

BIOL 351: Data Visualization and Communication for Biologists

M/W from 6:00– 7:15 pm in Gottwald A-201
If remote, join through [Zoom](#)

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Office Hours by appointment. Book at:	https://____.youcanbook.me	https://____.youcanbook.me

Course Description:

Data sets are increasingly becoming larger and more complex, whether used to direct advertising to your social media feed, track human impact on climate change, or understand the genetic underpinnings of cancer. The need to communicate complex data in clear, accurate, and engaging ways to both novice and expert audiences remains essential.

In this course, we will focus on the presentation of datasets in biology and learn visualization approaches that accurately represents data in compelling ways. You will learn about the common pitfalls, mistakes, and misleading practices in data presentation. We will use tools such as Tableau and Program R to manage and process large data sets and visualize trends in data. You will also explore more creative and visually compelling ways to present data to better communicate your results and support your conclusions. These skills are important across many careers and for guiding decision-making in other aspects of your life.

Learning Objectives:

Use creativity, revision, and experimentation to learn principles of data visualization and interpretation

Acquire publicly available data and develop programming skills to wrangle and organize data sets

Identify and avoid common pitfalls that can result in inaccurate presentation of data and figures

Appreciate the role of data in the propagation of misinformation and learn to recognize BS

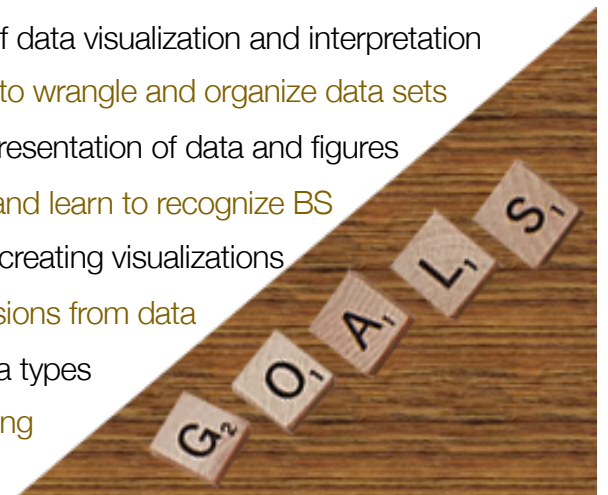
Gain experience with Tableau & Program R as software tools for creating visualizations

