

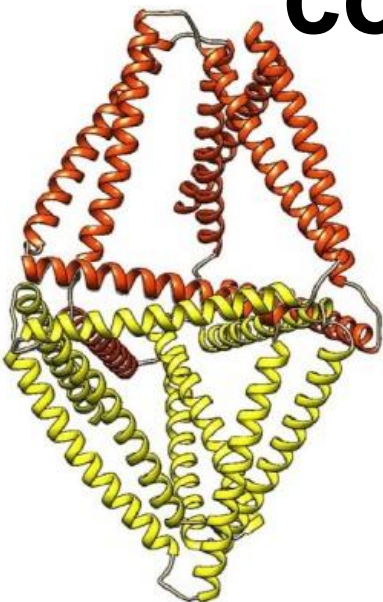


NATIONAL INSTITUTE OF CHEMISTRY



ERC Advanced Grant

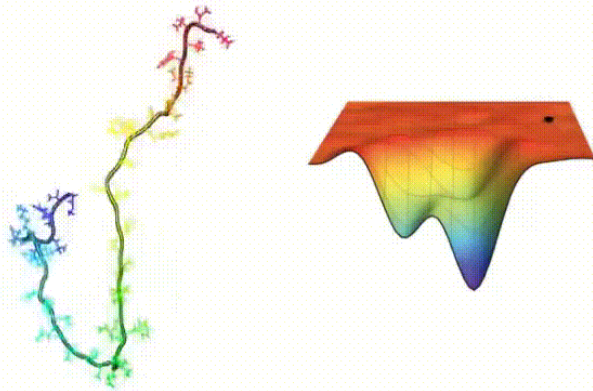
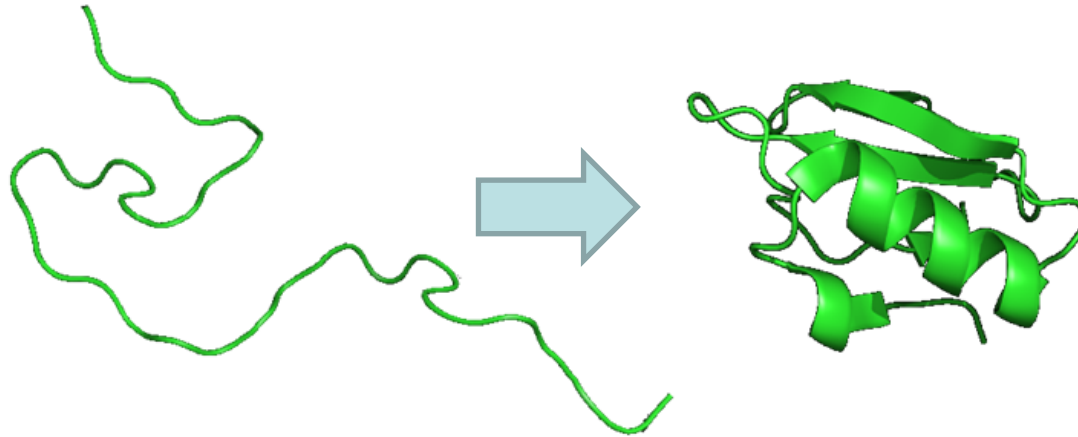
Molecular machines based on coiled-coil protein origami (MaCChines)



