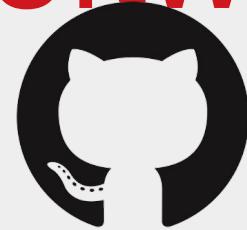


Hosted by quantitative Cell & Molecular Biology, Colorado State University

# Open Source Software Development with



GitHub

# Open Source Software Development with GitHub

## Outline

- Open source software and Github
- User Testimonials
- How to – user interface (Kristin)
- How to – commandline (Reed)

# Open Source Software

Source code: the technical blueprint that tells the computer program how to function.

```
<!DOCTYPE html>
<html id="home-layout">
  <head>
    <meta http-equiv="content-type" conte
    <title>Source Code Pro</title>
    <!-- made with <3 and AFDKO -->
    <meta name="keywords" content="sans,
      monospace, open source, coding, for
    <link rel="stylesheet" type="text/css
  </head>
  <body>
    <div id="main">
```



```
00111111000000111100100110001101110010100111111111101
11011111100001110101111101100011101011111010101100110
1101111100001110001101010010111010011111000110001000110
110001110111011111011111111101000111110111011111110
11111001101110001111011101011101000111111011111110
110011011111011000100100000010111011101011111111111
11111000111111000111111111110011110011111110010111111
0111111010011101111101011111011111110110011111110
111111110001111111010100101000111101111011110110100111101
00011111111011000101000011110010000000111100100100011
1011111001111111010101111100010111011110000100111110
01110000111101110111110011111110011111111001100000110111
10111011010001001100110001110111000011001000001100111
1101100110010111101101000111110100011010111110010111
11111111001100011110011110101000110100111000100100010
11101000010111001111100000111110111111011110101111100
11100100110101111111001111111111111110010101111111
0000000001111111100001100111101100100011011011010110001
010001001111111001111111111110011111000111110011110101
0100011110010011111110000101111011001101111011001111111
```

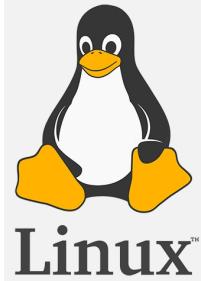
# Open Source Software

Open Source: source code that is accessible to inspect, modify, copy and use.

```
<!DOCTYPE html>
<html id="home-layout">
  <head>
    <meta http-equiv="content-type" content="text/html; charset=UTF-8">
    <title>Source Code Pro</title>
    <!-- made with <3 and AFDKO -->
    <meta name="keywords" content="sans, monospace, open source, coding, font">
    <link rel="stylesheet" type="text/css" href="css/style.css" />
  </head>
  <body>
    <div id="main">
```

Closed Source: proprietary source code that can not be accessed or change by the public.

```
00111111000000111100100110001101100101001111111101
11011111000011010111110100011101100101011001010
1101111100001110001101010101011101001100010001000110
11001100110111011111110100011111010110111111110
11111001101110111111111101000111111010111111111110
111110001111110001111111111111001111110010111111111
0111111011011101111111111101011111111111110111111111
0111111100011111110011111111111111001111111111111110
11111111000111111100111111111111111100111111111111111
00011111111101101000101000011110010000000111100100100011
101111100111111111111111111111111111111111111111111110
011100001111011111001111111111111111111111111111111110
10111010110100011011001001101100011001100100011001100111
1101100110001101011101101100111111111111111111111111111
1111111111111111111111111111111111111111111111111111111
1110100010111101111111111111111111111111111111111111111
1110010001111111111111111111111111111111111111111111111
0000000011111111110011111111111111111111111111111111111
0100010011111111110011111111111111111111111111111111111
01000111100100111111111100110111111111111111111111111111
```



iTunes

# Open Source Software

## Its a Philosophy!



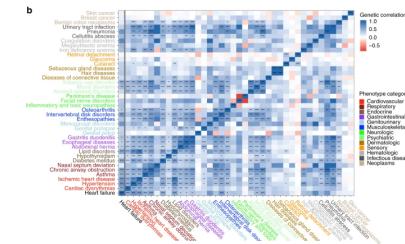
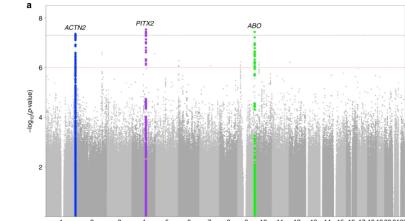
- Proponents believe people should have the right to use their software in whatever way they see fit without licensing restrictions.
- Allows software to evolve through open contributions from many users.
- Critics worry if open source leads to difficulty in managing programs and wonder if software can be reliably developed without profit intensive.

