

# Welcome to the November 2021 Virtual CCDL scRNA-Seq Training Workshop!

Nov 1 – Nov 5, 2021  
Childhood Cancer Data Lab

<https://alexslemonade.github.io/2021-november-training>



# Tell us about you!

- What's your name?
- What are you studying?
- What was your favorite Halloween costume that you saw this year?

# Meet your instructors



**JOSH**  
Joshua Shapiro

**Data Scientist @ the CCDL**

PhD Ecology & Evolution, *UChicago*  
Postdoc Integrative Genomics, *Princeton*

Research interests:

- **Evolutionary genomics**
- **Single cell workflows**



jashapiro

# Meet your instructors



**CHANTE**

Chante Bethell

**Biological Data Analyst @ the CCDL**

Bachelor's in Bioinformatics from *Rowan University*

Research interests:

- **Functional motifs in the proteome**



cbethell

# Meet your instructors



**Ally**  
Ally Hawkins

**Data Scientist @ the CCDL**

*PhD Cancer Biology University of Michigan  
Postdoc Computational Biology Cornell*

Research interests:

- **Single cell data analysis**
- **Origins of pediatric solid tumors**



allyhawkins

# Meet your instructors



**JACLYN**  
Jaclyn Taroni

**Director @ the CCDL**

PhD Genetics *Dartmouth*  
Postdoc Computational Biology *UPenn*

Research interests:

- **Transcriptomics in rare, complex diseases**
- **Unsupervised pattern extraction**



[jaclyn-taroni](https://github.com/jaclyn-taroni)

# Other staff you may see



**JEN**  
Jen O'Malley

**Scientific Community  
Manager**  
@ CCDL

- Maintains a supportive environment for pediatric cancer researchers
- Manages Data Lab communications



**KURT**  
Kurt Wheeler

**Data Engineer**  
@ CCDL

- Builds scalable systems
- Manages servers



**DAVID**  
David Mejia

**Developer**  
@ CCDL

- Make websites
- Debugs

# Tell us about you!

- What's your name?
- What are you studying?
- What was your favorite Halloween costume that you saw this year?

# Code of Conduct

# Be kind, have fun

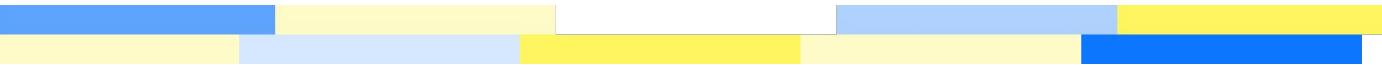
We value the involvement of everyone in the community. We are committed to creating a friendly and respectful place for learning, teaching, and contributing.

- Use welcoming and inclusive language
- Be respectful of different viewpoints and experiences
- Gracefully accept constructive criticism
- Focus on what is best for the community
- Show courtesy and respect towards other community members

Read the full Code of Conduct here:

<https://alexslemonade.github.io/2021-november-training/code-of-conduct.html>

If you at any time feel harassed or treated inappropriately, please contact  
[ccdl@alexslemonade.org](mailto:ccdl@alexslemonade.org).



# What you will learn (and what you won't)



# What you will learn

We will introduce you to the R programming language, R Notebooks, and some reproducible research practices.

We cover pipelines for the quality control, pre-processing, and initial analysis of single-cell RNA-seq data almost entirely through hands-on exercises.

We generally elect to go *broad* and not *deep*.

**Our overarching goals:** To prepare you to perform “frontline” analyses of your own data, to get you more comfortable reading documentation/learning new methods on your own, and to give you tools to collaborate more effectively with analysts when needed

# What you won't learn

We don't address experimental design (e.g., how many replicates you need).

We won't compare tools (e.g., Bioconductor vs. Seurat for single cell analysis).

We won't cover every feature (or assumption) of the tools we do present.

You may not be able to perform every analysis you need for your own work, particularly for complex experimental designs. For example, in the context of single-cell analysis, we do not cover integrating data from multiple samples.

We present analysis as a series of *linear steps*. In practice, it's *not*. It's important to consult analysis experts when you need to and to keep track of and report what you've done.

# How do we pick what we teach?

We want methods to be or to have:

- Useful for a wide range of experimental designs, sample sizes
- Easy to use, well-documented, and consistently updated
- Solid tutorials, a sizeable user base, and responsive authors/maintainers

We have a preference for methods that integrate easily into a single workflow that can be run on a laptop (and our own personal biases as scientists).

