



**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: EDC 179 Fall 2017

**Lecture and Lab**

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

D2L Course: BIOL 315 L01 - (FALL 2017) – PRINCIPLES OF ECOLOGY (F2017BIOL315L01)

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%	<b>1 Nov 2017 @ 18:30 – 20:30 in ENA 201</b>
Lab Assignments	12%	
Final Exam (Cumulative)	30%	<b>Scheduled by the Registrar</b>
Quizzes	11%	
Final Portfolio (Individual component)	5%	
Learning Surveys & Peer Evaluations	2%	

**Team Work<sup>1</sup>**

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 and assignments). 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.

<sup>1</sup>At the end of the term, each student will evaluate the contributions of the other members of his/her team. 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).

**Final Grade Scale :**

- A+: 95 or higher
- A : 90 and under 95
- A- : 85 and under 90
- B+: 80 and under 85
- B : 75 and under 80
- B- : 70 and under 75
- C+: 65 and under 70
- C : 60 and under 65
- C- : 55 and under 60
- D+: 53 and under 55
- D : 50 and under 53
- F : <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 Nov 2017 @ 18:30 – 20:30 in ENA 201**

**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. *Quantitative Biology I: Lab Skills 2016/2018*. LR Linton, L. Harder & K. Flanagan. Department of Biological Sciences. Available at the Bookstore.
2. *The Analysis of Biological Data, 2<sup>nd</sup> ed. (2014)*. Michael Whitlock and Dolph Schluter. Available at the Bookstore.

**Online Course Components:** Some teamwork resources may be provided by **CATME** ([www.CATME.org](http://www.CATME.org)), a system of secure web-based tools for forming teams and conducting Peer Evaluations and assigning student to teams. This tool is free to all students. Students will be invited by email to create a CATME account in the first week of the course. The course may also use **ITP Metrics** ([www.itpmetrics.com](http://www.itpmetrics.com)), a University of Calgary - based web tool for peer assessments. Students will also use **Top Hat** (TH; [www.tophat.com/](http://www.tophat.com/)) in class to enhance learning in the classroom. Students who do not have a cell phone or a portable computing device should contact the instructor in the first week of class. Use of Top Hat is not tied to any grading components of this course and is only used to facilitate classroom engagement and understanding of the material.

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.

## Ethics in Biological Sciences

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. See also [Section E.5](#) of the University Calendar.

## 10. OTHER IMPORTANT INFORMATION FOR STUDENTS:

(a) **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

(b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).

(c) **Student Accommodations:** 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 [http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities\\_0.pdf](http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf).

Students needing an Accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of Biological Sciences, Dr. H. Addy by email [addy@ucalgary.ca](mailto:addy@ucalgary.ca) or phone 403 220-3140.

(d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

**(e) Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, 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 also <http://www.ucalgary.ca/secretariat/privacy>.

**(f) Student Union Information:** VP Academic Phone: 403 220-3911 Email: [suypaca@ucalgary.ca](mailto:suypaca@ucalgary.ca)  
SU Faculty Rep. Phone: 403 220-3913 Email: [science1@su.ucalgary.ca](mailto:science1@su.ucalgary.ca), [science2@su.ucalgary.ca](mailto:science2@su.ucalgary.ca) and [science3@su.ucalgary.ca](mailto:science3@su.ucalgary.ca);  
Student Ombuds Office: 403 220-6420 Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca); <http://ucalgary.ca/provost/students/ombuds>

**(g) Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

**(h)** At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses ([www.ucalgary.ca/usri](http://www.ucalgary.ca/usri)). Your responses make a difference - please participate in USRI Surveys.

Department Approval \_\_\_\_\_ ORIGINAL SIGNED \_\_\_\_\_ Date \_\_\_\_\_

Associate Dean's Approval for  
out of regular class-time activity: \_\_\_\_\_ ORIGINAL SIGNED \_\_\_\_\_ Date: \_\_\_\_\_  
Biol 315 co F17;8/16/2017 2:01 PM

COURSE OUTLINE  
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 9-10, Wed 10-11 & Fri 3-4

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.

**RESPONSIBILITIES and EXPECTATIONS:**

My philosophy of teaching is that it is my responsibility to 'set the stage' for learning to occur. It is my job to ensure that the classroom environment, support materials, assessment tools used all support the conditions that allow students to learn. Feedback from students is very important in this so that we will know whether such conditions exist, how well the course is going and where problems are arising. In addition to a mid-semester and an end-of-semester course evaluation, I will also encourage that you feel free to tell me about these things at any point in the semester. In this course, we will also have **Peer Mentors**. Peer Mentors are students who have taken this course before and have come back to help you do well. Please feel free to contact the Peer Mentors or me at any time. It is also my goal that, as much as possible, students will spend class time actively working with course material and applying what has been learned from the readings and lectures. This means coming to class prepared and willing to participate.

My expectations of you:

- treat others in class with respect. This means:
  - be considerate, open, and encouraging of the contributions of other students in the class
  - listen actively to others
  - do your best to minimize any disruptions/distractions for others around you
  - be on time & come prepared; participate actively in class and lab activities
  - please let me know if you are dealing with any issues that are preventing you from performing at the level you want to be at in this class

What you can expect from me:

- treat all students with respect
- start and end classes on time
- available outside of class time to discuss course content or any other course concerns
- prepare reading guides and organize review sessions for exams
- post materials for lecture and labs on D2L in a timely manner
- reply to emails within 24 h (except weekends)

**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 CATME or ITP Metrics to divide you into teams of 6 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 5-7 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 Module Objectives 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 a valid excuse (medical or family emergency) 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, 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 (5% 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, the only documentation that will be accepted in BIOL 315 is a completed Physician/Counselor Statement form, which can be downloaded from: [http://www.ucalgary.ca/UofC/departments/UHS/PDFs/deferred\\_exam\\_form.pdf](http://www.ucalgary.ca/UofC/departments/UHS/PDFs/deferred_exam_form.pdf) You must provide the completed form, signed by your physician, 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 Fall 2017

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

<sup>1</sup> 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 required Lab Manual, available at the bookstore.