# Open Source Software FOR YOU!

- Transparency & reproducibility in data analysis
- Collaborative development of and easy access to community tools
- Coding Portfolio

SCIENTIFIC  
REPORTS

nature



NumPy

biopython

Pandas

# How do you develop open source software?

1) Write some code



```
class BaseController(ContainerAware, metaclass=abc.ABCMeta):
    """Abstract base class for all controllers.

    An action is the last action that was called on the controller.

    Args:
        action (string): The last action that was called on the controller.

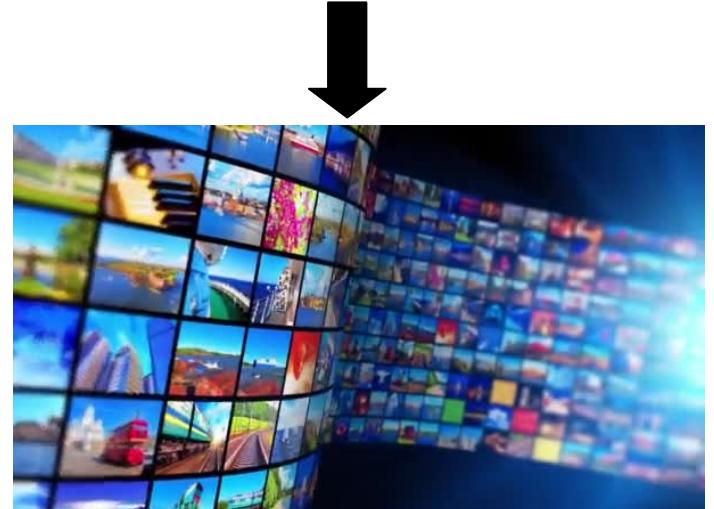
    """
    def __init__(self, *args, **kwargs):
        super().__init__(*args, **kwargs)
        self._action = None

    @abc.abstractmethod
    def execute(self, **kwargs):
        method = self.get_execute_method(**kwargs)
        self._action = method
        return method(**kwargs) or {}

    @abc.abstractmethod
    def get_execute_method(self, **kwargs):
        raise NotImplementedError('Implementation of get_execute_method() is required')
```



2) Publish on Internet

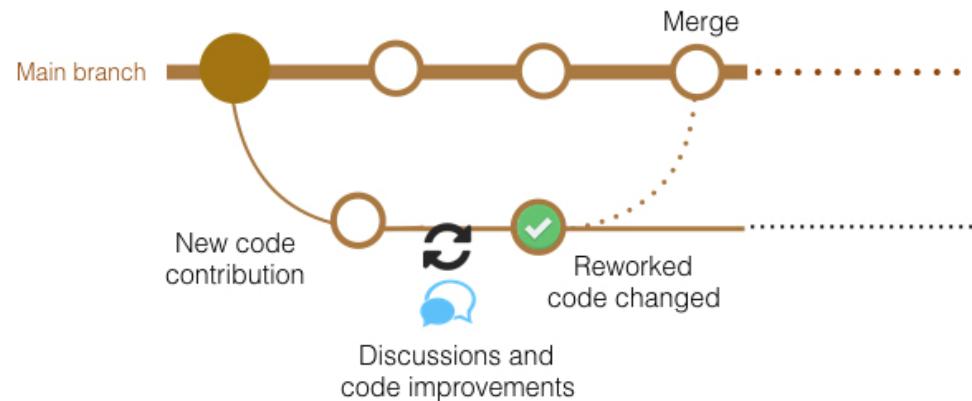


# Developing Open Source Software with GitHub



A screenshot of a GitHub repository page for the project "twbs / bootstrap". The page shows various metrics: 18,441 commits, 19 branches, 55 releases, 1 environment, 1,061 contributors, and an MIT license. It includes tabs for Code, Issues (276), Pull requests (31), Projects (3), Insights, and Settings. A search bar at the top allows users to search or jump to specific files. Below the header, a list of recent commits is displayed, each with a link to the pull request and the date it was made. The sidebar on the left lists various configuration and build files like .github, .build, .dist, .js, .nuget, .scss, .site, .babelrc.js, .browserslistrc, .editorconfig, .eslintignore, .eslintrc.json, .gitattributes, and .gitignore.