# Schedule

## Monday

### Workshop Intro

### Intro to R

RStudio Server

Base R

ggplot2 & tidyverse

### Consultations

Exercise notebooks

## Wednesday

### Single-cell RNA-seq

Dimensionality reduction

Clustering

Marker identification

## Friday

### Consultations

Your own data

Exercise notebooks

## Tuesday

### Single-cell RNA-seq

Quantification & QC

Filtering & Normalization

## Thursday

### Pathway Analysis

Overrepresentation

GSEA

### Consultations

Exercise notebooks

Your own data

### Consultations

Exercise notebooks

Your own data

Full schedule: <https://alexslemonade.github.io/2021-november-training/workshop/SCHEDULE.html>

# Daily Schedule Outline

## Instruction

Full group  
Lectures

- Introduce concepts and background
- Demonstrate usage
- Answer general questions

## Breakout

Small groups  
Start exercise notebooks

- Split up into Zoom breakout rooms
- Ask questions of instructors and other participants

## Consultation Period

Exercise notebooks  
Your own data

- Practice what you have learned
- Work on exercises individually or in groups
- Work with your own data

# Module Layout

00a-rstudio_guide.md
00b-debugging_resources.md
00c-good-scientific-coding-practices.md

These are reference documents.  
Go through these on your own.

01-intro_to_base_R-live.Rmd
01-intro_to_base_R.Rmd
01-intro_to_base_R.nb.html
02-intro_to_ggplot2-live.Rmd
02-intro_to_ggplot2.Rmd
02-intro_to_ggplot2.nb.html
03-intro_to_tidyverse-live.Rmd
03-intro_to_tidyverse.Rmd
03-intro_to_tidyverse.nb.html

These are **Instruction** notebooks.  
We'll walk through these together,  
step-by-step, during the workshop.

exercise_01-intro_to_base_R.Rmd
exercise_02-intro_to_R.Rmd
exercise_03a-intro_to_tidyverse.Rmd
exercise_03b-intro_to_tidyverse.Rmd

These are **Exercise** notebooks.  
Use these to practice what you  
have learned. We're here to help!

# Module cheatsheets cover key functions

<https://github.com/AlexsLemonade/training-modules/tree/2021-november/module-cheatsheets>

## dplyr

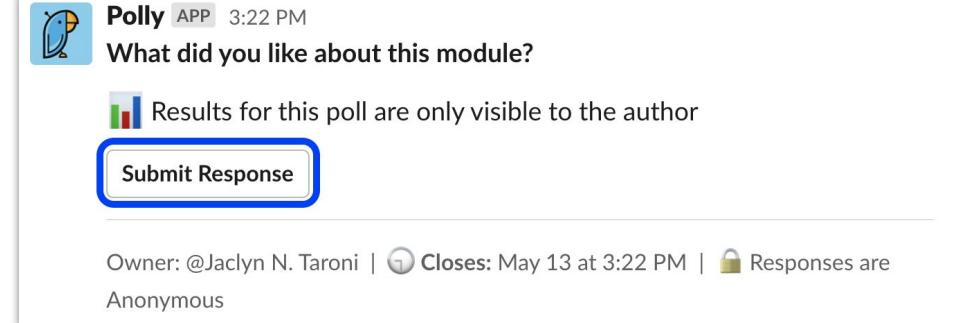
Read the `dplyr` package documentation [here](#).

A vignette on the usage of the `dplyr` package can be found [here](#).

Library/Package	Piece of code	What it's called	What it does
<code>dplyr</code>	<code>%&gt;%</code>	Pipe operator	Funnels a data.frame through tidyverse operations
<code>dplyr</code>	<code>filter()</code>	Filter	Returns a subset of rows matching the conditions of the specified logical argument
<code>dplyr</code>	<code>arrange()</code>	Arrange	Reorders rows in ascending order. <code>arrange(desc())</code> would reorder rows in descending order.
<code>dplyr</code>	<code>select()</code>	Select	Selects columns that match the specified argument
<code>dplyr</code>	<code>mutate()</code>	Mutate	Adds a new column that is a function of existing columns
<code>dplyr</code>	<code>summarise()</code>	Summarise	Summarises multiple values in an object into a single value. This function can be used with other functions to retrieve a single output value for the grouped values. <code>summarize</code> and <code>summarise</code> are synonyms in this package.
<code>dplyr</code>	<code>rename()</code>	Rename	Renames designated columns while keeping all variables of the data.frame
<code>dplyr</code>	<code>group_by()</code>	Group By	Groups data into rows that contain the same specified value(s)
<code>dplyr</code>	<code>inner_join()</code>	Inner Join	Joins data from two data frames, retaining only the rows that are in both datasets.

# We want your feedback!

At the end of each module,  
we will post a few questions  
in the Slack channel.



A screenshot of a Slack message from the 'Polly APP' at 3:22 PM. The message asks, 'What did you like about this module?'. It includes a note that 'Results for this poll are only visible to the author' and a 'Submit Response' button, which is highlighted with a blue border. Below the message, it says 'Owner: @Jaclyn N. Taroni | Closes: May 13 at 3:22 PM | Responses are Anonymous'.

