Instructor Information.

Dr. Benjamin PÉLISSIÉ
Email: pelissieb@unk.edu
Skype: benjaminpelissie

Since I am not in Kearney for this spring semester, you can reach me by email or (if you want to actually talk to me) by Skype.

- *For emails:* I check email messages at least twice a day and will respond within 24 hours during weekdays. Under special (and rare) circumstances, and if I don't judge your question as being urgent, I might take 2 days to respond.
- *For Skype:* Please, prefer using emails for regular requests. If your request/enquiry is urgent, write me a message on skype and we will decide together whether we need to talk about it or not. If you prefer to talk to me, please enquire a Skype appointment with me via email. If you call me on Skype right-away, I might not be able to pick up.

Course Description.

[from UNK Graduate catalog]

This class is divided into two main areas. The first is biological statistics: the collection and analysis of scientific data. The second area is experimental design: how an experimental hypothesis is built and what are the pieces and procedures needed to conduct a successful experiment. The class is not mathematically intensive and relies on the power of computers beyond a few examples done by hand. The class includes both parametric and non-parametric statistics with continuous and categorical variables. Offered online, every Fall and Spring.

Required Course Materials.

Whitlock, MC and D Schluter. 2014. The Analysis of Biological Data, 2nd Ed. 768 pp. WH Freeman Publisher.

First edition books can be used as well but there may be issues with page numbers, and both practice and assignment problem numbers will be different than second edition. This book is published by 2 publishers; but the 2nd edition from either publisher will be fine.

Introduction to the Course.

The goal of this course is to provide graduate students in the Life Sciences with an introduction to modern statistical practices. An understanding of the concepts will be stressed along with their applications to real-life situations. Mathematical complexity (although necessary to some extent) will be kept to a minimum and analysis of data will receive substantial attention. The development of the ability to interpret results and to evaluate critically the design and methods used will be of most importance.

Teaching is done entirely online and includes lectures, readings, graded assignments, discussion sessions and exams. Every week you are required to watch one lecture (you need an internet

connection), read the corresponding book chapters, participate in discussions (via discussion board posts; please see below) and complete a written homework assignment.

The study of statistics can seem somewhat scary and the associated material (including the present syllabus!) appear complex and "dry". However, the learning curve is not as steep as it seems and often, students are amazed by how much and how quickly they end up learning about statistics. Once you master the basics (which is the goal of this course), statistics are also really fun and you will get practical knowledge that is applicable to almost any aspect of life.

Detailed Objectives (learning outcomes)

After taking this course, you should be able to:

1. Understand the fundamental concepts of probability and inferential statistics.
2. Describe almost any type of data and understand their nature.
3. Have a critical opinion about (and correct) statistical analyses carried by others.
4. Design your own experiments based on the statistical power needed to test the biological hypotheses you are investigating.
5. Carry your own statistical analyses using the R software.
6. Communicate your work in a precise, clear, sharable way.

Lectures.

Every week's lecture will be available on Canvas every Monday, 12:00 p.m. CST (starting Wednesday, January 15 for the first week of class). The length of the lectures will be variable (30 min – 90 min; cf. schedule) and depend on the topics covered. Producing one lecture per week is a deliberate choice that should allow you to focus on applying the covered concepts and techniques throughout the rest of the week, as well as to prepare your homework. This course design should also give you a lot of control over your schedule and the way you decide to learn.

Readings.

While lectures should be enough for you to understand the concepts and methods we will cover and prepare yourself for the exams, I strongly advise you to read the associated chapters from the textbook every week after viewing the lecture *Whitlock, MC and D Schluter. 2014. The Analysis of Biological Data, 2nd Ed.* (please see the *Course Schedule*)

The textbook will be of prime importance in:

- Serving as a reference for all the subjects covered in lectures.
- Offering you the opportunity to get slightly different perspective on the subjects covered (sometimes reading the same information in a slightly different way is enough to unlock my brain!).
- Providing you with practice problems (incl. solutions) to assess your performance and progress throughout the class.
- Presenting various real-life examples and graphical representations to illustrate the ideas we will be discussing.