Commit	Description	Date
XhnikosR Replace uglify-js with terser. (#27813)	Replace CONTRIBUTING.md for the current state of things. (#28283)	12 hours ago
.github	Replace `v4-dev` with `master` after the branch change. (#28252)	4 days ago
.build	Release v4.3.1. (#28252)	6 days ago
.dist	Remove incorrect aria-haspopup from dropdown toggles (#28299)	12 hours ago
.js	Replace 4.3.0 with 4.3.1 in nuget files. (#28273)	4 days ago
.nuget	Deprecate form-control-focus mixin (#28262)	4 days ago
.scss	Replace uglify-js with terser. (#27813)	7 hours ago
.site	add babel plugin proposal object rest spread to our dev deps	6 months ago
.babelrc.js	Move the browserslist config to a separate file.	7 months ago
.browserslistrc	.editorconfig: remove rule for *.py files. (#24443)	a year ago
.editorconfig	Enable cache for ESLint.	a month ago
.eslintignore	Update devDependencies and gems.	7 months ago
.eslintrc.json	Revert "Simplify .gitattributes."	4 months ago
.gitattributes	Clean up .gitignore. (#28050)	a month ago



# Developing Open Source Software with GitHub

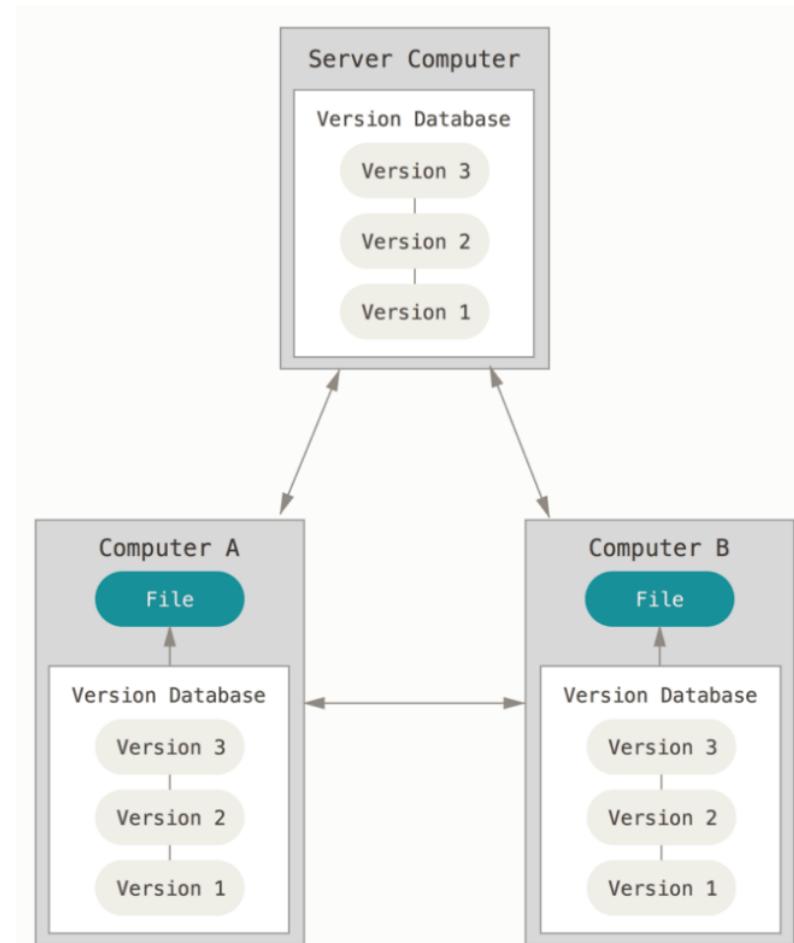


## Resources:

- GitHub's User manual
- Community support
- YouTube
- Google!

# Version Control

**Version control is a system that records changes to a file or set of files over time so that you can recall specific versions later.**



# Version Control



## 20 BEST VERSION CONTROL SYSTEMS OF 2020 - 1/2

01

### AWS CodeCommit

It is a fully-managed source control service that empowers your team to collaborate on code. It offers a secure storage solution for your binary files, documents, and source code in the cloud.

02

### Team Foundation Server

It is an integrated server suite to share code, track and monitor workflows, and ship software. Its version control solution offers unlimited private repositories for storage and collaboration on the code

03

### GitHub

It is a software development platform built explicitly for developers. It empowers you to manage projects, build software, and host and review code

04

### JEDI VCS

It is an open-source VCS platform. It offers features such as project and line history, time tracker, project-based rights management, an integrated ToDo Manager, and customizable DiffTool

# Protecting Your Open Source Projects

## Choose an open source license

An open source license protects contributors and users. Businesses and savvy developers won't touch a project without this protection.

{ Which of the following best describes your situation? }

[choosealicense.com](http://choosealicense.com)



I need to work in a community.

