Nanobiotechnology and Nanomedicine
Course code: 601104

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Protein

- Proteins are macromolecules which serve essentially all biological processes.
- It is a biocatalyst which catalyze the biological reactions. For example DNA polymerase catalyse the DNA replication process.
- It also serve as transport of molecules such as oxygen.
- Provides mechanical support to cell Such as cytoskeleton protein tubulin.
- It has major role immune protection.
- Responsible in nerve impulses transmission.
- It control growth and differentiation. Therefore It has essential role in contolling the cancers.

Properties and functions of Protein

- Various key properties enable proteins to participate wide range of functions.
- Proteins are linear polymers built of monomer units called amino acids.
- The construction of a vast array of macromolecules from a limited number of monomer building blocks.
- Does protein function depend on the linear sequence of amino acids? The function of a protein is directly dependent on its three dimensional structure.
- Proteins spontaneously fold up into three-dimensional structures which are determined by the sequence of amino acids in the protein polymer.
- Proteins are the embodiment of the transition from the one-dimensional world of sequences to the three-dimensional world of molecules capable of diverse activities.

Properties and functions of Protein

- **Proteins contain a wide range of functional groups. These functional groups include alcohols, thiols, thioethers, carboxylic acids, carboxamides, and a variety of basic groups. When combined in various sequences, this array of**
- **Functional groups accounts for the broad spectrum of protein function. For instance, the chemical reactivity associated with these groups is essential to the function of enzymes, the proteins that catalyze specific chemical reactions in biological systems.**

Properties and functions of Protein

- **Proteins interact with one another and with other biological macromolecules to form complex assemblies.**

- **These assemblies include macro-molecular machines that carry out the accurate replication of DNA, the transmission of signals within cells, and many other essential processes.**

Properties and functions of Protein

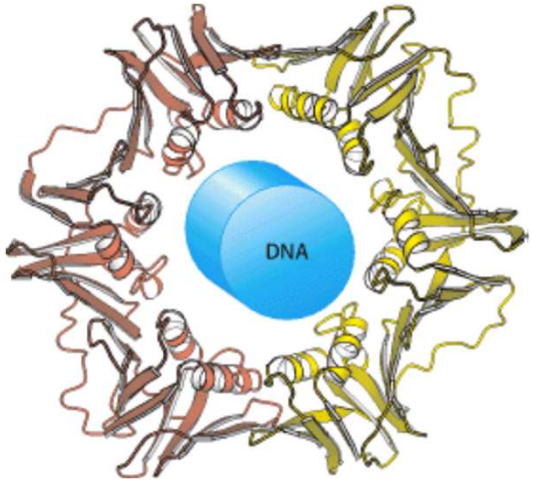
- **Some proteins are quite rigid, some display limited flexibility.**
- **Rigid units can function as structural elements in the cytoskeleton (the internal scaffolding within cells) or in connective tissue.**

- **Parts of proteins with limited flexibility may act as hinges, springs, and levers that are crucial to protein function.**

- **The assembly of proteins with one another and with other molecules into complex units, and to the transmission of information within and between cells**

Structure guide the function

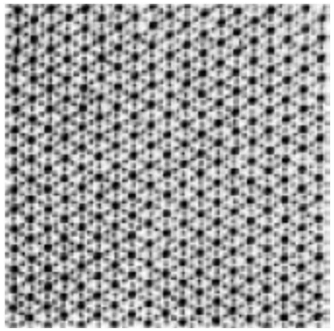
- **A protein component of the DNA replication machinery surrounds a section of DNA double helix.**
- **The structure of the protein allows large segments of DNA to be copied without the replication machinery dissociating from the DNA.**



Complex protein assembly

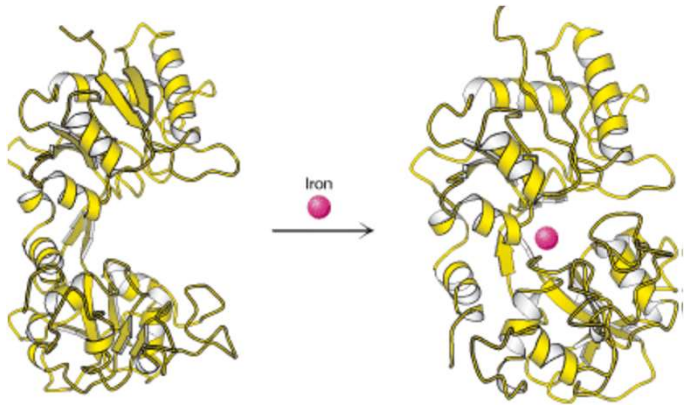
- An electron micrograph of insect flight tissue in cross section shows a hexagonal array of two kinds of protein filaments.

