

Proteins - Enzymes



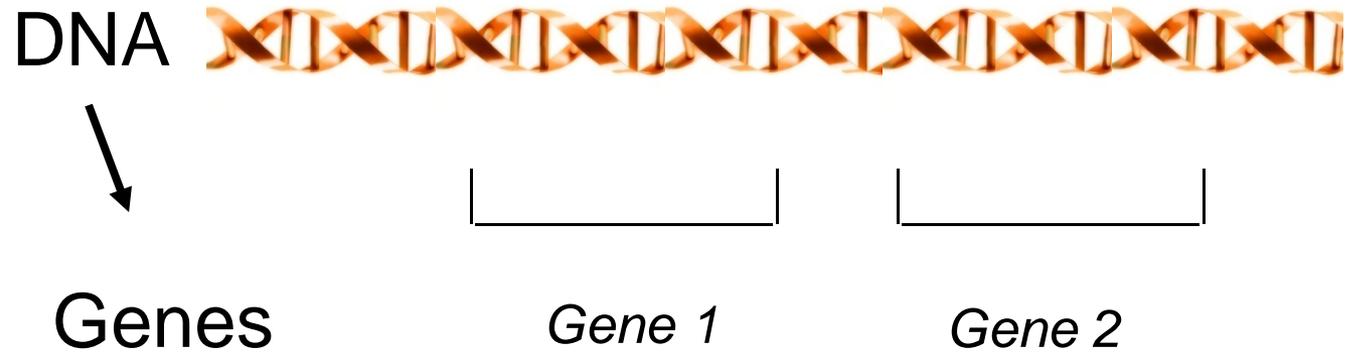
Proteins

- Each person has 30,000 different types of proteins and many millions of copies.
- Structure determines function
 - Or “proteins are shaped to get the job done”

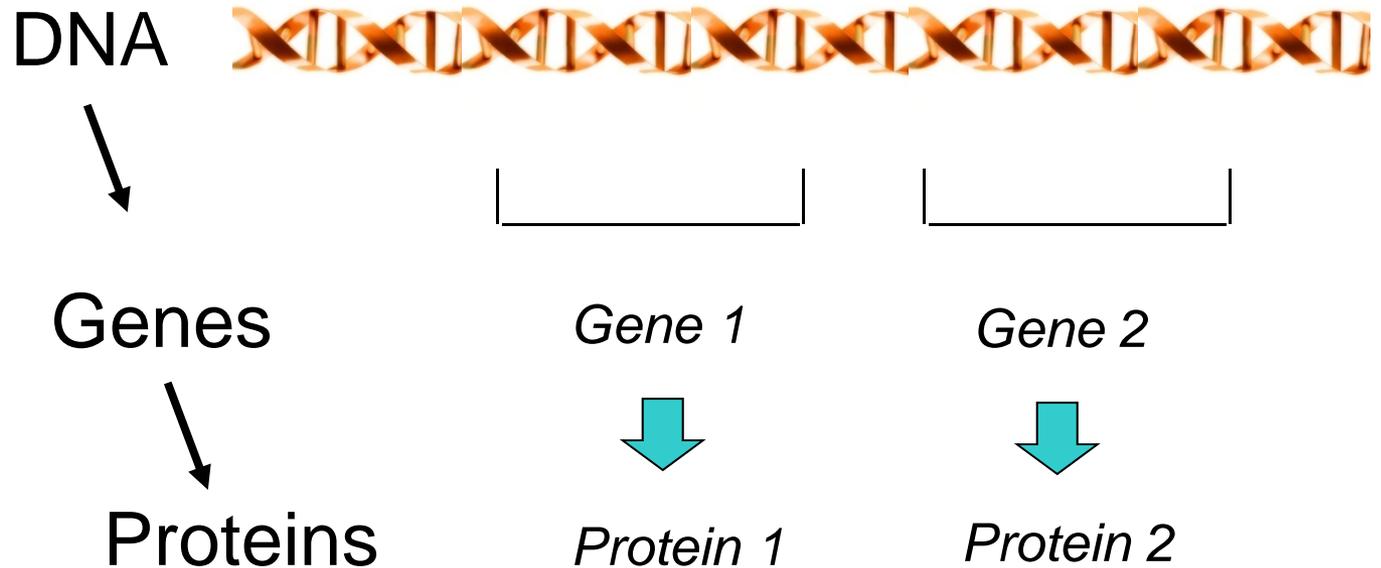
The **CENTRAL DOGMA** says:

