

**BIostatistics for Biology Majors**  
**Biology 293**

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*Course Objectives.*—The objectives of this course are to introduce undergraduate biology majors to the types of statistical analyses used in the life sciences, to improve their skills in experimental design and to introduce them to a software package that is used by many biologists to analyze data. It is an applied course designed to give equip students with a skill set required for independent research in the biological sciences. This course will become part of the new biology core curriculum and should be taken in the second year of the student’s coursework for the biology major. It is a required core course for the Bachelor’s degree in biology at George Mason University.

*Competencies.*—The student should be able to read and express him/herself both orally and in writing on a college freshman level as measured by a college English competency examination. You need to have completed (with a C or better) any introductory biology class and have successfully placed into math 163 or higher or completed all units of math one. It is helpful to have a working knowledge of blackboard, Microsoft PowerPoint, Excel and.

*Texts.*—(1) Samuels ML, Witmer JA, Schaffner AA. 2012. Statistics for the life sciences. Prentice Hall 654 pgs. ISBN: 978-0-321-65280-5. (2) McKenzie JD Jr. 2004. The student guide to minitab, release 14. Pearson Addison Wesley. 542 pgs. ISBN 978-0-201-77469-0 (Comes with software below). These texts are optional, but it’s best if you have the software on your personal computer. NVCC computer labs are equipped with minitab.

*Software.*—Minitab v. 14, Microsoft office (Word, PowerPoint and Excel)

*Evaluation.*—Students will be graded according to the results of four hourly exams (totaling 600 points) and one project/presentation (200 points). Attendance is mandatory; if a student misses more than three lectures he/she will automatically receive a failing grade for the course. All exams will contain problem-based practical questions that are completed with “live” data in the computer lab. There are no make-up exams and there is no extra credit.

*Students with Special Needs.*—Students with physical disabilities who may require accommodations are encouraged to contact the college center for students with disabilities. Students with learning disabilities should contact disability services (<http://www.nvcc.edu/depts/disability/>; contact also the disability services counselor, 703-845-6076, [smurphy@nvcc.edu](mailto:smurphy@nvcc.edu)). After disclosing, students should provide documentation and discuss his/her individual needs with the instructor; this should be done at the beginning of the semester. Instructors, in conjunction with the appropriate college officials, will provide assistance to students who have completed the aforementioned process.

*Plagiarism and Academic Honesty.*—At Northern Virginia Community College, we expect the highest standards of academic honesty. Academic dishonesty is prohibited in accordance with subsection II of the Student Conduct, Rights and Responsibilities described on pages 71-80 in the student handbook (<http://www.nvcc.edu/resources/stuhandbook/>). This policy prohibits cheating on examinations, unauthorized access to examinations or course materials, plagiarism and other proscribed activities. Plagiarism is defined as the use of another’s idea(s) or phrase(s) and representing that/those phrases as your own, either intentionally or unintentionally. Students that violate plagiarism and academic honesty codes will receive a failing grade and will be expelled from this course.

*Cancellation Days.*— In the event of class/lab cancellation, we will carry on at the next meeting as though the cancellation did not occur. For example, if we were to have an exam scheduled on September 1, and it snowed, the exam would take place on our next scheduled meeting on September 7th.

*Important Dates, Audit Policy and Incompletes.*—For critical dates regarding refunds, withdraw, etc. see: <http://www.nvcc.edu/academics/academic-calendar/index.html>. Last day to drop with a refund is February 1; last day to withdraw without a refund and grade penalty is March 25. A student may decide to audit the course with the instructor's permission only. If a student decides to audit the course he/she must begin the course as an audit. Students may not take the course for a grade and then switch to audit status. Incompletes are only granted if the students' circumstances are dire (health issues, deaths in the family). Incompletes will only be granted if students have completed all lab assignments, both lab exams and 3 lecture exams. Incompletes must be approved by the division dean and the provost. Health claims must be documented by medical professionals.

*Extension (Incompletes).*—My policy on extensions is as follows: I will not grant any student an extension unless there are serious and uncontrollable circumstances that prevent the student from completing the work. Falling behind in the work because you get busy juggling work, life and various other "normal" activities is not justification for an extension. Also, in order for an extension to be granted, you must have completed all labs and all but one of your exams. Remember, my Dean has to approve these extensions. Unless your requests meet the aforementioned criteria, your request will invariably be denied.

