Quantitative Methods Workshop 2022

Lecture 3 | (single particle) cryo-electron microscopy

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Preparatory readings and viewings

In preparation for the lecture, and to aid in the afternoon hands-on exercise, please take some time to either: 1) watch the YouTube videos listed below; or 2) read through the noted articles (or both :). You may want to watch videos multiple times or re-read sections, but I expect that in total the required material should take no more than 45 minutes, and that you should be able to cover the "Dive deeper" recommended material in no more than 120 minutes.

For those particularly interested in the subject, I've also included curated links to websites where you can learn more after the conclusion of the workshop. If you have questions during or after the workshop about any of the material, don't hesitate to reach out to Joey, Laurel, or Barrett.

- **If you would like to view 3D structures during the workshop, please download and install ChimeraX here:** https://www.rbvi.ucsf.edu/chimerax/download.html
- **For the afternoon workshop, please add the linked folder below to your google account** https://drive.google.com/drive/folders/17gJqcVaEjr_vzB8jDPuU1GTsWbEUh3tn
  - Follow the link, click on the arrow beside qmw_cryoem_data, choose "Add shortcut to Drive"

Getting started (required)

Online videos:

1. https://www.youtube.com/watch?v=026rzTXb1zw (5 minutes)
2. https://www.youtube.com/watch?v=BJKkC0W-6Qk (3 minutes)
3. https://www.youtube.com/watch?v=BtuAz12zXBs (7 minutes)

Readings:

- https://doi.org/10.1042/BIO04102046 (6 pages) - attached as 01_overview_guide.pdf

Dive deeper (recommended)

Online videos:

- https://www.youtube.com/watch?v=M5r8cYjdMBo (20 mins) – A recent seminar from Bridget Carragher

And if you're feeling very ambitions:

- https://www.youtube.com/watch?v=nkGRhYv01ag (45 mins) – The incredible Eva Nogales

Readings:

1. https://doi.org/10.1126/science.aat4346 (5 pages) - attached as 02_perspective.pdf
2. https://doi.org/10.1016/j.bpj.2020.08.027 (9 pages) - attached as 03_emerging_methods.pdf

Post-workshop take home learning (if you can't get enough)

CryoEM 101 course - https://cryoem101.org/

Grant Jensen's course - https://jensenlab.caltech.edu/courses/

Mathematics of cryoEM

- https://web.math.princeton.edu/~amits/publications/IEEE_Signal_Processing_Magazine.pdf
- https://arxiv.org/pdf/2003.13828.pdf