

# Welcome to the 2023 UQ-Bio Summer School!




## Hello and Zoom Etiquette

uq-bio

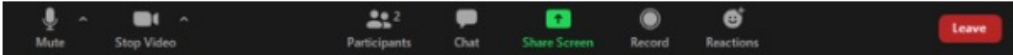
**Outline**

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



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

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Slack Invite

## 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.

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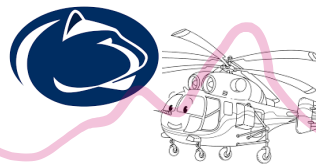
Slack Invite



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



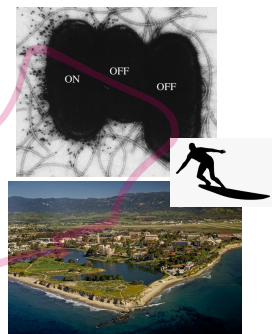
Now an Associate Professor of Chemical Engineering (and trail runner / birdwatcher) at the Colorado State University.



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

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### 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

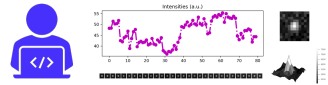
#### Microscope automation



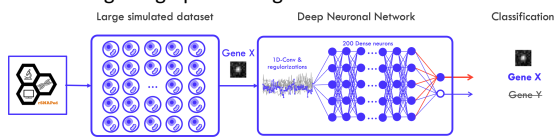
#### Software development




#### Stochastic modeling



#### Accelerating image processing with ML



#### Developing novel techniques for efficiently teaching programming





## Zach Fox and his Journey to UQ-Bio

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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

sports


animals

## Will Raymond and his Journey to CSU and UQ-Bio

uq-bio

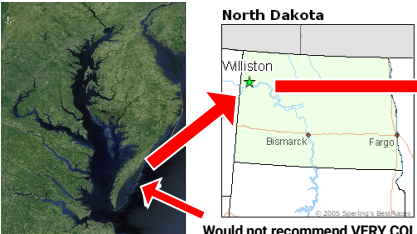
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**Grew up in VA, moved to ND, then to CSU**




Would not recommend VERY COLD

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

**Upcoming Paper!**  
 Using Mechanistic Models and Machine Learning to Design Single-Color Multiplexed Nascent Chain Tracking Experiments  
 William S. Raymond, Sarah Chaffin, Luis J. Aguilera, Eric Ron, Tatiana Floriano, Zachary R. Fox, Michael P. May, Timothy J. Stansick, Brian Plimley  
 doi: <https://doi.org/10.1101/2023.01.25.525583>  
 This article is a preprint and has not been certified by peer review (what does this mean?)

**Hobbies!**  
 Video game datamining  
 Painting  
 Swimming  
 Listen to a lot of music

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



**My Main projects while I have been at CSU:**


- rSNAPsim**  
Translation Modelling
- Transcription Modelling**
- NCT Multiplexing**  
Acc 0.8800  
Spot type 1  
Spot type 2  
Incorrect  
Uncertain
- Riboswitch ML**

## Tell us a Little About Yourself

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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/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

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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-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](mailto: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>


This is where you will find example codes and links lesson workbooks.

# The 2023 UQBIO Required Online Accounts

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Slack Invite

## 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/>):

- 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/>)

- 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

uq-bio

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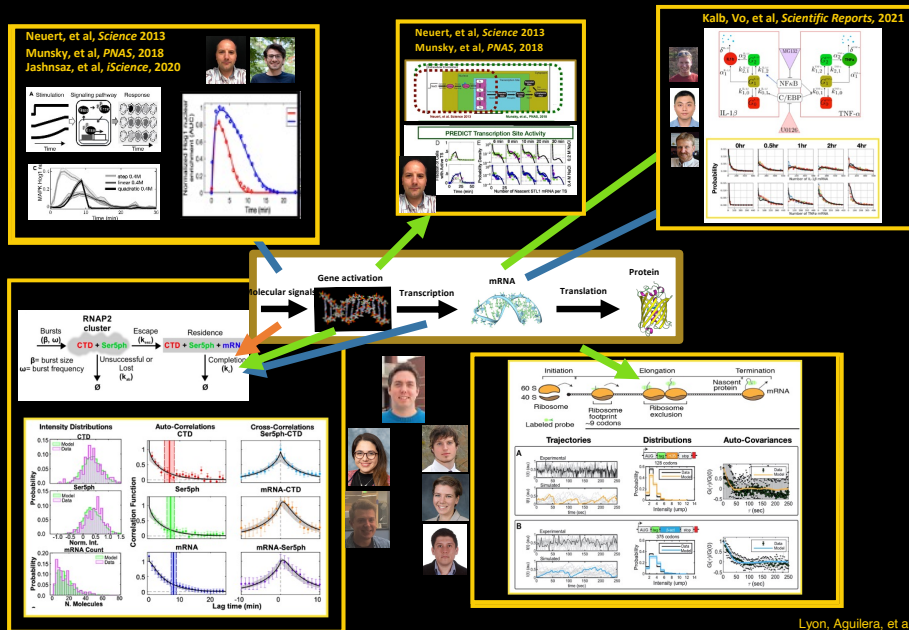


