DEPARTMENT OF BIOLOGICAL SCIENCES
COURSE OUTLINE

1. **Course:**   BIOLOGY 315 - Quantitative Biology I

    Lecture Section(s)   L01   MWF   14:00-14:50   ENE 243   WINTER 2015

    Instructor(s): Dr. Jeremy Fox   BI 260   403-220-5275   jefox@ucalgary.ca
                        Dr. Kyla Flanagan   BI 266   403-220-7644   kmflanag@ucalgary.ca

    D2L Course: BIOL 315 L01 - (WINTER 2015) – PRINCIPLES OF ECOLOGY (W2015BIOL315L01)

    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:

Lab Assignments	35 %	
Midterm Exam	30%	**March 2 @ 18:30-20:30 in ENE 241 & 243**
Final Exam*	30 %	
Top Hat Participation	5 %	

    *The final exam will be scheduled by the Registrar's office

    Each piece of work (assignment, laboratory report, midterm test or final examination) submitted by the student will be assigned a percentage score. 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, bearing in mind that an F grade will result if the student does not pass the overall lab OR the overall lecture component.

Letter Grade	Mark Cutoff
A+	95
A	90
A-	85
B+	80
B	75
B-	70
C+	65
C	60
C-	55
D+	50
D	45
F	<44

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.6 of the University Calendar

5. **Scheduled out-of-class activities: March 2 @ 18:30-20:30 in ENE 241 & 243**

    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: Lecture Readings and Lab Skills 2014/2016. LR Linton & L. Harder. Department of Biological Sciences. Available at the Bookstore.*
    2. *The Analysis of Biological Data, 2nd ed. (2014). Michael Whitlock and Dolph Schluter. Available at the Bookstore.*
    See attached Reserve Reading list.

    Online Course Components: Students will use **Top Hat** (TH; https://tophat.com/) in class to enhance learning in the classroom. If a student completes 75% or more of the in-class participation activities, s/he will receive the full 5% of the participation mark. **If s/he completes less than 75% of the in-class participation activities, s/he will receive 0% for the Participation mark.** It is the student's responsibility to ensure that their participation is being recorded by the TH system, and any discrepancies must be brought to the attention of Dr. Flanagan by 1700 on April 6, 2015 at the latest (but we encourage doing so at the earliest opportunity), as we will be unable to modify participation grades after this time. If a student is unable/unwilling to use the TH system, they must contact Dr. Flanagan within the first two weeks of class to make alternate arrangements

7. **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.6 of the University Calendar

    Students who are absent from the midterm exam because of illness or other unforeseen circumstances may be granted an excused absence by the Course Coordinator upon presentation of adequate documentation (a completed Physician/Counselor form <http://www.ucalgary.ca/registrar/PDFs/physcoun.pdf> for illness; equivalent documentation for other circumstances). There will be no "make-up" examinations for excused absences. The weight assigned to the midterm examination will be transferred to the final examination.

    Similarly, students who are unable to submit laboratory assignments on time because of similar circumstances will be required to submit the same type of documentation to the Lab Coordinator in order to be considered for an excused absence. You must provide the completed form, signed by your physician, to the Lab Coordinator within **48 hours** from the date that you missed the lab, class or midterm. Late assignments without the appropriate documentation will not be graded and the student will be assigned a grade of **zero**.

8. **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.

9. **Writing across the curriculum statement:** e.g. "In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also Section E.2 of the University Calendar.

10. **Human studies statement:** 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.

11. **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) **Academic Accommodation Policy:** Students with documentable disabilities are referred to the following links: Calendar entry on students with disabilities and Student Accessibility Services.

    (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

    (f) http://www.ucalgary.ca/secretariat/privacy.

    (g) **Student Union Information:** VP Academic Phone: 220-3911 Email: suvpaca@ucagary.ca. SU Faculty Rep. Phone: 220-3913 Email: sciencerep@su.ucalgary.ca; Student Ombudsman

(h) 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.

(i) 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). 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 W15; 12/19/2014 10:04 AM

COURSE OUTLINE

BIOLOGY 315
QUANTATIVIVE BIOLOGY I

COURSE PERSONNEL:

LECTURER(S):	Dr. Jeremy Fox	BI 260	jefox@ucalgary.ca
	Dr. Kyla Flanagan	BI 266	kmflanag@ucalgary.ca
LAB COORDINATOR:	Dr. Jeremy Fox	BI 260	jefox@ucalgary.ca

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

OFFICE HOURS:

Dr. Flanagan	Wed 10-11 & Fri 4-5
	Individual assistance is <u>always</u> available by appointment. I look forward to seeing you during student hours. Stop in! (office hours are really, really boring with no students)
Dr. Fox	I do not keep set office hours since no choice would suit more than a small fraction of students in the class. But I'm around most of the time, so please do either stop by, or email me to arrange a time. Like Dr. Flanagan, I am more than happy to meet with you. That's what I'm here for!

EMAIL COMMUNICATION: We 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. We hope to convince you that statistics is not only really useful, but really cool as well. And if you find the prospect of learning about statistics daunting, relax. We 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. We're going to do everything we can to help you understand this material, so that at the end, like many years' worth of students before you, you're glad you took the class and go away having learned a lot.

RESPONSIBILITIES and EXPECTATIONS:
Our philosophy of teaching is that it is our responsibility to 'set the stage' for learning to occur. It is our 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, we will also encourage that you feel free to tell us about these things at any point in the semester. It is also our goal that, as much as possible, students will spend class time <u>actively working with course material</u> and applying what has been learned from the readings and lectures. This means coming to class prepared and willing to participate.

