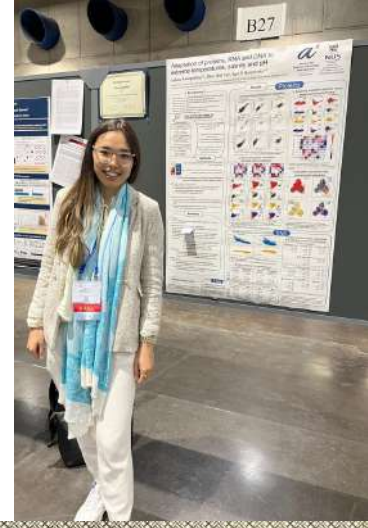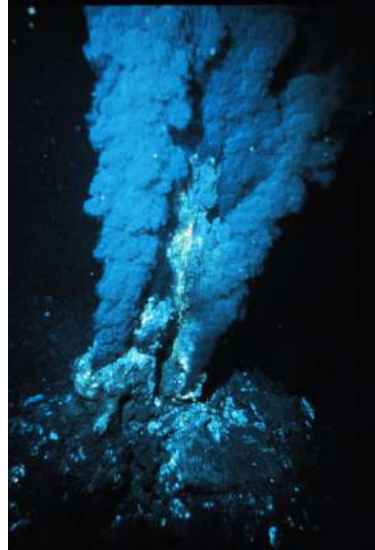# Igor Berezovsky group:
Physics and evolution of biological macromolecules

