Welcome to the 2024 UQ-Bio Summer School!

UNDERGRADUATE QUANTITATIVE BIOLOGY SUMMER SCHOOL

JUNE 3rd - 19th, 2024

CSU FORT COLLINS, COLORADO

10μm

Tell us a Little About Yourself

Slack Invite

Use the poll at this link to tell us a little about what you study and from where you are coming.

https://www.menti.com/al9ov4jv1gpt

The voting code:
28 67 14 3

Also, if you haven't done so already, please visit slack and write a longer introduction.
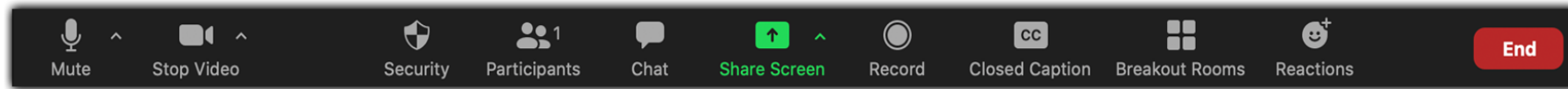
Hello and Zoom Etiquette

uq-bío

Slack Invite

Attendee controls:

Please MUTE your microphone!

Turn your video ON if you don't mind

Enter questions in **chat** or raise your hand in **reactions**

Please take a moment to rename yourself:
Click participants, hover over your name, Click **More**, and choose **Rename**

Name, University, Pronouns

Example:

Penelope Smith, CSU, (she, hers)

Desmond Fletcher, ETH (they, their)

COLORADO STATE UNIVERSITY

Welcome to the 2024 UQ-BIO Summer School

Slack Invite

Outline of Today's Activities

- Welcome and Introductions
- Finding and accessing UQBIO2024 Materials
- Goals of the 2024 UQBIO Summer School
- Tips and Best Practices
- **Breakout Sessions:**
  - GitHub and Installation Assistance
  - Initial Python Notebook Help

Friday, May 24, 9:00am – 11:45am (UTC-6hr)
- Zoom Link: https://zoom.us/j/98339683896?pwd=em9oY204TEdvcWIKSHByTkFTazRVUT09

Wednesday, May 29, 9:00am – 11:45am (UTC-6hr)
- Zoom Link: https://zoom.us/j/95388584173?pwd=M3ZIZURPVUlwa1lKM3dLbHQwWmlRZz09

COLORADO STATE UNIVERSITY

Brian Munsky and his Random Walk to UQBIO.

Slack Invite

Grew up playing soccer and writing dystopian poetry in Pittsburgh, Pennsylvania.

Now an Associate Professor of Chemical Engineering (and trail runner / birdwatcher) at the Colorado State University.
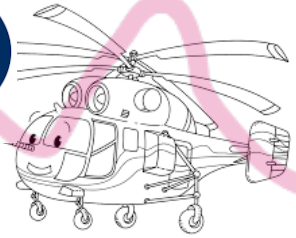
Started as an English major but later earned BS/MS in Aerospace Engineering studying *helicopter noise* at Penn State.

Spent a lot of time hanging out with quantum physicists as a Richard P Feynman Fellow at Los Alamos National Lab.

Studied *gene expression noise* (and surfing) for a Ph.D. in Mechanical Engineering student at UC Santa Barbara.

Luis Aguilera and his Journey to CSU and UQ-Bio

uq-bío

Slack Invite

Education

BSc Genomics and Bioinformatics
UANL- Mexico

PhD Biomedical Eng. and Physics
Nat. Polytechnic Institute, Mexico
Universität Heidelberg, Germany

Postdoc/RS at CSU, USA
Stochastic modeling and Image processing

Research interests

- Microscope automation

  samples → terminator scope → (lots of) data
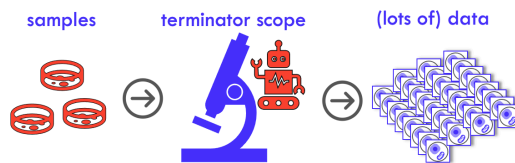
- Software development

  Python virtual environment

- Stochastic modeling

  Intensities (a.u.)
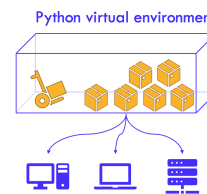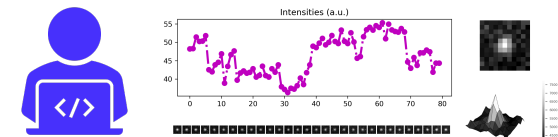
- Accelerating image processing with ML

