Differential gene expression analysis workshop

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Bioinformatics scientist

Center for Quantitative Biology, Geisel School of Medicine at Dartmouth

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Website: (https://sites.dartmouth.edu/cqb/projects-and-cores/data-analytics-core/

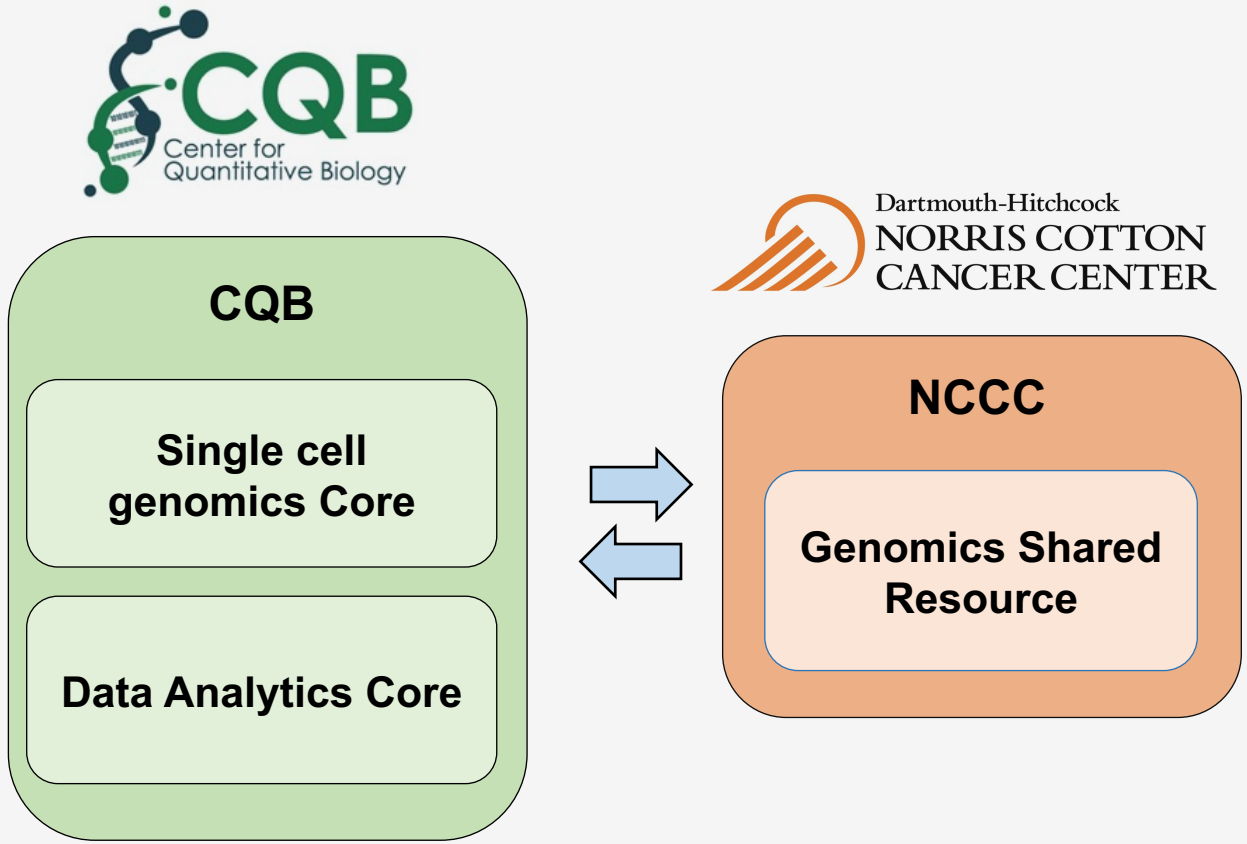
08/23/21

Center for Quantitative Biology at Dartmouth

Mission: Support and enhance quantitative biological research at Dartmouth and to facilitate its integration with experimental biology

Activities:

