



# Amino Acids & Proteins

- The Molecules in Cells
  - Ch 3

# Overview of Protein Function

- Proteins are involved in
  - cellular structure
  - movement
  - defense
  - transport
  - communication
  - catalysis (enzymes)
  - regulation



# Protein

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- Mammalian hair is composed of structural proteins
- Proteins have a broad size range
  - RNA digesting enzyme ribonuclease A  
(molecular weight of 5733 and 51 amino acids long)
  - Cholesterol transport protein apolipoprotein B  
(molecular weight of 513,000 and 4636 amino acids long)
- Enzymes regulate chemical reactions

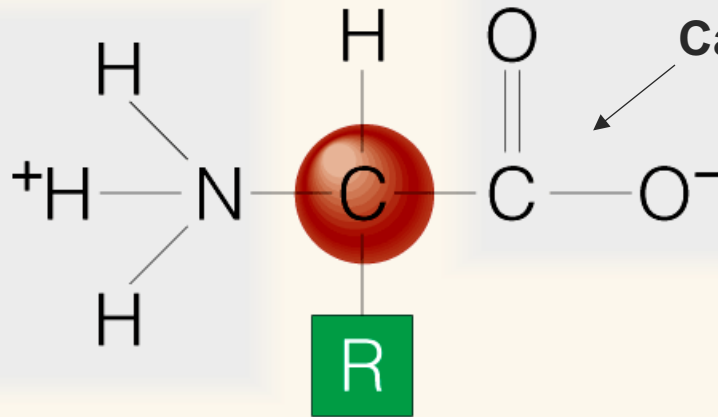
# Proteins

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- Made from 20 different amino acids
- Proteins are the most structurally and functionally diverse of life's molecules
  - Their diversity is based on different arrangements of amino acids

# Amino Acid Structure

Amino Group



Carboxyl Group

# Amino Acid Structure

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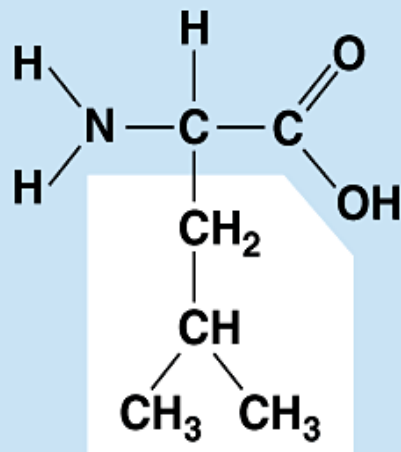
- Each amino acid contains:
  - an amino group
  - a carboxyl group
  - an R group, which distinguishes each of the 20 different amino acids
- Each amino acid has specific chemical properties

# Properties of Amino Acids

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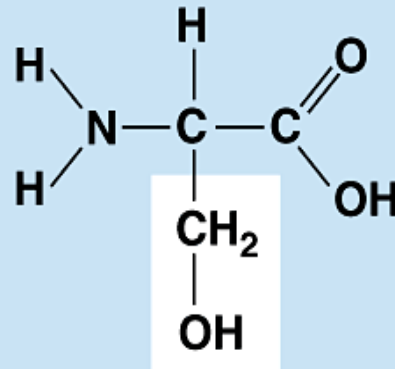
- Determined by the R group
- Amino acids may be:
  - Non-polar
  - Neutral, polar
  - Positively charged, polar
  - Negatively charged, polar

# Properties of Amino Acids

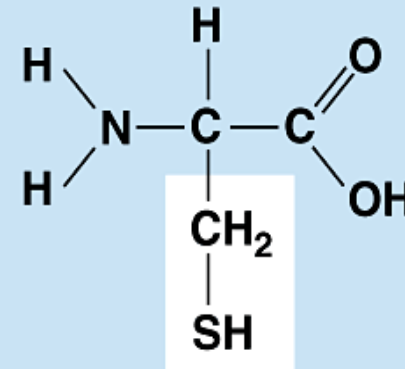


Leucine (Leu)

**HYDROPHOBIC**



Serine (Ser)



Cysteine (Cys)