<u>My expectations of you:</u>
• treat others in class with respect. This means:
- no talking when I am teaching
- turn off cell phones in class (unless we are doing Top Hat)
- restrict your use of laptops and other electronic devices to only those activities directly related to class. If you violate this policy or disturb other students you may be asked to leave the classroom
- be on time & come prepared; participate actively in class and lab activities
<u>What you can expect from us:</u>
- 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)

Tentative BIOL 315 Schedule Winter 2015[1]

Day	Date	Lecture	Reading p.#	Labs	Assignment
M	**Jan**	12 1: Statistics and why we need them	1-16, 23-24	**Lab 1**: Skills 1-4	1:Descriptive Statistics (2%) **Due: Jan 23**
W		14 2: Overview of the course	N/A	**Introduction to R**	
F		16 3: Descriptive Statistics I - variable types, graphing basics	25-51		
M		19 4: Descriptive Statistics II - Central tendency, dispersion	65-83	**Lab 2**: Skills 5-9	2: Binomial & Poisson Probabilities (3%) **Due: Jan 30**
W		21 5: Descriptive Statistics III - Probability and key distributions	117-138, 179-183, 217-223, 273-278	**Graphing in R**	
F		23 6: Populations vs Samples	3-11		
M		26 7: Inferential statistics: estimation	95-106	**Lab 3**: Skills 10-12	3: Sampling distributions and sampling error (3%) **Due: Feb 6**
W		28 8: Sampling Error: accuracy and precision	95-106	**Sample distributions, sampling error**	
F		30 9: Inferential statistics: likelihood, maximum likelihood estimation	655-668		
M	**Feb**	2 10: Precision of estimates: Central limit theorem, standard error	283-288	**Lab 4**: Skills 13-15	4: Confidence Intervals & Central Limit Theorem (3%) **Due: Feb 13**
W		4 11: Precision of estimates: confidence intervals	283-288	**Central Limit theorm, SE & Exploratory data**	
F		6 12: Inferential statistics: null hypothesis testing	149-159		
M		9 13: Hypothesis testing: General Linear Models (GLMs), single sample t-test	303-314	**Lab 5**: Skill 16	5: Type I & II Errors and single sample t-tests (3%) **Due: Feb 23**
W		11 14: Hypothesis testing: type I and type II errors. Power.	159-167, 176-177	**Type I & II errors and Single sample t-test**	
F		13 15: Experimental Design I: What is an experiment?	423-445		
M		16 **Reading Week (no lectures)**	N/A		
W		18 **Reading Week (no lectures)**	N/A	**NO LAB**	**NO ASSIGNMENT**
F		20 **Reading Week (no lectures)**	N/A		
M		23 16: Experimental Design II: Replication, independence and randomization	115-116, 201-202, 233-234, 301-302	**Lab 6**: Skills 17-18	6: Paired and two sample t-tests (3%) **Due: Mar 13**
W		25 17: Difference of means: paired and two-sample t-test	327-346	**Paired and two sample t-test**	
F		27 18: Review Lecture (practice problems)*	N/A		
M	**Mar**	2 19: Introduction to ANOVA: Why not just do many t-tests?	459-466		
W		4 20: ANOVA: partitioning variance in a general linear model (GLM)	459-466	**NO LAB**	**NO ASSIGNMENT**
F		6 21: ANOVA: determining the significance of ANOVA	467-469		
M		9 22: ANOVA: Power & assumptions	444-445, 470-471	**Lab 7**: Skills 19-21	7: ANOVA, tukey's test and assumption tests (3%) **Due: Mar 20**
W		11 23: ANOVA: Post-hoc tests, tukey's test	471-477	**ANOVA, Tukey's HSD, checking assumptions**	
F		13 24: Dealing with violations of assumptions: transformations	377-383		
M		16 25: Permutation tests	394-398	**Lab 8**: Skill 22 & 23	8: Transformations & Randomization (3%) **Due: Mar 27**
W		18 26: Worksheet Activity #1: Permutation tests*	Handout	**Transformations & Randomization**	
F		20 27: Linear Regression: Objectives, maximum likelihood estimation of slope and intercept	539-548		
M		23 28: Linear Regression: testing significance and assumptions	551-555	**Lab 9**: Skill 24 & 25	9: Linear Regression (3%) **Due: Apr 3**
W		25 29: Worksheet Activity #2: Linear Regression vs ANOVA*	554-555 & Handout	**Linear Regression**	
F		27 30: Correlation I	503-512		
M	**Apr**	30 31: Correlation II & Review*	512-515, 519-520	**Lab 10: All Skills**	**Take Home Final Lab (9%) Due: April 15**
W		1 32: Case Study: Experimental Design*	Handout	**Final Lab**	
F		3 **Good Friday (no lectures)**	N/A		
M		6 33: Analysis of Frequencies: G-test	203-223		
W		8 34: Analysis of Frequencies: Goodness of fit and Contingency analysis	235-251	**Final Lab cont...**	**Work on Take Home Final**
F		10 35: Common Statistical Errors and How to lie with statistics	Interleafs 2-6, 8-10		
M		13 36: Review*	Interleafs 2-6, 8-10	**NO LAB**	**FINAL LAB DUE APRIL 15**
W		15 37: Review*	N/A		

[1] The schedule may slightly deviate from this due to the needs of the class. The first 18 lectures will be taught by Dr. Fox and lectures 19-37 will be taught by Dr. Flanagan. 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; Lectures indicated with an * have expectations for high student participation.