Fluxomics Modeling from Tracer Data — EMU & COBRA — Hands-on

Learn how to move from stable isotope labeling data to quantitative intracellular flux maps. This module focuses on the EMU framework, 13C metabolic flux analysis workflows, building reaction and atom mapping models, fitting fluxes to tracer data and interpreting flux distributions together with COBRA-style constraint-based models for systems-level insight.

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Session Index

Session 1

Fee: Rs 8800 Apply Now

Fluxomics Concepts & EMU Framework

From tracer experiments to fluxomics questions

- pool sizes vs fluxes
- steady state vs non steady state
- central carbon and beyond

EMU (Elementary Metabolite Unit) framework basics

- isotopomers, isotopologues and EMUs
- atom transitions and mapping
- why EMUs scale better than

full isotopomer models

Inputs, assumptions and data requirements

reaction network and reversibility measured labeling patterns and flux bounds identifiability and experimental design links

Session 2

Fee: Rs 11800 Apply Now

Building EMU / Isotopomer Models

Defining the metabolic network for 13C MFA

choosing reactions and compartments irreversible vs reversible splits linking to genome scale models

Atom mapping and EMU decomposition

carbon atom mapping for key reactions automatic vs manual EMU generation reducing model size without losing identifiability

Software workflows and file formats

model specification tables/spreadsheets exchange with COBRA style models export/import to flux analysis tools

Session 3

Fee: Rs 14800 Apply Now

Fitting Fluxes & Assessing Uncertainty

Objective functions and optimization strategies

least squares cost functions constraints and bounds on fluxes global vs local optimization approaches

Goodness of fit and residual diagnostics

chi square and residual plots detecting model

misspecification
sensitivity to individual measurements

Confidence intervals and identifiability analysis

profile likelihoods and confidence ranges
flux coupling and unidentifiable directions
using results to improve experimental design

Session 4

Fee: Rs 18800 Apply Now

Mini Capstone: Flux Map & Report

End to end 13C MFA on a teaching dataset

from labeling data to fitted fluxes

Visualizing and interpreting the flux map

graphical flux diagrams
comparing conditions or genotypes
linking fluxes to phenotypes and pathways

Deliverables: model files, flux tables & methods text

reaction and atom mapping specification
flux estimates with confidence ranges
ready to edit methods/results template