Gene Regulatory Networks GRNs and Logic Models — Hands-on

Understand how gene regulatory networks encode decision making in cells and how to model them using logical and Boolean formalisms. This module covers GRN concepts, rule-based models, state space and attractor analysis with an emphasis on practical workflows for hypothesis generation and perturbation design.

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Session Index

Session 1

Fee: Rs 8800 Apply Now

GRN Concepts & Representations

Biological basis of gene regulatory networks

transcription factors and targets **activation vs repression** **regulatory motifs**

GRN representations and data sources

directed signed graphs **TF target databases** **curated vs inferred networks**

From wiring diagrams to model ready structure

nodes, regulators and regulators sets **signs and thresholds** **mapping biology to structure**

Session 2
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Boolean & Logical Rule Based Models

Boolean models of regulation

binary states and update rules **AND / OR / NOT logic** **synchronous vs asynchronous updates**

Multi valued and logical models

multi level activity **logical rules vs truth tables** **influence graphs**

Tools and formats for logic models

GINsim / BoolNet overview **SBML qual basics** **export and interchange**

Session 3
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State Space, Attractors & Perturbations

State transition graphs and trajectories

state space exploration **transient vs steady behavior** **visualizing transitions**

Attractors and cell fate interpretation

fixed points and cycles **attractors as phenotypes** **basins of attraction**

Perturbation and intervention analysis

knockouts and overexpression **in silico drug**

targeting robustness of attractors

Session 4

Fee: Rs 18800 Apply Now

Mini Capstone: Build & Analyze a GRN Model

Select a small GRN and encode logical rules

Theory + guided practical

Simulate dynamics and identify attractors

use of GINsim / BoolNet style tools state transition plots compare perturbation scenarios

Deliverables: model file, notebook and brief report

SBML qual / tool native format Python or R notebook PDF or HTML summary