



Omics Data Science Course

Fall 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
- Reading Materials & Omics Assistant – available in your home directory (<https://www.xialab.ca/users/UserLogin.xhtml>).
 - You need to first create and activate your account using the same email for registration.
- Lecture slides and course recordings will be available after each lecture (usually the coming Monday).

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](#).

Instructor:

Prof. Jianguo (Jeff) Xia (jeff.xia@xialab.ca)



Teaching assistants:

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- Dr. Yao Lu (yao.lu@xialab.ca)

Course schedule:

Saturday morning 9:00 - 11:30 AM (New York / Montreal Time)

Topic	Date	Lecture	Lab
Omics Data Science Foundation	Sept. 7	Key concepts and workflows	--
	Sept. 14	NGS and MS omics data	--
Transcriptomics	Sept. 21	RNAseq data analysis in model species	ExpressAnalyst & NetworkAnalyst
	Sept. 28	RNAseq data analysis in non-model species, gene expression meta-analysis	ExpressAnalyst & Seq2Fun
Proteomics & biological networks	Oct. 5	Biological networks creation, customization & visualization	NetworkAnalyst & miRNet
	Oct. 12	Proteomics data analysis and Biomarker analysis	ExpressAnalyst & MetaboAnalyst
Metabolomics	Oct. 19	Targeted metabolomics data analysis	MetaboAnalyst
	Oct. 26	LC-MS untargeted metabolomics data analysis	MetaboAnalyst
Microbiomics	Nov. 2	Marker gene data analysis	MicrobiomeAnalyst
	Nov. 9	Shotgun metagenomics data analysis	MicrobiomeAnalyst
Multi-omics	Nov. 16	Knowledge-driven multi-omics integration	OmicsNet
	Nov. 23	Data-driven multi-omics integration	OmicsAnalyst