Agent-Based Modeling for Tissues & Microbiomes — Hands-on

Learn how to represent cells and microorganisms as interacting agents to study tissue organization, biofilms and host–microbiome ecosystems. This module introduces core agent-based modeling (ABM) concepts, spatial lattices and continuous spaces, rule design, and coupling with omics or PDE fields. You will build and analyze ABMs for tissues and microbiomes using platforms such as NetLogo, Morpheus and PhysiCell, with Python/R-based analysis and publication-ready figures.

Agent-Based Modeling for Tissues & Microbiomes

Help Desk · WhatsApp

Session Index

Session 1

Fee: Rs 8800 Apply Now

ABM Concepts, Platforms & Model Setup

Foundations of agent-based modeling (ABM)

agents, environment, rules **discrete time steps & updating** **emergent behavior & stochasticity**

Spaces, neighborhoods & interactions

lattices vs continuous spaces | von Neumann / Moore neighborhoods | short-range vs long-range interactions

ABM toolchain & basic model setup

NetLogo (intro) | Morpheus / PhysiCell (overview) | model initialization & parameter files

Session 2

Fee: Rs 11800 Apply Now

Tissue-Scale Agent-Based Models

Modeling tissues as collections of cells

cell states (proliferation, death, differentiation) | cell–cell & cell–matrix interactions | boundary conditions & geometries

Coupling ABMs with fields (diffusion & signals)

nutrient / oxygen gradients | morphogens & cytokines (concept level) | PDE–ABM coupling (high level)

Tissue ABM platforms & workflows

Morpheus tissue templates | PhysiCell tumor/tissue examples | NetLogo prototypes & visualization

Session 3

Fee: Rs 14800 Apply Now

Microbiome & Host–Microbiome ABMs

Microbial communities as agents

species & strain-level agents | growth, death & competition rules | biofilms & spatial structure

Host–microbiome interaction modeling

immune & epithelial agents (high level) | cross-

feeding & metabolite exchange (concepts) linking ABMs to omics summaries

Tools, outputs & analysis

NetLogo / Morpheus microbiome examples simulation outputs to CSV/TSV Python/R analysis (trajectories, heatmaps)

Session 4

Fee: Rs 18800 Apply Now

Mini Capstone: ABM for a Tissue or Microbiome System

End-to-end mini ABM project (tissue or microbiome)

Theory + Practical

Model design, calibration & experiments in silico

defining agents, rules & parameters scenario & intervention experiments basic sensitivity checks & robustness

Deliverables

PDF/HTML ABM project report model files / configuration scripts environment.yml / requirements.txt