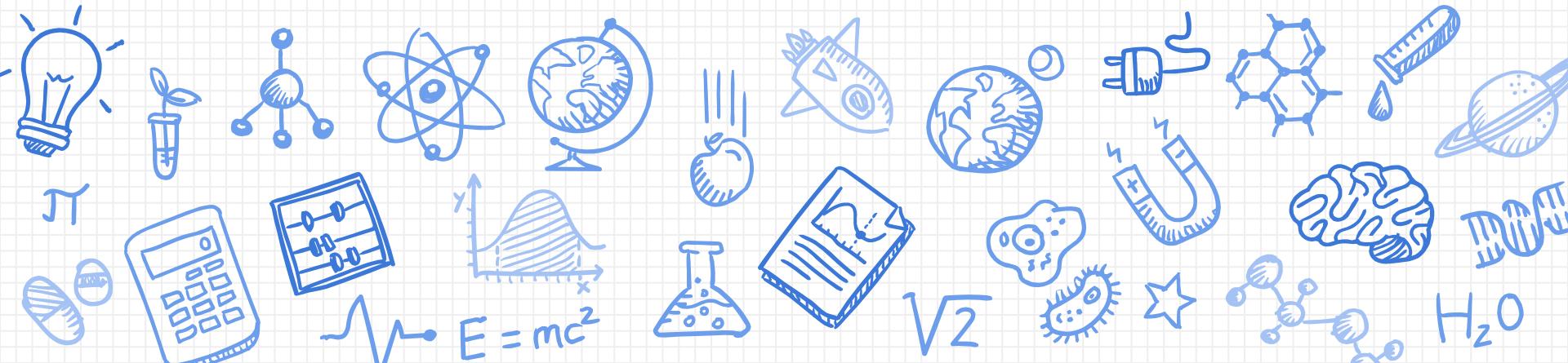
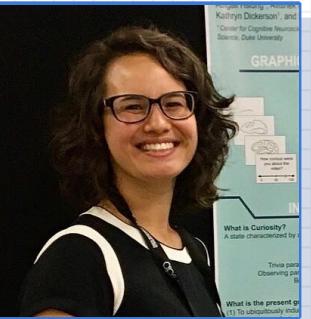


# An Introduction to Computer Programming for Experimental Research

CNRI  
2021.09.08



# Instructors for this Class



**ABBY HSIUNG** (she/her)

5<sup>th</sup> year PhD student in the Center for Cognitive Neuroscience

**Office Hours:**

Tuesdays @ 4:00 PM or by appointment

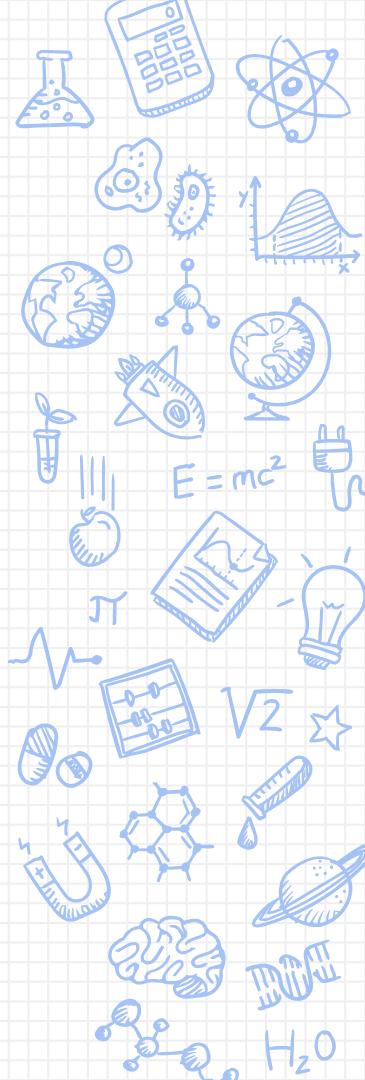


**BEN MUZEKARI** (he/him)

Lab Manager Extraordinaire for the Adcock Lab in the Center for Cognitive Neuroscience

