**Biology 226L: Mathematical Methods for Quantitative Biology Lab Syllabus**

**Wednesday, 1:30 PM – 2:15 PM in Stone Center0 210**

Credit Hours: 1. This course has a 1 hour computational lab each week.

Instructor:

Brian K. Taylor

Assistant Professor of Biology

Email: brian.taylor@unc.edu Website: <http://taylorlab.web.unc.edu/>

Course Website:

Office: Coker Building – Room 301A

Office Hours: Wednesday 3:00 PM – 4:30PM

Target Audience: Biology majors who are interested in quantitative biology, mathematical modeling, and computer simulation. Mathematics, physics, chemistry, and computer science majors who are interested in biological applications of mathematics.

Course Prerequisites: MATH 231 and one of BIO 201/202/205

Course Goals and Key Learning Objectives:

* Write down mathematical models to describe molecular, cellular, and organismal processes.
* Solve the mathematical models numerically or analytically and evaluate them against experimental data.
* Become proficient in the use of MATLAB for biological applications, both in terms of writing programs and using software packages.

Course Requirements:

Students will be expected to review assigned readings from the course packet, lecture notes, and other materials posted on webassign and/or Sakai before each lab.

Grades: Graded work will consist of approximately ten lab exercises (60%), one lab report (20%), and a final exam (20%). Lab exercises include activities to demonstrate proficiency at mathematical modeling and the use of MATLAB. Lab reports are formal write-ups of two-week projects.

While all submitted work must ultimately be your own, I want to encourage you to help each other, and ask each other questions on assignments. This course should be a community where we all help to increase each other’s comprehension and understanding of the material. Therefore, if you agree with a classmate to help and/or receive help on a particular assignment via webassign, that exchange will be recorded. To get credit, you must both separately indicate the party that provided help, and the party that received it. At the end of the semester, I will take the total number of times you received/gave help, compare that to the number of times possible (i.e., assignments given), and convert that to a maximum of 2 percentage points that will be added to your grade after the final grade has been computed.

Course Policies:

*Late Lab Report and Lab Activity Policy:* 10% will be deducted the first hour the assignment is late, and then 20% will be deducted each day unless the student can provide a written excuse with documentation for valid reasons (illness, family emergency, religious observance, university sponsored travel, etc.). A student should present his or her explanation for any absences in writing in advance if the reason for the absence could be foreseen, or within 5 days of the due date of the assignment if the reason could not be foreseen.

*Honor Code Statement:* “It is expected that each student will conduct him or herself within the guidelines of the Honor System. All academic work should be done with the highest level of honesty and integrity that this University demands.” In particular, all tests and quizzes should be taken without texts without consultation with other student’s work. Students are encouraged to work together on all homework assignments.

*Attendance:* Sign-in sheets will be circulated during each lab, but attendance will not be figured into your grade directly. However, attending the lab is necessary to complete group work and lab projects. You will be responsible for any lab reports and exercises that may be assigned during your absence.

Course Resources:

*Suggested Text:* F.C. Hoppensteadt and C.S. Peskin. Modeling and Simulation in Medicine and the Life Sciences. Second Edition, New York: Springer-Verlag, 2002.

Sakai Resources: Supplemental reading and labs will be posted to [www.unc.edu/sakai](http://www.unc.edu/sakai) throughout the semester. Digital assignments will be maintained on [www.unc.edu/sakai](http://www.unc.edu/sakai).

*Webassign:* Homework will be assigned and submitted through webassign. Please create an account using your onyen as the username at <http://www.webassign.net>.

**Instructor Section Class Key**

**Brian K. Taylor BIOL 226, section 001 unc 9974 3469**

*Grading Scale:* A letter grade will be based on the following APPROXIMATE scale: A= 90-100%, B= 80-90%, C= 70-80%, D= 60-70%, F= less than 60%.

Tentative Time Table (Approximately 1 Lab/week):

NOTE: Lab order may be changed to better fit material being covered in class.

Lab 1: Introduction to Matlab

Lab 2 - 3: Random walks and programming in Matlab

(Mathematics: vectors, matrices, matrix addition and multiplication, linear maps, basic probability)

Lab 4: Vector representations of genomes and simple fitness functions

(Mathematics: Basic probability, expected value, normal distribution, independence, conditional probability, basic statistical tools).

Lab 5: Developing a model of diffusion

(Mathematics: Tangent lines, partial derivatives, tangent planes, boundary conditions)

Lab 6-10: Solving differential equations in Matlab, and looking at feedback loops

Lab 8: Simulating feedback loops using differential equations in Matlab

(Mathematics: numerical methods, Matlab tools, Numerical solution of nonlinear differential equations)

Lab 10-11: Simulating nerve dynamics in Matlab

(Mathematics: Numerical solving systems of nonlinear differential equations)

Lab 10-11: Simulating crossbridge attachments in Matlab and calculating force-velocity curves

(Mathematics: The probability density function, linear regression)

Final exam held during the last lab.