*How to submit assignments.*—To submit assignments, scroll to the bottom of the page and click on the, "view/complete assignments" tab that corresponds with the assignment that you want to submit. Attach the appropriate file and click "submit." If for some reason your blackboard interface is different than mine, please contact me and we will figure out the problem together.

*Comments on submitting work.*—Your work must (1) be free of common spelling errors and typos, and (2) contain one font only, please be consistent. If you cut and paste, clean it up before submitting. Use Times New Roman. Use only one color, black. When submitting work please label it as the following (as an attachment, use caps lock): LAST NAME\_ASSIGNMENT #. You do not need to put your section since you are submitting via Blackboard

*Emails and discussion board.*—My email and discussion board policy: Please use proper English when composing emails and posting discussions. Please keep writing free of slang and as grammatically correct as possible. Please address me in the emails as Dr. or Professor Tupper, not as "hey."

*General comments on success in this course.*—Doing well in this course requires a substantial commitment. You need to set aside quite a bit of time for reviewing lecture notes, reading, studying and practicing statistics. You should spend about three hours a week reviewing the lecture material/practicing. This time frame of course varies from student to student. Nonetheless, expect to devote a substantial amount of time to this class each week. It helps if you are familiar with PowerPoint, Excel and. If you are not comfortable with these programs, it's okay, I will teach you what you need to know. You can also come to my office hours for help with each of these programs. I expect citations in your assignments to follow CSE (Council of Scientific Editors; <http://library.osu.edu/sites/guides/cse/d.php>). The link to the guidelines is on my website; it's called "CSE guidelines." Please visit the site. If citations do not follow these guidelines, then points will be deducted from your final project/presentation. A few last comments: It will likely be useful if you make use of the discussion board and become friendly with other students in the class. It helps calm anxieties about the course if you have some peer support. Be on time to class. I will lock the door 10 minutes after the start of lecture and will not open the door until we break. Use of any type of cell phone/ipad is prohibited during lecture. If you are caught using a cell phone/ipad in lecture, you will be asked to leave the classroom. There are no unexcused exceptions.

## Tentative Schedule

1. Introduction Sampling, experimental design, descriptive statistics (Week of Jan 14)
2. Sampling, experimental design, descriptive statistics (Week of Jan 21)
3. Evaluating results from samples with tables, figures and descriptive statistics (Week of Jan 28)
4. The normal distribution, z-scores, and the binomial test (Week of Feb 4)
5. Testing a hypothesis about a single mean: the one sample z-test and one sample t-test (Week of Feb 11)
  - Diagnostics: Normal probability plots, Kolmogorov-Smirnov tests
    - Nonparametric option: One sample sign test
6. **EXAM 1** first, then: Testing a hypothesis about two related means: paired t-test (Week of Feb 18)
  - Nonparametric option: One sample sign test
7. Testing hypothesis about two independent means: independent sample t-test (Week of Feb 25)
  - Diagnostics: Normal probability plots, Kolmogorov-Smirnov tests, Levene's test for equality of variances
    - Nonparametric option: Mann-Whitney U test
8. Testing a hypothesis about multiple means: One way Analysis of Variance (Week of March 4)
  - Diagnostics: Normal probability plots, Kolmogorov-Smirnov tests, Levene's test for equality of variances
  - Tukey's post-hoc multiple comparison
    - Kruskal-Wallace
9. **EXAM 2** first, then: Testing a hypothesis about multiple means when you have more than one factor: Two way Analysis of Variance (Week of March 18)
10. Comparing expected and observed counts: Chi-square analysis (Week of March 25)
  - "Univariate" chi square
  - Contingency tables
    - Alternative when cell counts are less than 5: Fisher's exact test
11. Correlation analysis and intro to linear regression (Week of April 1)
  - Diagnostics: Normal probability plots, Kolmogorov-Smirnov tests,
12. Linear regression (Week of April 8)
  - Diagnostics: Normal probability plots, Kolmogorov-Smirnov tests, Levene's test for equality of variances, examine residual plots
13. Linear regression (Week of April 15)
  - Diagnostics: Normal probability plots, Kolmogorov-Smirnov tests, Levene's test for equality of variances, examine residual plots
  - Testing regression models and making predictions with regression
14. **EXAM 3** and Final projects/presentations due (Week of April 29)
15. **CUMULATIVE FINAL EXAM** (Week of May 6)