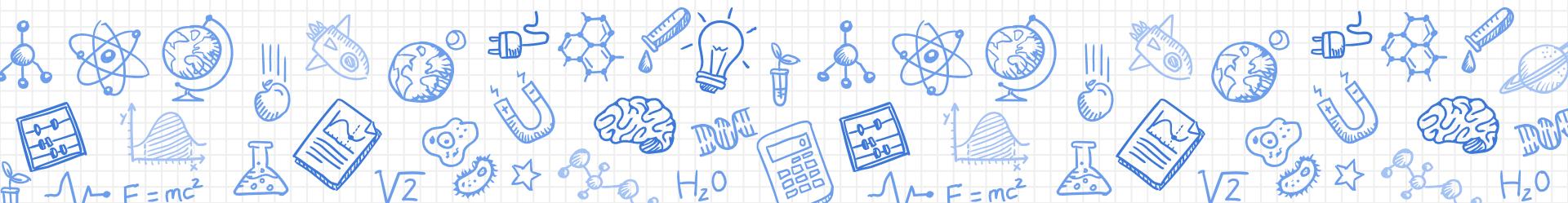
**Office Hours:**

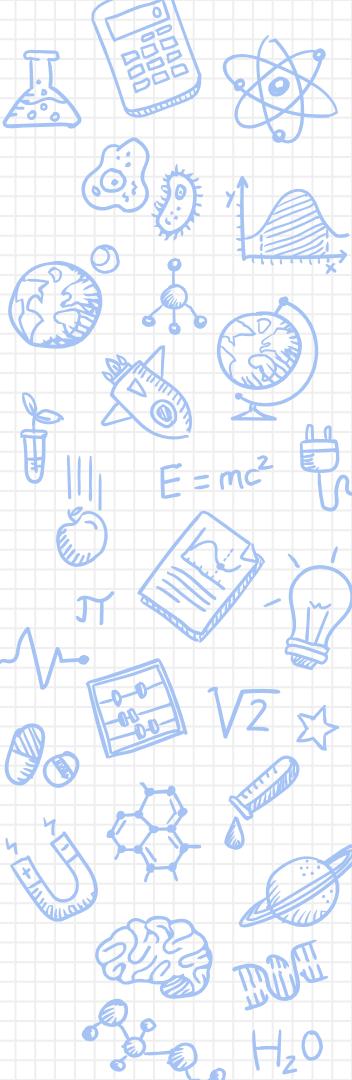
Mondays @ 2:00 PM or by appointment



# A very brief introduction to Computer Programming

What do we mean when we say  
computer programming?



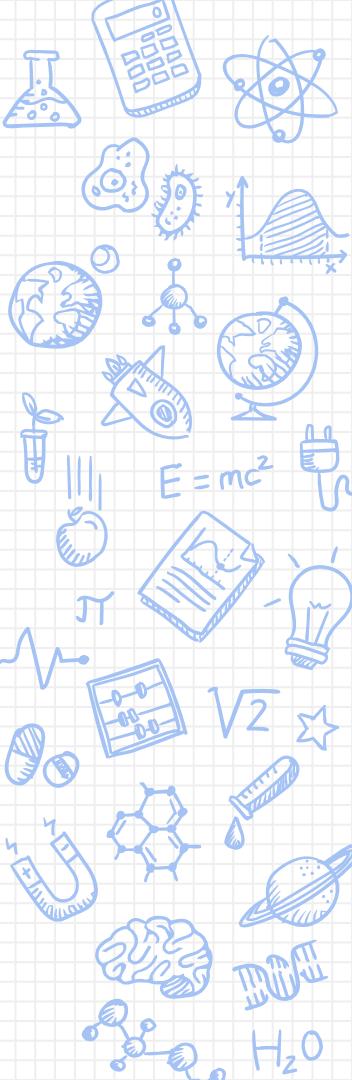


## What is a Computer Program?

X A way in which to tell your computer to do something!

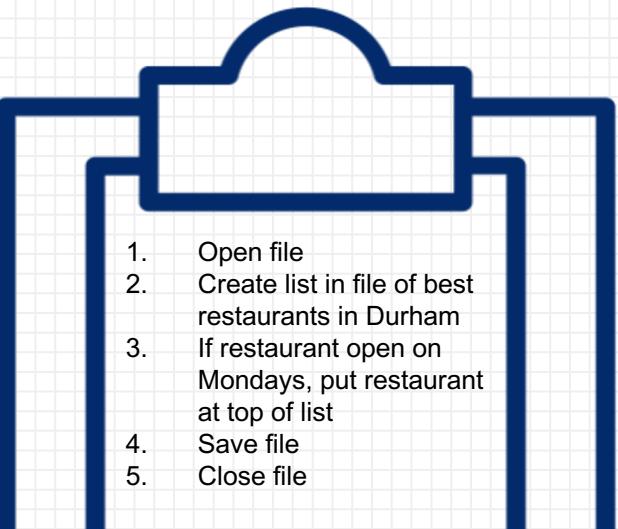
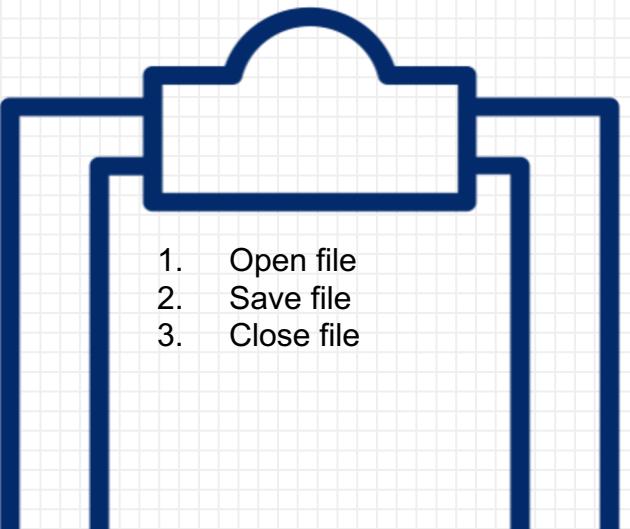


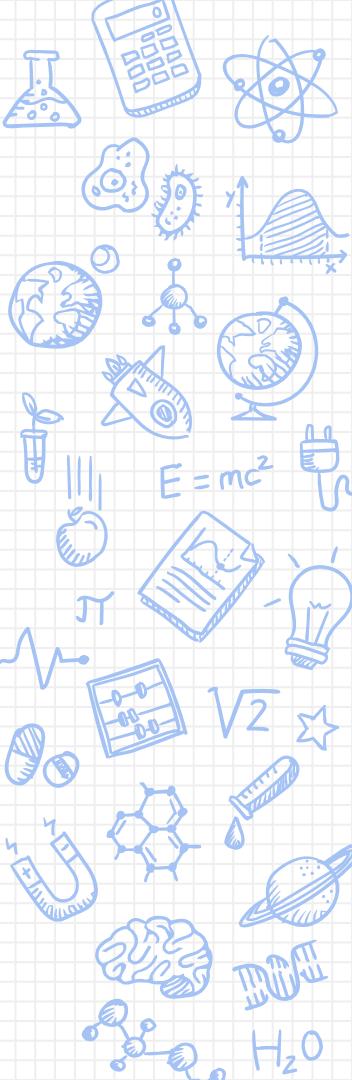
Most times you interact with your computer, you are executing small computer programs!