BII Annual Conference
May 12, 2023

Molecular mechanisms of adaptation
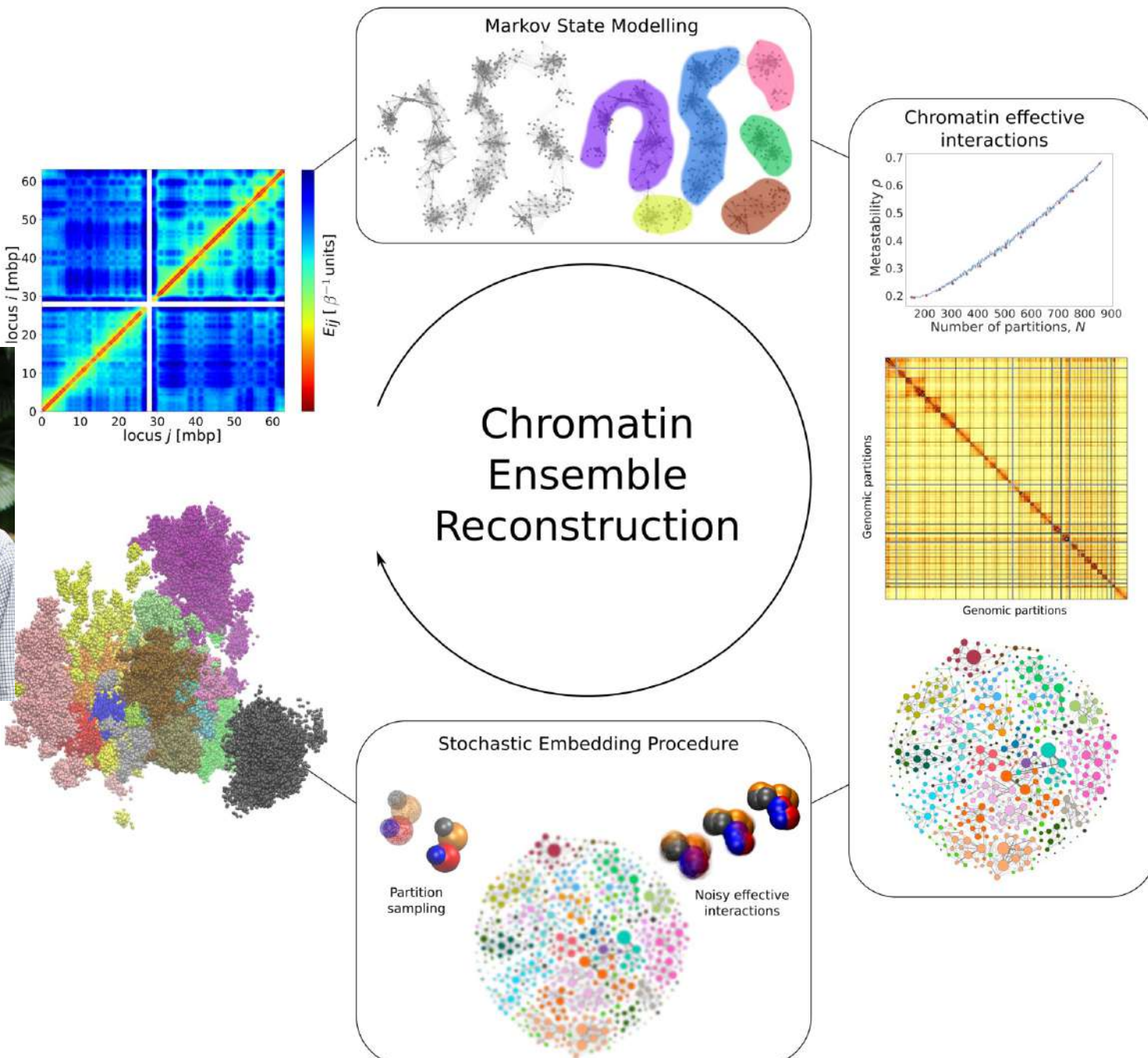
pH

Salinity

Temperature

# Chromatin structure, dynamics, and epigenetic regulation

Markov State Modelling

Chromatin effective interactions

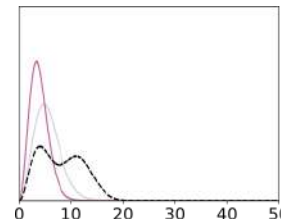Chromatin Ensemble Reconstruction

Stochastic Embedding Procedure

Partition sampling

Noisy effective interactions

Genomic partitions

Zhen Wah Tan

Enrico Guarnera

Chromatin architecture in olfactory sensory neurons: looking for the link from COVID-19 infection to anosmia