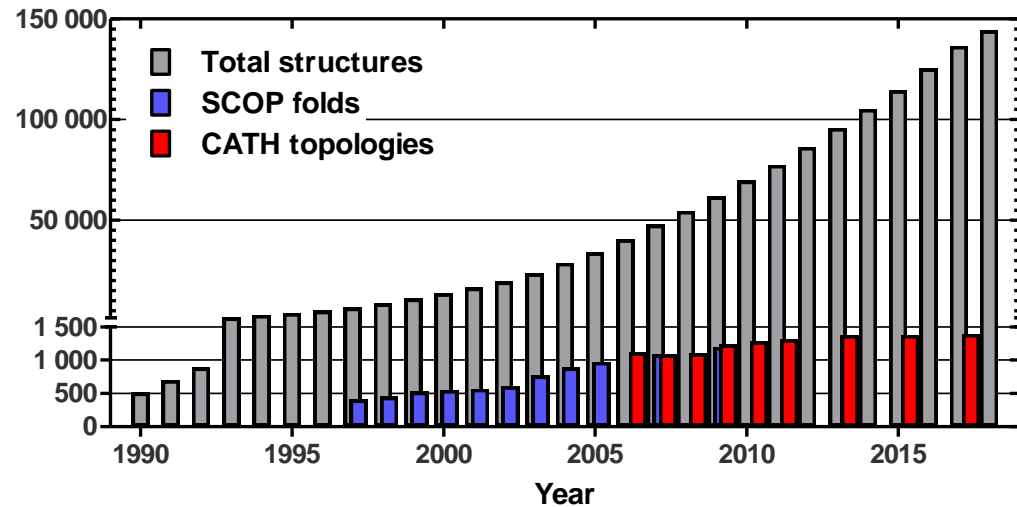
Roman Jerala

**Department of synthetic biology and immunology
National institute of chemistry**

Natural protein origami



<https://gycat.com/gifs/detail/hopefulliveasianpiedstarling>

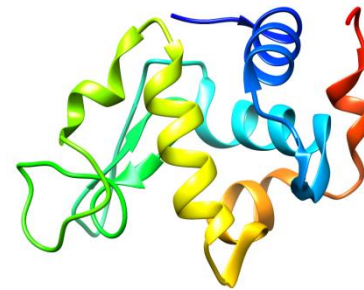
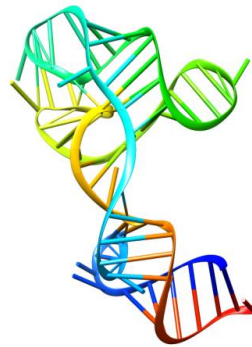


Natural and designed bionanostructures

DNA

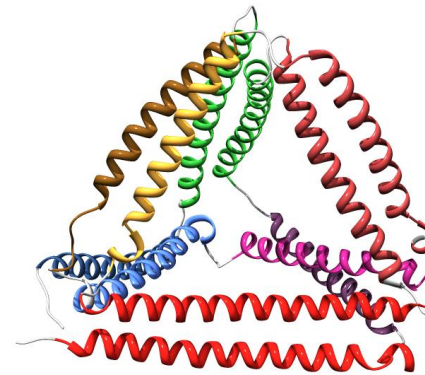
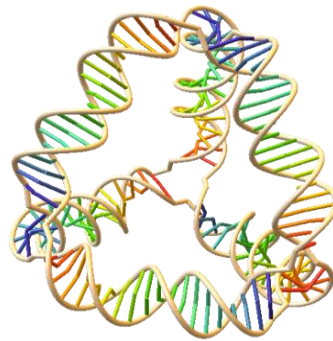
Protein

**Natural
globular
fold**



Analogue

**Modular
fold**

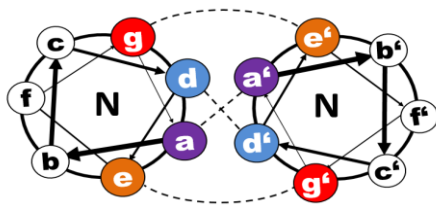
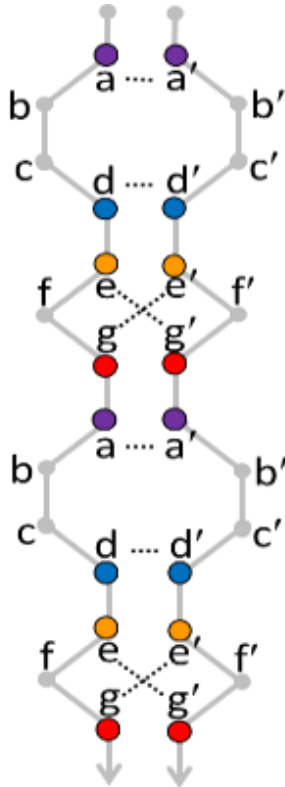


