

Precision Omics Lab: Training Material

“Live as if you were to die tomorrow. Learn as if you were to live forever.” -Mahatma Gandhi

Precision Omics Lab: Training Materials

[About the training materials](#)

[AI: the game changer](#)

[Coding: our bread and butter](#)

[Writing: nothing counts until others understand your ideas](#)

[Science: first, climb onto the shoulders of giants](#)

[How to give a talk](#)

[How to make figures](#)

[How to host an Open Box Science seminar](#)

[Career development](#)

About the training materials

Do you want to become a top computational biologist that uses omics + AI?

Do you want to make data-driven breakthroughs in biology & medicine?

How about not being stuck in your research, and being able to enjoy continuous growth and flow states?

You are in the right place. This is a list of curated materials that help you learn and practice the learned lessons right away.

Everything highlighted is required before you get started.

The materials here are not meant to be linear. You are free to pick the lesson that is most relevant to you at the moment & dive into one topic. You can always come back to revisit a lesson when it's most useful for what you are working on. After you finish each lesson, please proceed to the

use-it-right-away assignment within a day's time. You learn best when you put it into practice.

How do you know you're ready?

You may already have many related/similar trainings. How do you know you're ready to meaningfully contribute to our research? Try the <https://github.com/Bioinformatics-Research-Network/skill-assessments/tree/main>

Particularly, you should be able to accomplish after training:

- Python/R for Programming & Linux for Bioinformatics
- Python/R for Data Science
- Single-Cell RNA-Seq Analysis (if you're on single-cell/spatial omics track) or Working with Genomic Variant Files (if you're on precision genomics track) → Send this to Kuan once you completed a version that you think you successfully tackled most questions. If you tried and feel there are still significant knowledge gaps, please see the below tutorials. In the end, you shall be able to complete assignments at this level (thanks to Phuc for providing):
<https://github.com/Mustardburger/BRN-assignments>

AI: the game changer

- LLM, including openAI's GPT2 → GPT3 → ?:
<https://chat.openai.com/>
- Others worthy of note: GitHub co-pilot, Whisperer, etc.
- Learning, coding, writing, research, presentation, etc can all be better done in cooperation with AI.
- Be creative and leverage these tools in your co-creation process!

Coding: our bread and butter

- R basics (recommended by BRN): <https://r4ds.had.co.nz/index.html>

- Python basics (recommended by BRN):
<https://jakevdp.github.io/PythonDataScienceHandbook/>
- **[UPDATE 2025]** Strongly encouraged to use an AI-embedded IDE like VSCode and use Co-Pilot (in the least) if not Cursor, Augment, Windsurf
- Git & GitHub: version control, team coding, and using it as a “search platform” for similar codes you may leverage:
<https://product.hubspot.com/blog/git-and-github-tutorial-for-beginners>
- You can also learn through IDE tutorial of Git:
<https://code.visualstudio.com/docs/sourcecontrol/overview>
- Good coding practices (by Dan Larremore):
https://drive.google.com/file/d/1TraVwRkbkCbHq-s_-NS69ZEBRNwH8XNh/view
- A compilation of resources from Harvard Informatics group:
<https://github.com/harvardinformatics/learning-bioinformatics-at-home>
- Don’t reinvent the wheel: always search GitHub for possible codes to deploy, adapt, and learn from before coding a major software
- If you’re using Minerva for HPC (mostly for ISMMS members):
<https://labs.ica hn.mssm.edu/minervalab/resources/the-minerva-user-group-and-training-classes/>
- When encountering an “unsolvable” bug, always ask yourself, “have I googled? Have I asked GPT/Perplexity/Claude/Gemini etc?”
- **Use-it-right-away: incorporate these practices and put your code for your manuscript onto GitHub.**

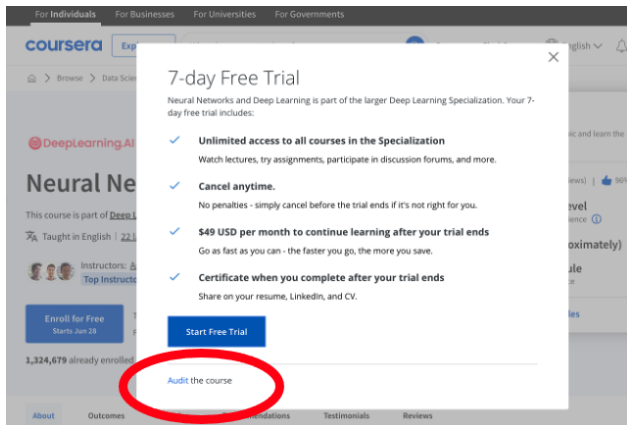
Writing: nothing counts until others understand your ideas

- <https://www.coursera.org/learn/sciwrite/>
- https://dilbertblog.typepad.com/the_dilbert_blog/2007/06/the_day_you_bec.html

- Tools: Grammarly, etc to check grammar. LLM AI tools, to generate prose and come up with alternatives
- Use-it-right-away: rewrite & edit one paragraph of your manuscript. Read it out loud. Does it make a difference?

