



Proteins: Exploring the Structure and Isolation from milk

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What will we learn today?

- Proteins and their structure
- Look into tools to understand 3D structure
- Work on a hands-on activity to isolate protein from milk

When you think about a protein what comes to your mind?



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Where are proteins found?

Examples

Food Sources

- Seafood
- Meat
- Milk
- Eggs
- Nuts
- Lentils

Human body

- Nails
- Hair
- Muscles/organ tissues
- Hormones
- Enzymes
- Receptors

Microorganisms

- Bacteria
- Fungi

Non Living

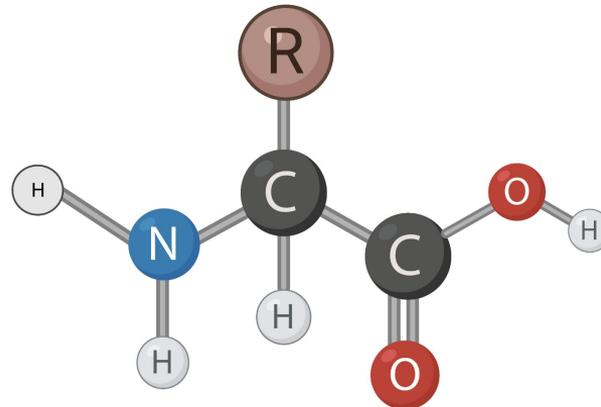
- Viruses



What are Proteins Chemically?