## What is a Computer Program?

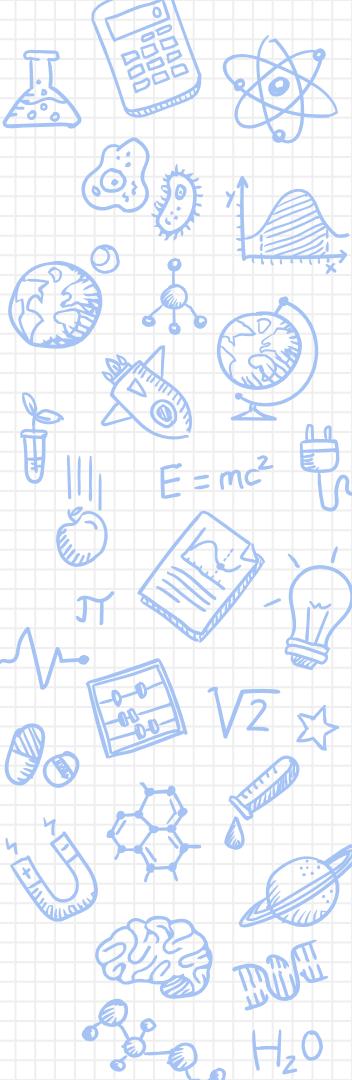
- More formally: A computer program is a **set of instructions** that can be executed by a computer to achieve a particular task.



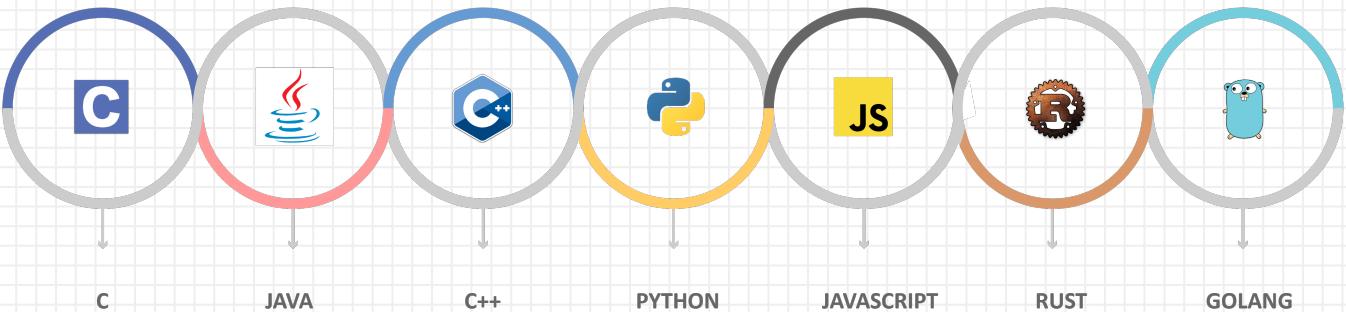


If not point and click, how do we “talk” to our computers?

- ✗ We can write computer programs in different **computer languages**
- ✗ Each language can differ in how they relay instructions
- ✗ Most computer languages can be described by:
  - ✗ The **syntax**, or rules and form of how instructions are written
  - ✗ The **semantics**, or meaning behind the instructions, what to actually do

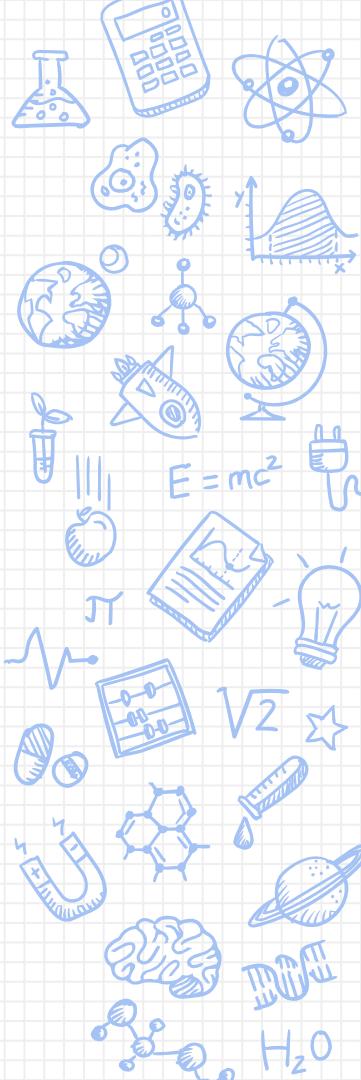
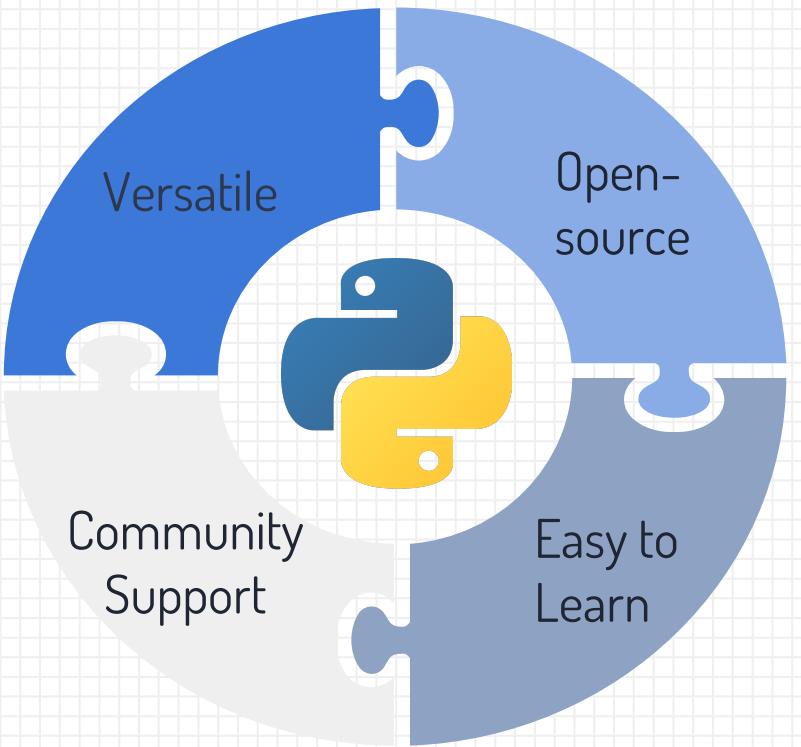