Use the [license preferred by the community](#) you're contributing to or depending on. Your project will fit right in.

If you have a dependency that doesn't have a license, ask its maintainers to [add a license](#).



I want it simple and permissive.

The [MIT License](#) is short and to the point. It lets people do almost anything they want with your project, like making and distributing closed source versions.

[Babel](#), [.NET Core](#), and [Rails](#) use the MIT License.



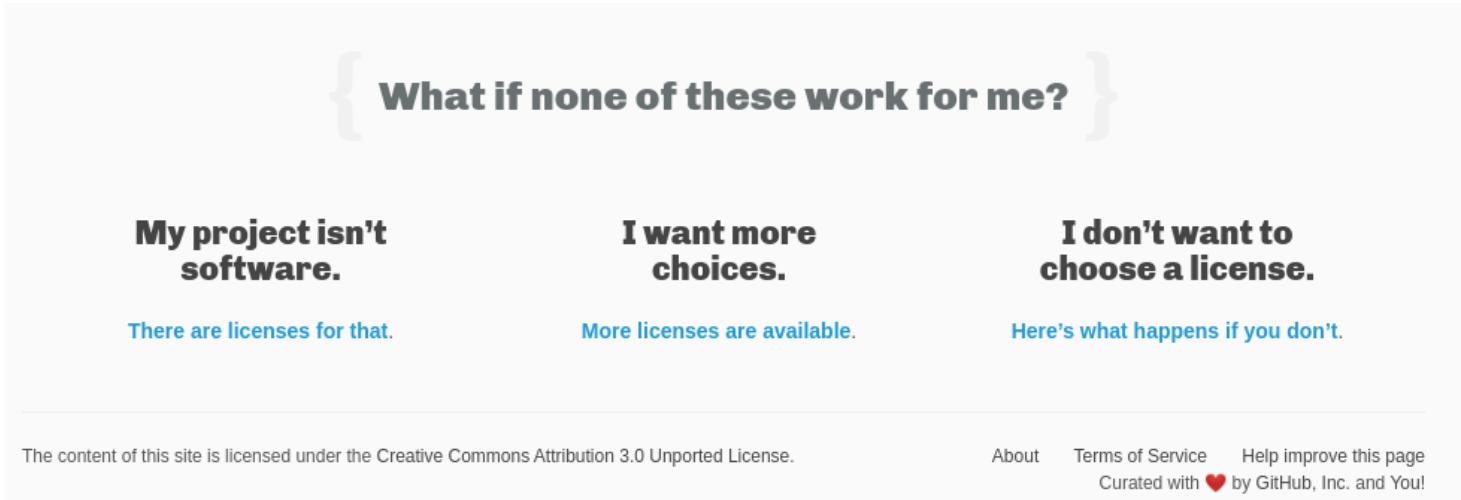
I care about sharing improvements.

The [GNU GPLv3](#) also lets people do almost anything they want with your project, except distributing closed source versions.

[Ansible](#), [Bash](#), and [GIMP](#) use the GNU GPLv3.

# Protecting Your Open Source Projects

[choosealicense.com](https://choosealicense.com)



The image shows the homepage of choosealicense.com. At the top center, there is a large, bold, dark gray question mark icon. Below it, the text "What if none of these work for me?" is centered between two light gray curly braces. The main navigation menu at the top includes links for "Software Licenses", "Non-Software Licenses", "Creative Commons", "Curated Lists", "About", and "Contact". The main content area has three columns. The first column, titled "My project isn't software.", contains the text "There are licenses for that." in blue. The second column, titled "I want more choices.", contains the text "More licenses are available." in blue. The third column, titled "I don't want to choose a license.", contains the text "Here's what happens if you don't." in blue. At the bottom of the page, there is a footer with the text "The content of this site is licensed under the Creative Commons Attribution 3.0 Unported License." followed by links for "About", "Terms of Service", "Help improve this page", and "Curated with ❤️ by GitHub, Inc. and You!".

{ What if none of these work for me? }

**My project isn't software.**  
There are licenses for that.

**I want more choices.**  
More licenses are available.

**I don't want to choose a license.**  
Here's what happens if you don't.

The content of this site is licensed under the Creative Commons Attribution 3.0 Unported License.  
[About](#)   [Terms of Service](#)   [Help improve this page](#)  
Curated with ❤️ by GitHub, Inc. and You!