**Discrete/
Modular**

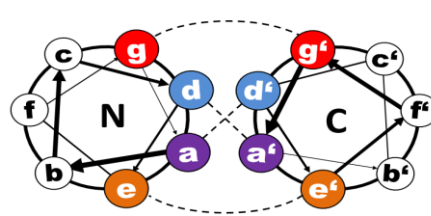
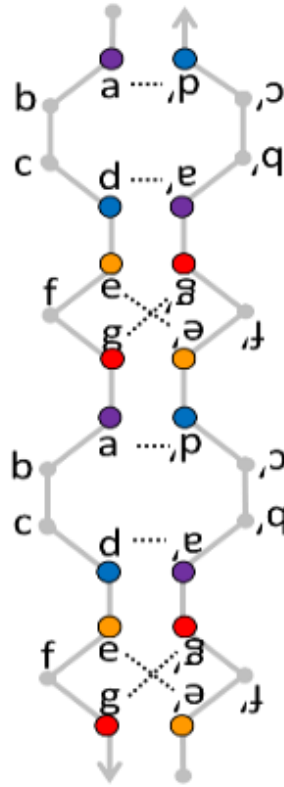
Building block dimerization specificity

Coiled-coil dimers

parallel dimer

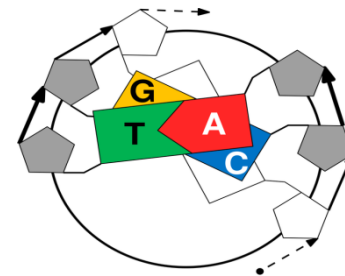
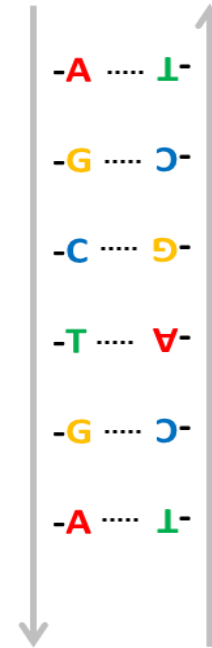