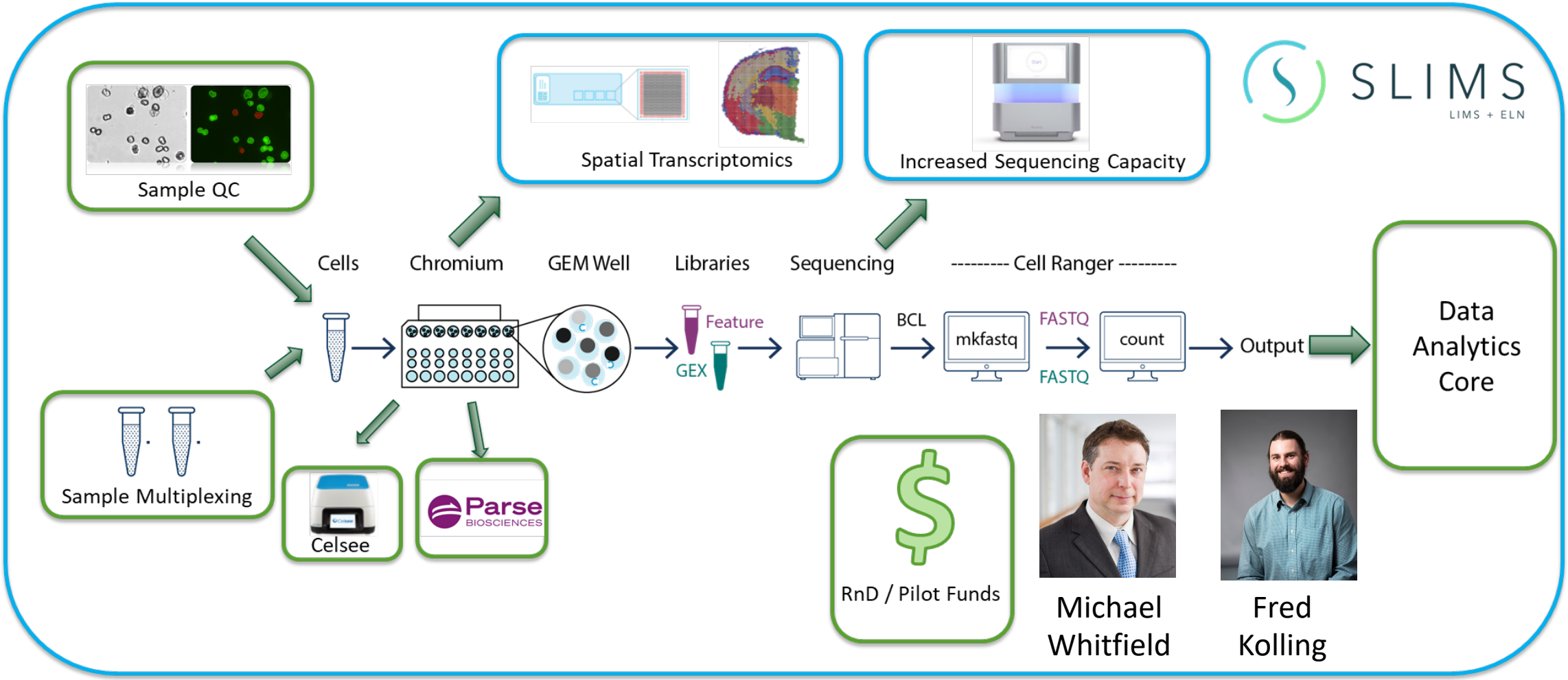
- Invest in instruments and infrastructure
- Improved sample management
- Support for new method development
- Pilot grants for new users or novel projects
- Dedicated data analysis resources



Website: *https://sites.dartmouth.edu/cqb/*

The Single cell Genomics Core (SCG)

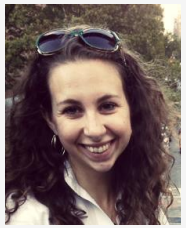
- The SCG Core provides end-to-end single cell services



The Data Analytics Core

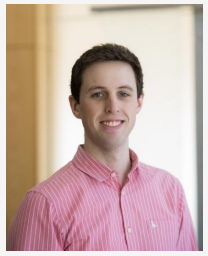
Mission statement
Facilitate advanced genomic & bioinformatic data analysis solutions to CQB faculty & the Dartmouth research community