# Protecting Your Open Source Projects

 BioRRW	Add files via upload	...	bd204c1 on Oct 19	⌚ 182 commits
 containers	Update R2R-0.0.1-Fasta-QC-Ann-Only.nf		3 months ago	
 docs	Update usage.md		last month	
 .gitignore	Update .gitignore		7 months ago	
 LICENSE	Create LICENSE		9 months ago	
 R2R-0.0.1.nf	Add files via upload		last month	
 README.md	Update README.md		3 months ago	
 nextflow.config	Update nextflow.config		3 months ago	

Hybrid and non-hybrid whole genome assembler with resistome identification for Illumina, PacBio and Nanopore reads.

 Readme

 MIT License

## Releases

 1 tags

[Create a new release](#)

Permissions	Conditions	Limitations
<ul style="list-style-type: none"><li>● Commercial use</li><li>● Distribution</li><li>● Modification</li><li>● Private use</li></ul>	<ul style="list-style-type: none"><li>● License and copyright notice</li></ul>	<ul style="list-style-type: none"><li>● Liability</li><li>● Warranty</li></ul>

# **Why would anyone want to use my code?! How does my open source code help me?**



## Bioinformatics Engineer

[APPLY FOR THIS JOB](#)

REMOTE / COMPUTATIONAL SCIENCE / FULL-TIME

### Qualifications

- MS or PhD in Bioinformatics, Biology or Computer Science, or a related field
- Minimum 2 years experience in building and maintaining production scale bioinformatics pipelines
- Fluency with Python
- Experience with AWS
- Experience with metagenomics
- Proven record of bioinformatics expertise, vis a vis publications, publicly-available computational tools  
packages, or github repos that show thoughtful genomics analysis

**Job posting from Trace  
Genomics on 11/30/2020**

# **Why would anyone want to use my code?!**

## **How does my open source code help me?**



## **BIOINFORMATICS ANALYST**

- Documentation and Reproducibility: Writes and maintain tools/scripts with documentation, concept of singularity, version control and reproducibility. Familiarity with GitHub is preferred. Maintain transparent open access documentation of project goals, analytical approaches and milestones for each project.

**Job posting from  
Cincinnati Children's  
Hospital on 11/30/2020**

# Who else uses GitHub?

Netflix, Inc.  
NETFLIX OSS  
Netflix Open Source Platform  
Los Gatos, California <http://netflix.github.io/> [netflixoss@netflix.com](mailto:netflixoss@netflix.com)

Repositories 187 Packages People 22 Projects

Find a repository... Type: All Language: All

**vmaf**  
Perceptual video quality assessment based on multi-method fusion.  
Python 458 stars 2,007 issues 49 (11 issues need help) 6 updated 2 minutes ago

**titus-control-plane**  
Titus is the Netflix Container Management Platform that manages containers and provides integrations to the infrastructure ecosystem.  
containers titus  
Java Apache-2.0 64 stars 271 issues 2 2 updated 40 minutes ago

**genie**  
Distributed Big Data Orchestration Service  
java distributed-systems cloud microservices big-data spring-boot  
microservice  
Java Apache-2.0 324 stars 1,413 issues 2 1 updated 1 hour ago

**conductor**  
Conductor is a microservices orchestration engine -  
<https://netflix.github.io/conductor/>  
Java Apache-2.0 962 stars 3,103 issues 208 (27 issues need help) 31 updated 2 hours ago

Top languages  
Java JavaScript Python Go Ruby

Most used topics  
security python aws machine-learning monitoring

People 22 >

Report abuse

# Who else uses GitHub?

Amazon

<https://github.com/amazon> Verified

Repositories 117 Packages People 16 Projects

Pinned repositories

**ion-java**  
Java streaming parser/serializer for Ion.

Java 780 76

**style-dictionary**  
A build system for creating cross-platform styles.

JavaScript 1.4k 203

**computer-vision-basics-in-microsoft-excel**  
Computer Vision Basics in Microsoft Excel (using just formulas)

2.2k 212

**sketch-constructor**  
Read/write/manipulate Sketch files in Node without Sketch plugins!

JavaScript 454 28

**smoke-http**  
Specialised HTTP Client for service operations abstracted from the HTTP protocol.

Swift 48 8

**milan**  
Milan is a Scala API and runtime infrastructure for building data-oriented systems, built on top of Apache Flink.

Scala 24 8

# How else can I utilize GitHub?

Overview    Repositories 158    Projects    Packages



**Monica Powell**  
M0nica

Building tech to elevate people.  
Founder of React Ladies a community  
for React JS developers.

Follow    Sponsor    ...