If not point and click, how do we “talk” to our computers?



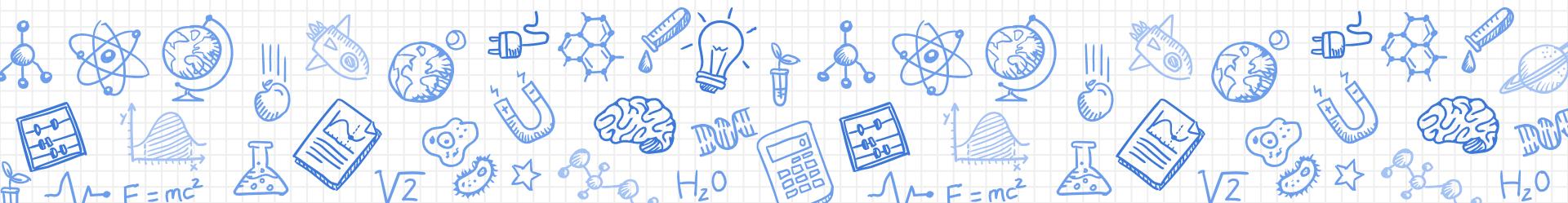
X We have many languages to choose from to write our instructions, so how do we choose?

## Choosing a Programming Language

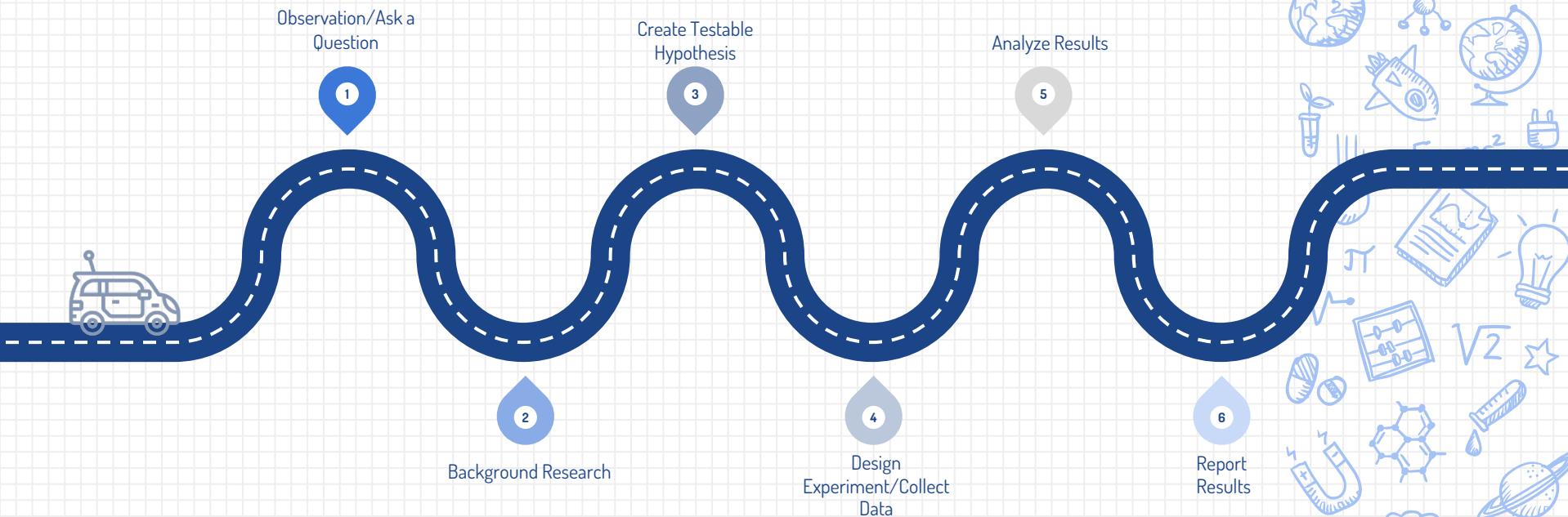


# Why do we (as scientists) need Computer Programming

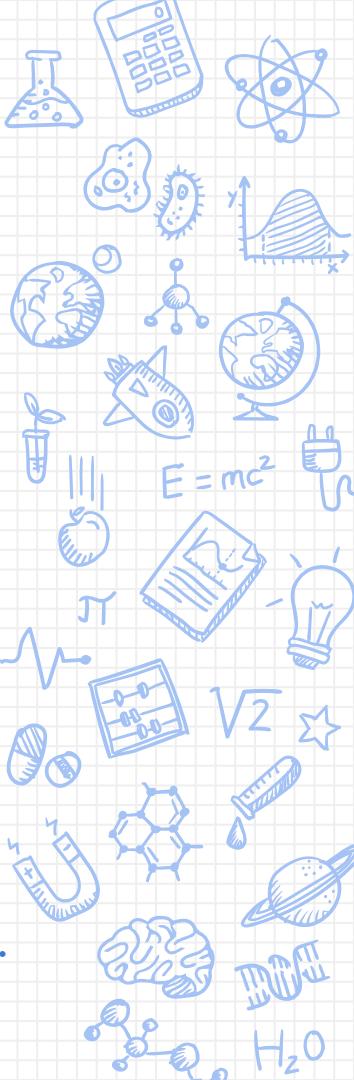
Let's start with examining the elements  
of conducting science



