Nanobodies Workshop: Binder Recovery by In Silico and In Vitro Panning

Monday 22 September 2025 - Friday 26 September 2025

University of Nova Gorica

Scientific Programme

The Nanobodies Workshop programme is now available for download on the right-hand side of this page. For more details on each session, please refer to the **Programme Contributions** section.

Our keynote speaker will be announced shortly.
Please note that minor changes to the schedule or session content may still occur.

Fundamentals of Nanobodies

Here we introduce the core principles of VHH library construction and display. Participants compare immune, naïve/pre-immune and synthetic library formats. They explore methods for generating diversity such as PCR amplification and CDR randomisation. The session also covers quality metrics—library size, complexity and error rates—and presents an overview of phage, yeast and ribosome display workflows.

In Silico Modelling and Design

These sessions introduce core computational workflows for nanobody discovery, beginning with repertoire profiling and homology modelling to generate initial VHH structures and assess binding via virtual panning and docking. It then progresses to *de novo* design strategies, showcasing machine-learning and mutational-scanning approaches for proposing novel CDR variants with enhanced stability and affinity.

Experimental Panning

These sessions focus on hands-on selection techniques for recovering antigen-specific VHHs. Participants run phage-display panning rounds, learn to adjust washing stringencies and elution methods, and compare solid-phase versus live-cell panning protocols. The session emphasises optimization at each round to maximise binder enrichment.

Biophysics and Optimization

This session focuses on computational approaches for predicting and improving nanobody biophysical properties. Beginning with homology modelling, molecular docking and molecular dynamics, it explores how these methods can assess stability, affinity and aggregation propensity of VHHs. Given the compact size of nanobodies (~125 amino acids), such simulations can be performed efficiently, culminating in protocols that use all-atom dynamics and whole-molecule docking to evaluate sequence tolerance to mutation and guide optimization strategies.

Structural and Imaging Applications

Here we address the role of nanobodies in structural biology and advanced microscopy. The session begins by examining how VHHs act as crystallization chaperones and cryo-EM stabilizers, reducing conformational heterogeneity, stabilizing transient protein states and serving as fiducial markers to improve particle alignment and orientation diversity. The session then explores super-resolution fluorescence imaging with monovalent, minimal-linkage-error nanobody probes, covering customizable labeling chemistries, quantitative live-cell kinetics and plug-and-play systems such as anti-GFP and anti-ALFA-tag nanobodies.

PhD2PhD

Each evening, early-stage researchers have the opportunity to present a concise overview of their PhD projects or novel methodological concepts in ten minutes, followed by a moderated discussion. This sessions are designed to encourage peer feedback, collaborative problem-solving and the exchange of practical insights.

Keynote Lecture

Plenary keynote addresses broad perspectives on the current research landscape and future directions of nanobody science. More information to follow.