Omics Data Science Course
Winter 2024

Course objectives:
The main purpose of this course is to introduce current practices for analyzing common omics datasets generated by two widely used technologies – next-generation sequencing (NGS-omics) and mass spectrometry (MS-omics), within the context of transcriptomics, proteomics, metabolomics, microbiomics, and multi-omics integration. The lectures are accompanied with live demo and hands-on practices using our user-friendly web tools.

Expected outcome:
After taking the course, you will be able to
- Develop a good knowledge of the key concepts and approaches in omics data analysis.
- Understand the subtleties or uniqueness of common omics data analysis workflows.
- Perform effective omics data analysis using XiaLab omics tools (community / pro) through web interface.
  * With the current progress in AI technologies, programming is quickly becoming unnecessary for most bioinformatics tasks. Therefore, we focus on teaching concepts and workflows. If you are already familiar with R, we are happy to answer your questions related to using the underlying R packages of XiaLab omics tools.

Target audience:
Senior undergraduates, graduate students, postdoctoral fellows, researchers and clinicians who are interested in omics data analysis.

Prerequisite:
Good understanding of basic statistics and molecular biology.

Course Materials:
- Desktop/laptop computers with good internet connection
- Slides and recordings (lecture and lab demo) will be available after each lecture.
- Other reading materials – they will be shared with you together with the Zoom link

Instructor:
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Course Schedule (next page):

Topics	Date	Lecture	Lab
Overview of omics data science	Jan. 6	Common data formats, statistics and visualization techniques	--
	Jan. 13	NGS and MS omics data	--
Transcriptomics	Jan. 20	RNAseq data analysis in model species	ExpressAnalyst & NetworkAnalyst
	Jan. 27	RNAseq data analysis in non-model species, gene expression meta-analysis	ExpressAnalyst & Seq2Fun
Proteomics & biological networks	Feb. 3	Biological networks creation, customization & visualization	NetworkAnalyst & miRNet
	Feb. 10	Proteomics data analysis and Biomarker analysis	ExpressAnalyst & MetaboAnalyst
Metabolomics	Feb. 17	Targeted metabolomics data analysis	MetaboAnalyst
	Feb. 24	LC-MS untargeted metabolomics data analysis	MetaboAnalyst
Microbiomics	Mar. 2	Marker gene data analysis	MicrobiomeAnalyst
	Mar. 9	Shotgun metagenomics data analysis	MicrobiomeAnalyst
Multi-omics	Mar. 16	Knowledge-driven multi-omics integration	OmicsNet
	Mar. 23	Data-driven multi-omics integration	OmicsAnalyst

Course Delivery:

- Online (Zoom) and in English
  * Since some people have only registered individual topics, we will share the Zoom links three days before each topic.
- Saturday morning 9:00 - 11:30 AM (New York / Montreal Time)

09:00 – 09:40	Lecture #1: key concepts and methods
09:40 – 10:00	Lecture #2: Introductions to the omics tool
	10 min break
10:10 – 10:30	Tool demo + exercise assignments
10:30 – 10:50	Guided lab practices I
	10 min break
11:00 – 11:20	Guided lab practices II
11:20 – 11:30	Discussion and conclusion

* The first two lectures have no lab session. We will review important concepts in omics data science.