Welcome to the 2023 UQ-Bio Summer School!
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
Colorado State University acknowledges, with respect, that the land we are on today is the traditional and ancestral homelands of the Arapaho, Cheyenne, and Ute Nations and peoples. This was also a site of trade, gathering, and healing for numerous other Native tribes. We recognize the Indigenous peoples as original stewards of this land and all the relatives within it. As these words of acknowledgment are spoken and heard, the ties Nations have to their traditional homelands are renewed and reaffirmed.

CSU is founded as a land-grant institution, and we accept that our mission must encompass access to education and inclusion. And, significantly, that our founding came at a dire cost to Native Nations and peoples whose land this University was built upon. This acknowledgment is the education and inclusion we must practice in recognizing our institutional history, responsibility, and commitment.
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.

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

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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

• 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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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
Hanieh Mazloom-Farsibaf from Iran to UQBIO 2023

- BSc and MS in physics – IRAN
  MS, many-body system (Sharif University of Technology)

- PhD in Biophysics and Optics
  University of New Mexico
  PhD project: Membrane-protein confined within the actin structures

- Postdoc in UTSW
  Department of Bioinformatics

How does cell shape shape the cell?

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

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

North Dakota

Williston

Fargo

Ely

Elephant

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

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

Upcoming Paper!

Using Mechanistic Models and Machine Learning to Design Single-Color Multiplexed Nascent Chain Tracking Experiments

My Main projects while I have been at CSU:
1. rSNAPsim
   - Translation Modelling

2. Transcription Modelling

3. NCT Multiplexing
   - Spot type 1
   - Spot type 2
   - Incorrect
   - Uncertain

4. Riboswitch ML

Hobbies!
- Video game datamining
- Swimming
- Painting
- Listen to a lot of music
Keisha Cook, PhD
Assistant Professor
keisha@clemson.edu

Enhancing Diversity in Graduate Education
https://www.edgeforwomen.org/

Parallel Stochastic Simulations of Biochemical Reaction Systems

Intracellular Transport in Live Cells

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Joshua Cook and his Journey to UQBIO.

**Grew up in Aurora, CO**

**Education:**
Became apart of the dual degree program at CSU for undergraduate degrees in Chemical and Biological Engineering and Biomedical engineering

**Current Studies:**
Continued with a masters degree in Dr. Munsky’s group at CSU with research interests in image processing, stochastic simulation, finite state projection, model identification and optimizing experiment design.

**Hobbies:**
Tennis, Learning Piano, ring/knife making
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Kaan Ocal

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Grew up in Istanbul (Turkey) reading comic books, playing with street cats, enjoying city kid life

Studied pure maths in Bonn (Germany), the old capital before Berlin

Doing a PhD in stochastic modelling & inference in Edinburgh (Scotland)

I've always loved music - Classical, Folk, Jazz...

Moving to Scotland turned me into a dedicated hiker...

... and I still hugely enjoy reading!
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Ania Baetica and her Random Walk to UQ-BIO.

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Grew up loving math on a farm in Romania.

Our cat Berlioz
Wild animal

Math major at Princeton. Quickly discovered math can be used to model biological dynamics.

Starting my own lab at Drexel University March 1st 2023!!

We will study biological feedback for biotechnological and medical challenges.

Attended the 2015 Q-Bio Summer School CSU as a grad student.

Became an engineer in biology.

Studied feedback control in synthetic biology for a Ph.D. in Control and Dynamical Systems at Caltech.

Met my cute spouse.

Caltech

Reference
Sensor
Actuator
Controller (K)
Input
Actuated Input
Process (P)
Output

Sensor

Gene

DNA

mRNA

Protein

process

Computation, and Actuation

Sensor, Controller, Error
Eric Ron

Grew up in Boulder Colorado playing tennis and taking Pictures

Earned a BS Biochemistry at C.S.U in 2013

Worked in industry as lead in an analytical chemistry lab, and a clinical immunology practice.

Went back to CSU in 2019 and am working towards a MS degree in Bio Engineering. I’m an experimentalist in Dr. Munsky’s lab doing smiFISH experiments and mountain biking in my free time!

Started a business with local friends and Australian investors.

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The 2023 UQBIO Website and Resources

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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
- 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: 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 Goals of the 2023 UQ-Bio 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

Neuert, et al, Science 2013
Munsky, et al, PNAS, 2018
Jashnsaz, et al, iScience, 2020

Kalb, Vo, et al, Scientific Reports, 2021

Munsky, et al, PNAS, 2018
Neuert, et al, Science 2013
Jashnsaz, et al, iScience, 2020
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

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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:
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.
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 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.*
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**