Signaling Pathways & Dynamic Causal Graphs — Hands-on

Learn how to represent signaling pathways as dynamic and causal models that connect receptors to downstream phenotypes. This module covers pathway maps, feedback and cross talk, ODE based signaling models and dynamic causal graphs for interpreting perturbation and intervention data.

Signaling Pathways & Dynamic Causal Graphs

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Session Index

Session 1

Fee: Rs 8800 Apply Now

Signaling Pathways and Circuit Motifs

Signaling cascades and pathway maps

receptors and second messengers | **kinase and phosphatase cascades** | **cross talk between pathways**

Feedback, feedforward and adaptation motifs

positive and negative feedback | **incoherent feedforward loops** | **signal amplification and robustness**

Pathway databases and standards

KEGG, Reactome, WikiPathways | SBGN process diagrams | from maps to models

Session 2

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Dynamic Models of Signaling (ODE & Rules)

From reactions to ODE based signaling models

mass action and Michaelis Menten | phosphorylation cycles | time course simulation

Rule based and combinatorial complexity

molecular site based rules | overview of rule based tools | when rule based modeling is useful

Input output behavior of signaling modules

dose response and ultrasensitivity | pulses, adaptation and memory | robustness to parameter changes

Session 3

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Dynamic Causal Graphs & Interventions

Causal graphs and directed acyclic graphs DAGs

causal vs correlational edges | confounders, mediators and colliders | do calculus concepts

Time and perturbation aware causal structures

dynamic causal graphs | using time course data | drug and knockout perturbations

From causal graphs to intervention planning

predicting effects of targeted inhibition | combination strategies overview | sensitivity of outcomes to edges

Session 4

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Mini Capstone: Signaling and Causal Model

Select a signaling pathway and define questions

Theory plus guided practical

Build a small dynamic and causal representation

ODE or rule based core model | simple causal graph overlay | single and combination perturbations

Deliverables: model, causal diagram and brief report

SBML or notebook | DAG diagram or graph file | PDF or HTML summary