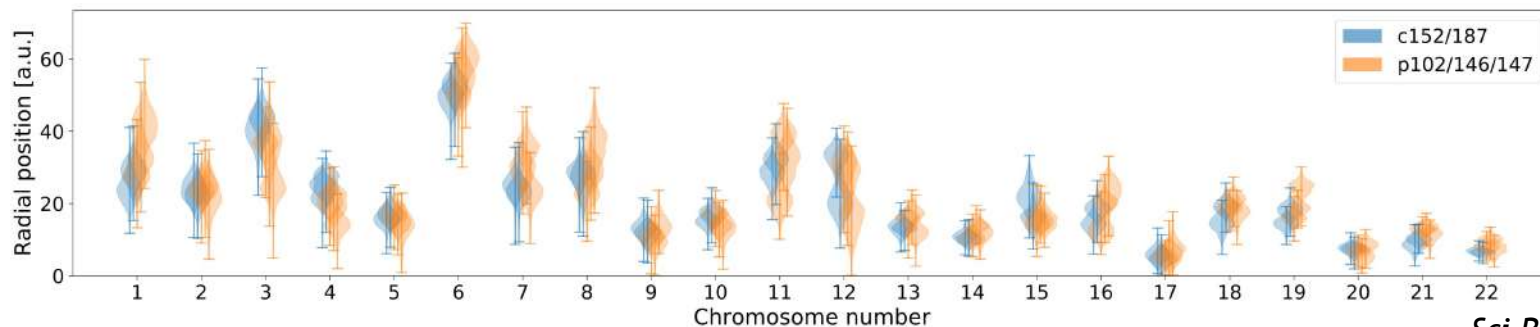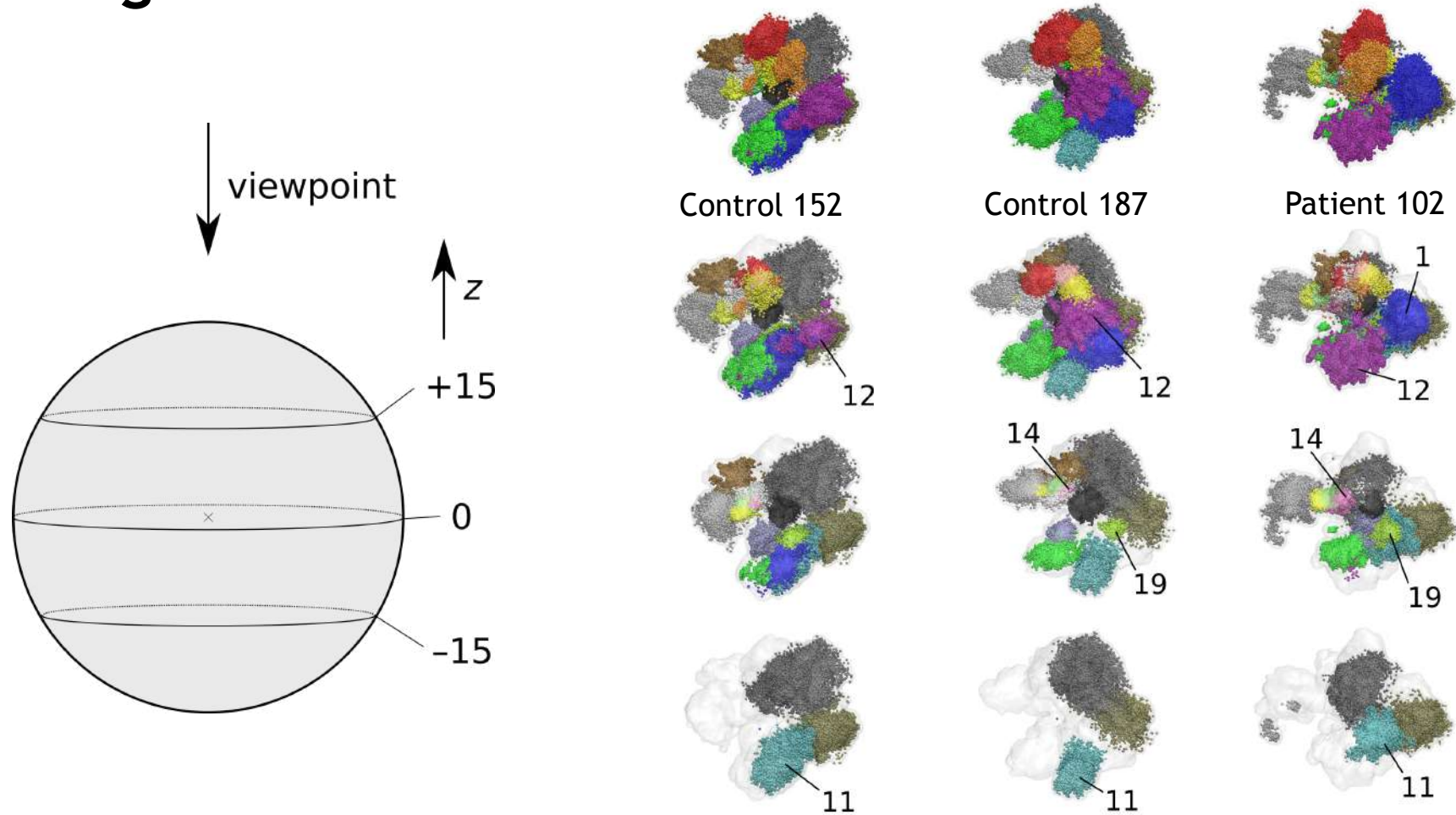
Chromosomal intermingling and interactions
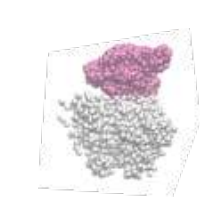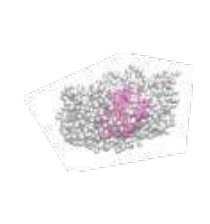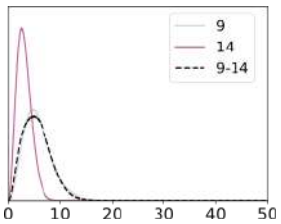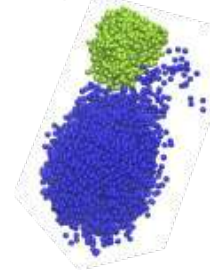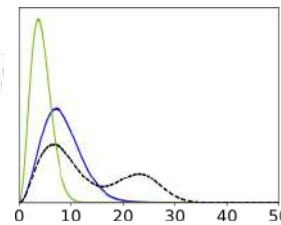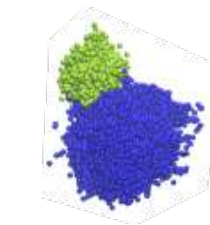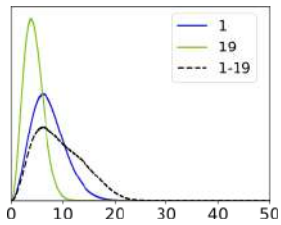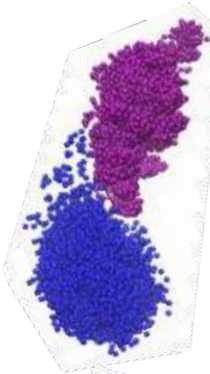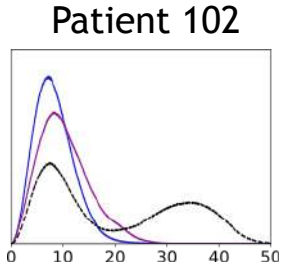
Local hierarchy of chromatin structural organization