DNA → RNA → protein

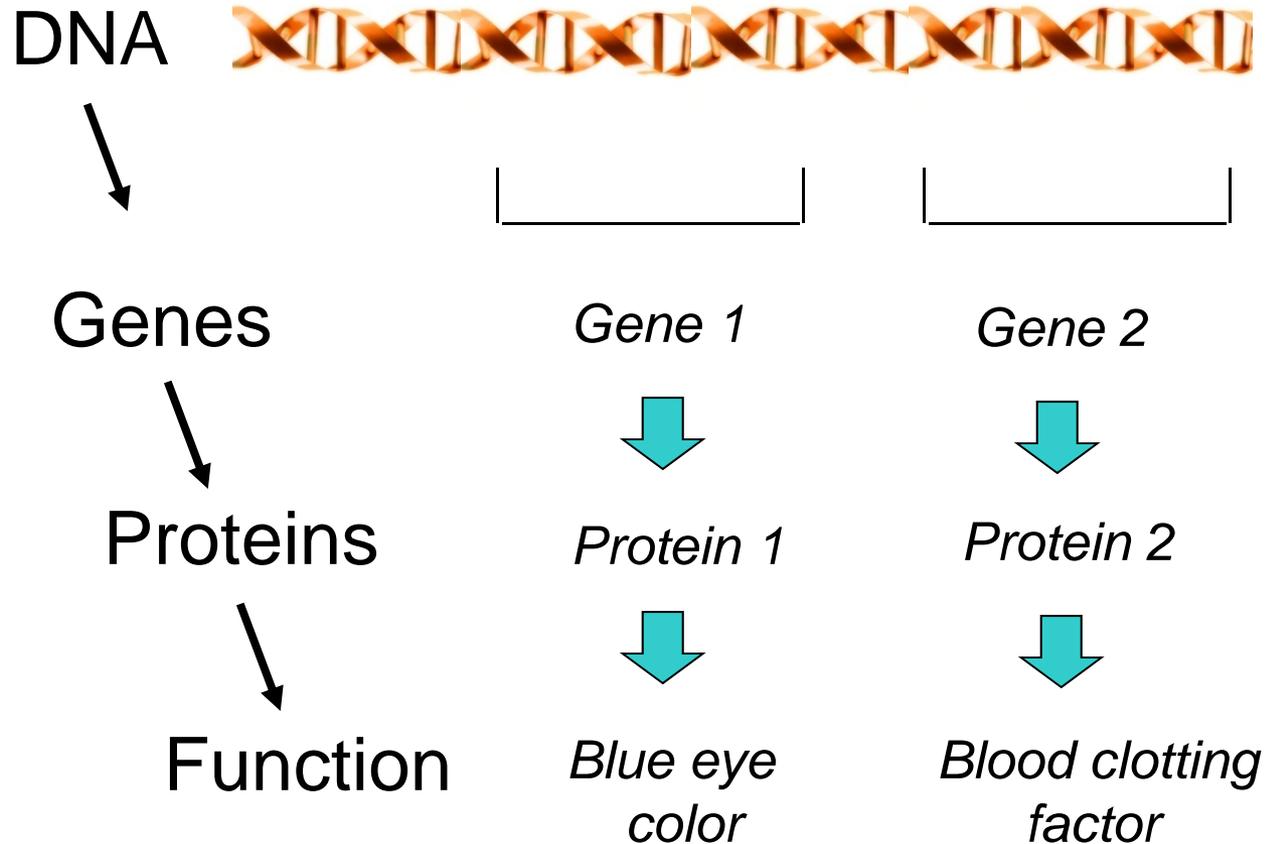
DNA Contains Genes



Genes Provide Instructions for Making Proteins



Proteins Have Function



Proteins are the body's worker molecules

Structure

A protein called alpha-keratin forms your hair and fingernails, and also is the major component of feathers, wool, silks, scales, horns, and hooves.

The hemoglobin protein carries oxygen in your blood to every part of your body.

Transport

Pigments

Muscle proteins called actin and myosin enable all muscular movement—from blinking to breaching to rollerblading.

Ion channel proteins control brain signaling by allowing small molecules into and out of nerve cells.

Muscle contraction

Receptor proteins stand the outside of your cells and transmit signals to partner proteins on the inside of the cells.

Enzymes in your saliva, stomach, and small intestine are proteins that help you digest food.