Basic component of living cells: made up of C, H, O, N, S

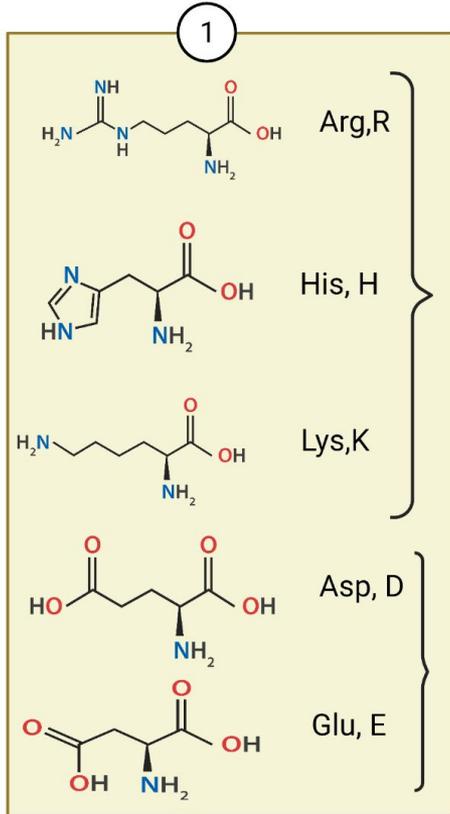
Building block: Amino acid



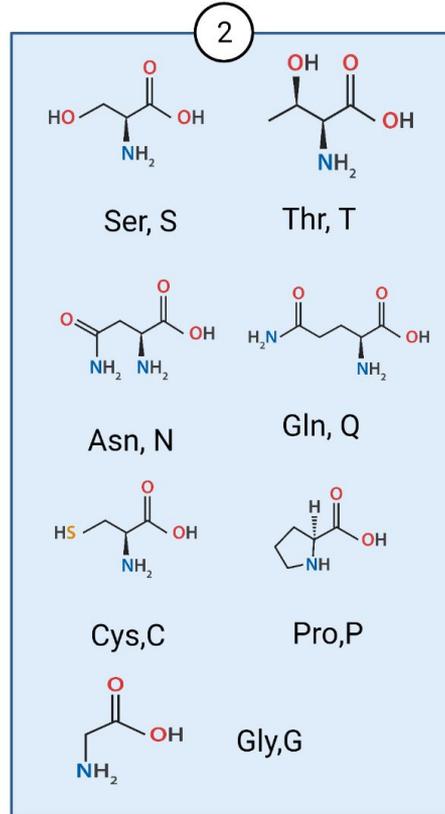


Amino acids

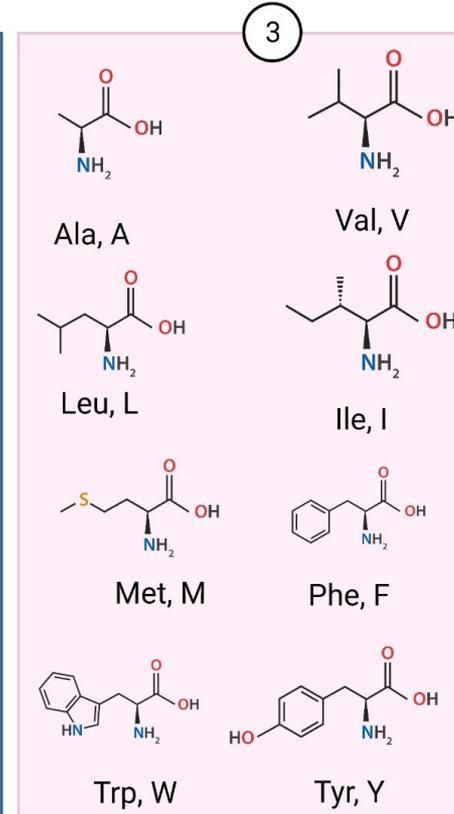
Electrically charged side chains



Polar and special cases



Hydrophobic Side chains



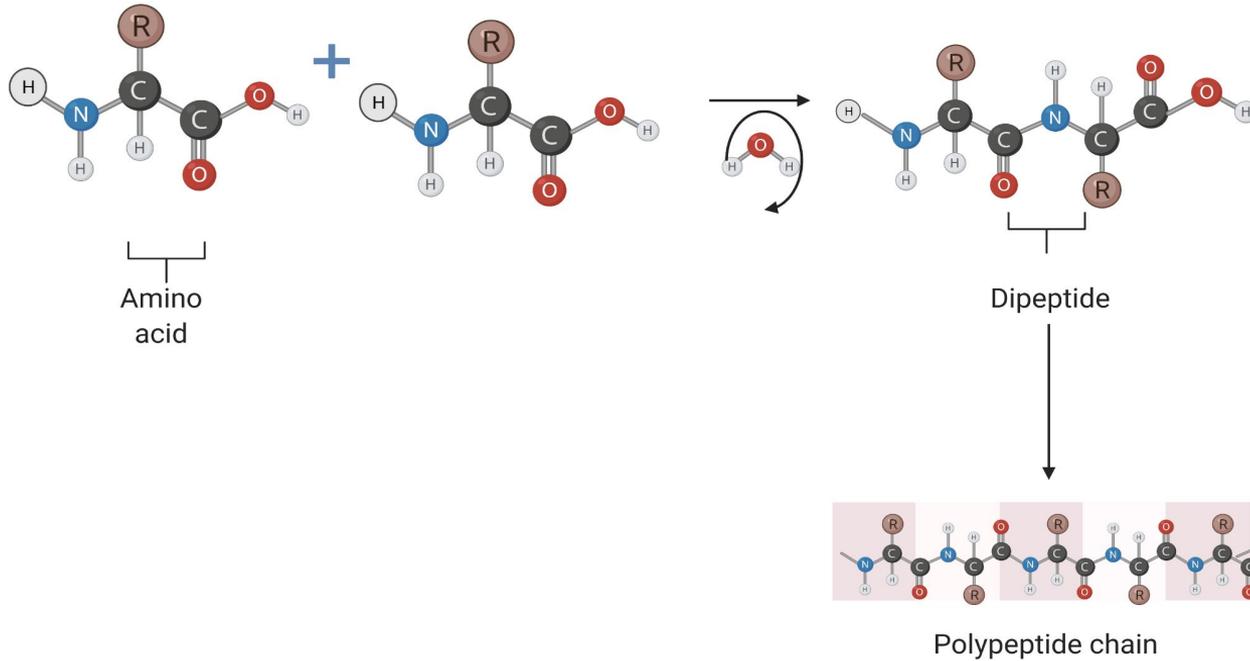


Structure

- Primary
- Secondary
- Tertiary
- Quaternary



Building Blocks: Primary Structure

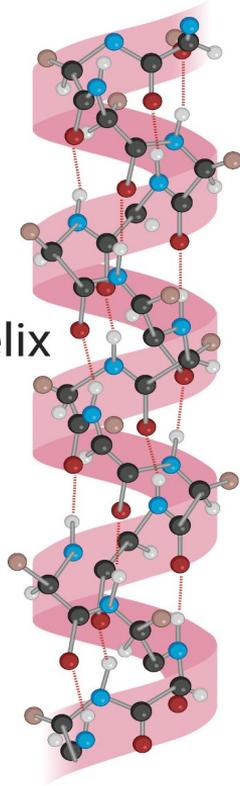




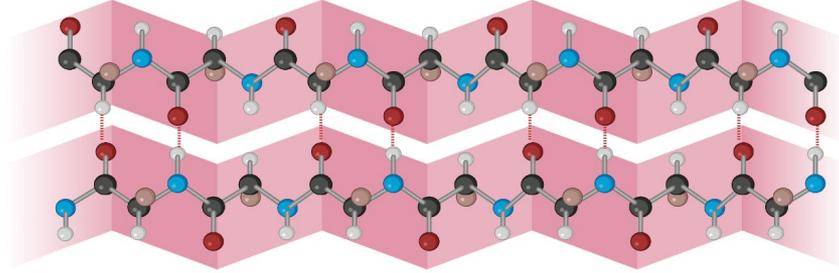
Secondary Structure

Secondary structure

α -helix



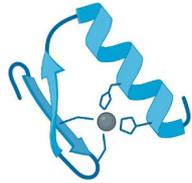
