Welcome to the 2023 UQ-Bio Summer School!

Hello and Zoom Etiquette

Attendee controls:

- Please MUTE your microphone!
- 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)
- Enter questions in chat or raise your hand in reactions
- Turn your video ON if you don’t mind

Outline
- Welcome and Logistics
- Meet the UQBIO Organizers:
  - Brian
  - Luis
  - Zach
  - Will
- Overview of the 2023 UQBIO Program and Resources
- Tips and Best Practices
- Python Warm Up

Slack Invite

Colorado State University
Welcome to the 2023 UQ-BIO Summer School

Outline of Today's Activities

• Welcome and Introductions
• Finding and accessing UQBIO Materials
• Goals of the 2023 UQBIO Summer School

Brian Munsky and his Random Walk to UQBIO.

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

Started as an English major but later earned BS/MS in Aerospace Engineering studying helicopter noise at Penn State.

Now an Associate Professor of Chemical Engineering (and trail runner / birdwatcher) at the Colorado State University.

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

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Research interests
- Microscope automation
- Software development
- Accelerating image processing with ML
- Stochastic modeling
- Developing novel techniques for efficiently teaching programming

Zach Fox and his Journey to UQ-Bio

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Research interests
- 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

Hobbies!
- sports
- animals

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
Will Raymond and his Journey to CSU and UQ-Bio

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

North Dakota

Did my undergrad in BME and CBE here and continued to do my PhD here as well.

Research Interests!
- Codon Optimization
- Machine Learning
- RNA Biology
- tRNA abundances
- mRNA translation

Upcoming Paper!
- New Results
- Using Phenotypic Models and Machine Learning to Design Single Color Multiplexed CRISPR-Cas9 Repressive Experiments

Hobbies!
- Video game datamining
- Swimming
- Painting

Tell us a Little About Yourself

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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/al1qmthust1p

The voting code 1450
5845

Also, if you haven’t done so already, please visit slack and write a longer introduction.
The 2023 UQBIO Website and Resources

Website: [https://q-bio.org/wp/](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-2023/](https://q-bio.org/wp/uq-bio-schedule-2023/)
- 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/uqbio2023](https://github.com/MunskyGroup/uqbio2023)
This is where you will find example codes and links lesson workbooks.

The 2023 UQBIO Required Online Accounts

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

Google:
- Throughout the summer school, we will be making extensive use of “Google Drive” and “Google Colab”. For many of the planned lectures and tutorials, you will not be able to follow without a working google account.
- Please make sure that your storage space is not full. You may need to temporarily store images and videos (up to 1GB) during the course.

OpenAI ([https://platform.openai.com/](https://platform.openai.com/)):
- Occasionally, we will use OpenAI (e.g., ChatGPT) to help us with some coding tasks. For these to work you will need to register and obtain a secret API Key.
- See instructions in the Slack ‘General Channel’. You may need to create a paid account.

GitHub ([https://github.com/](https://github.com/))
- We may occasionally 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.
The 2023 UQBIO Summer School Goals

The Goals of the 2023 UQBIO Summer School are:

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

2. To provide students with helpful resources and networking opportunities to advance their careers 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.

Measuring and Modeling the Central Dogma of Molecular Biology

Hayes, R. L., Scientific Reports, 2021
Munsky et al., PNAS, 2018
Jashnsaz et al., iScience, 2020
Forero, Raymond et al., Nat. Genet., 2021
Lyon, Aguilera et al., Molecular Cell, 2019
Aguilera, Raymond, et al., PLoS Comp Biol, 2019
Kalin, Yu, et al., Scientific Reports, 2021
The 2023 UQBIO – Tips and Best Practices

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

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

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 IF/WHEN YOU FALL BEHIND
- HAVE FUN!

But don’t just take my word for it…

After the 2021 and 2022 UQ-Bio Summer Schools, we asked students what advice would they give to future students. Here is what they said:

- BUILD CONNECTIONS WITH OTHER PARTICIPANTS
- WORK TOGETHER ON ASSIGNMENTS
- START PRACTICING EARLY
- TRY EVERYTHING AND STAY INVOLVED
- DON’T GIVE UP IF/WHEN YOU FALL BEHIND
- HAVE FUN!
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 interrupt others. Learning is maximized through interaction and obtaining feedback.

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!
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.

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
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 quantitative biology research, so take this opportunity 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.

- 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
Now on to today’s Main Event: Python Warm Up

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First – Go to the UQ-Bio 2023 GitHub Page:
https://github.com/MunskyGroup/uqbio2023

Check out Will’s great artwork on the theme of single-cell quantitative biology!

Scroll down to the first set of Colab shown under **Module 0**

We are going to start with the first one.