James O'Malley, PhD
Director



Shannon Soucy, PhD
Senior Research Scientist

Tim Sullivan, BA
Bioinformatics Research Scientist



Owen Wilkins, PhD
Bioinformatics Research Scientist

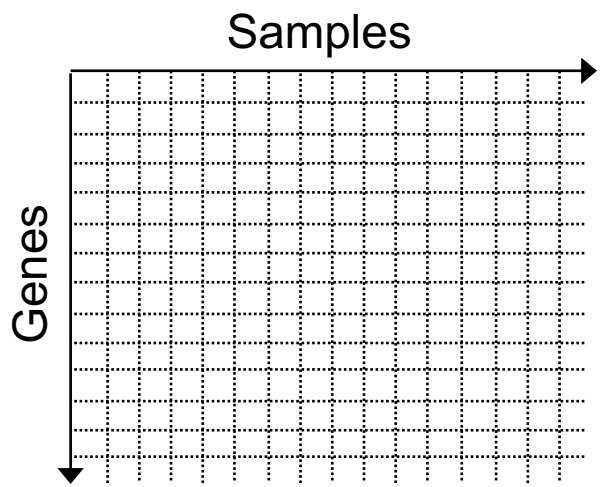
- **Genomic data analysis**
  - Analytical support for Dartmouth researchers
  - Pipeline development & maintenance
- **Bioinformatics consulting**
- **Publication & grant support**
  - Writing for methods & results sections
  - Letters of support
- **Training**
  - Group workshops

Goals of the workshop

- Understand the basic principles of a differential expression analysis using RNA-seq data
- Develop a working understanding of the fundamental statistics behind a typical differential expression analysis using R/Bioconductor packages
- Perform a differential expression analysis using R/Bioconductor packages
- Learn how to explore the results and make robust insights from your data

Workshop outline

Gene expression matrix
(read counts)



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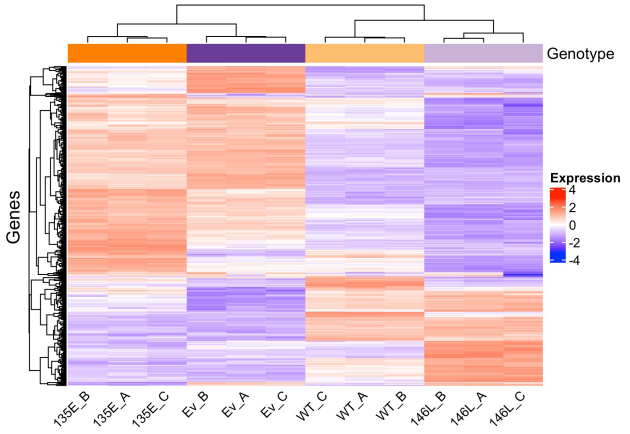
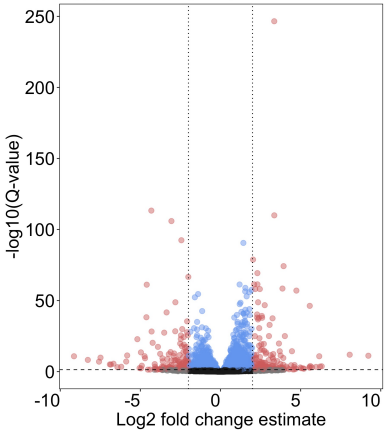
Sample metadata