Note: The lectures won't follow the textbook strictly linearly. Not all the book sections will be covered in the lectures (unnecessary readings will be specified in each week's assignment prompt).

Discussions.

Discussions are a significant portion of this course. They will allow you to share information, challenge others' opinions and get your own ideas challenged. Note that your *Participation grade* will be based on the quality of your posts each week on the *Discussion Board*. Each week, I will post a subject on the Discussion board at the same time as the week's lecture. Discussion boards will be open from Monday 0:01pm to Friday 11:59pm. Failure to post at least 2 posts during weeks 1-6, 8-10, 12-13 and 15-16 (12 weeks in total) will give you a 0 on *Participation* for this week.

Guidelines for the discussion posts:
The more thoughtful your comments, the better the quality of discussion will be for the entire class. When needed, your comments/statements should be supported with information, file attachments or web sites, and should be relevant to the current topic of discussion. References are encouraged but shouldn't be over-utilized (be specific!). Comments should be at least a few sentences and demonstrate that you are aware of the discussion that has been taking place. While you can answer "I agree" to someone else's statement (it is useful and fair to encourage good comments), it will typically not be counted as one of the 2 "good comment" you need to obtain full credits in this week's discussion. Overall, conciseness and clarity are necessary (i.e. page long postings might not be appropriate), both to keep the reading load for the class to a reasonable level and to state your reasoning as precisely and as efficiently as possible.

Finally, I expect you to be polite, professional and constructive, for the discussion to be as useful and enjoyable as possible.

Homework Assignments.

There will be weekly homework assignments. Doing homework on a regular basis is the best way to learn. Much of your learning will take place while working the problems. Homework has 2 aspects: (i) it is *THE* way to make yours all what you read and listen to, and (ii) it will provide you with feedback on your work, allowing you to assess your progress through the class.

Every week, homework will be available on Wednesday at 12:00pm CST, and due the following Wednesday before 12:00pm CST. Do not underestimate the time needed to complete your assignments on time. Again, no late submission will be accepted. Your submissions should be clear, organized and easy to read: points will be docked if your homework assignment is hard to get through. I will provide solutions for every homework as soon as I can, hopefully on the following Monday, along with the new lecture. One advice: organize your homework solutions neatly: it will help you for the exams.

Format requirements.

- Your homework will require you to write equations: use the equation modules present in either Microsoft Office, LibreOffice or Google Docs productivity suites to produce your assignments. Whatever software you choose, your submission to Canvas should be in a .pdf file format (all text editors mentioned above support PDF exports). No other format will be accepted.
- Your homework will require you to carry analyses using R: you will need to copy/paste your script (the commands you use), the results obtained via the R console and the graphics you produce in your document. Again, be as clear and organized as possible.

WARNING: any case of plagiarism will result in a 0 for the impacted assignment.

Exams.

There will be 2 midterm exams (Wednesdays, March 4 and April 15) and 1 final exam (Wednesday, May 6). Exams will cover lecture materials, discussions, homework and readings, and are aimed at evaluating your understanding of the concepts and techniques presented in the lectures. They will include both questions/answers and some data exploration and analyses to do in R.

You will have the entire day to complete both assignments (questions/answers and analyses in R). Prompts will be available from 0:01am to 11:59pm CST. Your time will be limited (still to be determined; it should not last more than 2-3 hours).

!!Notice of any conflict (religious or other) with these dates must be given to me within the first week!!

Format requirements for exams (both midterms and final) are the same as for Homework (see above).

Note: no lecture will be posted, and *Discussion board* will be closed, during Midterm and Final weeks, in order to give you more time to prepare (and potentially to catch-up on some sections).

WARNING: any case of plagiarism will result in a 0 for the impacted assignment.

Late Work.