Local chromatin structural organization in Class I and II olfactory receptor gene clusters

Generic framework for obtaining allosteric control over protein function

Structure-based statistical mechanical model of allostery (SBSMMA)

Allosteric Signaling Map

Allosteric Probing Map

AlloSigMA   AlloMAPS
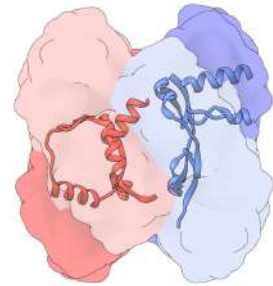
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http://allomaps.bii.a-star.edu.sg
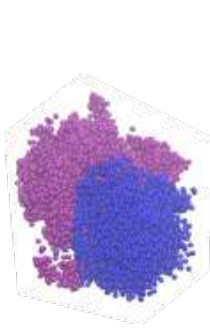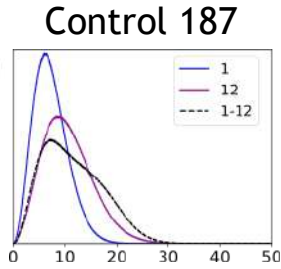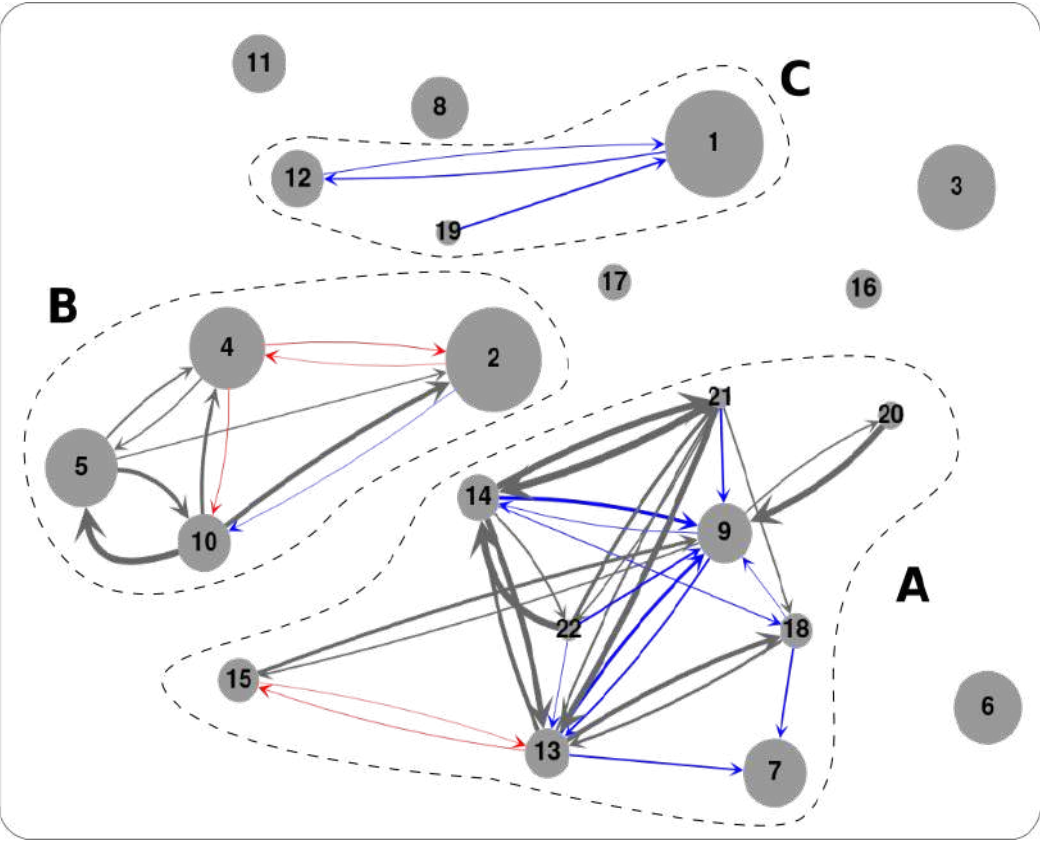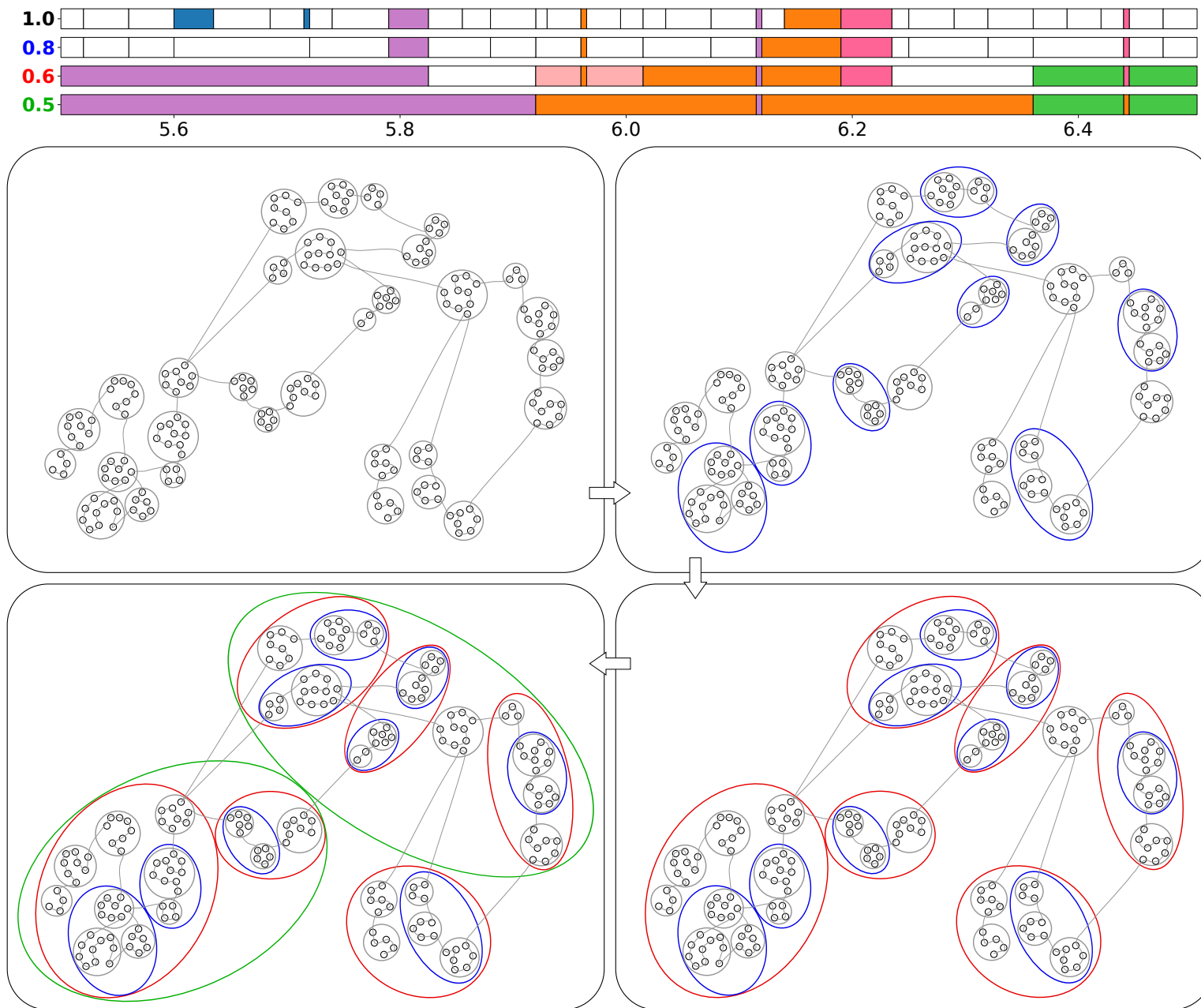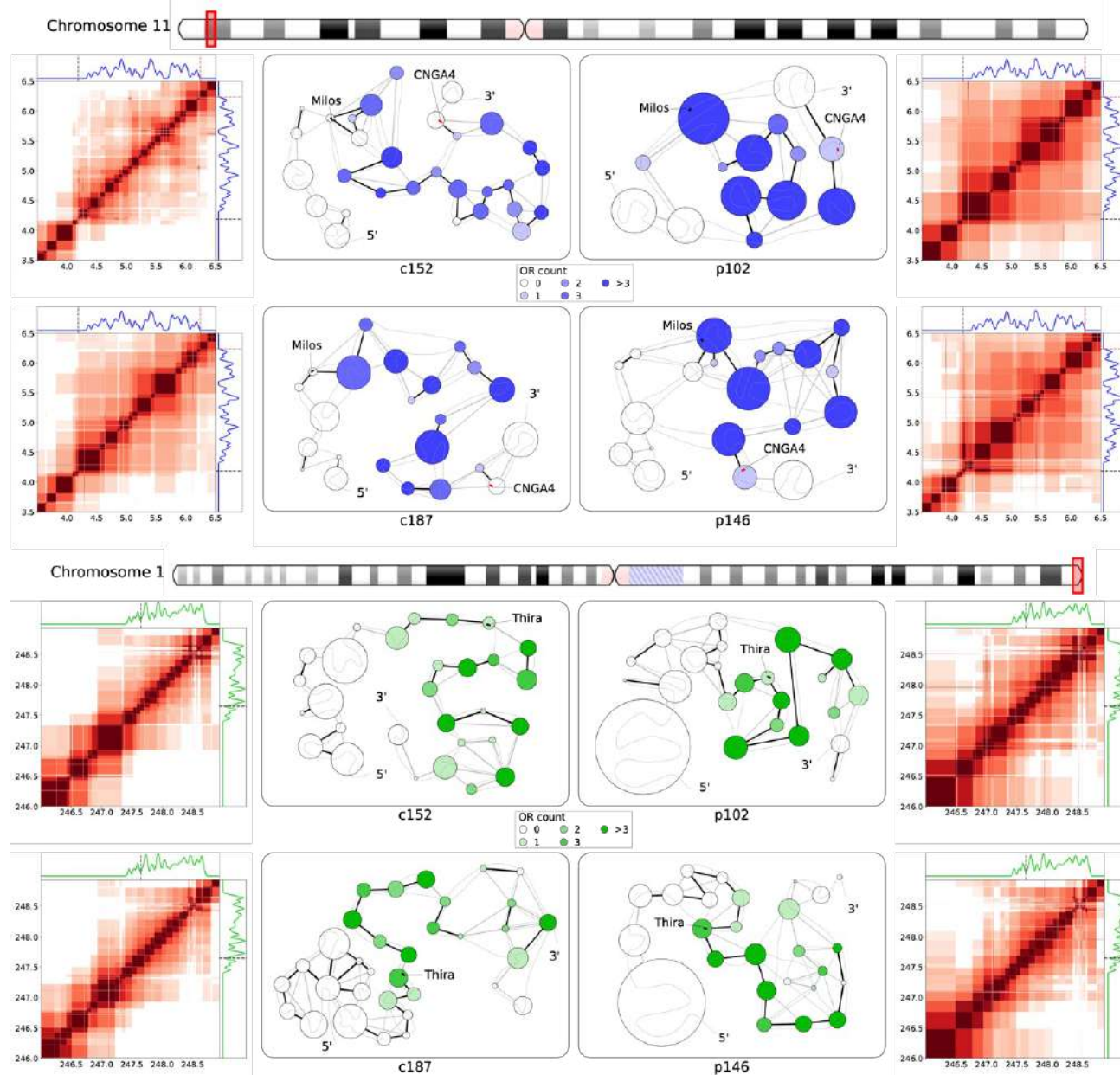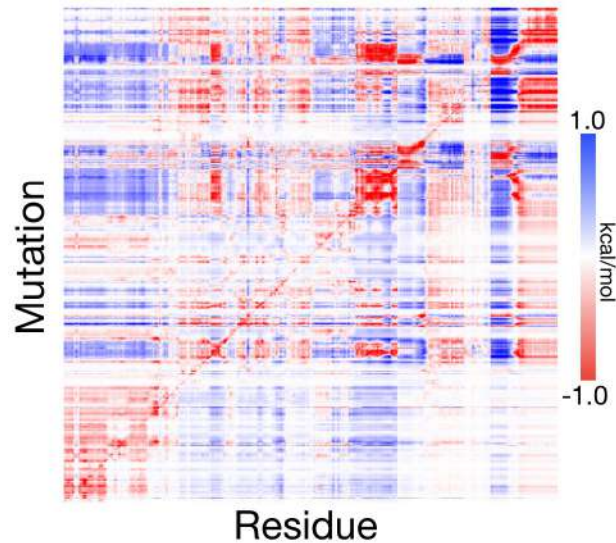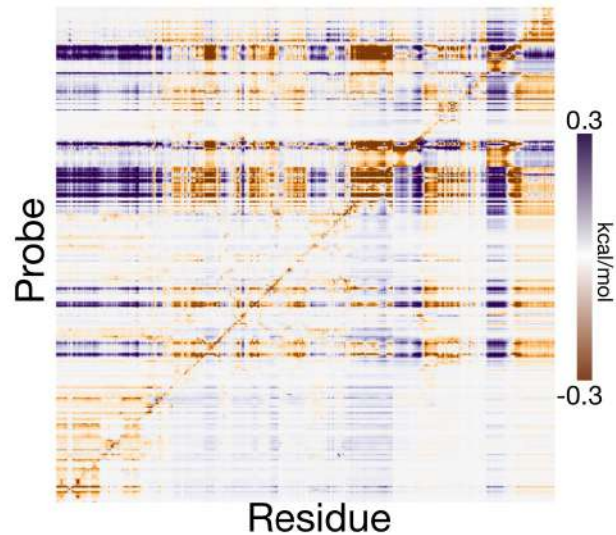NAR (2023) 51, D345   NAR (2020) 48, W116