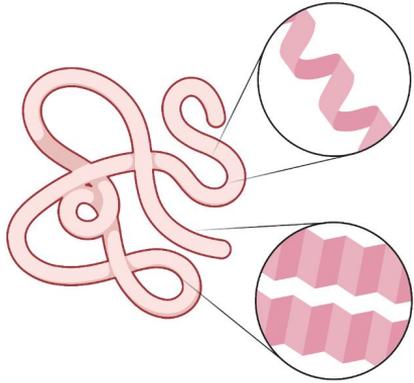
β -pleated sheet



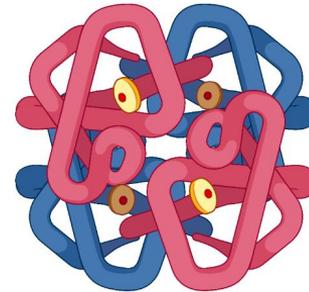
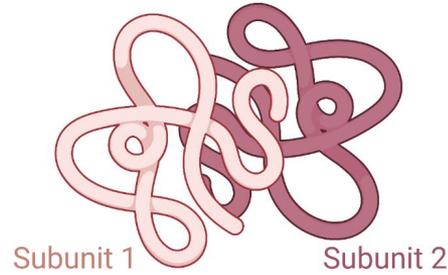
Tertiary and Quaternary Structure



Tertiary structure



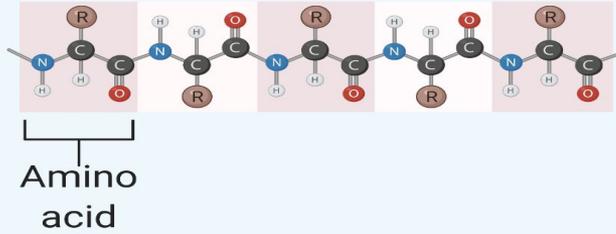
Quaternary structure





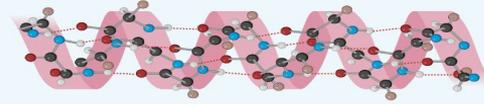
Primary structure

Polypeptide chain

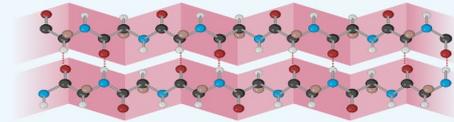


Secondary structure

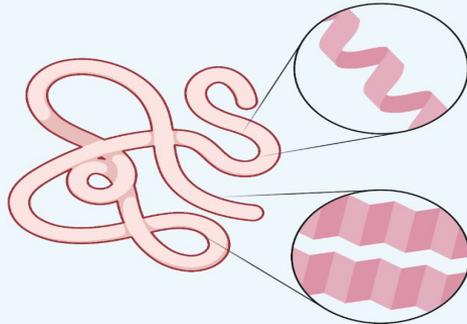
α -helix



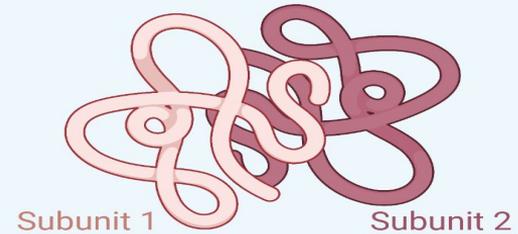
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Tertiary structure



Quaternary structure





Protein Structure: Bioinformatics

Protein structure databases:

