Proteins

an introduction

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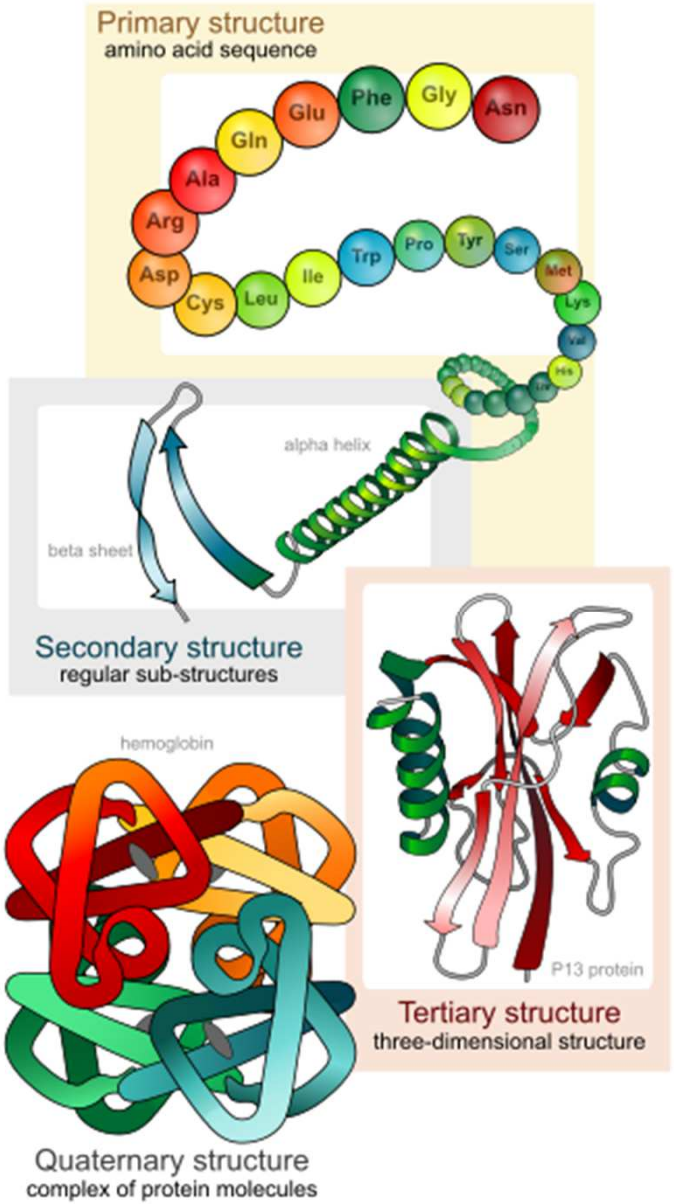


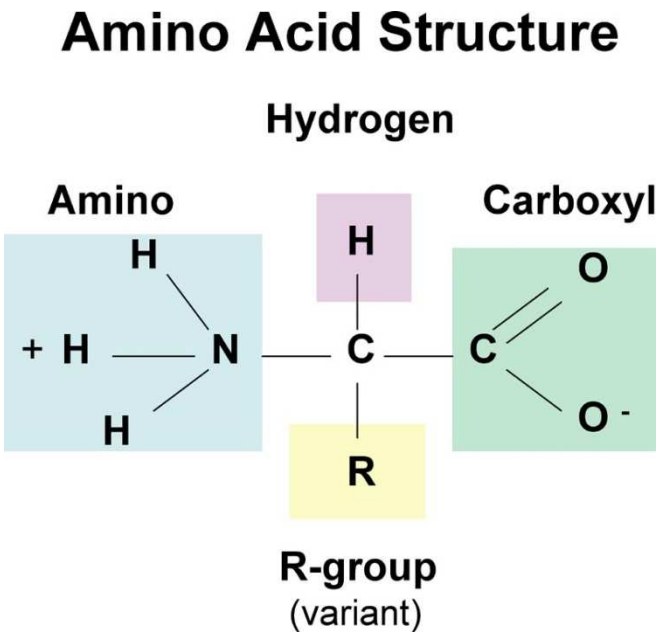
What is a protein?

- A protein consists of one or more polypeptides
- A polypeptide is a linear chain of amino acids bonded together by peptide bonds between the carboxyl and amino acid

- Primary structure = sequence of amino acids
- Secondary structure = folding of polypeptide chain into specific substructure (e.g. α-helix)
- Tertiary structure = substructures together form a 3-D structure of the protein
- Quaternary structure = structure formed by several protein

Characteristic for each protein

- amino acid composition and order



<u>The R-group varies in…</u>

- (un)charged groups
- presence of (di)sulfide groups
- hydrophobicity

<u>…and determines the</u>

- folding of the polypeptide chain
- iso-electric point = pH at which net charge is zero
- overall hydrophobicity and solubility
- heat denaturation temperature = temperature at which protein starts to unfold

TOGETHER they determine protein functionality!