Recent targets and topics of interest

- Allostery in SARS-CoV-2 Spike protein: *Structure* **30**, 590-607 (2022)

- Allosteric biologics/drugs : *J Mol Biol* **434**, 167577 (2022)
  J Mol Biol **434**, 167692 (2022) *J Mol Biol* **434**, 167751 (2022)

- Allosteric fingerprints of AlphaFold proteins: *NAR* **51**, D345 (2023)

- Sequence-dependent model of allostery: *J Chem Phys* **158**, 135101 (2023)

15 September 2022 / Volume 434 / Issue 17

jmb
Journal of Molecular Biology

Special Issue:
Allostery: From Mechanisms to Therapies
Edited by Igor N. Berezovsky and Ruth Nussinov

Sequence-dependent model of allosteric communication

A Sequence dependent couplings

$B(A_i, A_j)$

$$J_{ij} = B(A_i, A_j)\, \sigma(d_{ij})$$

$\sigma(d_{ij}) = 1/(1 + e^{(d_{ij} - d_c)/\xi})$
$d_c = 8\ \text{Å}$
$\xi = 0.1$

$\sigma(d)$ vs distance d [Å]

B Ensembles from elastic network decomposition

C Free energy map
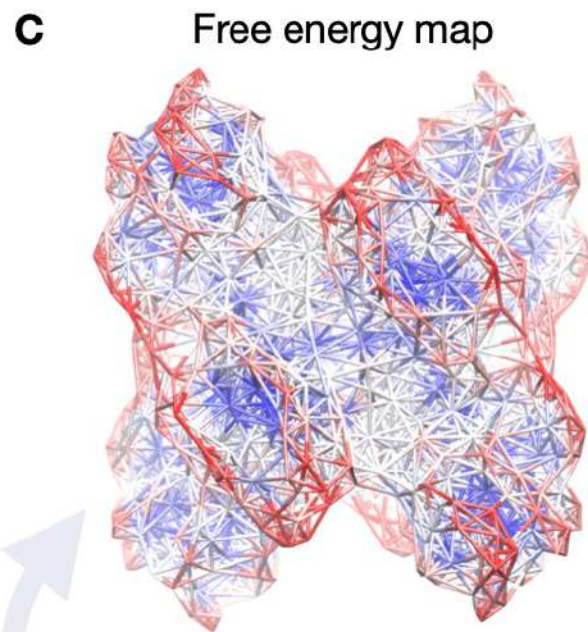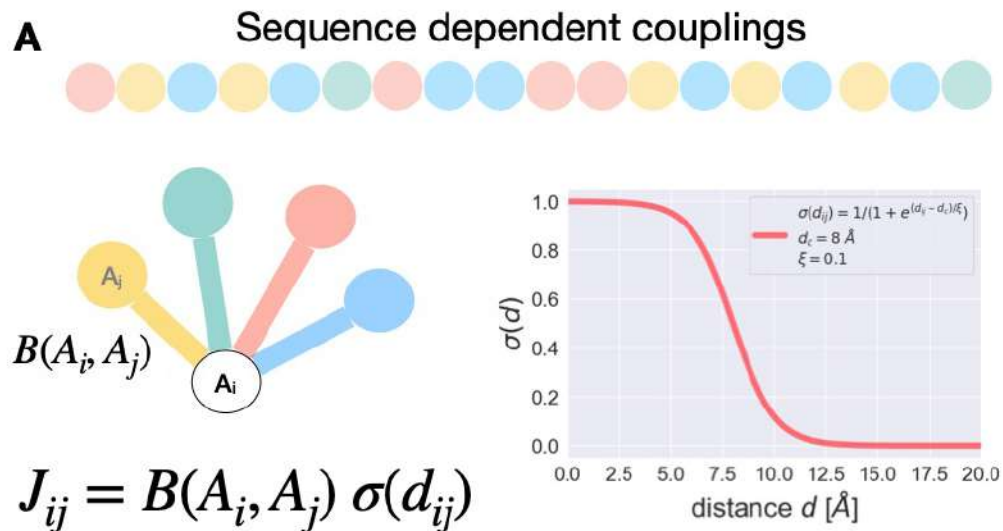
Enrico Guarnera
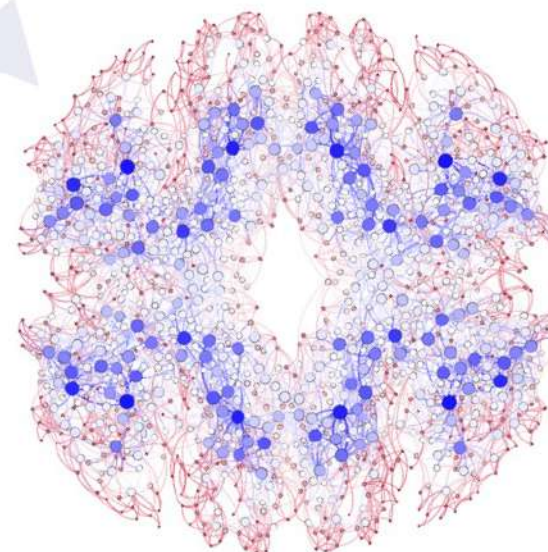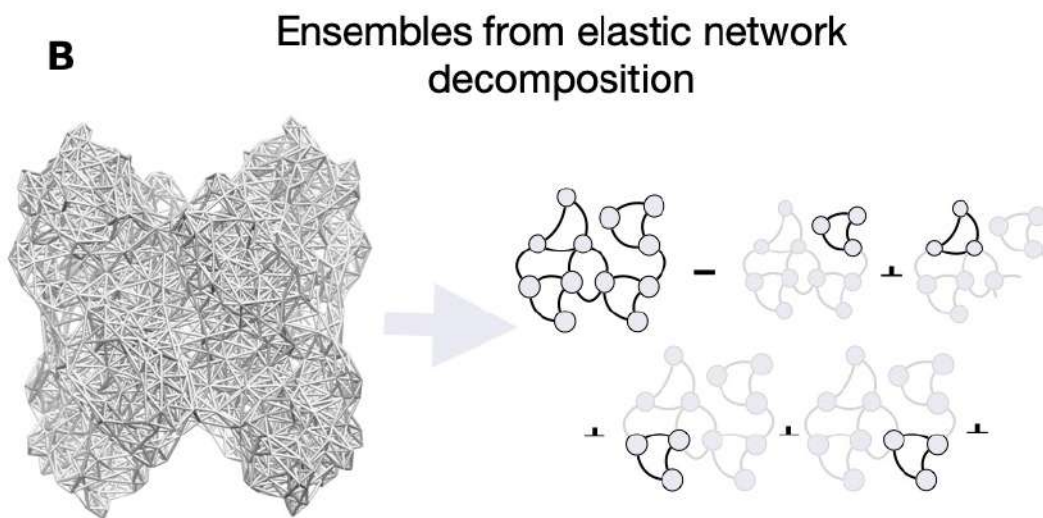
From drug repurposing to design for high specificity