**HYDROPHILIC**



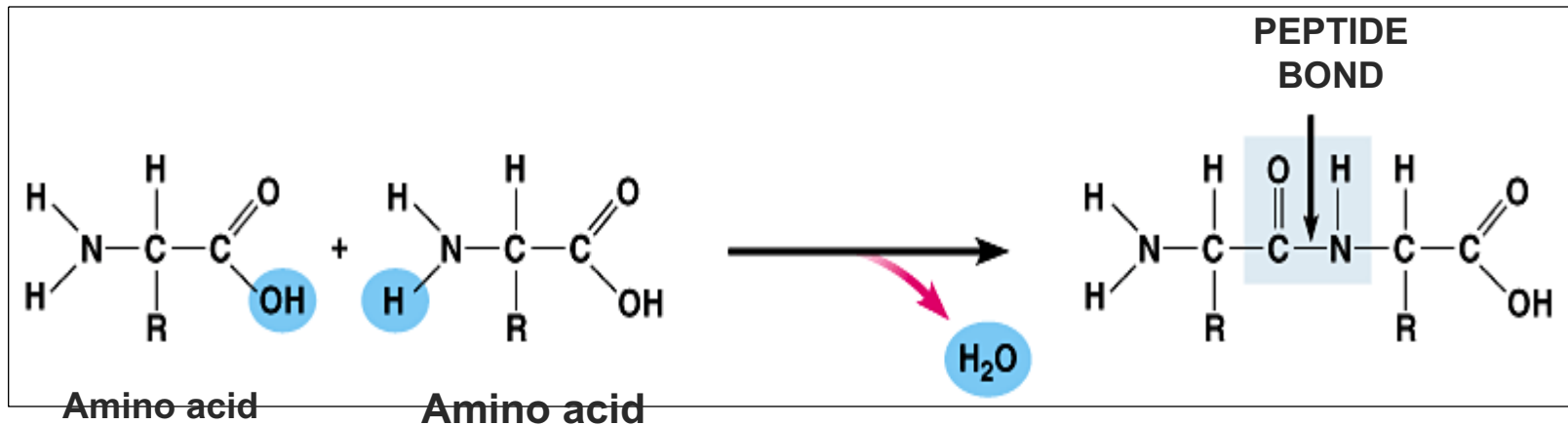
# Protein Synthesis: Amino acids can be linked by peptide bonds

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- A protein is a chain of amino acids linked by peptide bonds
- Peptide bond
  - Type of covalent bond
  - Links amino group of one amino acid with carboxyl group of next
  - Forms through dehydration synthesis reaction

# Peptide Bond Formation

## *Dehydration Synthesis Reaction*



# Primary Structure of Proteins

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- A protein's primary structure is its amino acid sequence
- Unique for each protein
- Two linked amino acids = dipeptide
- Three or more = polypeptide

# Primary Structure & Protein Shape

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- Primary structure influences shape in two main ways:
  - Allows hydrogen bonds to form between different amino acids along length of chain
  - Puts R groups in positions that allow them to interact

# Protein Shapes

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- Fibrous proteins

- Polypeptide chains arranged as strands or sheets

- Globular proteins

- Polypeptide chains folded into compact, rounded shapes

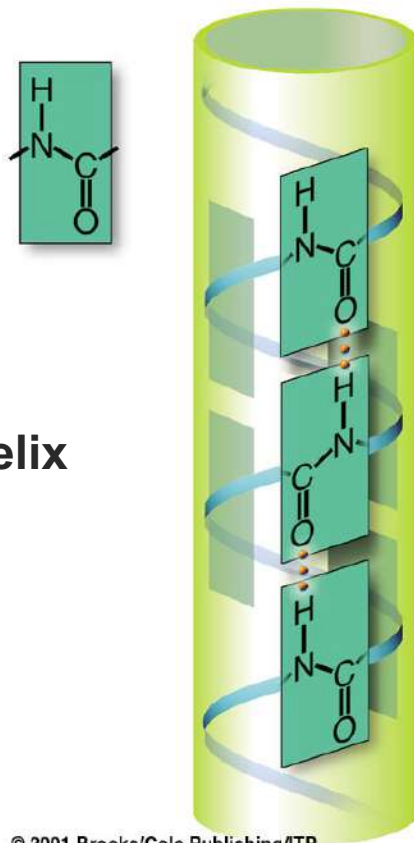
# Secondary Structure of Proteins

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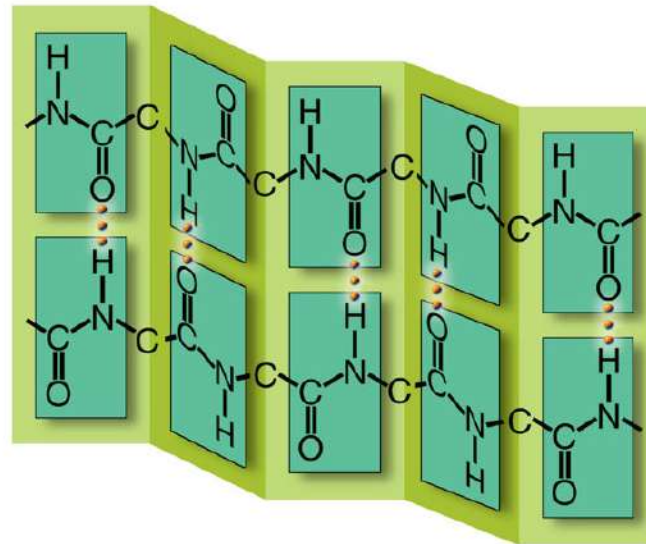
- Hydrogen bonds form between different parts of polypeptide chain
- These bonds give rise to coiling or folding pattern
- Helix or pleated sheet