antiparallel dimer

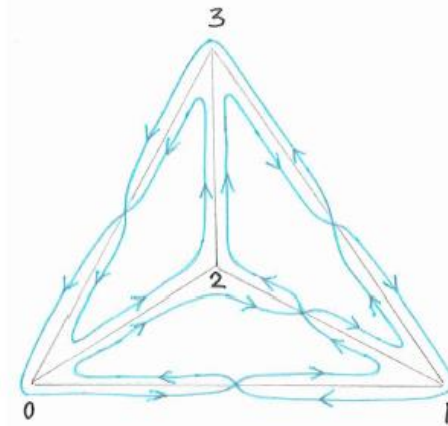
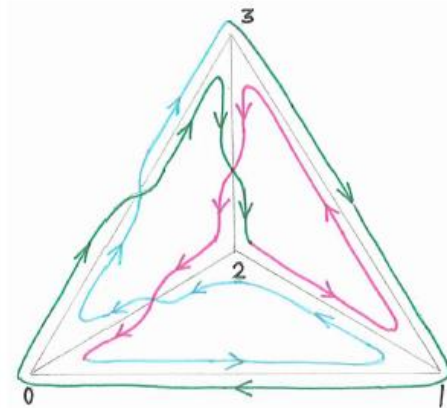
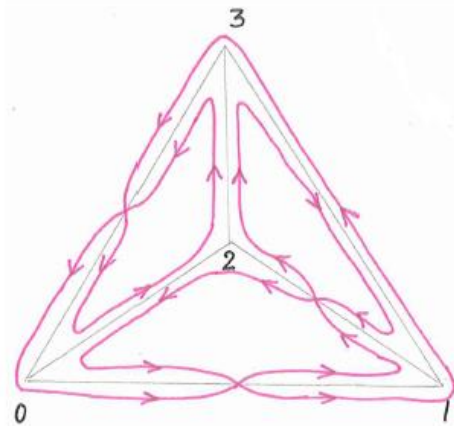
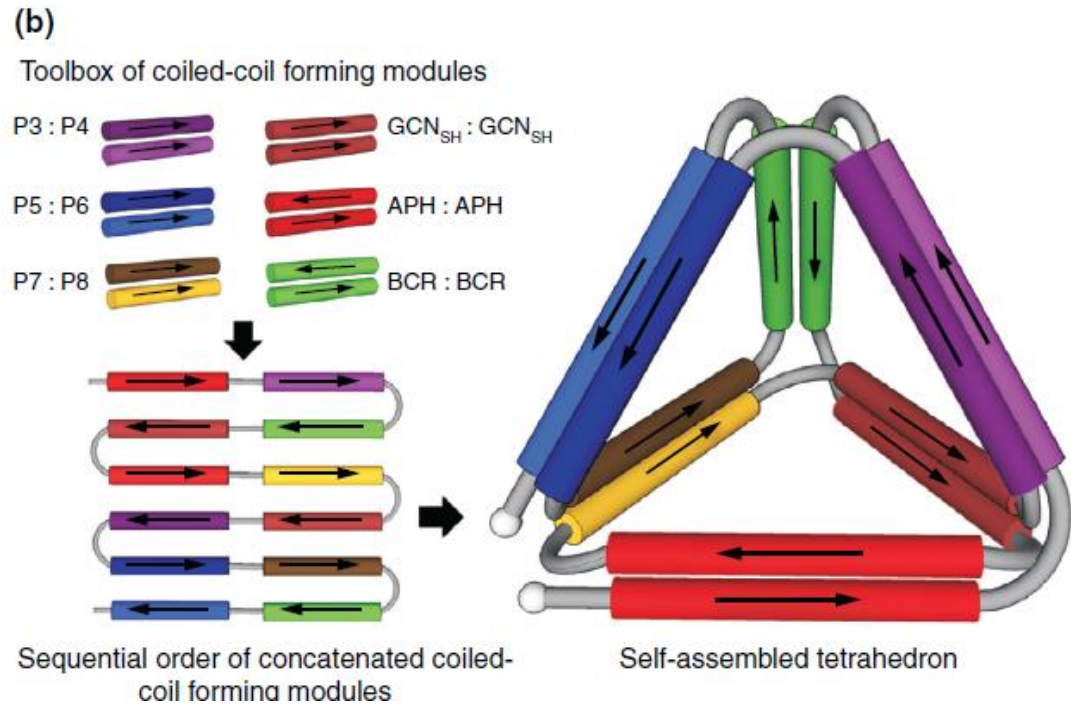
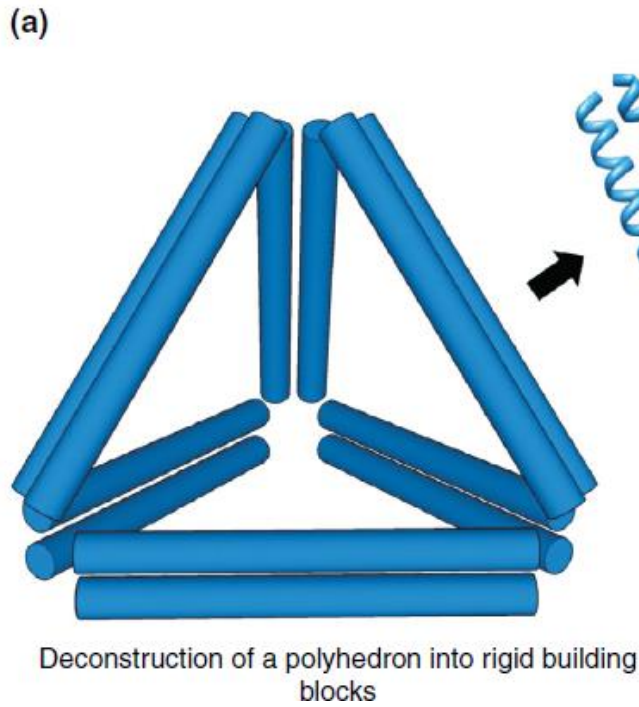


