



Program Background, Student Expectations & HPCBio Projects

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High Performance Biological Computing (HPCBio)

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PROGRAM OVERVIEW

R25 Partnership

Quick summary:

- Partnership that aims to provide external Bioinformatics education opportunities to Fisk students and faculty
- Partnership is between:
 - Fisk University
 - University of Illinois at Urbana-Champaign (UIUC)
 - BD2K/KnowEnG

R25 Program

What does this mean for you?

- Remote access to UIUC Bioinformatics seminars
 - That was this past Spring
- Summer research experiences
 - Potentially for **two** consecutive Summers
 - More on that later...

So many groups!

- Fisk University
- University of Illinois at Urbana - Champaign
 - BD2K
 - **KnowEnG**
 - **HPCBio**
 - **SROP**
- *Let's take this one group at a time...*

BD2K

BD2K = Big Data 2 Knowledge

- Program that aims to “facilitate broad use of biomedical big data, develop and disseminate analysis methods and software, enhance training relevant for large-scale data analysis, and establish centers of excellence for biomedical big data”
- They are funding this Summer program. Yay money!



Jun Song

HPCBio

HPCBio = High Performance Computing in Biology

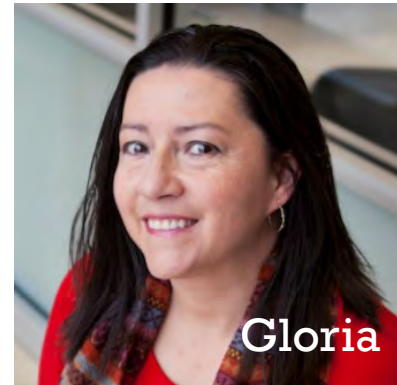
- A consulting group at UIUC that provides Bioinformatics analyses and workshops for researchers and students
- You will be working one-on-one with us most of the Summer



Jessica

Program
Manager/Coordinator

Main instructors



Gloria



Chris



Kim



Meng-Chun



Jenny

SROP

SROP = Summer Research Opportunities Program

- “Provides undergraduate students from populations underrepresented in graduate study with an opportunity to explore careers in research”
- 9 week program
 - Conduct research project in a real lab
 - Attend professional development seminars
 - Attend research team meetings and research writing sessions
 - Attend social events



Daniel Wong
Assoc. Director of
Educational Equity
Programs



Renee Hart
Office Support Specialist

SROP

- You'll be housed in the same building as the other SROP students
- You'll be able to participate in most activities for 5 weeks
 - If you come back to UIUC next year (2019), you'll be fully immersed in SROP and assigned a faculty advisor



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R25 SUMMER RESEARCH EXPERIENCE

General Expectations

1. Be at HPCBio every weekday for research
 - Hours may vary from week to week
 - Building: Institute for Genomic Biology
 - Our offices: 2000 or 2112
2. Attend SROP activities
 - Seminars, research team meetings, research writing, social activities
3. Create PP Presentation of research project by end of June
 - Will create figures throughout month
 - Last week will put it all together
5. Respond to emails promptly
6. Complete any homework by due dates

Learning Expectations

1. **Creating reproducible research**
 - Project organization on Linux machine
 - Keep a Bioinformatics lab notebook
2. **Using a computational cluster**
 - IGB's Biocluster
3. **Understanding of RNA-Seq**
 - Its purpose and applications
 - Basic analysis steps
4. **Presenting scientific research**
 - PowerPoint presentation

Detailed Timeline

- **Week 1**
 - Get acquainted with campus and HPCBio
 - Learn bioinformatics basics
 - Visit a sequencing center to see where data comes from
 - Meet with labs that generated RNA-Seq datasets
- **Week 2**
 - Learn about what an RNA-Seq analysis is
 - Choose RNA-Seq project
 - Perform RNA-Seq pre-processing steps
- **Week 3**
 - Finish up pre-processing
 - Learn basics of R
 - Perform statistical analysis on RNA-Seq data

Detailed Timeline

- **Week 4**
 - Finish up statistical analysis
 - (optional) learn an additional skill
 - Transcriptome assembly or alternative RNA-Seq pipeline
- **Week 5**
 - Summarize projects and a PowerPoint presentation
 - Present PowerPoint during HPCBio group meeting
- **3 weeks of research at Fisk University**
 - Can continue to use Biocluster for this
 - RNA-Seq project
 - This is what you'll write your research proposal on for the SROP research writing

Project 1

RNA-SEQ ANALYSIS

Definition

RNA sequencing (RNA-Seq):
Using next-generation sequencing to determine the presence and quantity of RNA in an organism at any given moment



Applications of RNA-Seq analysis

1. To assemble a transcriptome

- What genes & transcripts exist?**
- What is their structure?**

2. To find out what an organism's genes doing under certain conditions

- What genes are being expressed?**
- Are the gene expression levels different under varying conditions?**
 - Is this significant (or likely true)?**



LAST YEAR'S RNA-SEQ PROJECTS

RNA-Seq Dataset 1

Human

- 9 samples
- 3 conditions
 - Irrelevant siRNAs
 - Mov10 knock down
 - Mov10 over expression
- 3 replicates each
- How does the gene silencing Mov10 gene affect the expression of other genes in humans?



RNA-Seq Dataset 2

Mouse fire fighting study



- 70 samples
- 3 treatments
 - Control, left in lab
 - No smoke, went to location but not exposed
 - Smoke, went to location & exposed to fire after extinguished
- 2 fire-fighting scenarios
 - Outside-in fires
 - Inside-out fires
- 11-12 reps of each condition/technique
- **How do different smoke conditions and fire-fighting scenarios affect our gene expression?**

RNA-Seq Dataset 3

Infected Mice

- 24 samples
- 3 conditions
 - Control (0 days)
 - 4-day post-infection
 - 8-day post-infection
- 2 tissues
 - Spinal cord
 - Cerebellum
- 2 sexes
- 4 reps of each condition/tissue
- **What genes are affected by infection? Specifically in the nervous system tissues: brain & spinal cord**



RNA-Seq Dataset 4

Honeybee behavior



- 48 samples
- 2 times
 - Morning, when inactive
 - Afternoon, before leaving to forage or seek mates
- 2 sexes/behaviors
 - drones (male) - seek mates or queen bees
 - workers (female) - forage for nectar & pollen
- 12 reps of each time/sex
- **What genes are active during the anticipation of a reward-seeking flight in response to learned/trained or instinctive behaviors?**

GETTING AROUND CAMPUS

UIUC Campus

- Our campus is situated in two towns
 - Champaign & Urbana (pop. ~239,000)
- Huge campus
 - 353 main campus buildings (647 total)
 - Don't worry, we'll help you navigate 😊
- Well known for research & development in science and engineering
 - Including Bioinformatics!

MTD System

- Serves campus and much of Champaign & Urbana
- Many ways to determine bus schedule...
 - Website: <https://mtd.org/>
 - Trip planner
 - Maps
 - Bus stops
 - Phone app: Illini Bus
 - Paper schedule (can find them on buses)
 - Bus kiosks
 - Bus-stop signs

Walking

- Bring an umbrella!
 - Weather has unpredictable lately
- Use your maps
 - Paper handout
 - Interactive map:
<https://map.illinois.edu/view>
- Campus is generally safe, but always be vigilant, especially at night

FINAL THOUGHTS



Questions for you

- What day/time will you leave?
- Do you need to borrow a laptop?

Questions?

- What concerns do you have?
- Is there anything I didn't cover?