  Large simulated dataset → Gene X → Deep Neuronal Network (1D-Conv & regularizations, 200 Dense neurons) → Classification: Gene X, ~~Gene Y~~
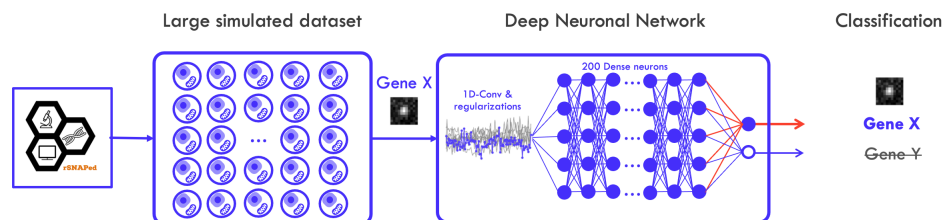
- Developing novel techniques for efficiently teaching programming

Zach Fox and his Journey to UQ-Bio

University of Delaware (Bachelors)
Systems Biology
HIV/Cancer gene regulatory networks
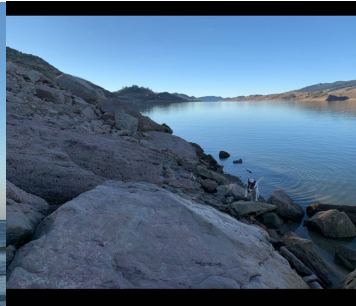
Colorado State University (PhD)
Stochastic models of gene regulation
Computational and methods for parameter inference

Institut Pasteur (PD I)
Stochastic models of gene regulation
Reactive microscopy software

Los Alamos Nat Lab (PD II)
Stochastic models of gene regulation
GNNs for molecules
Attention-based models

Currently | Oak Ridge National Lab

Research Scientist for AI in Health

NLP-based informatics of pathology reports
Molecular design using Large Language Models
Diffusion models in discrete state spaces
Other stuff

Hobbies!
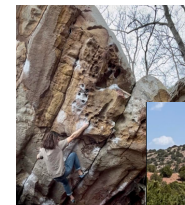
sports
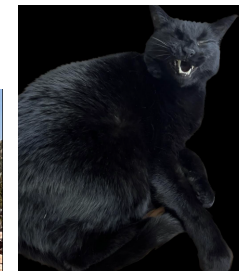
animals

Will Raymond and his Journey to CSU and UQ-Bio

uq-bío

Grew up in VA, moved to ND, then to CSU

North Dakota

Williston

Bismarck   Fargo

© 2005 Sperling's BestPlaces
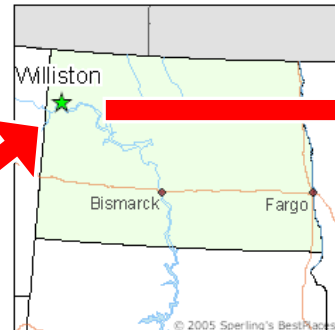
Would not recommend VERY COLD
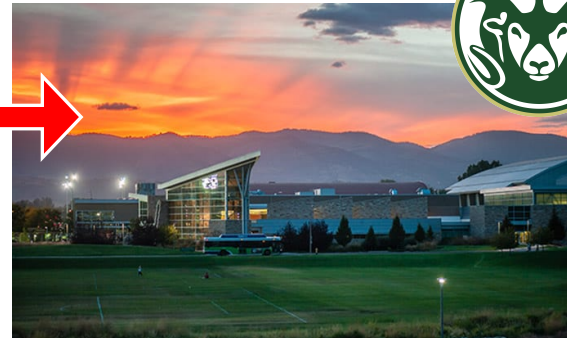
Did my undergrad in BME and CBE here and continued to do my PhD here as well.

Research Interests!

Codon Optimization
Machine Learning
tRNA abundances
mRNA translation
RNA Biology

Upcoming Paper!

Identification of potential riboswitch elements in *Homo Sapiens* mRNA 5'UTR sequences using Positive-Unlabeled Machine learning

William S. Raymond, Jacob DeRoo, Brian Munsky
doi: https://doi.org/10.1101/2023.11.23.568398

Hobbies!