Digest

Recognition

Antibodies

Antibodies are proteins that help defend your body against foreign invaders, such as bacteria and viruses.

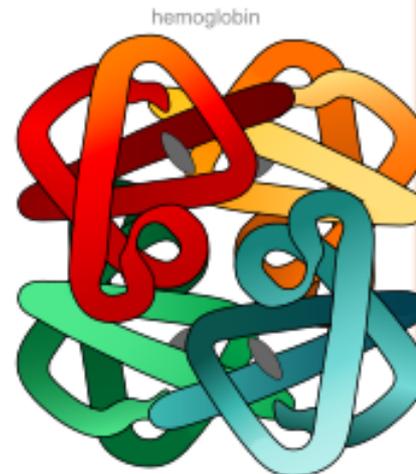
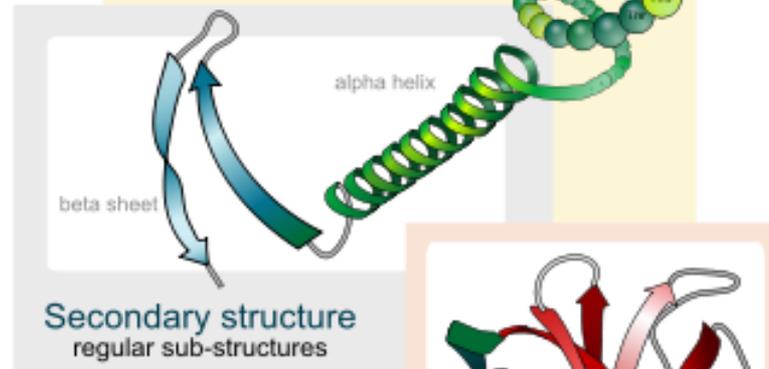
Huge clusters of proteins form molecular machines that do your cells' heavy work, such as copying genes during cell division and making new proteins.

Enzymes

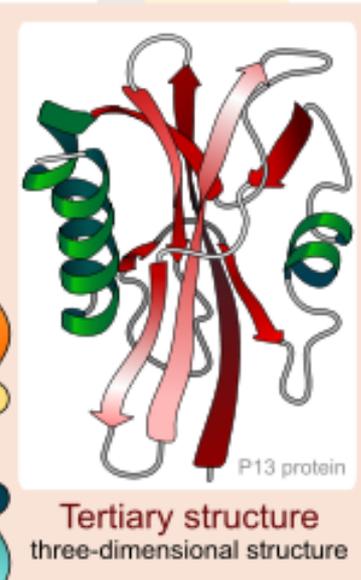


Protein Shape Determines Function

Primary structure
amino acid sequence



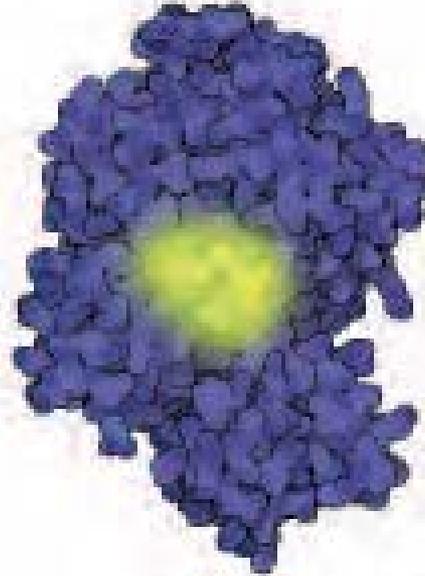
Quaternary structure
complex of protein molecules