Appreciate the role of statistics and modeling in reaching conclusions from data

Learn to select appropriate visualization types for a variety of data types

Understand misuse of data such as “p-hacking” and data dredging

Convey clear and accurate messages with data visualization

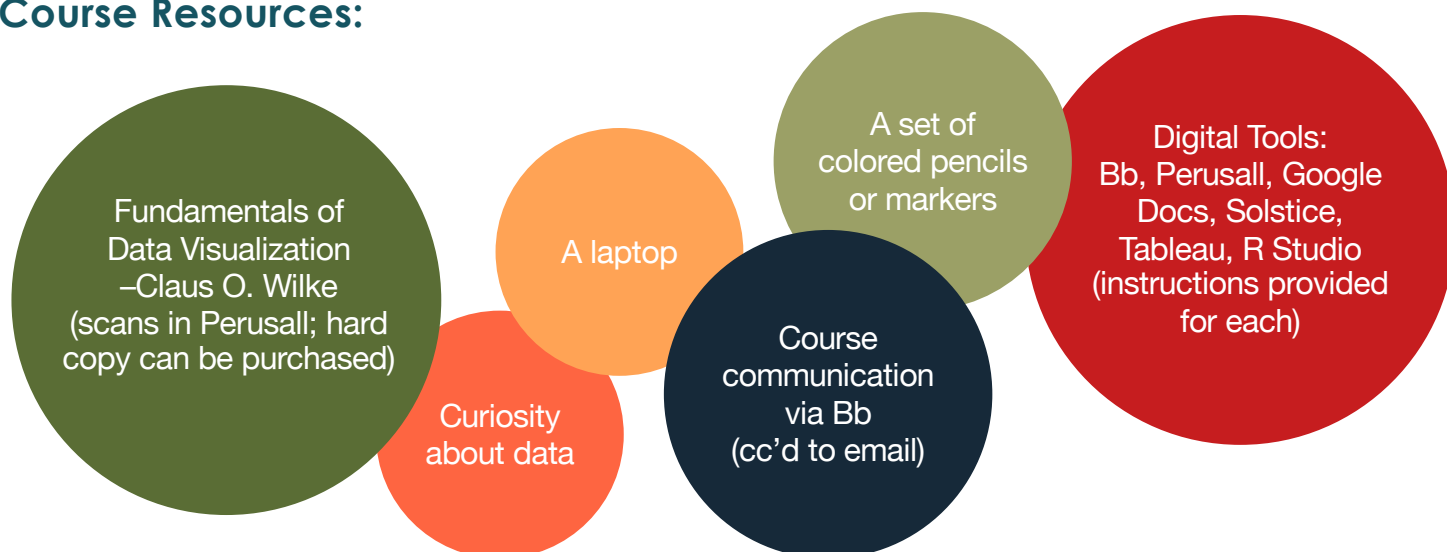


Course Schedule: Weeks 1-10

Week #	Class Day	Date	Topic ¹
1	Mon.	1/18/2021	No Class: MLK Day Observance
	Wed.	1/20/2021	Course Intro, Power of Data Visualization
2	Mon.	1/25/2021	Giving Context to Data: Coordinate systems and axes
	Wed.	1/27/2021	Basics on Displaying Data: Use of color and overview of graph types
3	Mon.	2/1/2021	Intro to Tableau; Visualizing amounts vs. proportions
	Wed.	2/3/2021	Data exploration and hypothesis-driven science
4	Mon.	2/8/2021	Visualizing Distributions
	Wed.	2/10/2021	Misinformation in a Data-Driven World
5	Mon.	2/15/2021	Visualizing Associations; Correlation vs. causality
	Wed.	2/17/2021	Visualizing Time
6	Mon.	2/22/2021	Visualizing uncertainty; Clarity with legends, themes, labels
	Wed.	2/24/2021	Visualizing spatial data; Misuse of maps
7	Mon.	3/1/2021	Fake news and scientific misconduct
	Wed.	3/3/2021	Susceptibility to Data BS and how to refute it; Welcome to Program R
8	Mon.	3/8/2021	Program R practice; How programmers troubleshoot
	Wed.	3/10/2021	Presentations for Mid-Semester Project; Program R
9	Mon.	3/15/2021	Presentations for Mid-Semester Project; Program R
	Wed.	3/17/2021	Presentations for Mid-Semester Project; Program R
10	Mon.	3/22/2021	Presentations for Mid-Semester Project; Program R
	Wed.	3/24/2021	Consider your audience; Open data revolution

¹ Note that the pace or order of topics might change, but the dates of the mid-semester projects will not, unless there is a University closure. Please note the final exam period time (Fri. 04/30/21 from 7-10 PM), as we will use that for the final project. The final weeks of the schedule will be posted later.

Course Resources:



Typical Weekly Structure and What to Expect:

Stuff You Should Know:

Course reading will be listed on Blackboard (Bb) by Wednesday of the previous week.

All readings will be loaded in Perusall. Actively read and comment through the link.

Most weeks, all reading must be completed by 1pm on Monday.

Typically, homework will be due on Wednesday of each week.

There are no exams in this course. You will show your growth through assignments.

You will have two major projects (mid-semester and final).

It is important to cultivate a growth mindset about progress in science and in this course.