Video game datamining
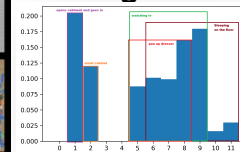
Painting

Swimming

Listen to a lot of music
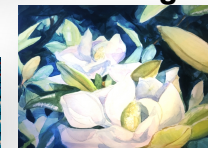
My Main projects while I have been at CSU:

1

rSNAPsim
Translation Modelling

2

Transcription Modelling

3

Acc 0.8800
- Spot type 1
- Spot type 2
- Incorrect
- Uncertain

NCT Multiplexing

4

Riboswitch ML

RS
UTR
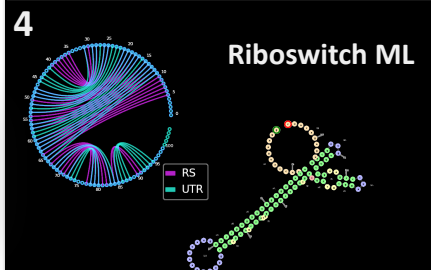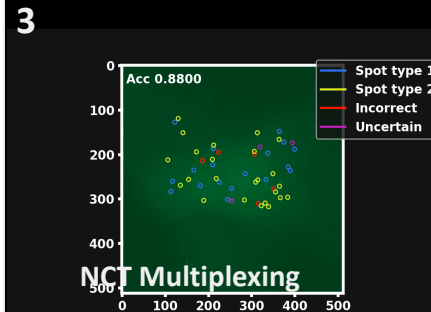
Alex Popinga and her Journey to CSU and UQ-Bio

Music major at the University of Northern Iowa
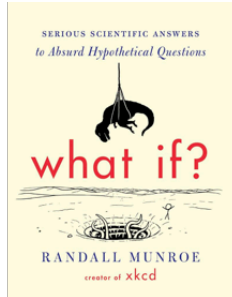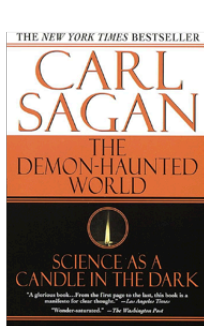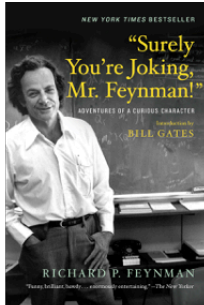
Inspired by science, scientists, science popularisers; developed particular fascination with genetics and evolutionary biology; switched into biology

Imposter syndrome, COVID-19 pandemic, etc. -> rock climbing obsession
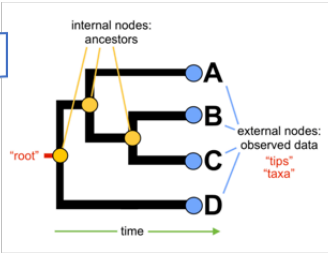
Developed strong interest in computational / statistical methodology and started studying bioinformatics, too

Recovery & return to science -> discovery of Munsky Group! -> self-actualisation / living happily ever after?
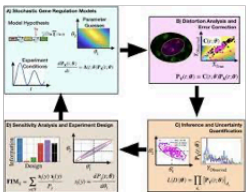
Pursued & completed PhD at the University of Auckland, NZ, on topics in computational biology

The 2024 UQBIO Summer School Goals

uq-bío

Slack Invite

The Goals of the <u>2024 UQ-Bio Summer School</u> are:

1. **To advance the integration of experimental, mathematical and computational tools and principles needed to achieve <u>rigorous</u>, <u>reproducible</u>, and <u>quantitatively predictive</u> understanding for the <u>mechanisms</u> of biological processes.**

2. **To provide students with helpful resources and networking opportunities to advance their <u>careers</u> in quantitative biology, and to promote increased diversity, equity and inclusion among teams and networks that seek quantitative and mechanistic understanding of biological and biomedical phenomena.**

A quick note on the q-bio philosophy

uq-bío

Slack Invite

Congratulations on joining the **2024 UQ-Bio Summer School**. We are thrilled to have you join our community. If you want to apply mathematical or computational approaches to better understand biology, then **you are in the right place!**

Please be aware — you are about to embark on an **exciting**, but **very difficult** academic journey.

At UQ-Bio you will be challenged not only to learn new skills and new material, but also to work on **very difficult open problems** that have **no perfect solutions**. Although the program will last for only a couple of weeks, we hope that this journey will keep you challenged and entertained for **many years**.

It is not possible to complete every assignment that we assign during this program! **No one will master every concept introduced in the course!**

Embrace the challenge. Enjoy the process. Indulge yourself with the lessons that most excite you.