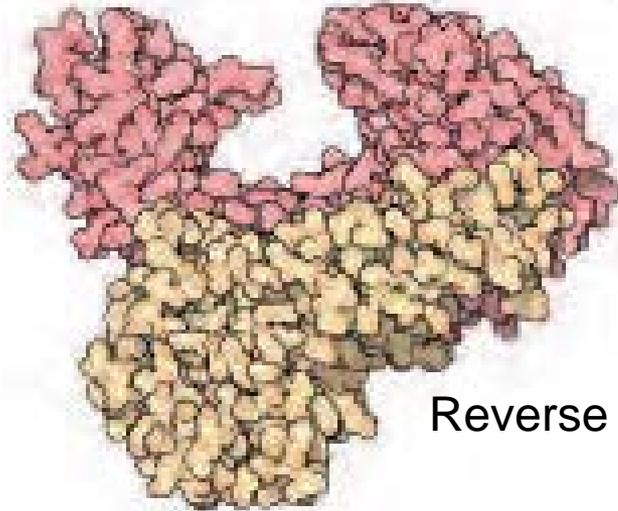
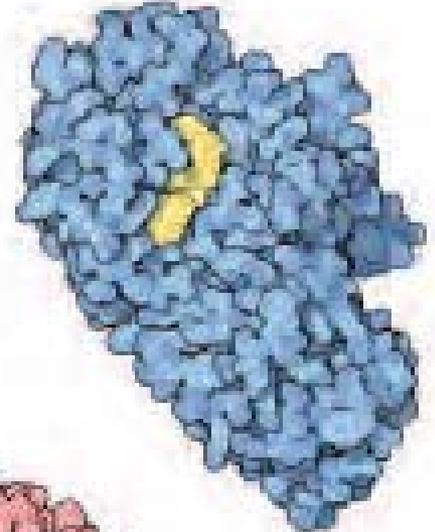
Enzymes

- Enzymes help the cell's chemical reactions.
- Often contain a groove or pocket to hold the molecule (substrate) that they are working upon.