1.6k followers · 27 following · 312

New York, New York  
github@aboutmonica.com  
<https://www.aboutmonica.com>  
@waterproofheart

**Highlights**

- \* Arctic Code Vault Contributor
- ★ GitHub Star
- ★ PRO

**Organizations**



**MONICA POWELL**  
software engineer, content creator &  
community organizer



I'm a software engineer who is passionate about making open-source more accessible, creating technology to elevate people, and building community. Some technologies I enjoy working with include ReactJS, Jamstack (JavaScript, APIs + Markup) and GraphQL. I recently was selected to be an inaugural GitHub Star ★ based on my involvement in the tech community. My interest in the React ecosystem led me to launch [React Ladies](#), a community for women and non-binary ReactJS developers.

**Find me around the web :**

- Learning in public on [Twitch](#) or [monica.dev](#) 🎙️🌐
- Tinkering with interactions on [Codepen](#) 💡
- Sharing updates on [LinkedIn](#) 💬

Pinned

**React-Ladies**  
We're a group of women and non-binary ReactJS enthusiasts in New York City (and beyond).

**affirmation\_generator**  
A random affirmation generator written with ReactJS :-)

<https://github.com/M0nica>

# How else can I utilize GitHub?

Lucia (Lucy) Williams

Research

Teaching

Outreach

CV



**Lucia Williams**

Computer science graduate student studying algorithms, both theory and application.

📍 Bozeman, Montana

✉️ Email

⌚ Github

I am a third-year PhD student in computer science at Montana State University in Bozeman, Montana. My advisor is [Brendan Mumey](#). I am interested in the design and analysis of algorithms and data structures for problems in computational biology. I have worked on flow network based methods for RNA sequencing and on methods for finding conserved genomic regions in the presence of missing data or without a single reference genome. I have also worked with the [Computational Topology and Geometry](#) group at MSU to develop the theory behind a new method for comparing shapes without manual landmarking. See my [research page](#) for more detail on my research pursuits.

Before starting my PhD, I worked as a data scientist at an online advertising company in Seattle, after earning undergraduate degrees in applied math and urban planning. Outside of work, my main hobby is playing and coaching Ultimate Frisbee. I also enjoy human-powered outdoor adventures.

# Recap so far

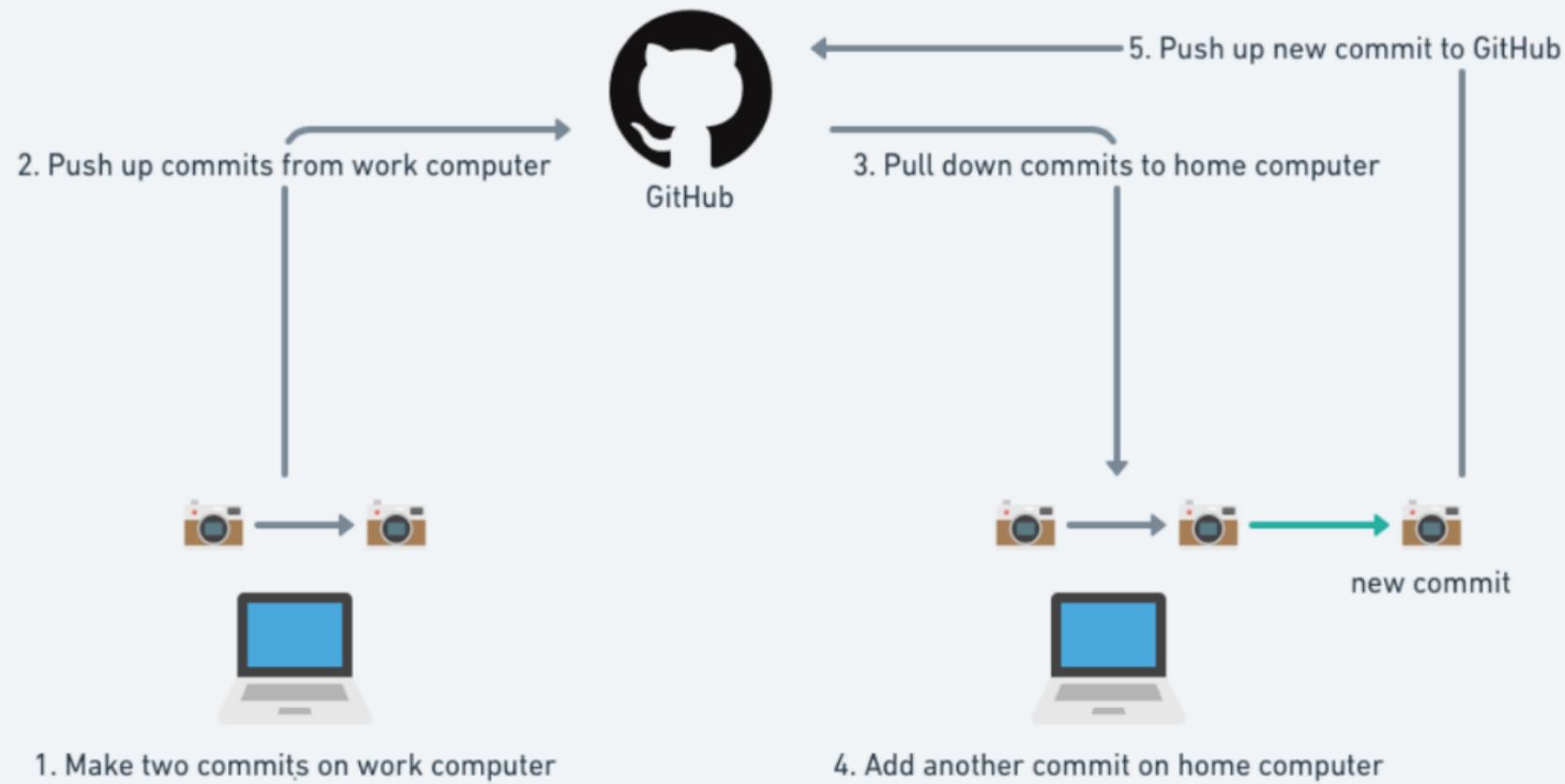
- Open Source Software
  - Allows software to evolve through open contributions from many users
- Version Control
  - a system that records changes to a file or set of files over time
- Protecting your work with licences
- Ability to centralize and showcase your work and collaborative projects

