment DUE: end of lab	
		1	Module 2: Experimental Design			
		4	Module 2: Team Application Activity #2	Lab 5: Skills 15-16 Exploratory data analysis & the G-test	2: Analysis of Frequency data (2%) DUE: Feb 25 @ 4:30 pm	
		6	Module 2: Case Study on Experimental Design			
8	Module 3: iRAT and tRAT Quiz					
REVIEW	Midterm	11	Module 3: Binomial & Poisson Distributions	No Lab	NO ASSIGNMENT	
		13	Module 3: Goodness of fit (G-test)			
		15	Module 3: Contingency analysis (G-test)			
		18	Reading Week			
4: Comparing Numerical Variables	Ch. 10, 11, 328-335	20	Reading Week		Team mini-assignment DUE: end of lab	
		22	Reading Week			
		25	Module 3: Team Application Activity #3 & Module Wrap-up	Lab 6: Skill 17-19 t-tests: single, paired and two sample		3: t-tests (2%) DUE: Mar 15 @ 4:30 pm
		27	Review & practise midterm			
5: Comparing 2 or more Means	Ch. 15	Mar 1	Review & practise midterm	Lab 7: Skills 20-22 ANOVA, Post-hoc Tukey's test & Assumptions	4: ANOVA, Tukey's HSD & Assumptions (2%) DUE: Mar 22 @ 4:30 pm	
		4	Midterm reflection & team activity			
		6	Module 4: iRAT and tRAT Quiz			
		8	Module 4: Normal Distribution, Central Limit Theorem			
6: Dealing with assumption violations: transformations & permutation tests	pp. 369- 383 394-398, 639-646	11	Module 4: t-distribution, Single sample t-test, paired t-test	Lab 8: Skills 23-24 Dealing with violations of assumptions	5: Transformations and Permutations (2%) DUE: Mar 29 @ 4:30 pm	
		13	Module 4: Team Application Activity #4 & Module Wrap-up			
		15	Module 5: iRAT and tRAT Quiz			
		18	Module 5: GLM, SS, ANOVA			
7: Regression and Correlation	Ch. 16 & 539-563 & Interleaf 4	20	Module 5: GLM, SS, ANOVA	Lab 9: Skill 25-26 Linear Regression & Assumptions	6: Linear Regression (2%) DUE: Apr 5 @ 4:30 pm	
		22	Module 5: Assumptions, Tukey's test			
		25	Module 5: Team Application Activity #5 & Module Wrap-up			
		27	Module 6: iRAT and tRAT Quiz			
REVIEW		Apr 29	Module 6: Transformations & Permutation tests	Portfolio & Assignment catch-up	Team mini-assignment DUE: end of lab	
		1	Module 6: Team Application Activity #6 & Module Wrap-up			
		3	Module 7: iRAT and tRAT Quiz			
		5	Module 7: Correlation			
		8	Module 7: Regression	Lab 10: All Skills Portfolio Wrap-up	7: Final Portfolio (10%) DUE: Apr 12 @ 11:59 pm	
		10	Module 7: Team Application Activity #7 & Module Wrap-up			
		12	Review and practise final			

¹ The schedule may slightly deviate from this due to the needs of the class. All reading chapter and page numbers refer to the required textbook by Whitlock and Schluter. All lab Skills are found in the Lab Manual (on D2L)