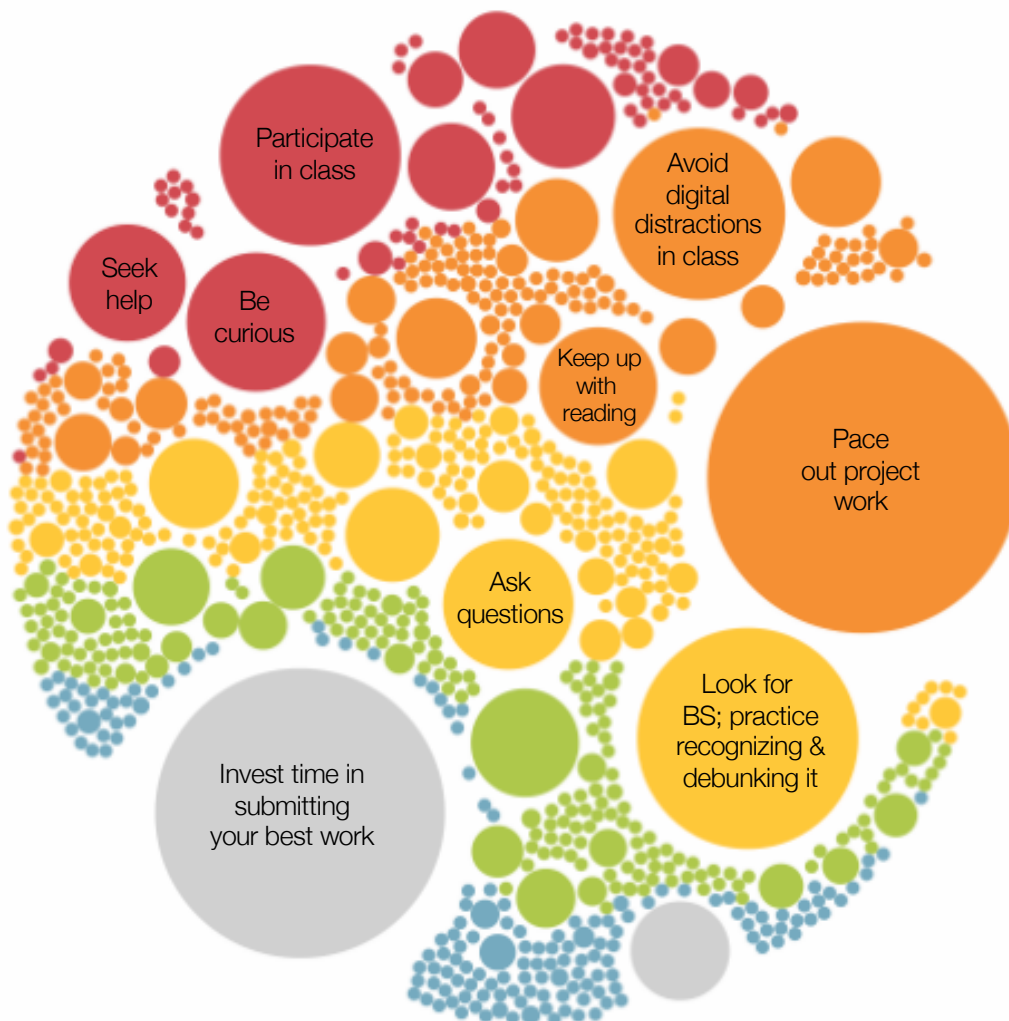
The skills you will be learning take time and experience to master.

These skills will help you in many aspects of life, not just in science.

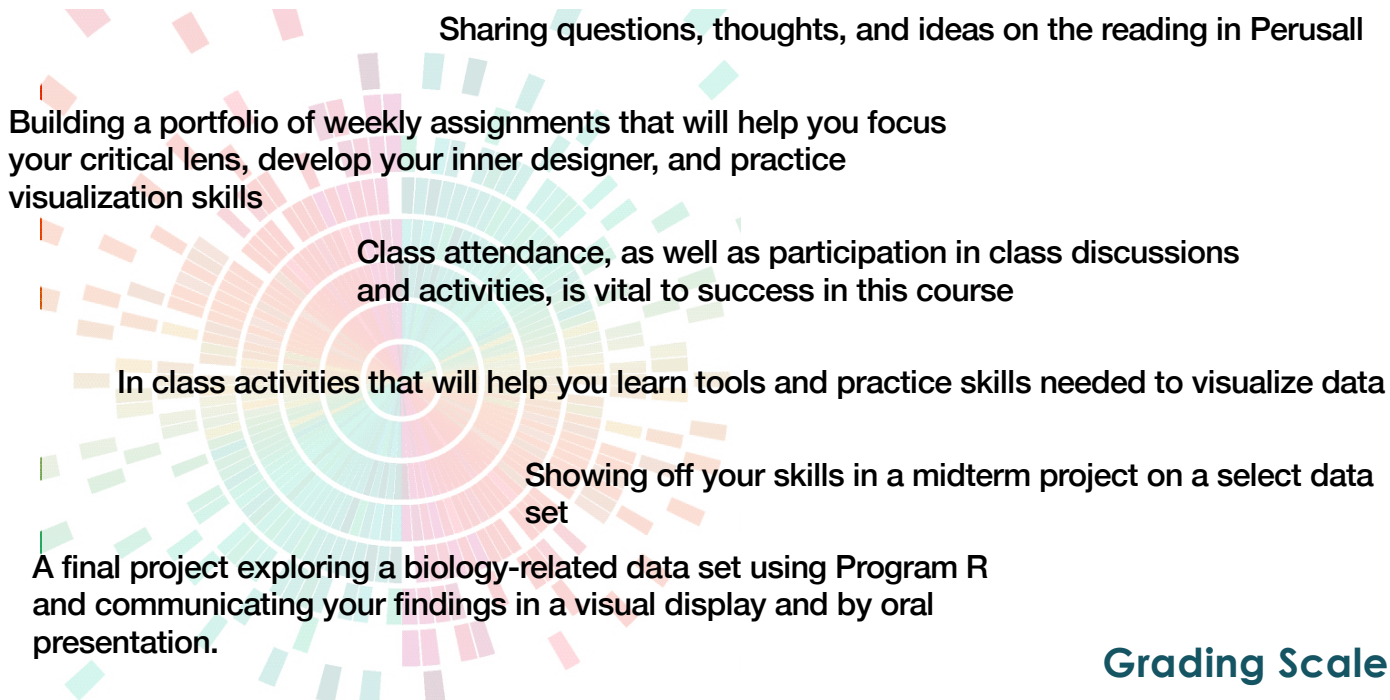
Have fun, explore, and experiment with data!