- Normalization
- Exploratory analysis
- Statistical modeling
- Visualization

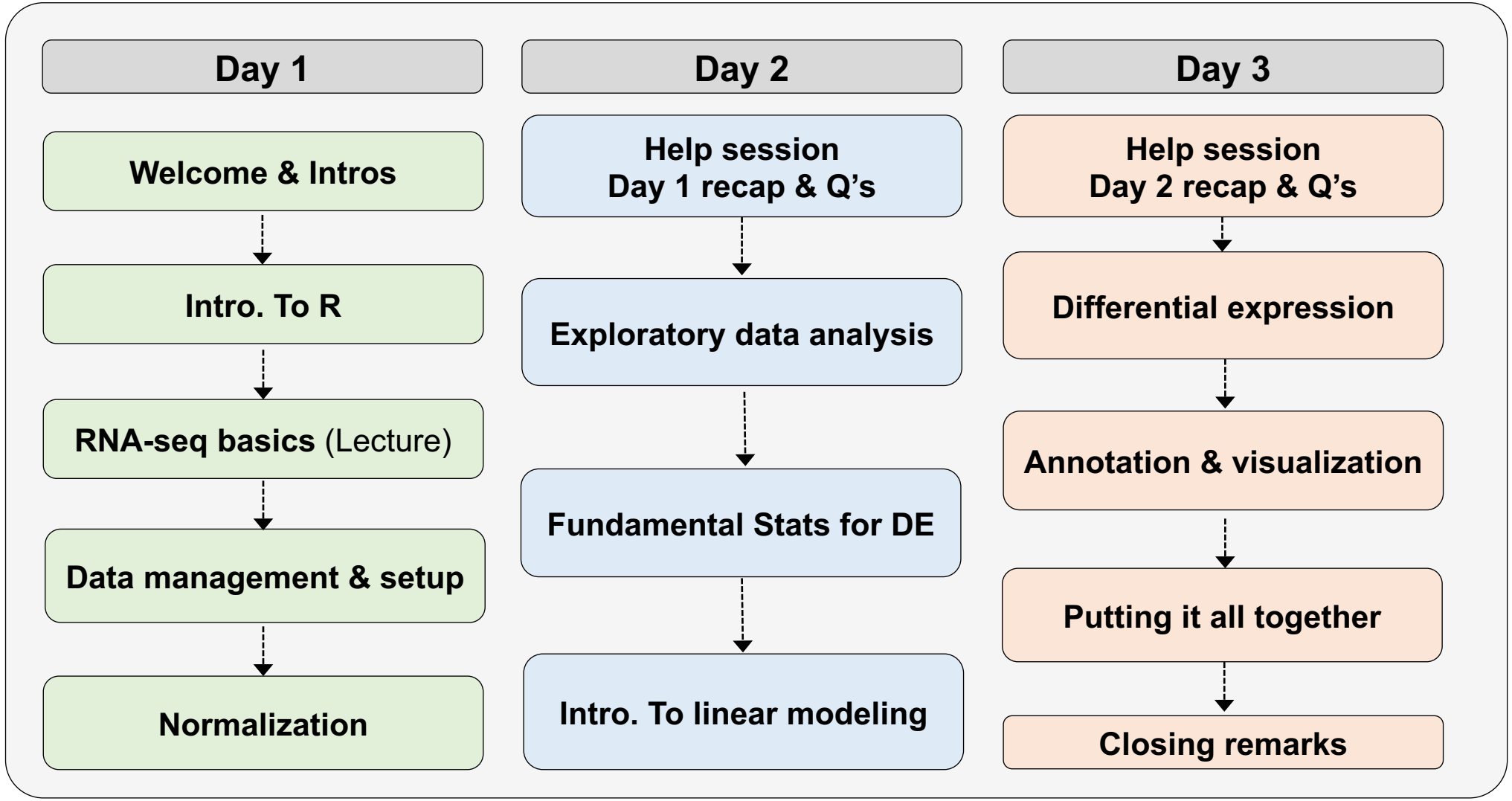
Differential expression results

ID	lfc	lfcSE	stat	pvalue	padj	Gene
ENSG032219	2.89	0.12	-25.4	1.6E-251	1.7E-249	ARID4A
ENSG012951	-3.44	0.15	-24.5	1.2E-132	1.4E-122	KLK10
ENSG016754	-3.14	0.12	-24.1	2.9E-123	1.4E-118	KLK5
ENSG080097	-2.78	0.11	-20.7	5.7E-115	2.4E-109	LGALS1
ENSG006277	5.92	0.28	19.8	1.9E-80	3.5E-92	UCHL1
…..	…..	…..	…..	…..	…..	…..





