Neutralizing Antibody Design & Affinity Maturation — Hands-on

Link structural and functional views of antibodies to conceptual design and optimisation workflows. This module explains neutralising versus non neutralising antibodies, binding and paratope features, and affinity maturation concepts that support vaccine, therapeutic and immunotherapy projects at a design brief level.

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Session Index

Session 1

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Neutralizing Antibodies & Binding Fundamentals

Neutralising versus non neutralising antibodies (conceptual)

blocking entry or key functional steps **effector functions and Fc contributions (orientation)** **examples from viruses and oncology targets (conceptual)**

Recap of antibody structure and binding regions (summary view)

Fab, Fc and variable domains | CDR loops and paratope overview | isotypes and subclasses orientation

Affinity, avidity and kinetic concepts in plain language

association and dissociation ideas | affinity versus avidity intuition | how these map to potency in assays (conceptual)

Session 2

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Paratopes, Epitopes & Determinants of Potency

Epitope classes and neutralisation mechanisms (conceptual)

receptor binding site and fusion region epitopes | conserved versus variable epitope choices | steric blocking versus allosteric effects orientation

Paratope shape and chemistry at a conceptual level

CDR length and composition ideas | electrostatics, hydrophobic and aromatic contacts | role of heavy and light chains in binding

Escape, variants and epitope resilience (conceptual)

mapping mutations on epitope surfaces | breadth versus potency trade offs | cocktail and bispecific concepts (orientation)

Session 3

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Affinity Maturation Concepts & Readouts

Natural affinity maturation in germinal centres (orientation)

somatic hypermutation concept | selection for higher affinity clones | implications for longitudinal samples

In vitro and in silico affinity maturation themes (conceptual)

display and selection style cycles overview **sequence level variant exploration** **structural and scoring readouts orientation**

Safety and developability considerations during optimisation (conceptual)

maintaining epitope specificity **aggregation and viscosity concepts** **link to immunogenicity and liability checks**

Session 4
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Design Brief: Towards Neutralizing Antibody Candidates

From target and epitope map to antibody design objectives (conceptual workflow)

define functional neutralisation goals **prioritise epitopes and regions of interest** **high level choice of antibody format**

Summarising binding and affinity maturation hypotheses (conceptual)

simple diagrams of epitope engagement **tables of candidate sequence or CDR ideas** **outline of optimisation cycles and decision points**

Handoff to discovery, engineering and clinical teams (conceptual)

content suitable for internal project kick off slides **clear assumptions and risk notes** **link to neoantigen, immunopeptidomics and systems modules**