And, if any lesson is too much for you right now, that is OKAY! **All materials will be available online so you can return to them later in your journey.**

You get to drink from the firehose!
(UHF, Orion Pictures, 1989)

The 2024 UQBIO Website and Resources

uq-bío

Slack Invite

Website: **https://q-bio.org/wp/**
- This is where you will find general information about the programs and where we are heading over the next few weeks.

Slack: **Use the QR code (bottom left) to join.**
- This is where online questions and discussions will be conducted.

Schedule: **https://q-bio.org/wp/uq-bio-schedule-2024/**
- This shows all the upcoming events. Look through your welcome email or scroll through the **Slack 'General' Channel** for links to recordings.

Contact Email: **qbio_summer_school@colostate.edu**
- This is how you get in touch if you are having trouble getting access to the Slack channel

GitHub Page: https://github.com/MunskyGroup/uqbio2024
- This is where you will find example codes and links to lesson workbooks.

The 2024 UQBIO Required Online Accounts

uq-bío

Slack Invite

GitHub (https://github.com/MunskyGroup/uqbio2024**)**
• We will frequently need to use or share codes over GitHub.
• If you have not done so before, I strongly recommend getting familiar with using GitHub to share and keep track of changes in computational projects. Please see the uqbio2024 GitHub page for instructions on getting started.
• Sign up for the **GitHub Student Developer Pack** as soon as possible. When you are granted access, activate the **GitHub Co-Pilot Extension**.

Scan this QR Code to Reach the GitHub Page

Anaconda Python and VS Code.
• We will be using Python extensively in this course. We recommend Anaconda and VS Code for these tasks.
• Please see installation instructions on the uqbio2024 GitHub README.

The 2024 UQBIO – Tips and Best Practices

uq-bío

Outline
- Welcome and Logistics
- Meet the UQBIO Organizers:
  - Brian
  - Luis
  - Zach
  - Will
  - Alex
- Overview of the 2024 UQBIO Program and Resources
- Program Goals
- **Tips and Best Practices**
- Breakout Sessions

Slack Invite

To get the most out of this program, make sure to:

- **BUILD CONNECTIONS WITH OTHER PARTICIPANTS**
- **WORK TOGETHER ON ASSIGNMENTS**
- **START PRACTICING EARLY**
- **TRY EVERYTHING AND STAY INVOLVED**
- **DON'T GIVE UP *WHEN* YOU FALL BEHIND**
- **HAVE FUN!**

But don't just take my word for it…

After previous UQ-Bio Summer Schools, we asked students what advice would they give to future students. Here is what they said:

The 2024 UQBIO – Tips and Best Practices

uq-bío

Slack Invite

To get the most out of this program, make sure to:

- ## BUILD CONNECTIONS WITH OTHER PARTICIPANTS

- *Make sure **to interact with the other students** and the instructors/learning assistants**, there's a lot to learn from them** and **great connections** to be made!*
- *Take this opportunity to **network.***
- *try to **make friends!***
- *Meet and **interact with as many people as you can**, take some time to explore campus and Colorado,*
- *Be eager to **ask questions** of and **befriend fellow students**, LAs and instructors*
- ***Talk to as many people as you can** - attend in person if possible!*
- *Enjoy and **interact with everyone** as much as you can,*
- *Also cherish the opportunities to **talk to professors** in the field, because they might have novel insights on your own research.*
- *I would advise them **to try to ask good questions** even if it feels uncomfortable to interrupte others. Learning is maximized through **interaction** and obtaining **feedback**.*

The 2024 UQBIO – Tips and Best Practices

uq-bío

Slack Invite

To get the most out of this program, make sure to:

- ## WORK TOGETHER ON ASSIGNMENTS

- *to make the most of all the opportunities that they have, and especially to try and **collaborate with peers and staff** in order to solve problems and aid understanding.*
- ***Search a good work group** and don't be afraid of say the things at time.*
- ***Be more interactive** with your project group**, work together** and discuss stuff with each other.*
- *I would advice them to better **engage with the projects** and weekly assignments and try to go one-step ahead of whatever asked (as Michael, from Team 3A, did). This is help them get most of out the course.*
- *Some advice that I would give to future students of the UQ-Bio program **is to start working with your group during the first week** that you are assigned and have regular communication with the rest of your group. Starting this early will help **build the foundation of the team,** and will hopefully allow project work to go smoothly.*
- *Start projects early, and **work with your team members early** on homework projects. If you have difficulty with the project or code **reach out to the learning assistants immediately**. If you cannot grasp a concept**, reach out to the faculty during the presentation** or after the presentation to learn the material.*
- ***ask for help when you need it!***