Workshop outline



Schedule

- Can be found at: https://github.com/Dartmouth-Data-Analytics-Core/RNA-seq-Differential-Expression-workshop-June-2021/blob/master/schedule.md
- 12pm-5pm each day
- Schedule is best guess, and we may deviate from it based on time
- If you will be absent for a session, just let us know

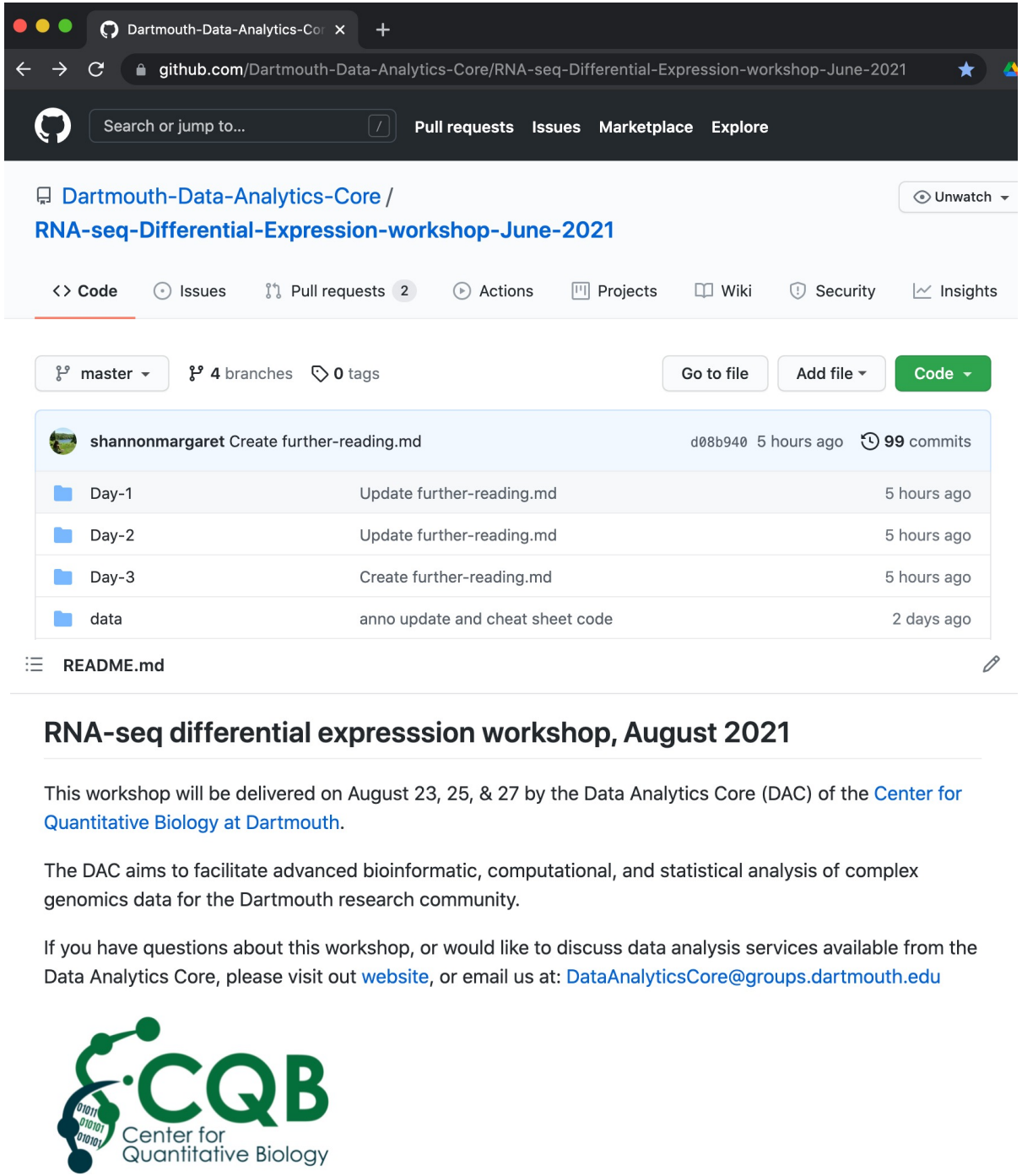
Logistics I

- Course materials are all online (and will stay there):

  https://github.com/Dartmouth-Data-Analytics-Core/RNA-seq-Differential-Expression-workshop-June-2021