Some more info…

- Protein has a high nutritional value
- Upon heating some proteins form a gel
- Most proteins can stabilize interfaces, e.g. in foams and emulsions

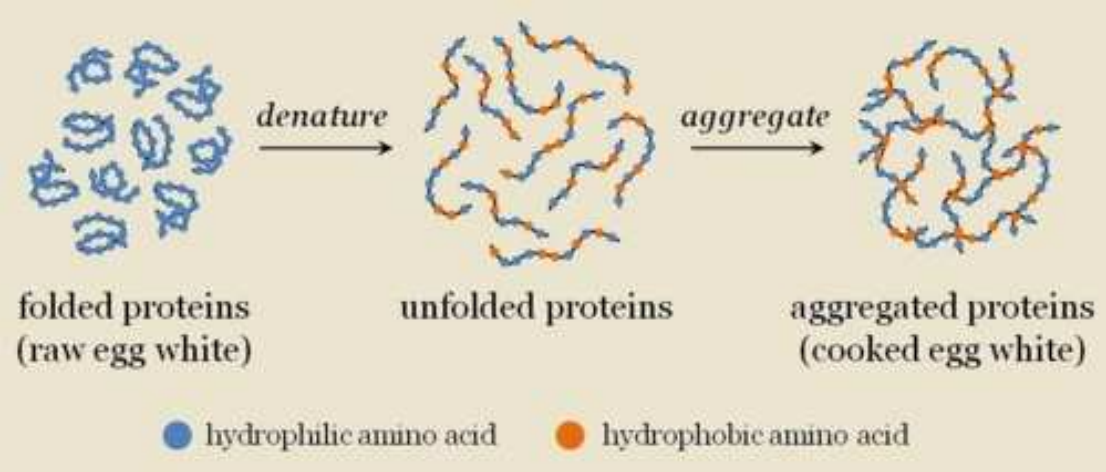
- Proteins may be globular (spheres), random coil or fibrillar (strands)

- Sources of protein, with each different functionality

- Milk, e.g. caseins	→ cheese	→ fracture
- Egg, e.g. ovalbumin	→ negerzoenen	→ stabilization air bubbles
- Wheat: gluten	→ bread	→ elasticity
- Soy beans, e.g. glycinin	→ tofu	→ water holding capacity
- Meat, e.g. gelatine	→ winegums	→ elastic network

- Industry uses mixtures of proteins, e.g. whey protein concentrate, soy protein isolate, egg white protein

Protein functionality – gelation



Heat treatment → unfolding → aggregation → gelation

Gelation kinetics and gel strength are a.o. influenced by:

- temperature-time
- pH
- presence of salts
- protein concentration

NOT every protein denatures and forms gels!

Processing conditions

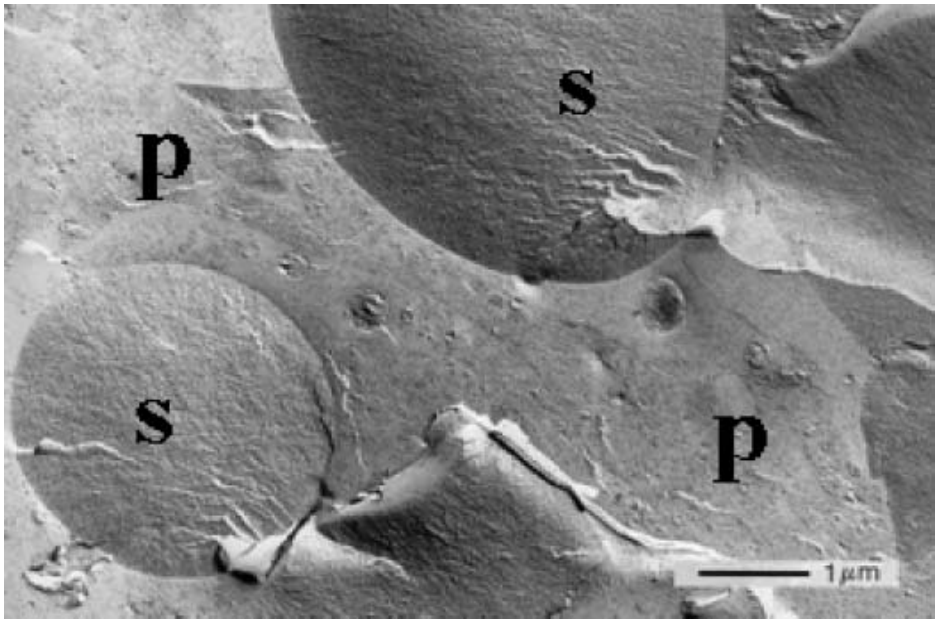
- heat → denature (unfold) → aggregation → gelation

- pH → pH2 → hydrolysis → breakdown into peptides (e.g. in gastro-intestinal tract)
- pH → iso electric point → zero net charge → cluster formation → insoluble

- salt → screening of charges on protein → increase and then decrease solubility

Pasta & Gluten

- Gluten is a vital component of pasta structure → firmness and elasticity
- 80% of gluten consists of gliadin and glutenin
- Gluten are not soluble in water



TEM image of spaghetti dried at low temperature.
(**p,** protein matrix; **s**, starch granule).