

## Exercise Sheet 5

*Aim: Recognizing amino acids, hydrogen-bonds and salt bridges in protein structures, as well as their function in secondary, tertiary, and quaternary structural elements of proteins.*

### **Protein structure: Introduction and basic analysis of structure**

#### **Exercise 5.1: The 20 amino acids**

For the interactive material for this exercise follow this link:

[https://www-cbi.cs.uni-saarland.de/wp-content/uploads/Softwarewerkzeuge\\_Teil\\_2/start.html](https://www-cbi.cs.uni-saarland.de/wp-content/uploads/Softwarewerkzeuge_Teil_2/start.html)

Start with 1. Einführung in die Strukturanalyse von Proteinen

- (1) Which is the largest amino acid, and why?
- (2) What is special about proline?
- (3) What is special about glycine?
- (4) Which residues (=amino acids) are most hydrophobic, and according to what criteria?

#### **Exercise 5.2: primary, secondary, tertiary, and quaternary structure**

Go back to start.html and follow the link

2. Elementare Strukturanalyse von Proteinen

Go through the shown links subsequently.

(a) primary structure

- (1) Which one is the smallest residue?
- (2) Which is the largest residue?
- (3) Which ones are the negatively charged residues?
- (4) Which ones are the positively charged residues?
- (5) Which one do have alcohols as side chains?
- (6) Which one possess the most flexible side chains?
- (7) Which ones are the most rigid residues?

(b) secondary structure

- (1)  $\alpha$ -helices: How many residues are required for one turn?
- (2)  $\beta$ -sheets: Compare the difference in patterns, respectively the orientation of the hydrogen-bonds between parallel and anti-parallel  $\beta$ -sheets. What are the most obvious differences?

(c) Final questions

- (1) Which amino acids do you expect at the surface of proteins (solvent exposed)?
- (2) And which ones should appear in the (hydrophobic) interior of proteins?
- (3) Which amino acids are typically found in the catalytic centre of enzymes?
- (4) What is characteristic about transmembrane proteins and membrane associated proteins regarding the amino acids in the transmembrane region?
- (5) How is a domain defined regarding its structure?