The 2024 UQBIO – Tips and Best Practices

uq-bío

Slack Invite

To get the most out of this program, make sure to:
- ## START PRACTICING EARLY

- ***Start early,***
- *Students should have a strong coding background to keep up with the demands of the course and to be able to participate fully with the teams.*
- ***Know your linear algebra*** *well.*
- *It is helpful* ***to work through colabs ahead of time***
- *This is a very intensive and highly important Training Program. You have to* ***come prepared and ready to learn****.*
- ***Stay current with the material****.*
- *I think I would tell them* ***to be regular followers of the content*** *and* ***be familiar with Python beforehand****.*
- ***Start early to get familiar with Python****. This also includes practicing your programming skills by doing relevant data analysis tasks with the language. In particular, as Numpy and Pandas are so widely used in data analytics****, play as much as you can with their tutorials.***

The 2024 UQBIO – Tips and Best Practices

uq-bío

Slack Invite

To get the most out of this program, make sure to:
- ## TRY EVERYTHING AND STAY INVOLVED

- *Work the assignments on your own time.*
- *Be prepared for lots of coding*
- *Pay attention and keep up with the material in a timely manner*
- *don't miss anything since everything will be interesting*
- *Attend on time*
- *...attend all the invited speakers cause they were awesome*
- *Dedicate the time to work on the code and projects because like learning a new language, this requires double the work.*
- *Attend all tutorials*
- *full time job and the summer school are hard to manage, try to make some time for it*
- *Free up your time to commit to q-bio, to get most out of the program.*
- *Make sure to keep up with the work. It is a fast paced program so if you fall far behind it will be difficult to catch back up.*
- *Follow each assignment as given to you and DON'T procrastinate!*
- *Try and attend all of the lectures*
- *be as involved as you can, do full participant if possible*

The 2024 UQBIO – Tips and Best Practices

uq-bío

Slack Invite

To get the most out of this program, make sure to:

- # DON'T GIVE UP IF/WHEN YOU FALL BEHIND

- *don't overcommit yourself to other things because this is a serious opportunity and requires lots of time*

- *I would advice the future uqBio student to **not be afraid to dive deeply** into topics introduced to them that are exciting, **even if that means not diving as deeply into other topics**. There was such a wide range of material covered and I think that the program was a great way to give students a **multitude of chances to get excited about some aspect of quantitative biology**.*

- *If you are planning on enrolling the course **make sure to have enough time to study after lectures and tutorials***

- *I'd say, **don't worry if it's overwhelming at times**... in the last week it all came together for me more!*

- *This is great opportunity for young students who would like to purse quantitive biology research, so take this opportuniy and **try to finalize all the modules on your own time even if you did not get to finish them all for the initially assigned weeks**.*

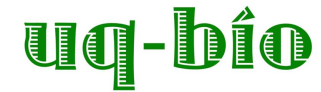# The 2024 UQBIO – Tips and Best Practices

uq-bío

Slack Invite

To get the most out of this program, make sure to:

- ## HAVE FUN!