# The Elements of Conducting Science

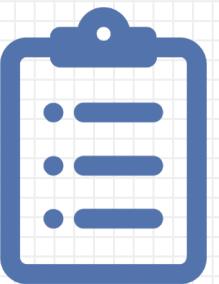


Do we actually *need* computer programming to complete these steps?

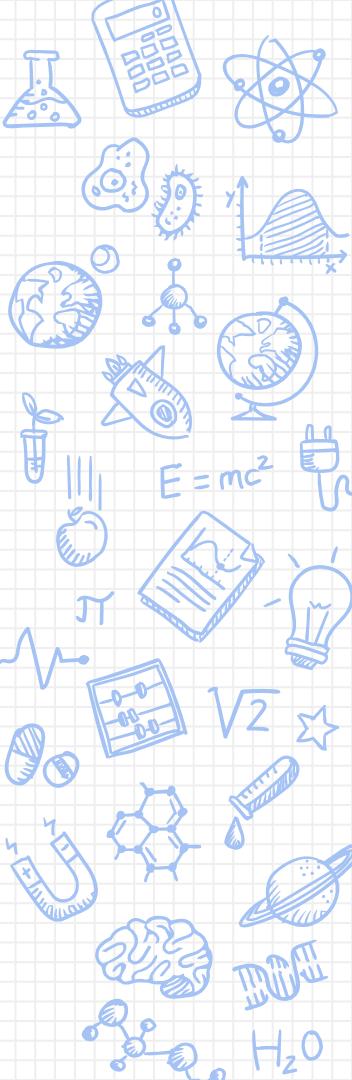


Do we actually *need* computer programming?

You could for example...



But this might not be such a great idea...

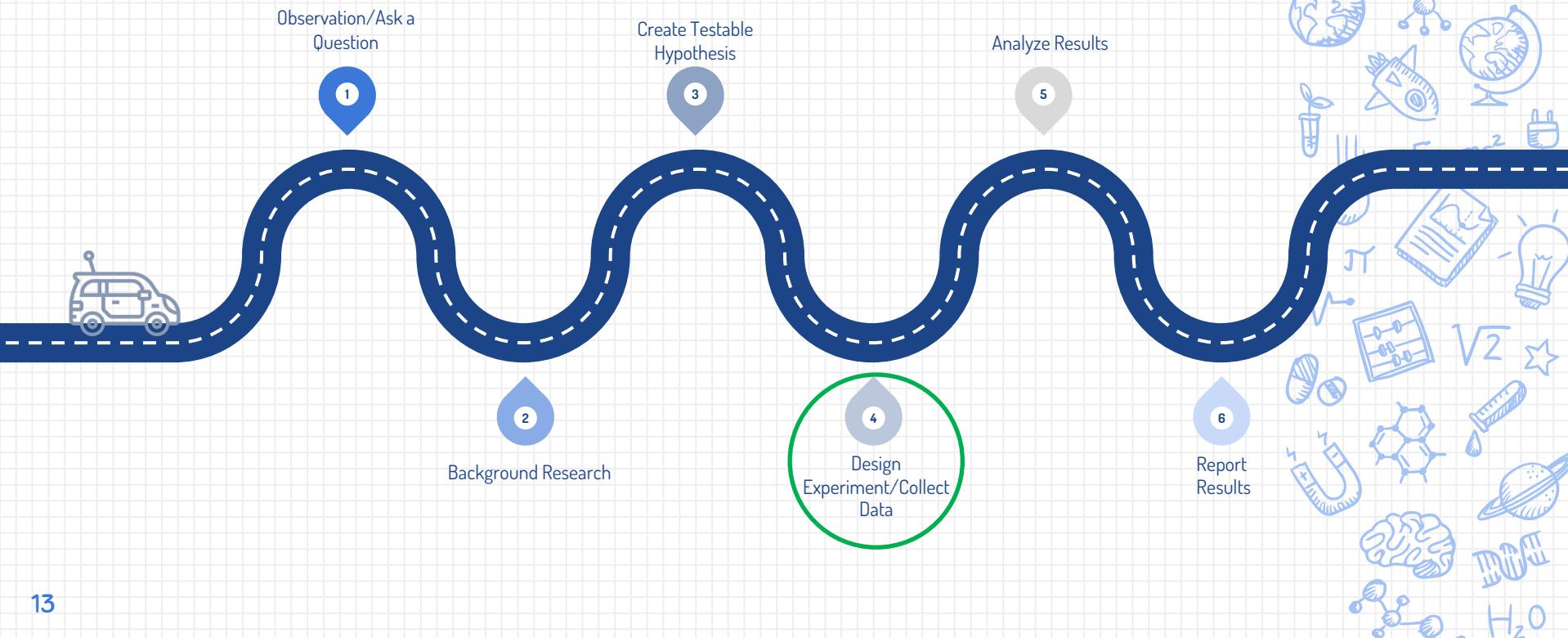


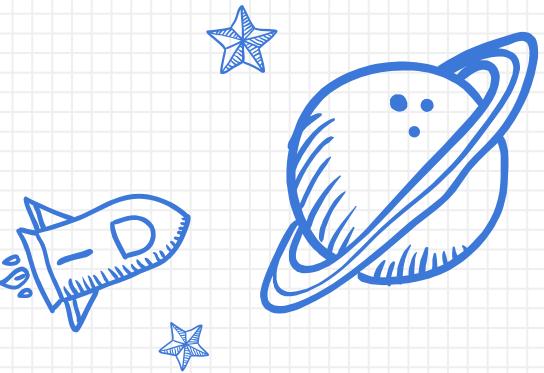
## What does computer programming offer us?

