Chem 452 - Lecture 2
Protein Structure
110919

Proteins are the workhorses of a living cell and involve themselves in nearly all of the activities that take place in a cell. Their wide range of structures are manifested by the wide range of 3-dimensional structures that they are able to possess. Proteins are linear polymers of amino acids, whose sequence is determined by the sequence of DNA base pairs in their corresponding gene. The connection between this linear sequence of amino acids for a protein and its 3-dimensional structure will be the focus of this lecture.

Introduction

- We will build on the concepts that we discussed in Lecture 1
  - How does a linear sequence of of amino acids (polypeptide) produce such a wide variety of 3-dimensional structures and exhibit such a wide range of functions?

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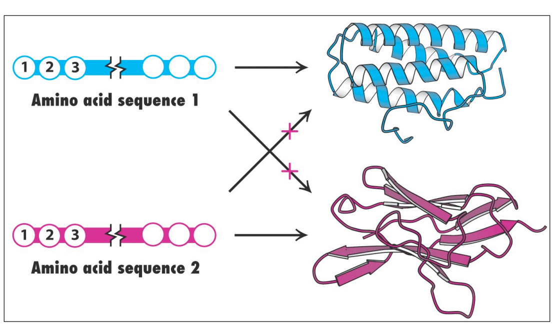

Questions

Of the interatomic interactions (bonds) that we discussed in Lecture 1, which have energies that are much greater than the thermal energy at room temperature?

Questions

Of the interatomic interactions (bonds) that we discussed in Lecture 1, which have energies that are comparable to the thermal energy at room temperature?

Introduction

- We will consider proteins structure hierarchically:

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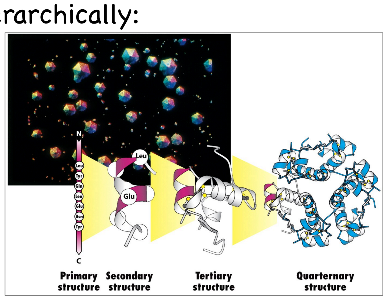

Introduction

- Proteins are versatile, they lie at the interface between:
  - the uniform, one dimensional world of the storage of genetic information (DNA), and
  - the the functioning three dimensional world that we live in.

Introduction

- The diversity of structure and function arise from the diversity of the amino acids used to build proteins.
  - structural diversity (size and shape)
  - chemical diversity (reactive functional groups)
  - physical diversity (non-covalent interactions)

Introduction

- Proteins can assemble and work together to produce remarkably complex, molecular machines.
  - The products of billions of years of research and development in the area of nanotechnology (evolution)

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The DNA Clamp used in DNA replication

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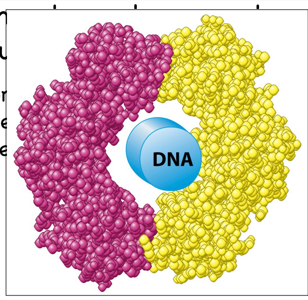

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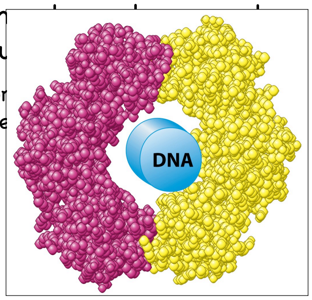

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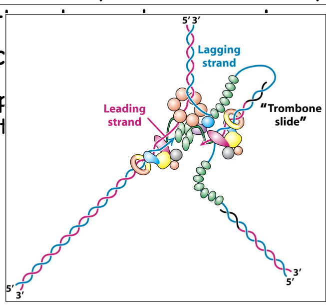

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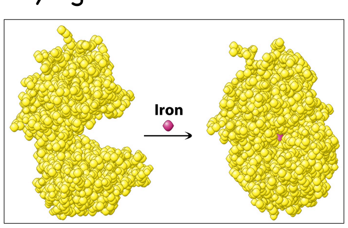
Introduction

- Proteins can be flexible when carrying out their functions.



Living Figure Living Figure

Lactoferrin

Introduction

- Proteins can be flexible when carrying out their functions.

Hexokinase

Next up

- A review of the 20 amino acids used to make proteins, and how they differ from one another.
- Protein secondary structure.
- Protein tertiary structure.