Courtesy of Dr. Michael Reedy



Flexibility and Function

- **Upon binding iron, the protein lactoferrin undergoes conformational changes that allow other molecules to differentiate the iron free and iron bound forms.**



Structure of protein

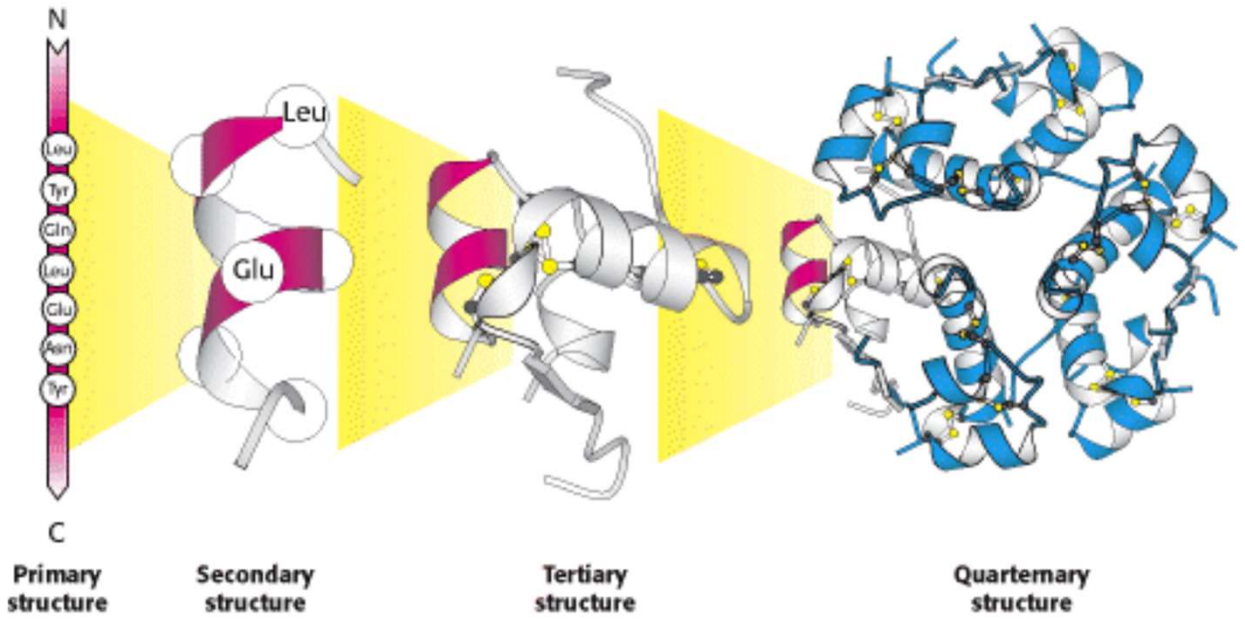


Fig: crystal structure of human Insulin, is a protein hormone for maintaining blood sugar at appropriate levels. From left the Chains of amino acids in a specific sequence (the primary structure) define a protein like insulin. These chains fold into well-defined structures (the tertiary structure) in this case a single insulin molecule. Such structures assemble with other chains to form arrays such as the complex of six insulin molecules shown at the far right (the quarternary structure). These arrays can often be induced to form well-defined crystals (photo at left), which allows determination of these structures in detail.[(Left) Alfred Pasieka/Peter Arnold.]

To be continued--------

Reference

- **J. M. Berg, J. L. Tymoczko, and L. Stryer Biochemistry (2002) 5th edition, New York WH Freeman, ISBN-10: 0-7167-3051-0.**