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- ✗ We can collect and store data quickly
- ✗ Less room for human error
- ✗ Easier to share/distribute
- ✗ Greater Reproducibility
- ✗ Greater Reliability

# The Elements of Conducting Science





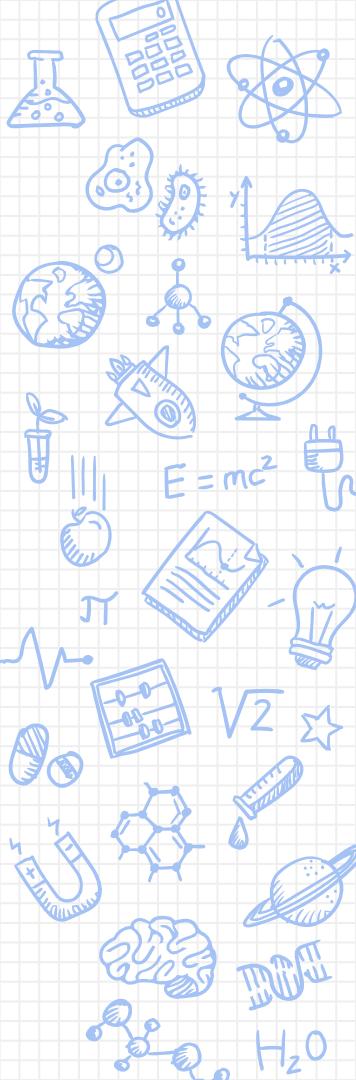
# What does a psychology experiment involve?

How are experiments different from observational studies or surveys?

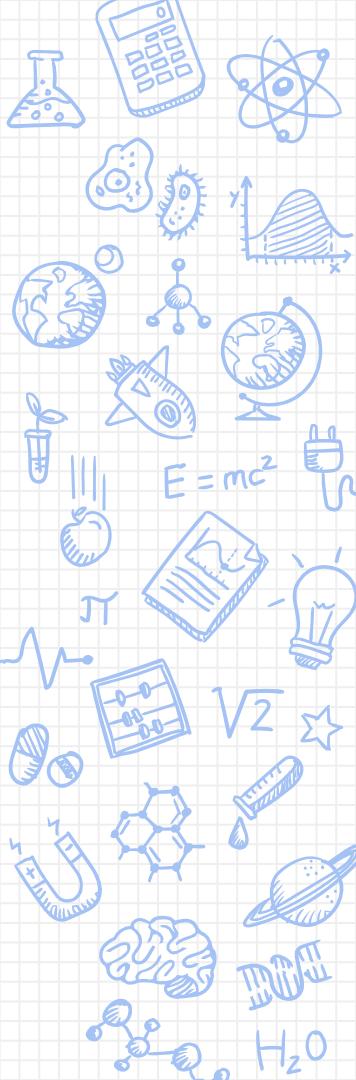
# What does a psychology experiment involve?

# Thought Problem:

Does napping or drinking coffee prior to a visual search task lead to better (faster and/or more accurate) performance?



