



Title | Cancer Metabolism: The Metabolomics Perspective

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Course Description

The field of cancer metabolism has grown tremendously in the past decade, contributing major advancements in our understanding of how to diagnose and treat tumors. Despite this, some of the tools required to study cancer metabolism remain out of reach for many labs. This is particularly true for metabolomics, as it requires deep prior knowledge and sophisticated instrumentation.

This course is designed to acquaint participants with principles and practice of cancer metabolism from the perspective of metabolomics. The approach will be multifaceted. Participants will become familiar with fundamental topics in cancer metabolism directly presented by top researchers in the field. A discussion-based approach on literature review will instruct participants on the essential cancer metabolism toolkit, method advancements and limitations. Crucially, participants will get a first-hand theoretical knowledge and practical experience on designing, analyzing, and presenting mass spectrometry-based metabolomics experiments. This two-part nanocourse aims to bridge this gap; inviting interested students/postdocs/instructors to become familiar with the basic principles of cancer metabolism and metabolomics theory and practice.

The course will be offered as a two-part series. Participants can choose to attend either first, second or both parts of the nanocourse series, based on previous experience and interests.

Part Two | Fall 2022

Metabolomics for cancer research – theory and practice

Part Two of the course will introduce a major tool in the cancer metabolism field - metabolomics by LC-MS. Participants will learn how to acquire, analyze, visualize, and present metabolomics data. This part will include a “hands on” and will provide an opportunity to incorporate participants’ own samples.

Course Objectives

1. Understand the fundamental concepts of LC-MS metabolomics
2. Collect, analyze, and visualize LC-MS metabolomics data
3. Use the tools to visualize and communicate your data effectively



Enrollment limit

This course is limited to 8 participants.

Session dates, times & location

Priority will be given to graduate students taking the course for credit. In order to receive credit, students must attend all sessions and complete all assignments. Postdocs can register, too and they will be granted access to the course as space allows. The course will take place in person.

Session One

Monday October 17, 9am – 3pm, lunch will be provided
BCH Enders 10 Conference room

Session Two

Wednesday October 19, 9am-3pm, lunch will be provided
TMEC L-008

Session Three:

Monday October 24 1pm-3pm, coffee and snacks will be provided
TMEC L-008



Session Outline

Session One

Monday October 17, 9am – 3pm, lunch will be provided
BCH Enders 10 Conference room

Day one of the course will focus on sample preparation and LC-MS analysis.

Participants will:

- Be introduced to the necessary concepts and instructed on the steps of sample preparation and analysis by LC-MS. Theory and specifics of chromatography, mass spectrometry and data collection will be discussed.
- Extract diverse samples (cells, livers, brain tissue, plasma) and process them for LC-MS using different conditions
- Write LC-MS methods, prepare chromatography and samples, and run the LC-MS machines.

Tentative Schedule

Time	Task	Notes
9-10pm	LC-MS and sample prep introduction	Lecture will take place in BCH conference room (TBD)
10-12pm	Sample prep, part 1 Two groups	Cells, livers, brain tissue, plasma +/- Ellman's reagent and two-three extraction buffers will be prepared by different student groups
12-13:30 pm	Lunch	Sample prep will continue without attendance
13:30-3pm	Sample prep, part 2 Write methods, run LC-MS	LC column will be set up, participants will write method and prepare sample pools and LC-MS vials. Participants will start runs



Session Two

Wednesday October 19, 9am-3pm, lunch will be provided
TMEC L-008

Day two will focus on LC-MS data analysis and statistics. Targeted and untargeted metabolomics platforms will be compared. Participants will work on analyzing metabolomics data using R-code and MetaboAnalyst.

Participants will:

- Be introduced to theory and practice of data analysis, chromatography peaks alignment, ion adducts, and isotopes.
- Be introduced to TraceFinder (TF) and Compound Discoverer (CD) and targeted vs untargeted LC-MS analysis
- Practice data analysis using TF and CD.
- Demo and practice data integration and statistics using R-code and MetaboAnalyst
- Demo and practice preparation of data for publication using Prism and Illustrator
- Participants will be given homework assignment: Data analysis, interpretation, visualization – communicate your results by preparing a short presentation. Group can present together.

Tentative Schedule

Time	Task	Notes
9-10pm	LC-MS data analysis intro	Discussion of targeted vs untargeted LC-MS analysis Introduction into peak quality and alignment
10-12pm	Data analysis set up	TF and CD will be run remotely. TF for targeted CD for untargeted
12-13:30 pm	Lunch	CD analysis will continue unsupervised over lunch
13:30-3pm	Finalize data analysis. Export data, analyze with R-code, Metaboanalyst and Prism	These steps will be on personal computers

Participants can communicate via email to finalize analysis and presentations.



Session Three

Monday October 24 1pm-3pm, coffee and snacks will be provided
TMEC L-008

Day 3 will focus on data integration and interpretation. Participants will be asked to present 2-3 slides showcasing their data analysis and interpretation of their results. Discussion and extended Q&A will allow participants to expand what they have learned and practice or demo any further aspects of LC-MS metabolomics.