DNA

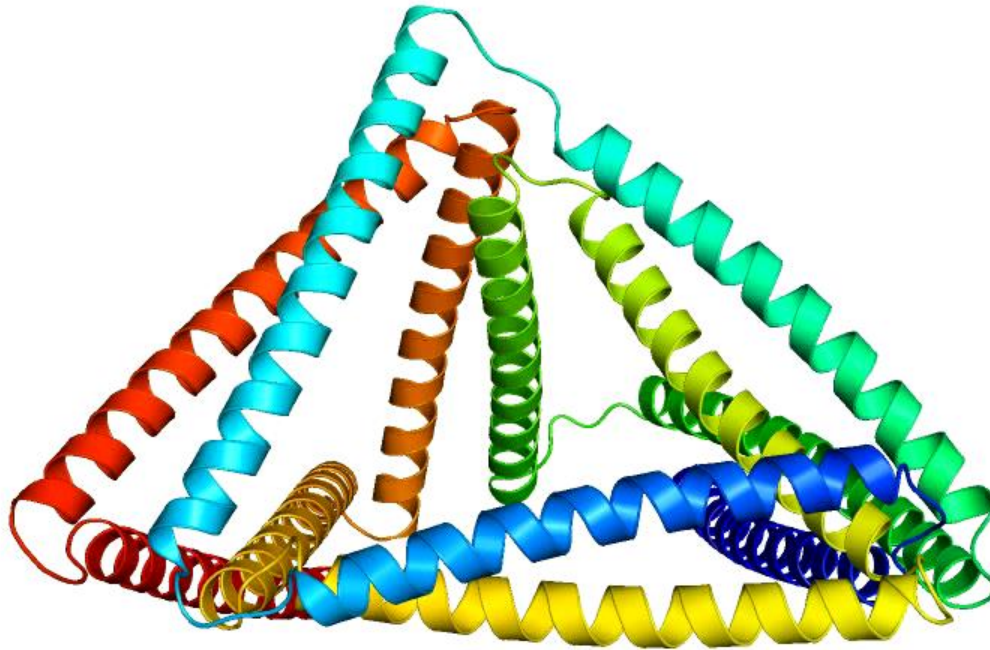
antiparallel dimer



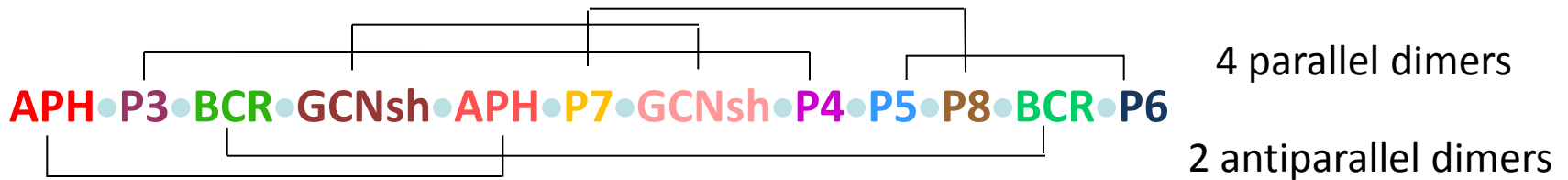
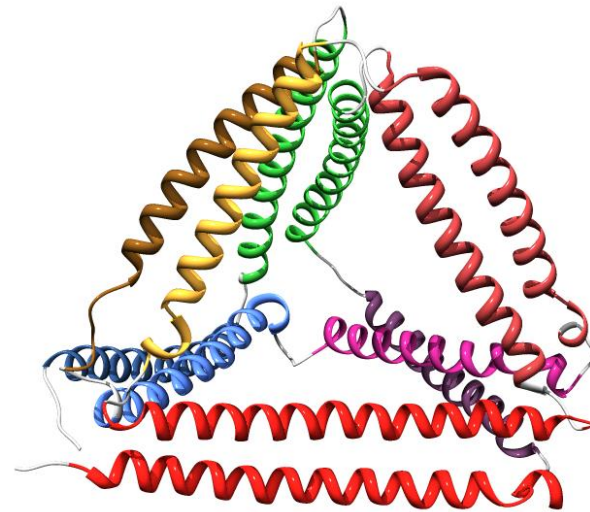
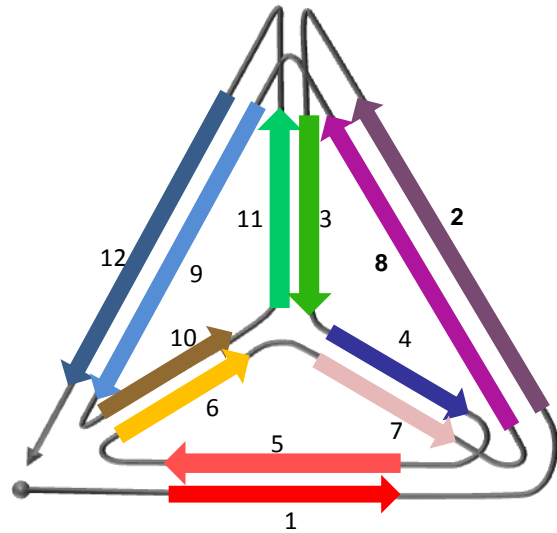
Deconstructing shape into modules