# Where's Waldo?



## What do we need for this experiment?

Show our  
images to our  
participant

Record the  
choices our  
participants  
make and when

Participants  
should all see  
the same set  
of images

Randomize which  
participants get  
coffee vs.  
napping

Judge whether  
participants  
performed well  
or not

Create a pool  
of “Where’s  
Waldo” images  
want to show

$\sqrt{2}$  $H_2O$ 

Variables, data types

Create Stimuli

Track Progression

Counters, more loops

Libraries, Control Flow: loops, lists

Display Stimuli

Randomize/ Counter-balance

Random number generators, functions

Storing and saving data

Collect Responses

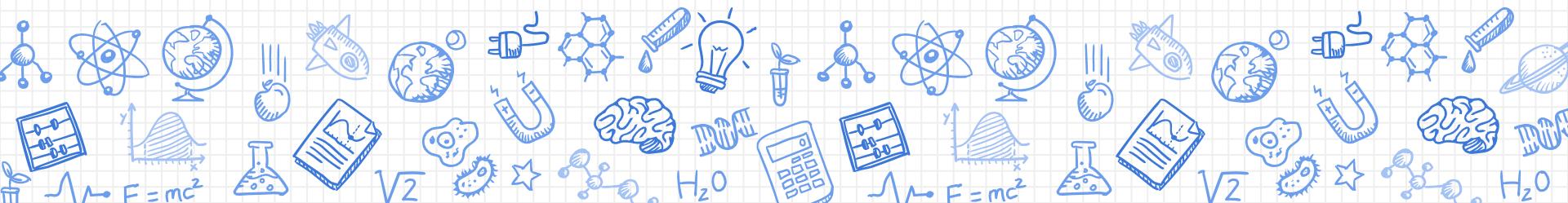
Evaluate Responses

Control Flow: Booleans, conditionality

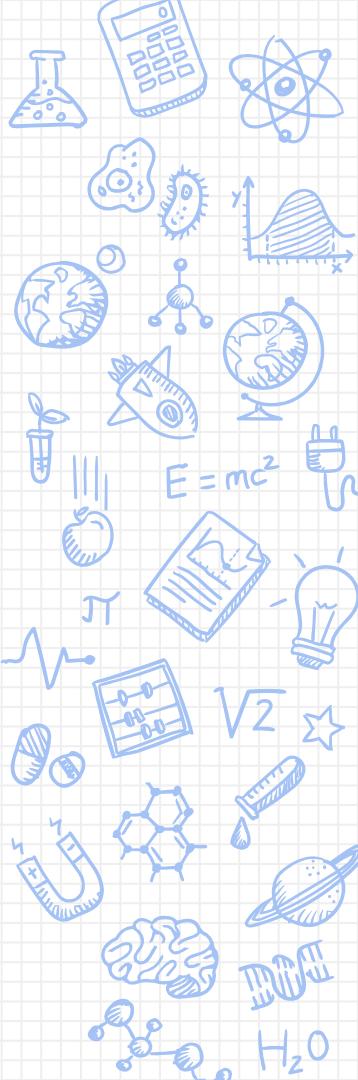
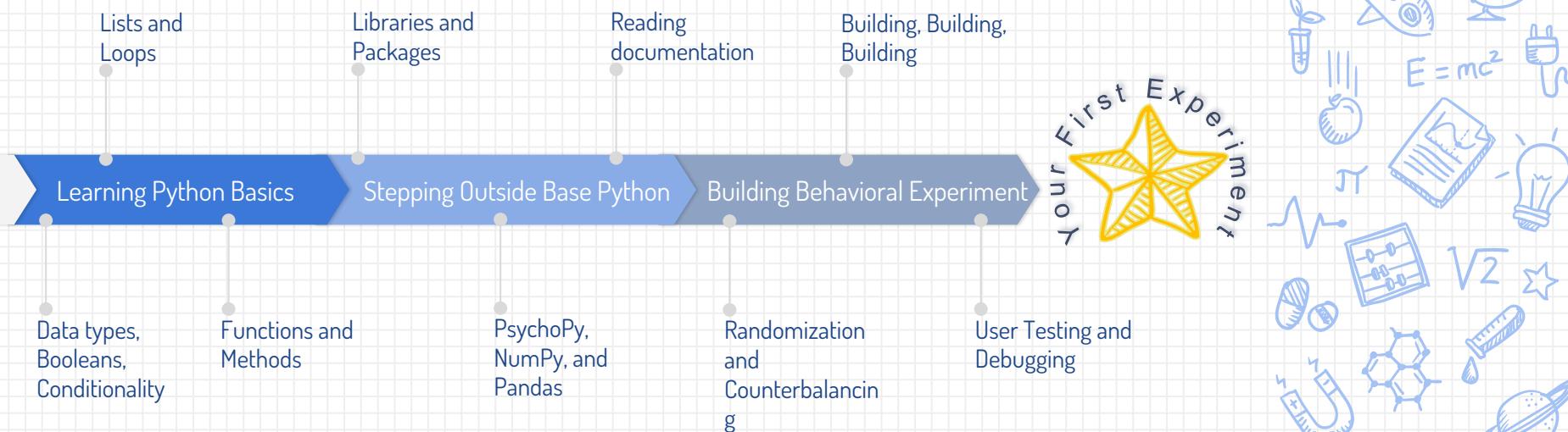
\*\* Not pictured: errors, debugging, testing, more errors, more debugging

# Overview of Python Class

How we expect y'all to learn and apply  
your Python knowledge



# Class Organization

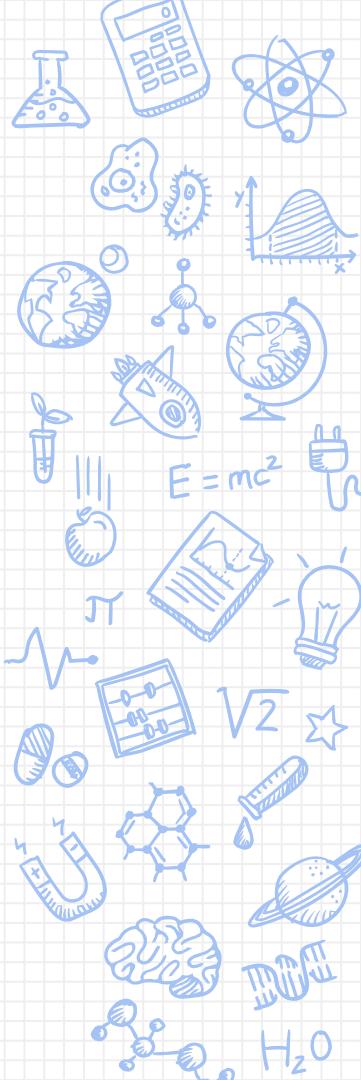


## Class Organization

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- ✗ Narrowed scope to center around your final learning application (experiment building)
- ✗ Lectures, examples, and homeworks will all provide help towards this goal