- The most difficult or confusing point of the module ("muddiest point")  
We will post additional material answering your questions the next day  
*Responses to this question will appear in the channel anonymously*
- What did you like about the module?
- How we can improve the module?  
*These responses will be collected anonymously (and not posted)*

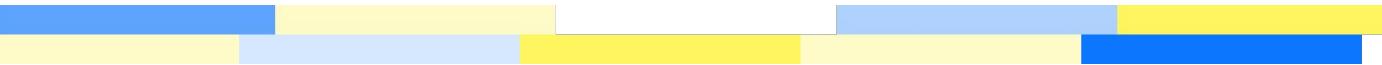
# Friday

## Your own projects Exercise notebooks

Spend Friday working with your own data, getting assistance as needed from CCDL staff and each other.

## Presentations

Present what you worked on during the consultation times to the group!

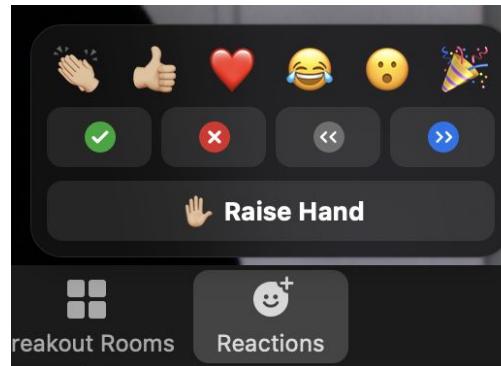


# Virtual Training Procedures



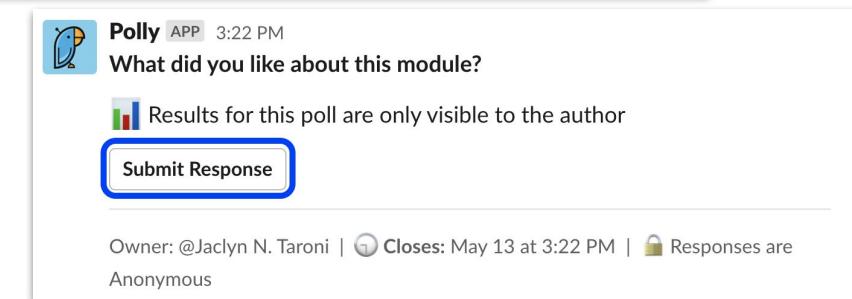
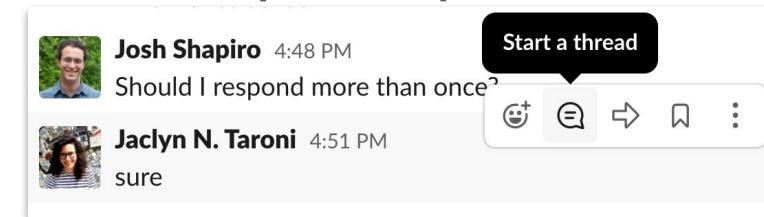
# General Zoom Etiquette

- Keep your microphone muted
- Type questions in the Chat window (directed to the host)
  - Click on the “Chat” button at the bottom of your window to open the chat.
- Use the Zoom reactions to tell us how you are doing!



# Using Slack

- Use the **#2021-november-training** Slack channel
- Post public questions, get help with errors and debugging, make comments, and help your fellow participants!
  - Use threads to keep related content together
- Watch out for feedback polls!



# Communication during instruction



- I have an **urgent question** that needs an answer before moving on:  
- ***Raise Hand*** or ***Chat*** with the room host
- I'm stuck with an **error** and can't proceed with the hands-on exercise  
- ***Chat*** with meeting host: Request 1:1 and you will be placed in a breakout room with a CCDL staff member



- I have an **general question** that does not need an answer right away.  
- ***Post*** in #2021-november-training
- I'm having trouble logging in to RStudio Server  
- ***Direct Message*** a CCDL staff member (not the current host or instructor)

Trouble logging into Zoom and Slack? ***Email*** [training@ccdatalab.org](mailto:training@ccdatalab.org)

# Communication at other times (consultation periods)



- I have questions about previous instruction or **exercise notebooks**
  - **Post** in `#2021-november-training`
  - If you need to share your screen, we will set up a 1:1 or group Zoom call
- I would like to be paired up with other participants
  - **Post** in `#2021-november-training`; we can set you up in a Zoom breakout room
- I have a question that is **highly specific to my data**
  - **Direct Message** a CCDL staff member
- I'm having trouble logging in to RStudio Server
  - **Direct Message** a CCDL staff member

Trouble logging into Zoom and Slack? **Email** [training@ccdatalab.org](mailto:training@ccdatalab.org)