# How is GitHub used in the biological sciences?

Examples from CMB Faculty

Erin Osborne Nishimura  
Department of Biochemistry and Molecular Biology

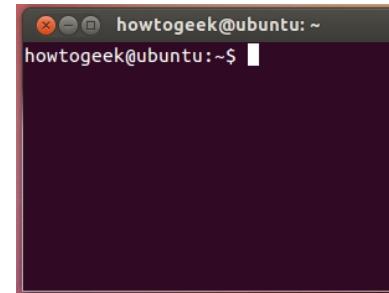
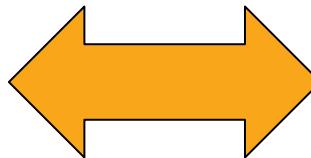
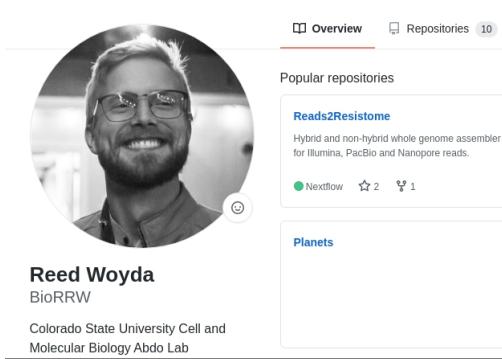
# Interacting with GitHub via the command line



# Interacting with GitHub via the command line

## What is Git?

- Git is the command line version control system (VCS) software which works on your local computer.
- Git was created by Linus Torvalds in 2005 for development of Linux
- You need Git to use GitHub. You can use Git locally without GitHub.



# Interacting with GitHub via the command line

## Brief introduction on git command line usage:

- **Cloning** existing repositories
- **Editing** code from repositories
- **Commit** modified code to existing repositories

THIS IS GIT. IT TRACKS COLLABORATIVE WORK ON PROJECTS THROUGH A BEAUTIFUL DISTRIBUTED GRAPH THEORY TREE MODEL.

COOL. HOW DO WE USE IT?