Every assignment must be submitted before its deadline (please see corresponding sections and the course schedule). Late assignments will not be accepted. Because technical difficulties happen, I advise you to not wait to submit your assignments. Also, backup your data safely, so that you don't lose your work if your computer crashes, gets stolen, gets a virus, etc. It happens to someone every year, and it might be you this time! There is nothing I will be able to do about it.

You must check in with Canvas regularly. Look at your grades to see if your scores are recorded and are correct. If a grade is missing, you must inform me promptly. Waiting until the end of the semester is unacceptable and I can do nothing at that point.

Computer and Software Requirements.

For this class, you will need to have frequent access to a computer with internet connectivity. Lectures will require internet access to be viewed. Again, I expect you to check Canvas site several times per week, ideally every day. Please refer to the eCampus website to make sure you meet the minimum hardware/software and internet connection speed required by all UNK eCampus students. You will need to use a productivity suite (either Microsoft Office, LibreOffice or Google Docs) to produce all your assignments and exams.

Statistical analyses.

Authentic experience with modern statistical practice cannot bypass the use of a computing tool. We will make use of the software R, which is free and has excellent graphics. It is available on all platforms (Windows, Mac and Linux). This tool is widely used for research in biology. There is no assumption in

this course of prior experience with R or with any other particular software. All information you need to use R will be provided to you. Most homework assignments will require the use of R.

Grading.

Your grade will be based on your performance and progress to reach the course learning outcomes in four areas of assessment:

1)	Homework assignments (over 12 weeks)	15%
2)	Participation (discussion board, over 12 weeks)	15%
3)	Midterm assignment (2 exams; weeks 7 and 14)	30%
4)	Final assignment	40%

Grade scale:

98.0-100	A+
92.0-97.9	A
90.0-91.9	A-
88.0-89.9	B+
82.0-87.9	B
80.0-81.9	B-
78.0-79.9	C+
72.0-77.9	C
70.0-71.9	C-
68.0-69.9	D+
60.0-67.9	D
60.0-61.9	D-
<60	F

Important notes on grading:

- Minor modifications to assigned points may occur and will be announced.
- Your final grade will be automatically rounded up to the nearest integer (no need to ask for it!).
- Please, do not contact me to increase your grade: I will not do it.

Academic Integrity.

By enrolling in this course, each student assumes the responsibilities of an active participant in UNK's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action.

Students with Disabilities.

It is the policy of the University of Nebraska at Kearney to provide flexible and individualized reasonable accommodation to students with documented disabilities. To receive accommodation services for a disability, students must be registered with UNK Disabilities Services for Students Office, 172 Memorial Student Affairs Building, 308-865-8988 or by email unkdso@unk.edu.

Students Who are Pregnant.

It is the policy of the University of Nebraska at Kearney to provide flexible and individualized reasonable accommodation to students who are pregnant. To receive accommodation services due to pregnancy, students must contact Cindy Ference in Student Health, 308-865-8219.

The following link provides information for students and faculty regarding pregnancy rights: http://www.nwlc.org/resource/pregnant-and-parenting-students-rights-faqs-college-and-graduate-students

Reporting Student Sexual Harassment, Sexual Violence or Sexual Assault

Reporting allegations of rape, domestic violence, dating violence, sexual assault, sexual harassment, and stalking enables the University to promptly provide support to the impacted student(s), and to take appropriate action to prevent a recurrence of such sexual misconduct and protect the campus community. Confidentiality will be respected to the greatest degree possible. Any student who believes she or he may be the victim of sexual misconduct is encouraged to report to one or more of the following resources:

Local Domestic Violence, Sexual Assault Advocacy Agency: 308-237-2599

Campus Police (or Security): 308-865-8911

Title IX Coordinator: 308-865-8655

Retaliation against the student making the report, whether by students or University employees, will not be tolerated.

Course Schedule.

Here is the course schedule that we will follow this semester. Slight changes might occur; they will be communicated in time, on Canvas.

