Host–Pathogen Interaction Networks & Systems

Immunology — Hands-on

Develop a systems view of how hosts and pathogens interact across pathways, cells and molecular networks. This module introduces host–pathogen interaction maps, immune circuitry and network level reasoning so you can interpret infection and vaccination data through a systems immunology lens for discovery and translational projects.

Host–Pathogen Interaction Networks & Systems Immunology

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Session Index

Session 1

Fee: Rs 8800 Apply Now

Host–Pathogen & Systems Immunology Foundations

From single pathways to host–pathogen networks (conceptual)

pathogen entry, sensing and response overview
innate and adaptive layers as interconnected systems
why a network view matters for infection and vaccination

Systems immunology in plain language (no maths required)

nodes and edges as biological entities and relations **feedback loops, crosstalk and emergent behaviour ideas** **connecting omics readouts to network concepts**

Data types that feed host–pathogen network thinking (orientation)

transcriptomics, proteomics and phospho signalling views **microbial genomics and virulence factor catalogs** **clinical and immunophenotyping context**

Session 2

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Interaction Maps: Pathways, PPIs & Immune Circuits

Host signalling and immune pathways as network backbones

pattern recognition, interferon and cytokine cascades **T cell and B cell activation circuits in overview** **mapping pathway diagrams to node edge thinking**

Pathogen factors and host targets (conceptual interaction map)

receptors and entry factors as contact points **viral or microbial proteins that hijack host machinery** **conceptual host–pathogen protein interaction map**

Immune cell circuits and cross talk in a network narrative

APCs, T cells, B cells and innate cells as nodes **cytokines and chemokines as communication edges** **links to tissue microenvironment and barriers**

Session 3

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Network Analytics for Infection & Vaccination

Key network ideas applied to immunity (in plain language)

hubs, bottlenecks and modules as immunological concepts **centrality measures as influence indicators (orientation)** **communities as coordinated response units**

Differential and perturbed networks for infection and vaccine data

before versus after infection or vaccination narratives **highlighting rewired edges and activated modules** **linking patterns to phenotypes and outcomes**

Connecting to AMR, virulence and pathogenesis at a network level

host targets used by resistant or highly virulent strains **network vulnerabilities and intervention ideas** **bridges to microbiome and systems modules**

Session 4

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Mini Case Study: Network Based Hypotheses

From omics and immunophenotyping to a network sketch (conceptual workflow)

identify key differentially affected nodes and pathways **connect them using curated host–pathogen links** **draw a simple infection or vaccine response circuit**

Formulating network based hypotheses for intervention (conceptual)

which nodes or interactions look like promising levers **possible biomarker and combination ideas connecting back to epitopes, antibodies and vaccines**

Summarising systems insights for project teams (conceptual)

network figures and bullet style narratives clear statements of assumptions and data limits handoff to experimental, clinical and modelling colleagues