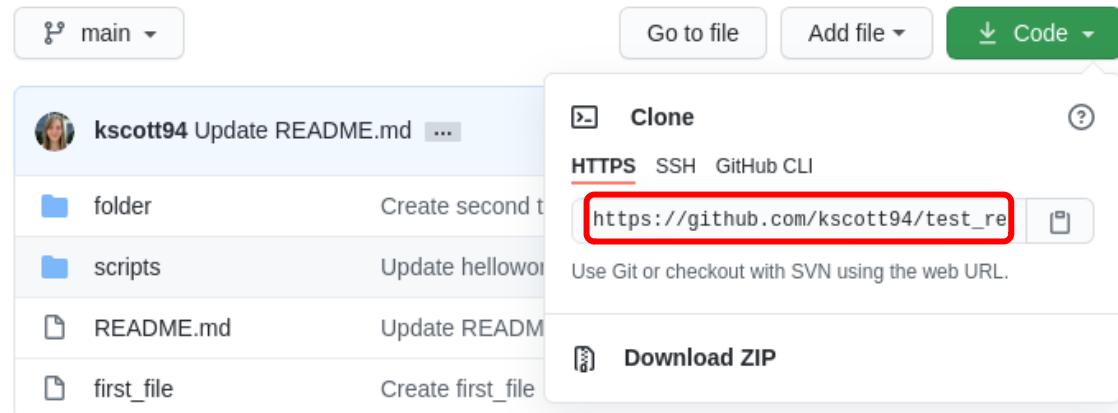
NO IDEA. JUST MEMORIZIZE THESE SHELL COMMANDS AND TYPE THEM TO SYNC UP. IF YOU GET ERRORS, SAVE YOUR WORK ELSEWHERE, DELETE THE PROJECT, AND DOWNLOAD A FRESH COPY.



# Interacting with GitHub via the command line

## How to obtain Open Source code from GitHub

1. Open terminal on local computer
2. Navigate to directory of your choosing
3. `git clone https://github.com/kscott94/test_repository.git`



# Interacting with GitHub via the command line

## Collaboration

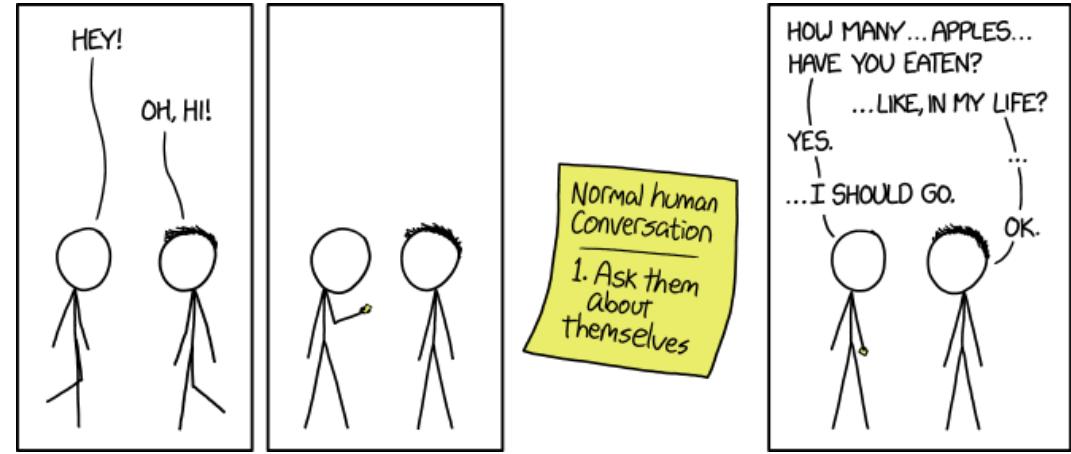
List of command I used to edit a script from a collaborators GitHub repository:

1. In desired directory, tell Git who we are:
  - a. git config --global user.name "BioRRW"
  - b. git config --global user.email [reedwoyda@gmail.com](mailto:reedwoyda@gmail.com)
2. Initialize current directory as a Git repository:
  - a. git init
3. Connect to the desired repository:
  - a. git remote add qcmb\_github [https://github.com/kscott94/test\\_repository](https://github.com/kscott94/test_repository)
4. Make edits to file of choice (here I edited the helloworld.py script)
5. Prepare the edited file for upload to GitHub:
  - a. git add helloworld.py
6. Lastly, **commit** the edited file for final upload to the repository:
  - a. git commit helloworld.py -m "Updated helloworld.py script"

# Recap: How to use GitHub/Git

- How to create a GitHub repository
  - Add content
  - Add collaborators
- How to download a repository from GitHub (command-line)
- How to ‘connect’ to an existing repository for collaboration (command-line)
  - Make edits
  - Commit those edits to the GitHub repository
- See edits reflected in GitHub repository

# Open Discussion/Questions



# Resources

- Basic Git usage
  - <https://git-scm.com/docs/gittutorial>
- Basic GitHub Guide
  - <https://guides.github.com/activities/hello-world/>
  - <https://pages.github.com/>
- GitHub documentation
  - <https://docs.github.com/en>
- Git/GitHub usage (Youtube)
  - [https://www.youtube.com/watch?v=SWYqp7iY\\_Tc&ab\\_channel=TraversyMedia](https://www.youtube.com/watch?v=SWYqp7iY_Tc&ab_channel=TraversyMedia)