Admittedly, this axis has no meaning; Can't put a number scale on all this awesome-ness

How to succeed in this course:



Graded Assessments:



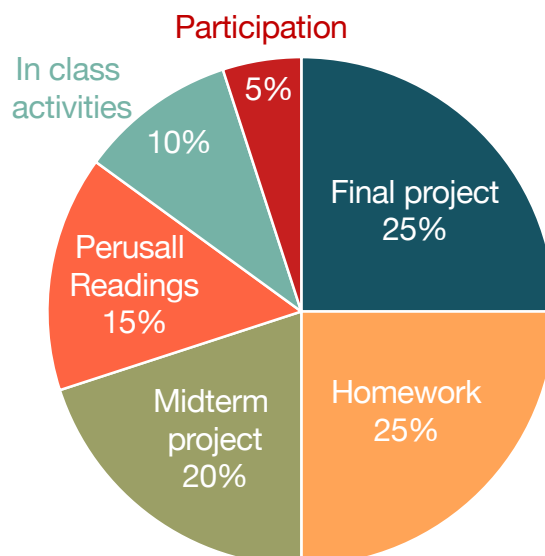
Assignment Policies:

You have one “grace pass” which allows you to turn in one weekly homework up to 3 days late (does not apply to mid-term and final projects).

After using your one late pass, points will decrease by 10% each day an assignment is late. Assignments won’t be accepted after 3 days, outside of extenuating circumstances in consultation with your instructor and Academic Dean.

Your lowest Perusall grade will be automatically dropped.

Grading Distribution:



Grading Scale:

100	A
94	A-
90	B+
87	B
84	B-
80	C+
77	C
74	C-
70	D+
67-69	D
64-66	D-
60-63	F
0	

Our Course during COVID-19:

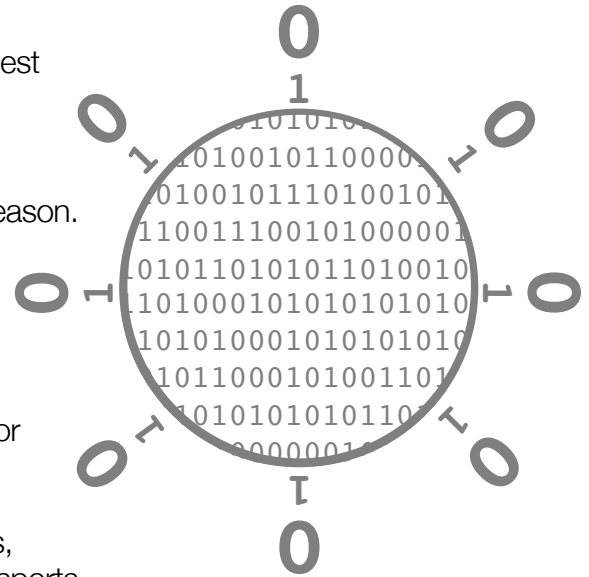
We all must be flexible and make decisions this semester in the best interest of our community. We will be transparent and understanding as we navigate this pandemic together.

Do not attend class in person if you are feeling ill, no matter the reason. Notify us in advance, if possible.

Prioritize your health and the health of others by following the guidelines in place for testing and returning to class.

Unless you are ill, you must attend class. Remote attendance is for illness, quarantine, and fully remote students unless prearranged.