- *Have fun!*
- *GO FOR IT!!*
- *Enjoy your time!*
- *Have fun and don't stress! Everyone is learning together.*
- *Enjoy yourselves, meet people, ask questions*
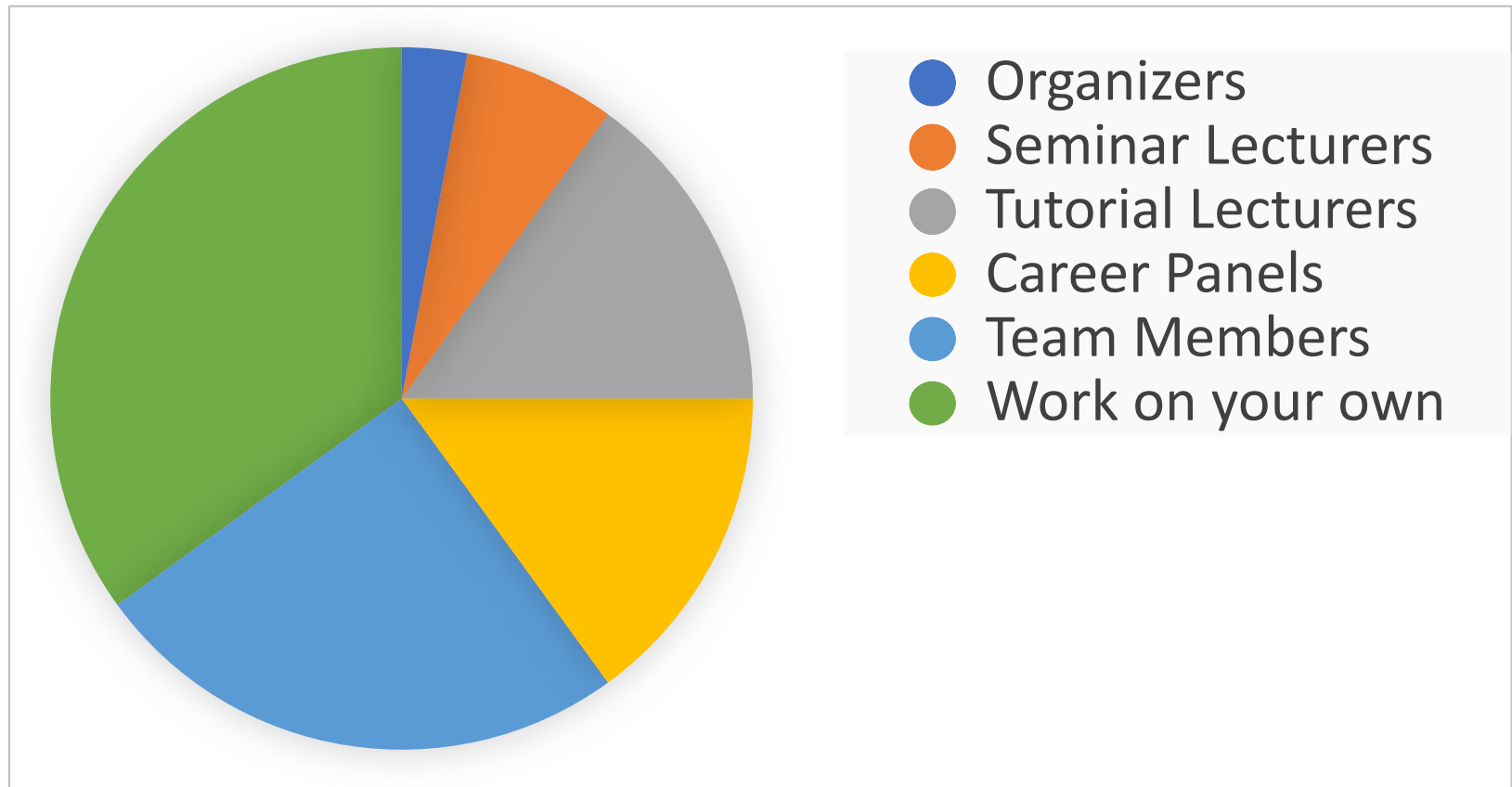
The 2024 UQBIO – Tips and Best Practices

uq-bío

Slack Invite

Who is going to teach you something during UQ-Bio?

- Organizers
- Seminar Lecturers
- Tutorial Lecturers
- Career Panels
- Team Members
- Work on your own

Slack Invite

First – Go to the UQ-Bio 2024 GitHub Page:

https://github.com/MunskyGroup/uqbio2024

Instructions for software installation and getting started are posted on the uqbio2024 GitHub page README.

Scan this QR Code to Reach the GitHub Page

📖 README   ⚖️ BSD-3-Clause license

Welcome to UQ-BIO Summer School 2024!

Below is the GitHub repository holding all the links to Jupyter Notebooks and files needed during the course and instructions on installing Python.

Authors:

Brian Munsky, Luis Aguilera,
Alex Popinga, Keisha Cook, Kaan Ocal,
William Raymond, Zachary Fox,
Eric Ron, and Dmitri Svetlov

Slack Invite

Four Breakout Session Rooms:

Stay Here — General Getting Started. Help with Finding online resources.

ROOM 1 — GitHub and Installation Assistance — WINDOWS. Join this room if you have a Windows computer, and you need help with installation and set up of GitHub, Anaconda, or VS Code.

ROOM 2 — GitHub and Installation Assistance — MAC. Join this room if you have a Mac computer, and you need help with installation and set up of GitHub, Anaconda, or VS Code.

ROOM 3 — Python Warm Up and Homework Assistance. Join this room if you have installed GitHub, Anaconda, and VS Code and you have questions on any of the Module 1 Notebooks or Homework assignments.