Science: First, climb onto the shoulders of giants

Coursera courses; good fundamentals can get you anywhere! (#click Courses within the specialization, and you can audit all of them for free!)



- Data Science:

<https://www.coursera.org/specializations/jhu-data-science?> Courses: 1-9 [These courses get you started with R and the basics of Stats/ML]

- Machine learning:

<https://www.coursera.org/specializations/machine-learning-introduction#courses>

Going deeper: <https://www.coursera.org/specializations/deep-learning>

- System biology:

<https://www.coursera.org/specializations/systems-biology?=#courses>

Courses: 1-3,5

- <https://www.coursera.org/specializations/genomic-data-science>

Courses: 1-6

- <https://www.coursera.org/specializations/data-science-python>
Courses: 1-4 [These courses get you started with Python and using it for data science]
- Statistical modeling for omics:
<https://learning.edx.org/course/course-v1:HarvardX+PH525.3x+2T2016/home#>
- Bioinformatics training materials:
<https://github.com/sib-swiss/training-collection?fbclid=IwAR3cgxR716vQ7fmgPzQ7xJAENKOodkeTK1T1c4B9a46Wm1WyUXDXPY0mLYU>
- Applied computational genomics:
<https://github.com/quinlan-lab/applied-computational-genomics>
[Including Unix, Rmarkdown, bam/vcf/etc basics]
- Cancer biology: <https://www.coursera.org/learn/cancer?>

Genomic seminars

- Models, Inference and Algorithms Meeting at the Broad Institute (and other BI video series):
<https://www.youtube.com/playlist?list=PLIMMtIgw6qNjROoMNTBQjAc dx53kV50cS>
- Medical & Population Genetics Primer at the Broad Institute:
<https://www.youtube.com/playlist?list=PLEEE2A91B09B77B4A>
- Manolis Kellis' lectures (**highly recommended**, you can pick a semester's class and go through them):
<https://www.youtube.com/c/ManolisKellis1/playlists>

Open Box Science seminars (Genomics, Neuroscience, Immunology, Career Dev)

- <https://www.youtube.com/channel/UCL6aPvssjS9p0BvH8vayeWw/videos>

Other seminars:

- ISMMS Genetics and Genomic Sciences departmental WIP, see schedule at: <https://mssm.knack.com/ica hn-ggs#home/>

- Other ISMMS seminars: TCI Seminar Series, FBI Seminar Series (email respective institute's admin to be added to listservs)
- DF/HCC Connect:Science seminar series:
<https://www.dfhcc.harvard.edu/events/dfhcc-connecting-the-scientific-community-seminar-series/>
- The Science of Childhood Cancer (St. Jude):
<https://www.stjude.org/education-training/advanced-training/seminars-symposia/science-of-childhood-cancer-series.html>
- JRNL club (recorded videos for selected publication):
<https://jrnlclub.org/>

Use-it-right-away: how do you use what you just learned, whether it's an algorithm, biological concept, or medical application, to help advance your current project? Could you come up with 3 project ideas based on what you just learned?

How to give a talk

- Fundamental:https://drive.google.com/file/d/13efH6iA6toPtJ91KBt_QCeAyQBcSN7SA/view (by Dan Larremore)
- When you are on a stage:
<http://pne.people.si.umich.edu/PDF/howtotalk.pdf>
- Use-it-right-away: prepare for your next lab meeting using the principles learned here.

How to make figures

- Data visualization workshop by Dan Larremore:
<https://drive.google.com/file/d/1LouVvISCRIWkltZgzoHcgoU5Q1VyHT4U/view>
- More tips are available here:
[/Huang_lab/manuscripts/TEMPLATE_MANUSCRIPT/doc/Figures_NOTE.ppt](#)

- Use-it-right-away: update a full figure for your project & show it to a lab member. Is it clearer now?

How to host an Open Box Science seminar

- 10-min video version:
<https://www.youtube.com/watch?v=3Fhb4qNNWMk>
- Follow the guidelines & email templates here:
<https://docs.google.com/document/d/1nPYf2MjzYQnYr417ggcsL1dqukf0en7zDEgg6CziGsA/edit>
- Use-it-right-away: host an OBS Computational Omics seminar

Career development

- Take Science Career IDP: <https://myidp.sciencecareers.org/>
- Ten Simple Rules for landing the right job after your PhD or postdoc [YouTube][Career Development Keynote Talk 2020: SearchOptimizationCareerKH]
- OBS covers diverse career paths, or sign up to host a related seminar! [Open Box Science: Career Development Symposia](#)
- For Academic Careers: Making the Right Moves:
<https://www.hhmi.org/science-education/programs/resources/making-right-moves>
- Use-it-right-away: Reach out to one potential mentor who inspire you for a career chat. They don't have to be a Nobel winner or billionaire yet, try to find the ones at the NEXT STAGE you want to be.