# Examples of Secondary Structure

Alpha helix

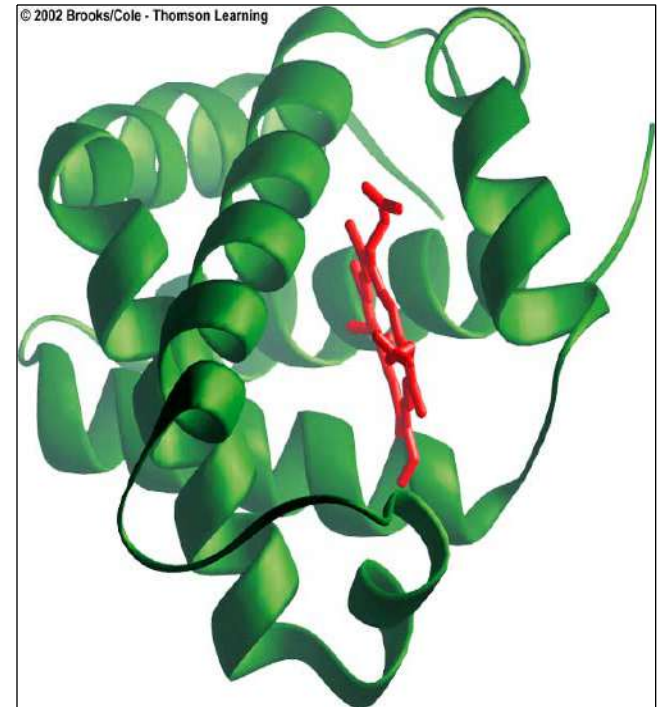


Pleated sheet



# Tertiary Structure of Proteins

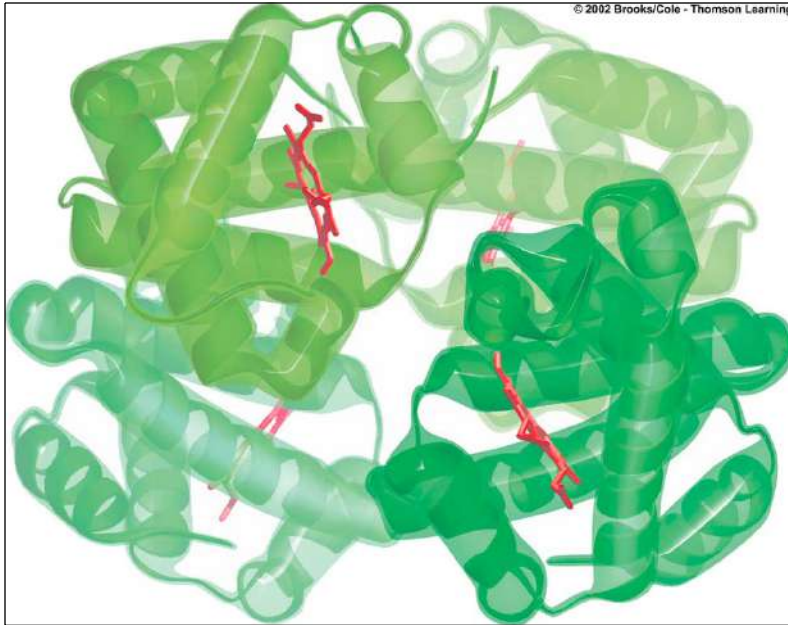
**Folding as a result  
of interactions  
between R groups**



**coiled and twisted polypeptide chain  
of one globin molecule**



# Quaternary Structure of Proteins



**Hemoglobin**

Some proteins are  
made up of more  
than one  
polypeptide chain

# Polypeptides With Attached Organic Compounds

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- Lipoproteins

- Proteins combined with cholesterol, triglycerides, phospholipids

- Glycoproteins

- Proteins combined with oligosaccharides

# Denaturation

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- Disruption of three-dimensional shape
- Breaking of weak bonds
- Causes of denaturation:
  - pH
  - Temperature
  - Salinity
- Destroying protein shape disrupts function

# In review ....

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- What are the similarities & differences between amino acids?
- Describe each type of protein structure.
- How does shape influence protein function?