## Class Organization

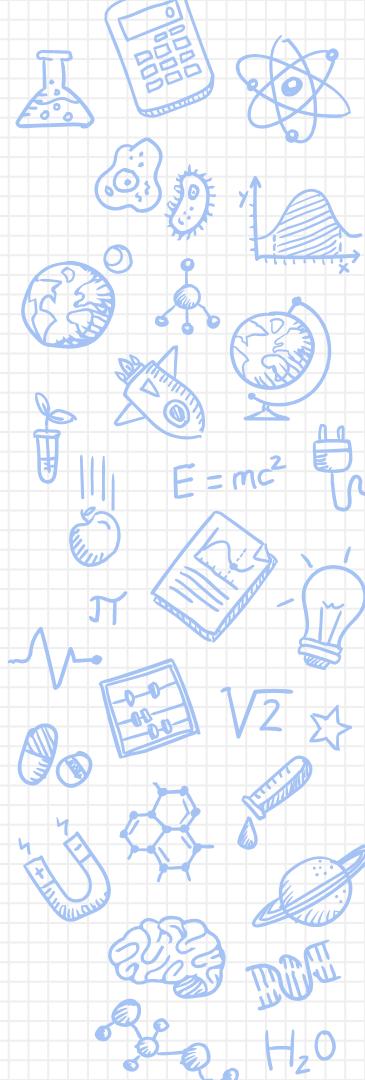
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### X In Class

- X Hybrid lecture-workshop class format
- X Introduce python concepts and practice applying them

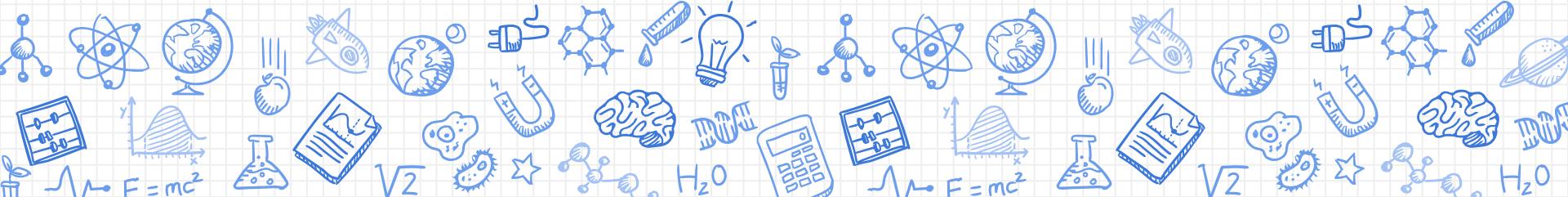
### X Homework

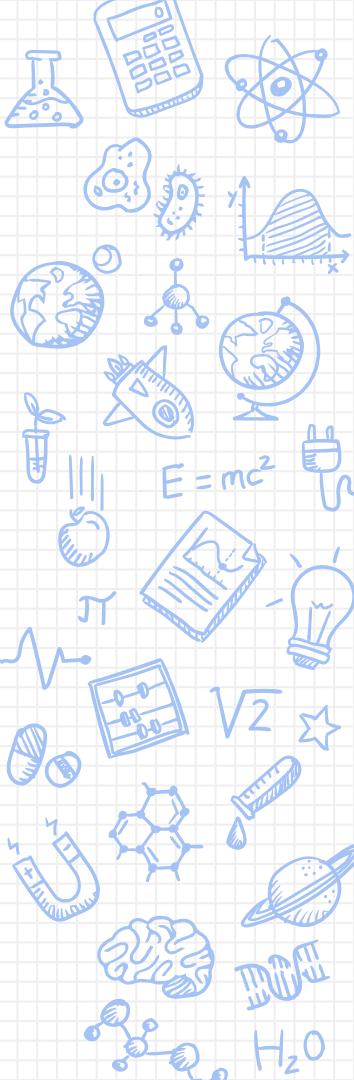
- X Individual and group repetition
- X Problem-solving with code
- X Practice asking Google questions



# Introduction to Google Colaboratory

And the concept of Markdown files

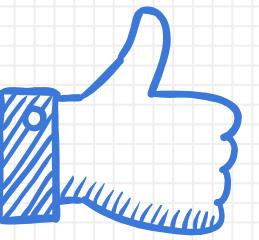




## For next class:

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- X Create a folder on your computer to house the google colabs
  
- X Complete [intro\\_to\\_colab.ipynb](#)



# THANKS!

## Any questions?

You can find me at

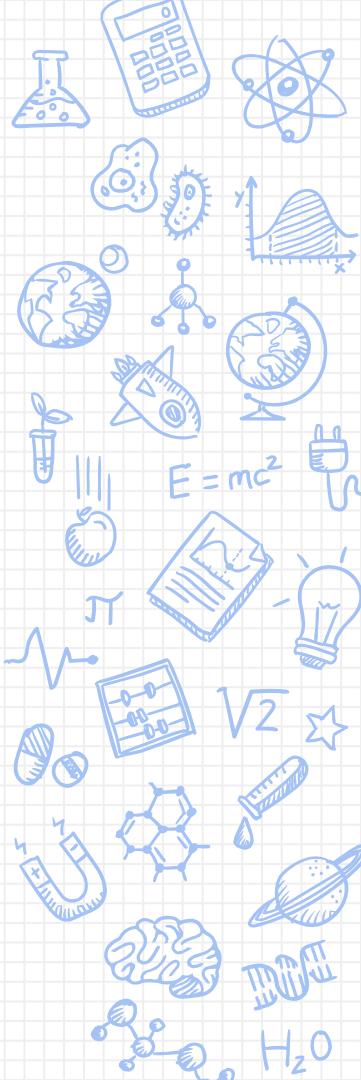
- ✗ @Abby on CNRI Slack
- ✗ [Abigail.hsiung@duke.edu](mailto:Abigail.hsiung@duke.edu)

## Credits

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Special thanks to all the people who made and released these awesome resources for free:

- ✗ Presentation template by [SlidesCarnival](#)
- ✗ Photographs by [Unsplash](#)



# Diagrams and infographics

