Research Techniques in Biology: Modeling
BIOL 220, Spring 2013

Contact Info	Dr. Gregg Hartvigsen, ISC 360, hartvig@geneseo.edu, 245.5448
Office Hrs	M 4:30 - 5:15, W 8:00 - 9:00, Th 2:30 - 4:30
Course resources	myCourses for this class
	Hartvigsen, G. *Taking Flight with Biostatistics Using R*
	Zuur, Alain F. *A Beginner's Guide to R* (online, Milne)
	Email messages sent by me to your Geneseo email account
	Your internet-enabled laptop computer (bring it to class)
Installed software	R, ver. 2.15.2 or later. http://cran.case.edu)
	RStudio. http://rstudio.com
Two TAs	Jarrod LaFountain and Hayley Martin (office hours TBD)

This is an introductory class on computer modeling of biological systems. I assume you have no computer programming experience and that you have not heard of R, other than some hidden fear that you're going to be using it in this class. If you're a complete novice do not be intimidated that there are students who have experience with R in the class. You will be evaluated on effort and growth (there's no curve). I do assume you're quite interested in learning how to build a computer model and that you will be enthusiastic about developing quantitative skills.

This course counts either as a single elective credit at the 200-level for biology or as a one-credit laboratory at the 200-level for biology. We are scheduled to meet one hour per week. In addition you are expected to meet with me and/or the TAs during an additional two-hour time period, scheduled at our mutual convenience. During these meetings you will be working on a combination of programming skill building for your project (writing and debugging code), as well as providing project updates. Sessions will be centered on answering your questions. Note that in this type of laboratory class you are expected to conduct most of the work independently.

Expected Learning Outcomes

After successfully completing this class you should be able to

1. write, run, and analyze a model of a biological system using the object-oriented programming language R;
2. correctly use "for" and "while" loops, "if" conditional statements;
3. write and call your own functions,
4. analyze statistically the data created by your models;
5. create appropriate visualizations of results from your models;
6. orally present the results from a deep exploration of an independent research project; and
7. understand, interpret, and present the results from a primary literature paper in the field of modeling biological systems using only a whiteboard.

Grading Stuff

Below are the point assignments for various activities. Since the number of homework assignments varies the total number of possible points is unknown. Your grade will be determined

from a percentage of possible points earned.

Item	Points for each	Total pts
Presentation of project plan	10	10
Presentation of primary literature paper	10	10
Mid-term R challenge quiz	15	15
Homework	5	variable number
Project updates	5	probably 2 for 10 pts
Final presentation of results	30	30

Letter grades are assigned as follows from numerical grades. Note that all grades are rounded to three significant digits (using `signif()` function in R.

$$.9\bar{3} \leq \quad A \quad \leq 1.00$$
$$.900 \leq \quad A\text{-} \quad < .9\bar{3}$$
$$.8\bar{6} \leq \quad B\text{+} \quad < .900$$
$$.8\bar{3} \leq \quad B \quad < .8\bar{6}$$
$$.800 \leq \quad B\text{-} \quad < .8\bar{3}$$
etc.

In the event that a letter grade is assigned it will be converted into a numerical value using the following mid-points between numerical cutoffs:

$$A \quad \rightarrow \quad .9\bar{6}$$
$$A\text{-} \quad \rightarrow \quad .91\bar{6}$$
$$B\text{+} \quad \rightarrow \quad .88\bar{3}$$
$$B \quad \rightarrow \quad .850$$
etc.

How are these grades assigned? The main part of this course involves your semester-long project. For the presentations you make I'll be looking to see that the project is interesting, appropriate, and improving over time.

Schedule

Below is the schedule for the semester. There are activities in lab and things you need to do or prepare for lab. Those things listed under "What to bring or prepare for lab" need to be done for that day. There may be some adjustments here and there but, in general, this is what we'll be doing. I'm quite flexible and if something seems unreasonable then we can make adjustments.

"Flight" refers to the book Taking Flight with Biostatistics Using R. This is beginner's book on R and will help you with this class. You will be generating data from your models so the chapters on getting up an running with R and RStudio, data analysis, visualization, and programming should all be helpful.

Date	Activities	What to bring or prepare for lab
1-23	Intro, expectations, R, RStudio, and discuss projects	Install R and RStudio on your computer Read Flight: Chapt. 1
1-30	Intro to programming	Flight Chapt 9, The intro part of chapter and sections 9.1, 9.2, and 9.3
2-6	Programming with functions	Flight Chapt: 8.1
2-13	Constructing and implementing an algorithm: the Monty Hall Problem and Baby Genders	http://marilynvossavant.com/game-show-problem/
2-20	Getting + analyzing data from a model	Flight Chapts: 2-4
2-27	Visualizing output from your model	Flight Chapt: 5; Hand in page #1 of primary literature paper of your choice
3-6	Present a primary literature paper	Give presentation using only whiteboard: methods + results (draw graphs). Finally, relate to your project
3-13	Give a presentation on how to model ISC project	Tour de ISC - find a poster to discuss
3-20	Spring Break	
3-27	Programming challenge	Organize your code!
4-3	Data Analysis	Flight Chapt: 7
4-10	Project update	Present 3 Powerpoint slides
4-17	No meeting	Review MBS talks at GREAT Day
4-24	Final project prep #1	GREAT Day Talk Review (include your original notes)
5-1	Final project update	Presentation on white board of major result
5-10	Final project presentations (3:30 - 6:30)	

BRING YOUR LAPTOP TO CLASS, unless otherwise instructed.