- You will download the materials on your local machine during the workshop

- We will be copying R code from markdowns (.md) into the RStudio



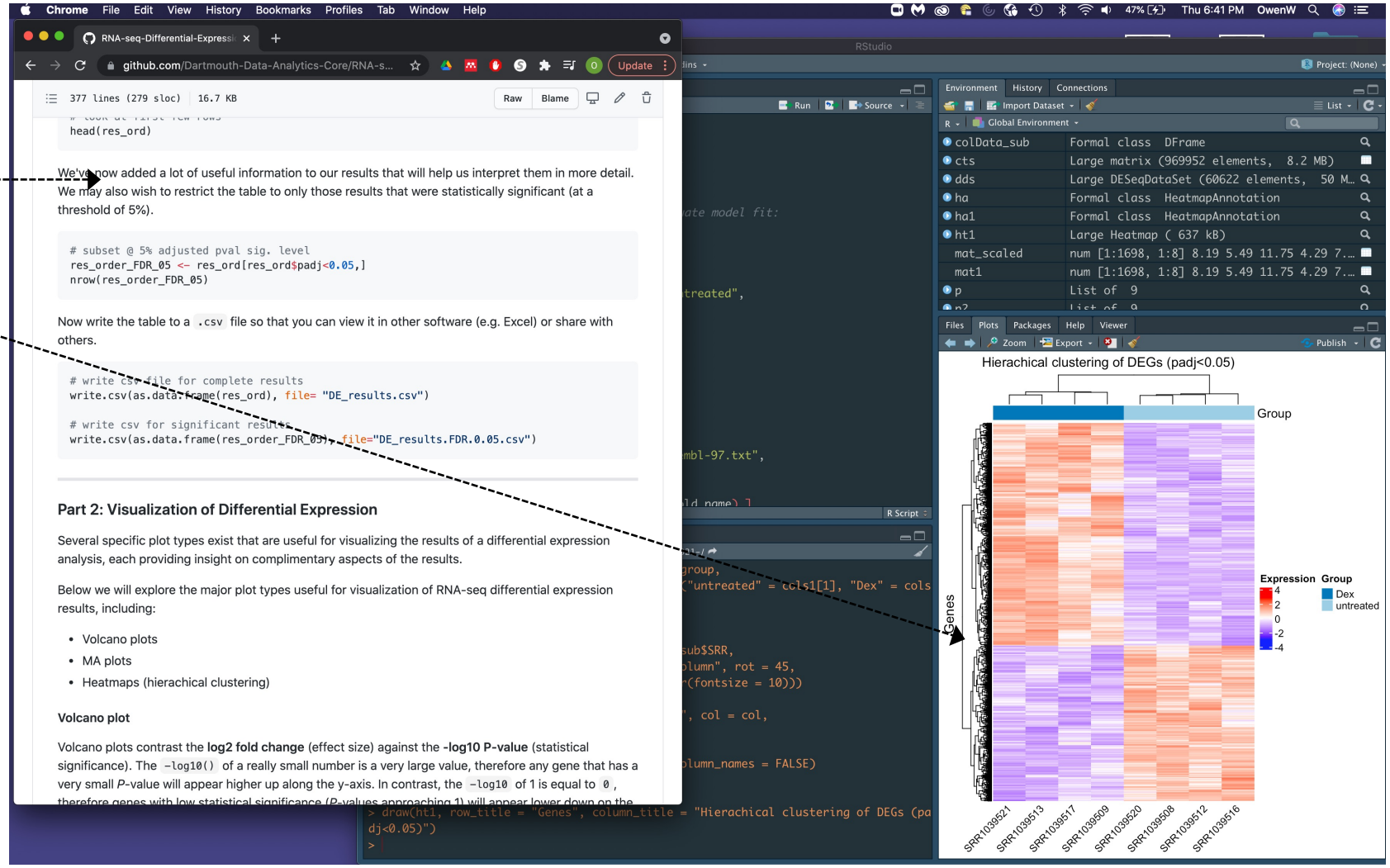
Logistics II

- Multiple tabs open:
  - Web browser
  - RStudio

- Copy & paste code from Markdowns to Rstudio

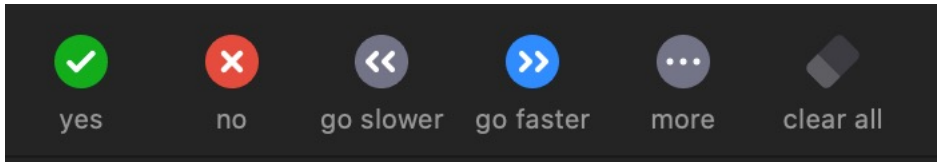
- If you finish: edit the code, try different options, generate scripts

- Use the ***cheat sheets for R!***

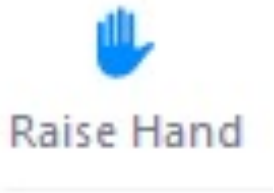


Logistics III

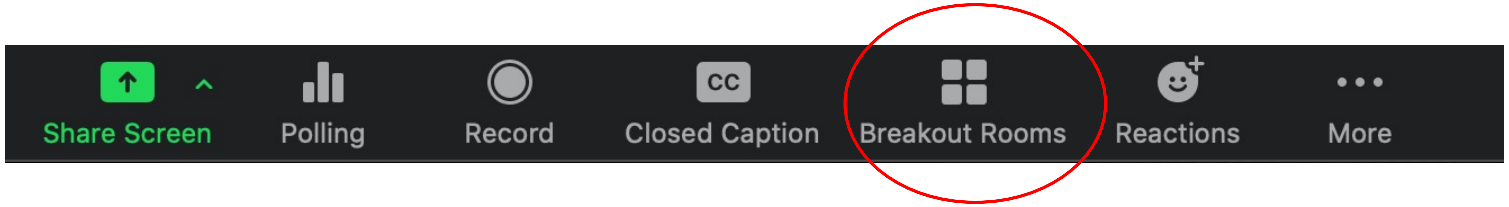
- Use buttons in *Participants* tab in zoom



- You'll be muted, but if you want to ask a question, just raise your hand

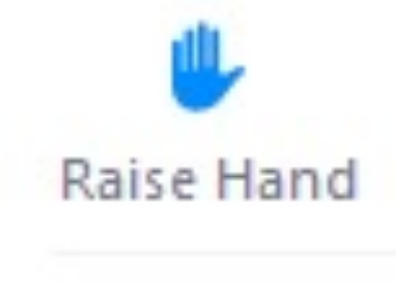


- We'll be using *breakout rooms (BRs)*
  - We will use these when we split up to run code independently
  - We've tried to pair everyone based on experience
  - If your stuck, message us, and we will come help you in your (BR)
  - When we are going to move on, breakout rooms will close



- Please be courteous on zoom..

How to get help?



- **Raise your hand in zoom** (bottom right, participants tab)

- **Use the slack channel to message one of us**
  - Use the ***general*** channel if it might benefit everyone
  - Message us directly if its specific

- **If all else fails, email us:**
  - DAC: DataAnalyticsCore@groups.dartmouth.edu
  - Shannon Soucy (Shannon.Margaret.Soucy@Dartmouth.edu)
  - Tim Sullivan (Timothy.J.Sullivan@dartmouth.edu)
  - Owen Wilkins (omw@Dartmouth.edu)

Questions after the workshop?

Bioinformatics office hours

Friday 1-2pm (every other week, check calendar):
https://sites.dartmouth.edu/cqb/upcoming-events/calendar/

Zoom link: https://dartmouth.zoom.us/s/96998379866

Passcode: bioinfo

- At the end, please give us feedback about this workshop, there will be a survey!

- And please ask lots of questions!

Questions?

…then.. Introductions!

Name, department/program, research interests, why are you taking the workshop?