Slack Invite

## The Goals of the 2023 UQ-Bio Summer School are:

- 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.
- 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

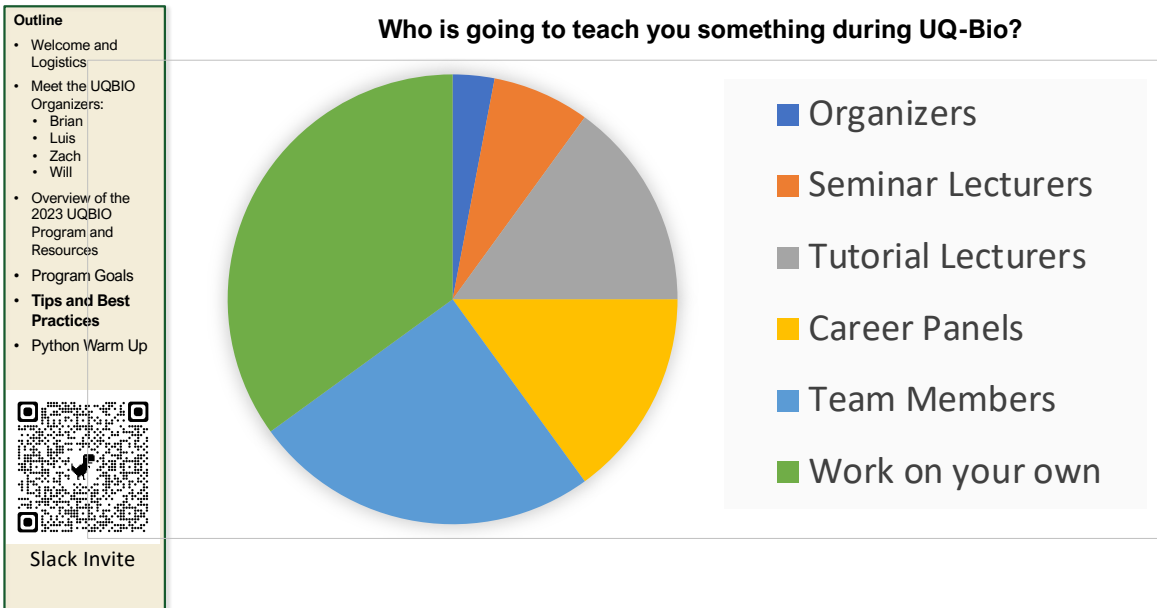


Forero, Raymond et al, *Nat. Comm.*, 2021

Lyon, Aguilera, et al, *Molecular Cell*, 2019  
Aguilera, Raymond, et al, *PLoS Comp Biol*, 2019  
Kesh, Aguilera et al, *Nat. Struct. Mol. Biol.*, 2020

## The 2023 UQBIO – Tips and Best Practices

uq-bio




## The 2023 UQBIO – Tips and Best Practices

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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 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:**

# The 2023 UQBIO – Tips and Best Practices

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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 interrupt others. Learning is maximized through **interaction** and obtaining **feedback**.*

# The 2023 UQBIO – Tips and Best Practices

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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 2023 UQBIO – Tips and Best Practices

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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 2023 UQBIO – Tips and Best Practices

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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

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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 pursue 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**.*

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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***

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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!



README.md

**Welcome to the 3rd Annual UQ-Bio Summer School!**

Below is the Github repository holding all the links to Colab Notebooks and files needed during the course.


**Authors**

Dr. Brian Munsky, Michael May, Dr. Linda Forero, Dr. Luis Aguilera, William Raymond, Dr. Zachary R. Fox, Lisa Weber, Kaan Ocal, and Dr. Huy D. Vo.

[uqbio.summer.school@gmail.com](mailto:uqbio.summer.school@gmail.com) • [2023 Undergraduate Summer School Schedule](#) • [UQ-Bio](#) • [Munsky Group](#)

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

We are going to start with the first one.

### Modules

Module 0 (Online) : Getting Started with Basic Scientific Computing in Python.

Date (MST)	Location	Description	Link
May 22-26	Online	Intro to Python: Hello (Python) World, Types, Arithmetic Operations, Iterables, and Containers	<a href="#">Colab</a>
May 22-26	Online	Intro to Python: Loops, Ranges, Functions, Lambdas, List Comprehension	<a href="#">Colab</a>
May 22-26	Online	Intro to Python: importing packages, classes/modules, os navigation, reading files	<a href="#">Colab</a>
May 22-26	Online	Intro to Python: Google Colab environment setup and navigation	<a href="#">Colab</a>
May 22-26	Online	Intro to Python: Matplotlib visualization	<a href="#">Colab</a>
May 22-26	Online	Intro to Python: NumPy and Linear Algebra Review	<a href="#">Colab</a>