BIOL 4650: Introduction to Computer Programming for Biologists
summer 2025
1 credit

Course description
There is only one piece of scientific equipment that all biologists—cell biologists, evolutionary biologists, neurobiologists, physiologists, biochemists, immunologists, ecologists, developmental biologists, astrobiologists…seriously, *all* biologists—use in their research. Yet few of them are trained properly to use it to maximal effect: the computer. This course provides a brief introduction to computer programming with biological applications. It is aimed at students who have never dipped a toe in the programming waters. Students can expect to emerge from this module with the ability to write simple programs (e.g., simulations of population processes, scripts to process data and perform statistics) in one computer language and, more importantly, with an appreciation for computational thinking and the knowledge of basic computations performed in virtually all programming languages.

Instructor
Prof. Manus Patten
mmp64@georgetown.edu | office: Regents 347 | office hours TBA and by appointment

Prerequisites: BIOL-103 (1203) and BIOL-104 (1204) or permission of instructor.

Credit: This course counts for 1 upper-level elective credit in all four Biology majors (Biology, Biology of Global Health, Environmental Biology, and Neurobiology). This course also counts toward the Biology minor. Students who have previously taken computer programming courses in a Computer Science department are not likely to gain much from this course, but students who take this course first and then fall in love with programming should by all means go on to take computer science courses.

Materials
1. [Required (but it's freely available as an e-resource from the library!)] *Hands-on Programming with R*, by Garret Grolemund.
2. [Recommended] *R in a Nutshell*, by Joseph Adler
3. [Recommended] *R Cookbook*, by Paul Teetor.
4. [Required] Students will need a computer that can run R and RStudio.

Grades
Your grade is determined from four sources, weighted according to this scheme:
50%   Homework assignments — a mix of theoretical and practical challenges. These will be due almost daily; each should take you ~1-2 hours to complete, but we will get a jump on some of the more challenging ones during class time.
20%   Exam — to test your comprehension of programming concepts *in theory*, without the aid of a computer.
20%   Final program — to test your comprehension *in practice*. You'll have to write a complete program demonstrating your competence with the programming skills and concepts covered in the class.
10%   Participation

To receive an A, your average must clear a 93.33…; an A-, a 90.0; a B+, an 86.66…; a B, an 83.33…; etc.

Schedule – This is the order in which we will cover the material. At the end of each a-and-b pair of lessons there will be a homework. You will have some time in class to get a start on the homeworks.

#	Topic
1a	Introduction, Assignment, Variables
1b	Random numbers, Relationals
2a	Scripts and Debugging
2b	Data structures
3a	Conditionals
3b	Loops
4a	User-defined functions and packages
4b	File input and output

Policies: the fine print

Illnesses and absence: Drink eight glasses of water a day, eat a balanced diet, exercise regularly, and try to sleep when it's dark outside. Do this and you won't get sick, and we won't have to worry about how to have you make up missed work. At least, that was my traditional advice. It's still good advice, generally, but these are different times. If you need to miss class, I think we've built in enough flexibility to accommodate it. Just be in touch please.

Continuity: I will do my best to follow my advice above, but unlike you I am old and frail, and my body might betray me at any moment. If something keeps me from class for a single day, we can fall back on recordings/Zoom. If I'm out of commission for longer, I have designated a replacement for myself, and that person can take over. But, fingers crossed, we won't need to resort to this.

Honor code: All students are expected to maintain the highest standards of academic and personal integrity in pursuit of their education at Georgetown. Academic dishonesty in any form is a serious offense, and students found in violation are subject to academic penalties that include, but are not limited to, failure of the course, termination from the program, and revocation of degrees already conferred. All students are held to the Georgetown University Honor Code. For more information about the Honor Code see: http://honorcouncil.georgetown.edu/. In a nutshell, Georgetown's honor code applies to everything you do in this class. If you are worried you might run afoul of it or suspect that someone else has, you must let me know.

Special accommodations: If you believe that you have a disability that will affect your performance in this class, please contact the Academic Resource Center (arc@georgetown.edu) for further information. The center is located in the Leavey Center, Suite 335. The Academic Resource Center is the campus office responsible for reviewing documentation provided by students with disabilities and for determining reasonable accommodations in accordance with the Americans with Disabilities Act (ADA) and University policies.

Diversity and inclusion: Our intellectual community is enriched by diversity along a number of dimensions, including: race, ethnicity, and national origins; gender and gender identity; sexuality; class; and religion. I am especially committed to decreasing the attrition of people from populations that have been historically excluded from participation in higher education and from the sciences in particular. There is little chance in this course of encountering any topics related to the above-named dimensions, but, should they arise, I trust that we will all enter into them with the necessary sensitivity for our peers and an open mind.

Work-life balance: This material is important, but on any given day it might not be as important as something else in your life. The best way to learn this material is to challenge yourself, but on any given day you might need one less challenge. I've designed things so that you can all take care of being yourselves first and take care of being a student of programming second, at least when you need to.

Sexual Misconduct: Georgetown University and its faculty and staff are committed to supporting survivors and those impacted by sexual misconduct, which includes sexual assault, sexual harassment, relationship violence, and stalking. Georgetown requires faculty members, unless otherwise designated as confidential, to report all disclosures of sexual misconduct to the University Title IX Coordinator or a Deputy Title IX Coordinator. If you disclose an incident of sexual misconduct to a professor or staff member in or outside of the classroom (with the exception of disclosures in papers), that faculty or staff member must report the incident to the Title IX Coordinator, or Deputy Title IX Coordinator. The coordinator will, in turn, reach out to the student to provide support, resources, and the option to meet. Please note that the student is not required to meet with the Title IX coordinator and no action will be taken without the student's awareness. More information about reporting options and resources can be found on the Sexual Misconduct Website: https://sexualassault.georgetown.edu/resourcecenter.

If you would prefer to speak to someone confidentially, Georgetown has a number of fully confidential professional resources that can provide support and assistance. These resources include:

- Health Education Services: Sexual Assault Response and Prevention: sarp@georgetown.edu
- Counseling and Psychiatric Services (CAPS): 202.687.6985

Additional resources are included below:

- Georgetown Self-Care Resource Guide: https://studenthealth.georgetown.edu/health-promotion/self-care/
- Georgetown Wellness Wheel: https://studenthealth.georgetown.edu/hoya-wellness-wheel/
- Georgetown Guide to Recognizing Students in Distress: https://studentaffairs.georgetown.edu/studentoutreach/facultystaffresources/

Pregnancy Modifications and Adjustments: Georgetown University is committed to creating an accessible and inclusive environment for pregnant students. At any point throughout their pregnancy students may request adjustments/modifications based on general pregnancy needs or accommodations based on a pregnancy-related complication or medical need. Students may also request accommodations following labor and delivery based on a complication or medical need.

To request pregnancy modifications, please complete the SCS Pregnancy Modification Request Form: https://forms.gle/ZBfASxui7u13A8TU6

More information about pregnancy modifications can be found on the Title IX Georgetown University Website: https://titleix.georgetown.edu/title-ix-pregnancy/student-pregnancy/