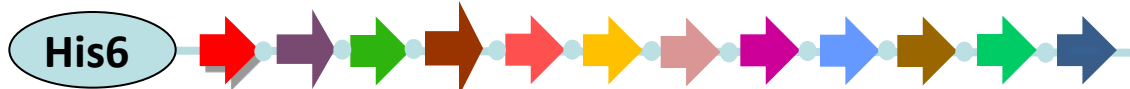
Design of a tetrahedral protein cage



Design of a tetrahedral protein cage

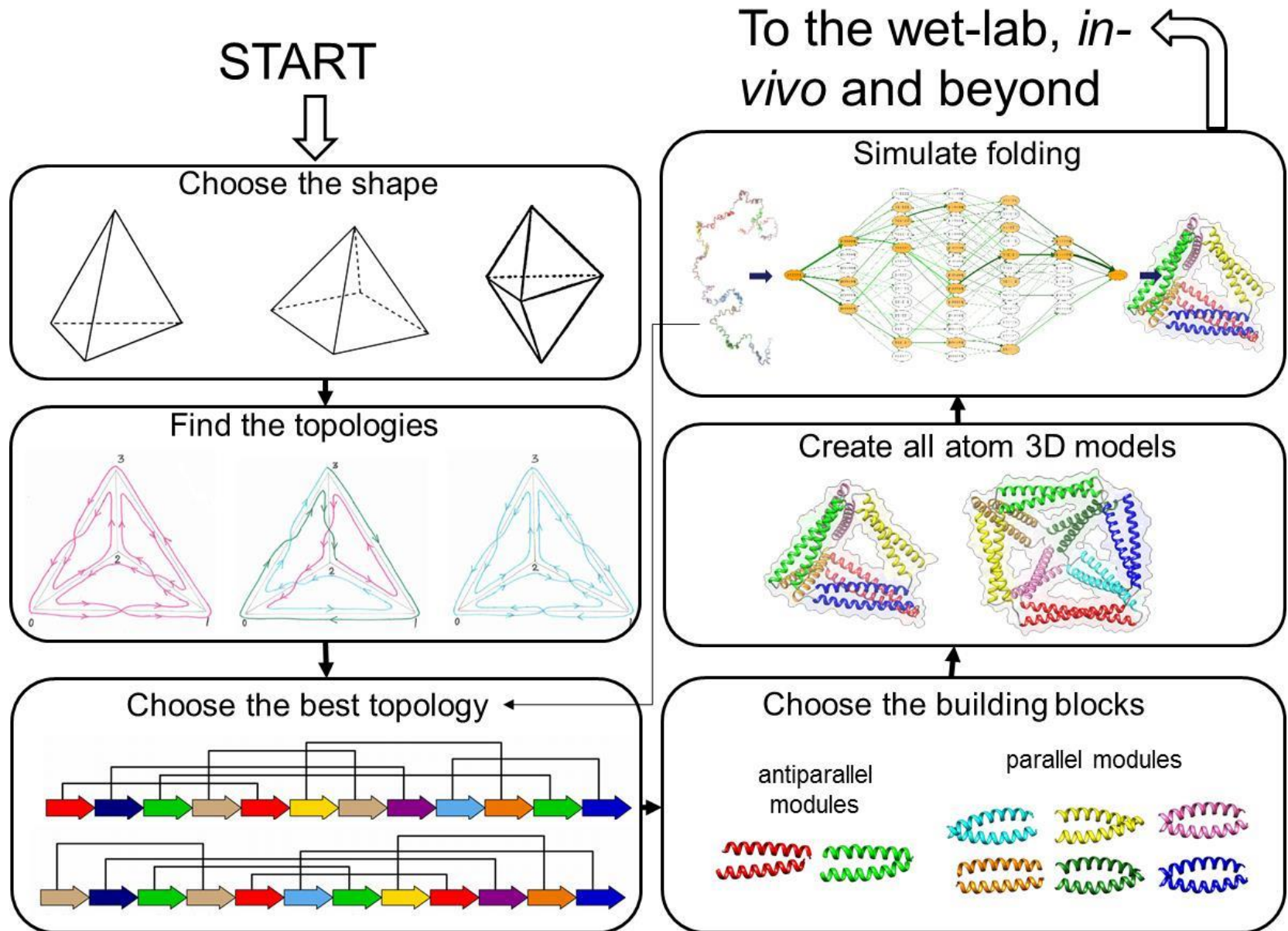


TET12



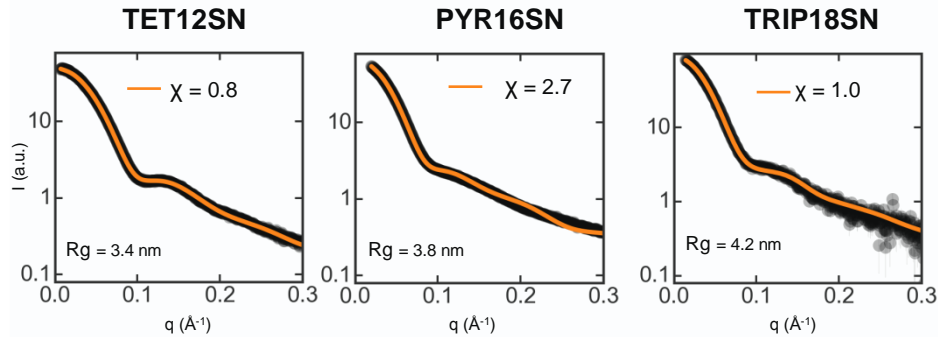
• flexible tetrapeptide linker

Pipeline for the design of CCPO



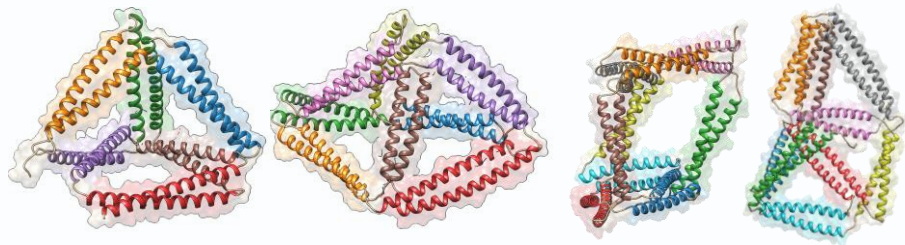
Structural analysis

SAXS

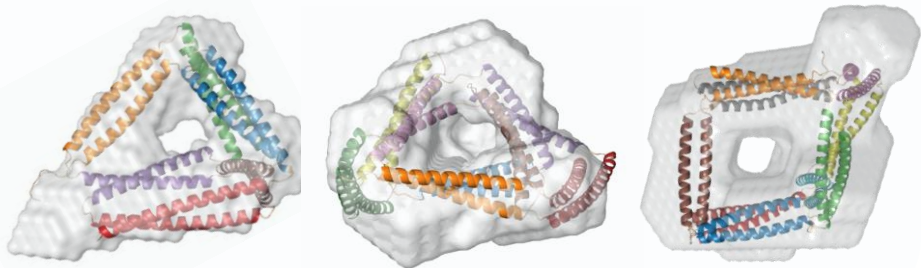


Small Angle Light Scattering