Orthosteric site

Drug Repurposing

Allosteric site
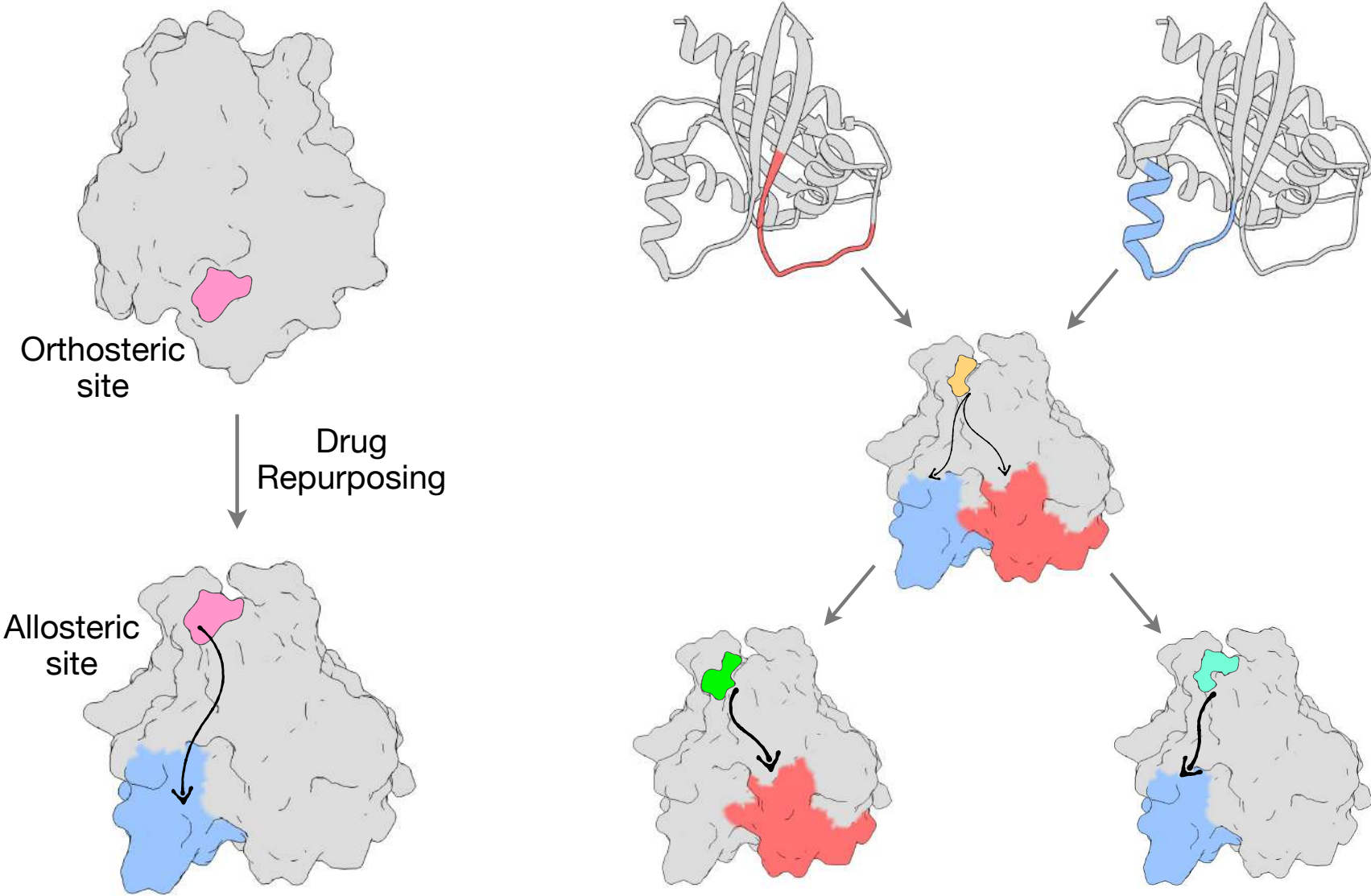
Wei-Ven Tee
CDA 2021

Sylvester Lim

2022-2023 contributions

- *Structure* **30**, 590-607 (2022)
- *J Mol Biol* **434**, 167577 (2022)
- *J Mol Biol* **434**, 167692 (2022)
- *J Mol Biol* **434**, 167751 (2022)

- *NAR* **51**, D345 (2023)
- *J Chem Phys* **158**, 135101 (2023)
- *Sci Rep 13*, 5906 (2023)

Technology Disclosure BII/Z/14042: patent application in preparation

Acknowledgments

The group

Recent alumni

Sylvester Lim   Aidana Amangeldina   Bingxue Dong   Wei-Ven Tee   Enrico Guarnera   Zhen Wah Tan