Luciferase

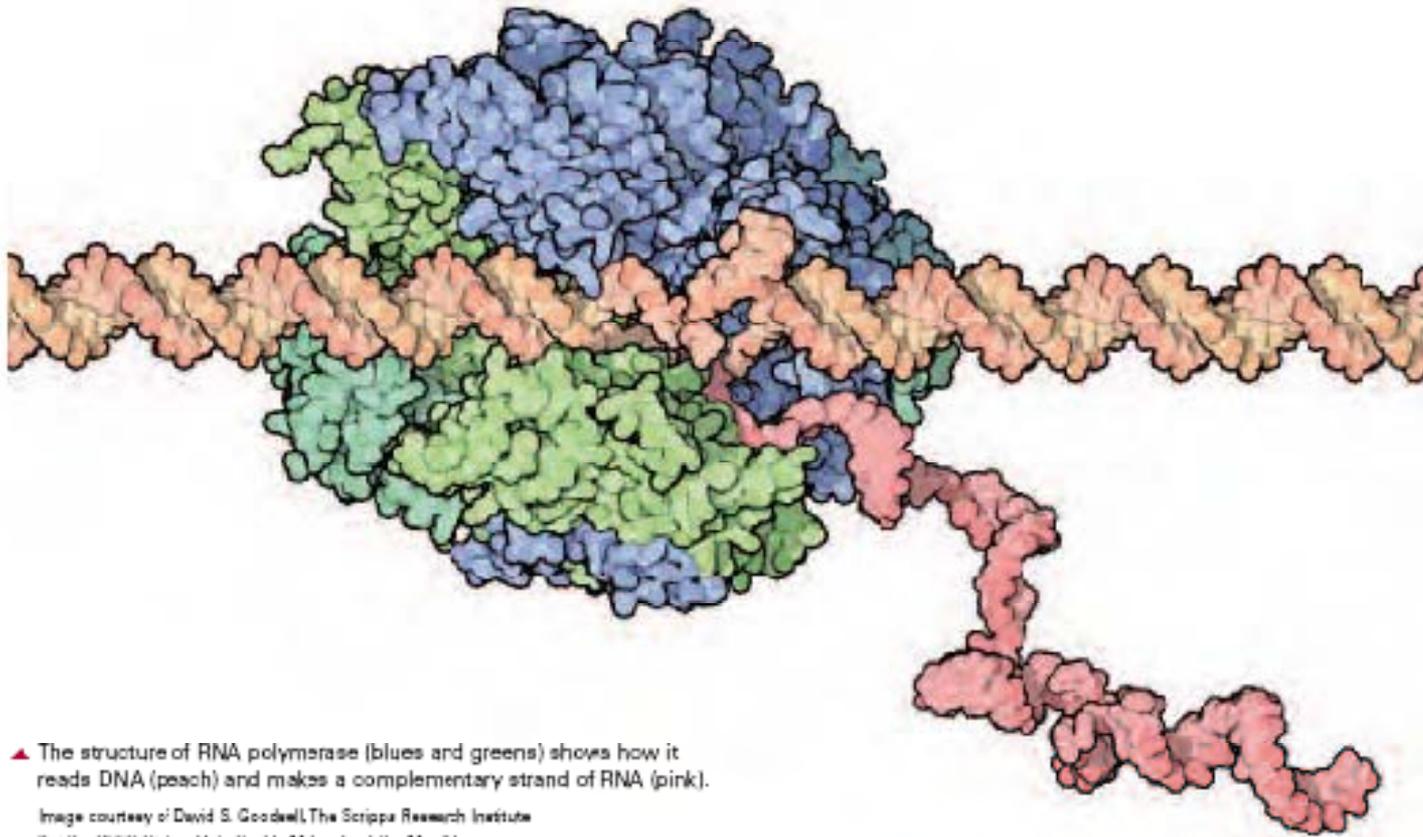


Amylase



Reverse transcriptase

DNA polymerase protein



- ▲ The structure of RNA polymerase (blues and greens) shows how it reads DNA (peach) and makes a complementary strand of RNA (pink).

Image courtesy of David S. Goodell, The Scripps Research Institute
(for the NCBI Protein Data Bank's Molecule of the Month)

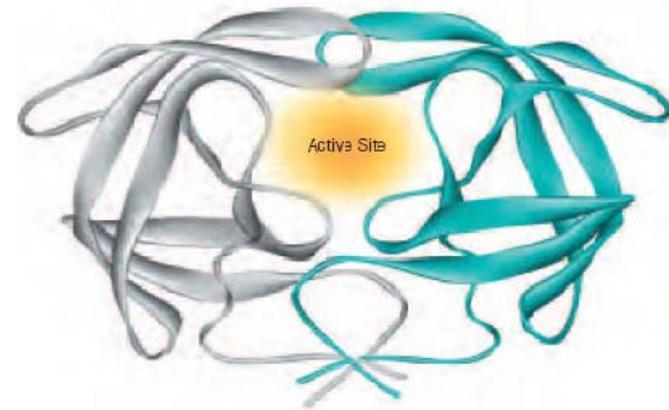


Enzymes speed up chemical processes in living things

- Also described as a catalyst:
 - Accelerates chemical reactions
 - Not used up in the reaction
- Only made in living cells
- 5000+ enzymes

Enzyme does a specific task

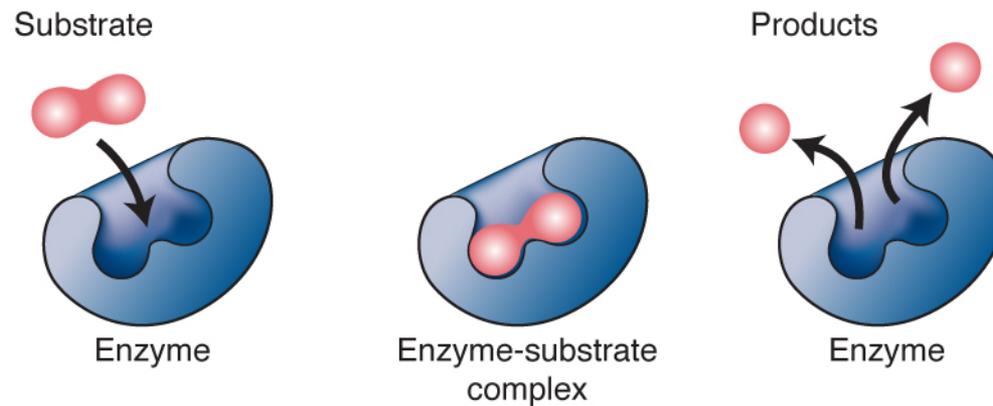
- An enzyme will work on 1 or 2 specific molecules (and no others)
 - Called a substrate
- Active site within a enzyme
 - Pocket that enclosed the substrate
 - Shape – critical to form the pocket
- An enzyme binds to substrate and makes it more “vulnerable” to chemical reaction





Enzymes are large molecules with small regions where enzyme and substrate fit together (Active Site)

Mechanism of enzyme activity



“Lock and Key model” or “Induced fit model”?



Naming enzymes

- Ending: “-ase”
- Substrate + “-ase”
- Function + “-ase”



Functions of enzymes

- Split substrates
- Re-arrange molecules in the substrate
- Make larger molecules of the substrate

- Most processes require a sequence of different enzymes



To work, enzymes must have

- Optimum temperature
 - If too high a temperature, a protein will lose its shape
 - Called “denatured” structure
- Optimum pH
- Optimum chemical composition of the enzyme’s liquid environment