← X-ray scattering curve fitted to the theoretical profile



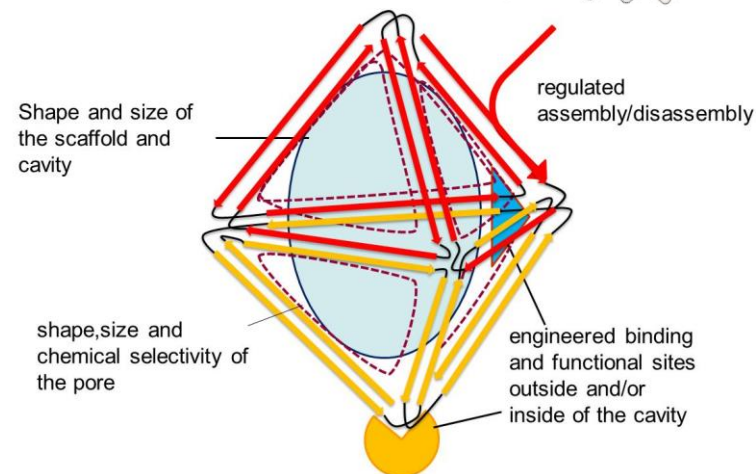
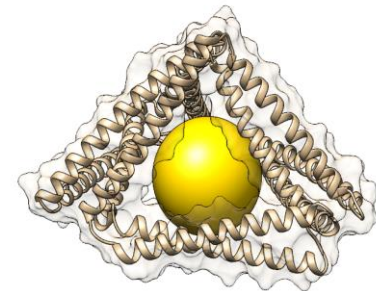
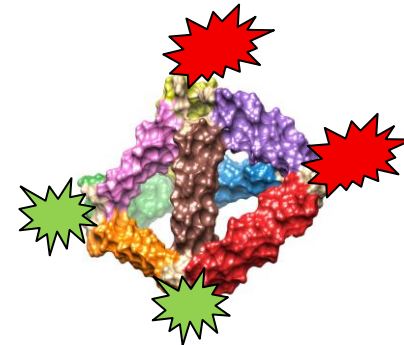
← Model used to fit the scattering curve



← Volumetric reconstruction of the scattering profile

Challenges for the ERC AdG MaCChines

- Design of complex functional nanostructures
- Cages based on new types of building modules
- Design of molecular knots
- Molecular cargo encapsulation
- Regulation of assembly/disassembly – molecular machine
- Technology for rapid gene assembly
- Applications: vaccines, drug delivery, enzyme encapsulation, sensors, catalysts...



Acknowledgements

Helena Gradišar

Fabio Lapenta

Ajasja Ljubetič

Andreja Majerle

Žiga Strmšek

Jana Aupič

Mojca Benčina

Duško Lainšček

Iva Hafner Bratkovič

San Hadži

Sandi Klavžar

Nino Bašič

Tomaž Pisanski

