Secondary structure in *de novo* designed peptides induced by electrostatic interaction with particles and membranes.

**Aim**

We are interested in design principles which will enable us to design peptides that adopt a given secondary structure upon attachment to a surface. We want to use this to design peptides which...

- adopt a pre-determined secondary structure upon attachment to a surface
- are selective to certain membranes
- induce lipid domains upon attachment
- have surface-activated function

**General design principles**

A helical wheel representation of a 28 amino acid peptide, designed to form an α-helix on a negatively charged surface.

**A catalytic example**

A His15-Lys19 pair forms a catalytic site for ester hydrolysis which is active only when the peptide is helical.

**Peptide-membrane interaction**

Compared to particles, membranes provide...

- Wider range of pH-stability
- Dynamic interface
- Varied surface composition

Membrane-peptide interactions are of relevance also to...

- Cell-penetrating peptides
- Antibiotic peptides
- Lipid raft targeting

**Anionic membranes**

We use large unilamellar vesicles (*d* ≈ 100 nm), composed of Cholesterol / DOPG / DOPC where the (anionic) DOPG content is used to control surface charge.

**The cationic peptides**

The peptides R2L and R2V have similar structure, but differ in the hydrophobic position. Both are *unstructured* on silica particles.

**Summary**

- Both peptides are random-coil in solution
- R2L peptides form α-helices upon attachment to negatively charged membranes, while R2V peptides form β-sheets
- The structure is (largely) unaffected by pH
- The degree of secondary structure is proportional to vesicle surface charge