Please let us know the first week of class about accommodations, religious observances, or University sponsored absences (varsity sports, SSIR, etc.). Stay in communication with us, particularly if you have missed class



Resources @ UR

We take the [Honor Code](#) seriously; it applies to all work in this class. We encourage you to discuss course material with one another, but any work that you submit must be your own. If you are helping a classmate, think of it as a consult. You can give advice and guidance, you may not simply supply the solution. If you have questions about what constitutes academic integrity in this course, talk to us!

The [Academic Skills Center](#) can help hone your academic and life skills. Take advantage of this professional development now - life coaches in the outside world are expensive!

Get a hold of your trusty librarian at [Boatwright](#) to aid you in your quest for great data and information.

Ready to take your writing or speaking skills to the next level? Talk to the experts at the [Speech Center](#) and the [Writing Center](#). Meet with trained consultants who are prepared to offer you friendly advice.

What do you want to do with your UR smarts and awesome ambition? Let the [Career Services](#) gurus help you explore your options, connect you with sweet internships, or help you plan your next step.

College is stressful enough in a normal year, and this is not a normal year. It is ok to not be ok. Taking care of your mental health is critical to your success whether you need help handling stress, anxiety, an important event, or other challenges. [CAPS](#) is here for you and filled with professionals to give you confidentiality and support.

Having problems with your computer, software, or webpages? Call the Help Desk (804-847-6400) or use the UR equivalent of Stack Overflow, a.k.a. [Spider Tech Net](#).

The [Office of Disability Services](#) works to ensure that students with disabilities are provided with accommodations to allow you to fully participate in the academic mission at UR. We will work with you to make sure any accommodations are met for this class.

Equity and Inclusion¹:

In an ideal world, collection, interpretation, and use of data would be objective. While the scientific endeavor has many tools that strive for objectivity, it is still undertaken by people with biases and perspectives that influence how they see the world. It would be a mistake to assume that, because we are scientists (in training or professionally), that we are entirely objective. Science has historically been inequitable in access. Progress is being made, but inequitable access affects who writes the materials we have access to, what questions are deemed important enough to study, and whose data is sought and included.

We will tackle these topics in our course, but we must acknowledge that there are covert and possibly overt biases that affect the data interpretation and resources that we read. In fact, one focus of the course is to uncover the bullsh^{**} masquerading as data-backed information. This bullsh^{**} can include information that tries to reinforce discriminatory practices. We will work to uncover and discuss these practices. From your perspective, you may see biases that your instructors don't. We encourage you to bring your ideas and perspective into our class discussions.

We will strive to create a learning environment that is equitable, inclusive, and supports the perspective of people with different thoughts and backgrounds.

To help accomplish this:

- We must honor one another's perspectives, but we must also listen if something we say hurts another person. Even if our intentions are good, our actions can be harmful.
- Remember that we all enter the classroom with our own perspective, lens, and implicit biases. Our perspective can help others learn, but we must also be open to learning from others.
- Your identity is important and affects how you see the world. If there are aspects of your identity that you would like to bring into the classroom, please do so, but only at your own level of comfort.
- If something is said in class that makes you uncomfortable and you do not feel comfortable addressing it in class, please talk to us. There will also be opportunities for anonymous feedback.
- Be aware of microaggressions and try to avoid participating in them. These include "everyday verbal, non-verbal, and environmental slights, snubs, or insults, whether intentional or unintentional, that communicate hostile, derogatory, or negative messages to target persons based solely upon their marginalized group membership."
- Microaggressions are alienating, negatively impact mental health, and detract from learning. Your instructors pledge to address microaggressions in the classroom by holding ourselves and you accountable for what is said and being receptive to criticism if we perpetuate microaggressions ourselves. We hope to build enough trust with you that you can speak to us about these issues, but until we earn that trust, you might explore Spiders Against Bias (a student peer to peer support network), [Common Ground's Bias Resource Team](#), or a series of student lead workshops called *Not So Slight: Combating mAcroaggressions*².

Your instructors realize that events outside of class might interfere with your ability to learn. Please talk to us if something is affecting your ability to work; we can be a resource for you and assist in finding others as well.

¹ Thanks to Dr. Monica Linden and Dr. Mary Wright, Brown University, for publishing information on their Diversity and Inclusion Syllabus Statements and inviting others to adopt it. Some of this language was inspired by their work.

² Thanks to UR students Penny Hu and Arju Patel, who drafted a syllabus statement on microaggressions. This section is inspired by their statement, which can be found in full [here](#).