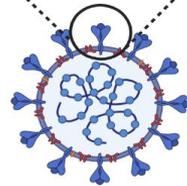
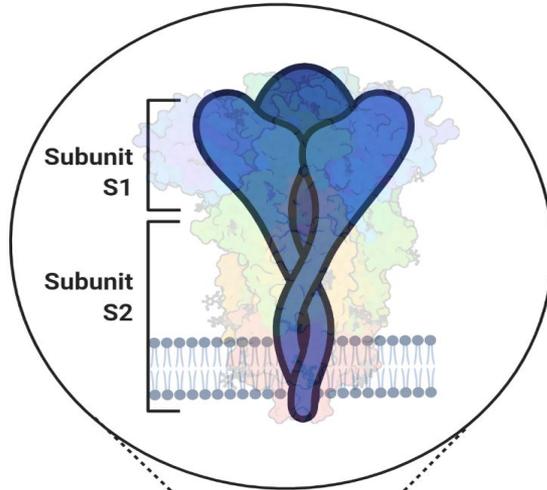
- (i) PDB :<https://www.rcsb.org/>
- (ii) EBI-MSD: <http://www.ebi.ac.uk/msd/>
- (iii) SCOP: <http://scop.mrc-lmb.cam.ac.uk/scop/>
- (iv) CATH: http://www.biochem.ucl.ac.uk/bsm/cath_new/

PyMol: Protein Visualization Software

<https://pymol.org/edu/?q=educational/>

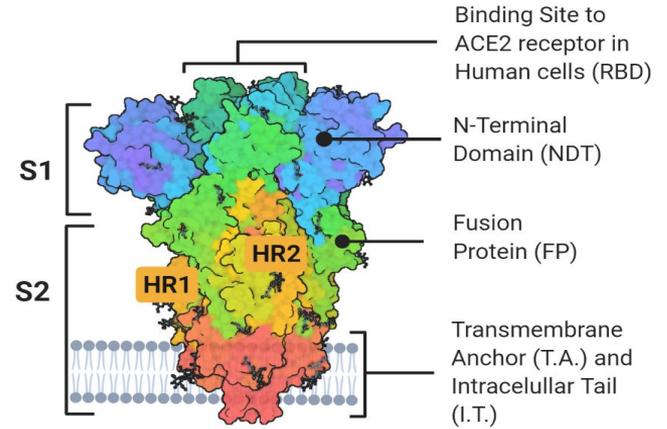


Virus spike protein Diagram

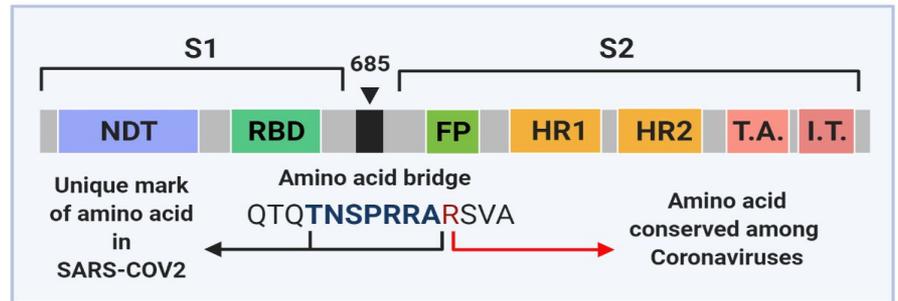


SARS-CoV2

Virus spike protein Crystallographic structure seen by electron microscopy (PDB ID: 6VXX-PDB)



Primary Structure



Acknowledgement: Diana Sofia Mollocana Yanez

Andersen K.G., et al.. (2020) The proximal origin of SARS-CoV-2. Nature Medicine.



Lets Try out PyMol

Spike Protein (6VXX) (6NDD)

Casein (β)

PyMol: Protein Visualization Software

<https://pymol.org/edu/?q=educational/>

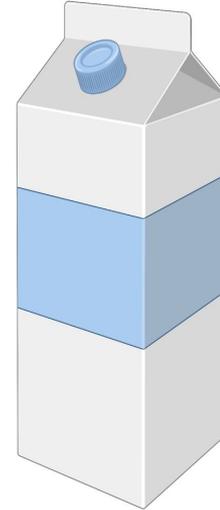
You tube video: <https://www.youtube.com/watch?v=luJqbV4D8Cc&t=10s>



Activity: Milk

Nutrients: Fat, Calcium, Vitamin D, Minerals and Proteins

Proteins: 82% Casein, 18% is serum or whey



Edible biodegradable food coating: <https://www.youtube.com/watch?v=wt32GgQGTcl>



DIY: Protein precipitation experiment

Ingredients

- Milk
- Vinegar
- Food Color (optional)



Acknowledgements

- CalACS Team
- Images created in biorender.com