I am gladly willing to try to accommodate (thus with a priori guaranty) students under exceptional conditions. If it is your case, you need to contact me at the beginning of the semester (within the first 2 weeks). Afterwards – I won't be able to do anything.

Week	Day	Date	**Lecture** (relative length)	**Readings** (book chapters covered)	**Discussion Board** (BD)	**Homework** (HW)	**Exam**
1	Mo.	13-Jan	[course available on Canvas]				
	We.	15-Jan	1. Presentation and Introduction (mid)		DB.1 open		
	Fri.	17-Jan			DB.1 closed		
2	Mo.	20-Jan	2. Data display and descriptive statistics (long)	Chapters 1, 2 & 3	DB.2 open		
	We.	22-Jan				HW.1 prompt	
	Fri.	24-Jan			DB.2 closed		
3	Mo.	27-Jan	3. Probability and Random Variables (mid)	Chapter 5	DB.3 open		
	We.	29-Jan				HW.1 deadline | HW.2 prompt	
	Fri.	31-Jan			DB.3 closed		
4	Mo.	3-Feb	4. Binomial & Normal distributions (short)	Chapters 7 & 10	DB.4 open		
	We.	5-Feb				HW.2 deadline | HW.3 prompt	
	Fri.	7-Feb			DB.4 closed		
5	Mo.	10-Feb	5. Sampling Distributions (short)	Chapters 4 & 10	DB.5 open		
	We.	12-Feb				HW.3 deadline | HW.4 prompt	
	Fri.	14-Feb			DB.5 closed		
6	Mo.	17-Feb	6. Hypothesis testing and analyzing proportions (mid)	Chapter 6 & 7	DB.6 open		
	We.	19-Feb				HW.4 deadline | HW.5 prompt	
	Fri.	21-Feb			DB.6 closed		
7	Mo.	24-Feb					
	We.	26-Feb				HW.5 deadline	**MIDTERM 1**
	Fri.	28-Feb					
8	Mo.	2-Mar	7. Chi-square test for proportions (short)	Chapter 8	DB.7 open		
	We.	4-Mar				HW.6 prompt	
	Fri.	6-Mar			DB.7 closed		
9	Mo.	9-Mar	8. Analysis of 1 sample and comparison of 2 paired samples (long)	Chapter 11 & 12 (+13.1)	DB.8 open		
	We.	11-Mar				HW.6 deadline | HW.7 prompt	
	Fri.	13-Mar			DB.8 closed		
10	Mo.	16-Mar	9. Analyzing 2 independent samples and aspects of experimental design (long)	Chapter 12 & 14	DB.9 open		
	We.	18-Mar				HW.7 deadline	
	Fri.	20-Mar			DB.9 closed		
11	Mo.	23-Mar					
	We.	25-Mar	SPRINGBREAK				
	Fri.	27-Mar					
12	Mo.	30-Mar	10. Violations of assumptions: corrective and nonparametric methods (short)	Chapter 13	DB.10 open		
	We.	1-Apr				HW.8 prompt	
	Fri.	3-Apr			DB.10 closed		
13	Mo.	6-Apr	11. Comparing proportions and testing independence/association (mid)	Chapter 9	DB.11 open		
	We.	8-Apr				HW.8 deadline | HW.9 prompt	
	Fri.	10-Apr			DB.11 closed		
14	Mo.	13-Apr					
	We.	15-Apr				HW.9 deadline	**MIDTERM 2**
	Fri.	17-Apr					
15	Mo.	20-Apr	12. Analysis of variance (long)	Chapter 15	DB.12 open		
	We.	22-Apr				HW.10 prompt	
	Fri.	24-Apr			DB.12 closed		
16	Mo.	27-Apr	13. Regression and correlation (long)	Chapters 16 & 17	DB.13 open		
	We.	29-Apr				HW.10 deadline | HW.11 prompt	
	Fri.	1-May			DB.13 closed		
17	Mo.	4-May					
	We.	6-May				HW.11 deadline	**FINAL**
	Fri.	8-May					