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

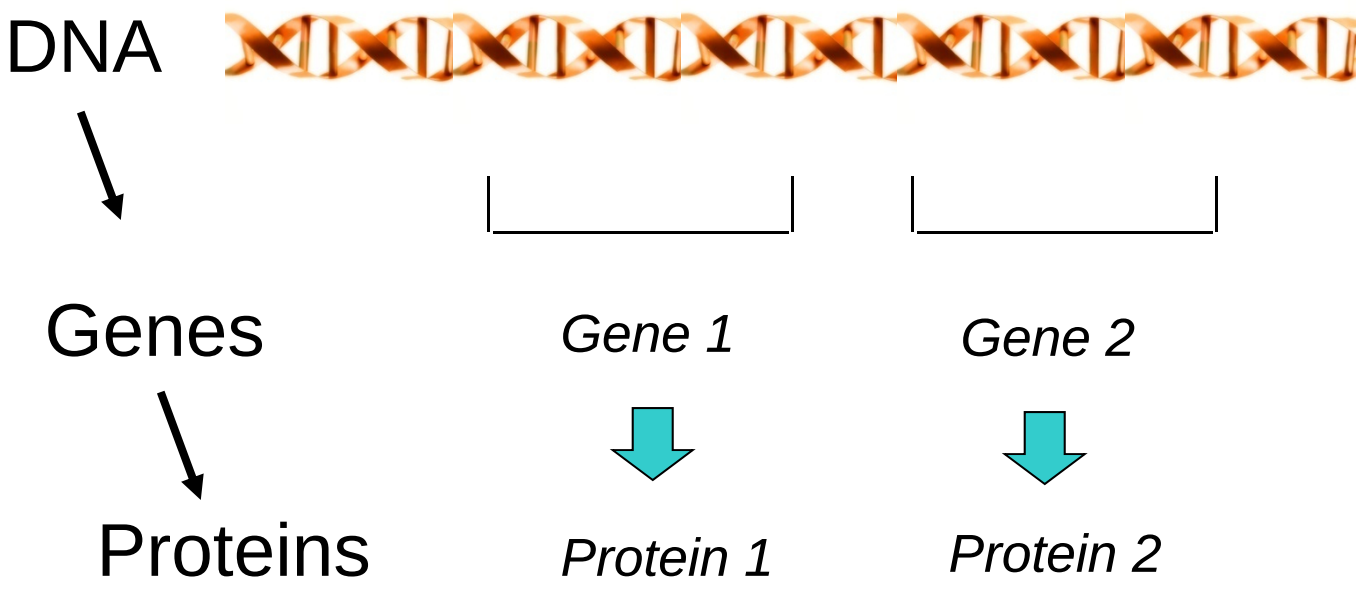
DNA

Genes

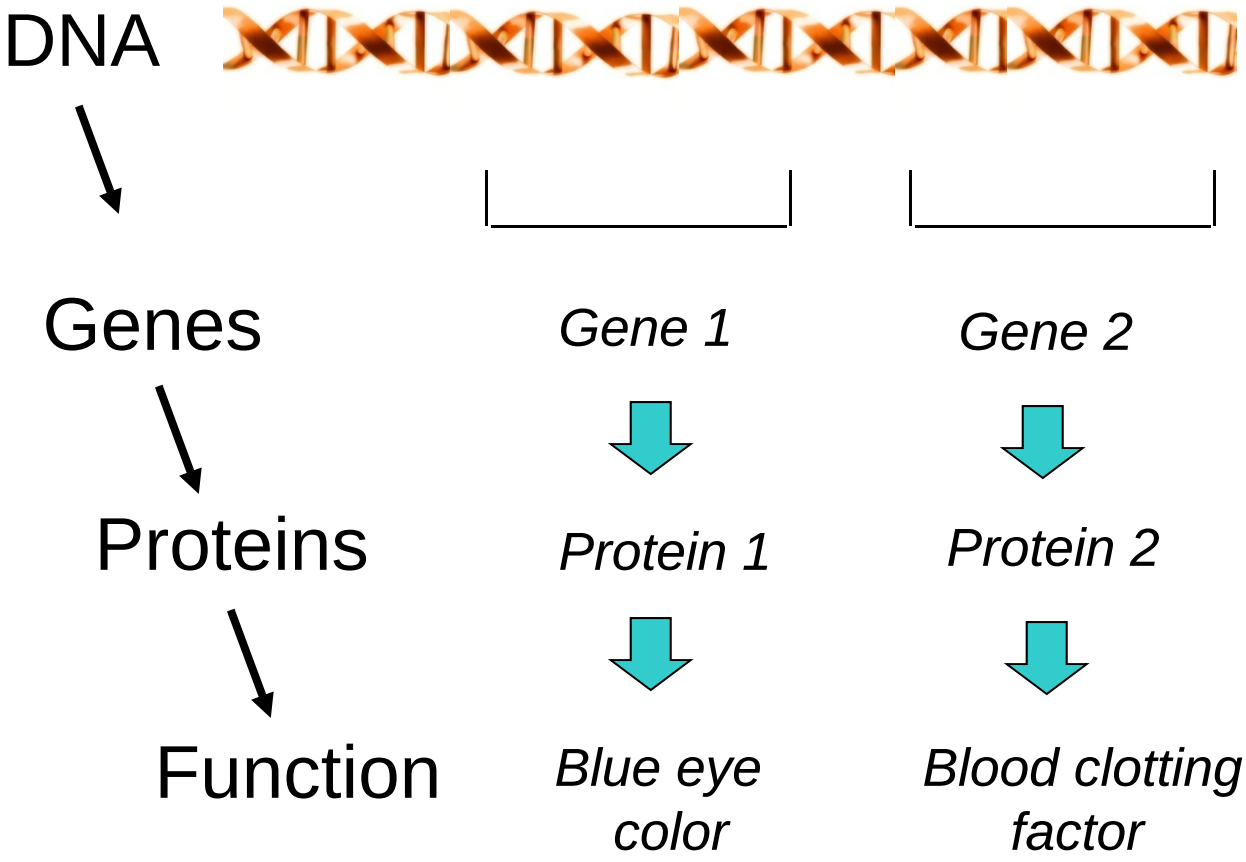
Gene 1

Gene 2

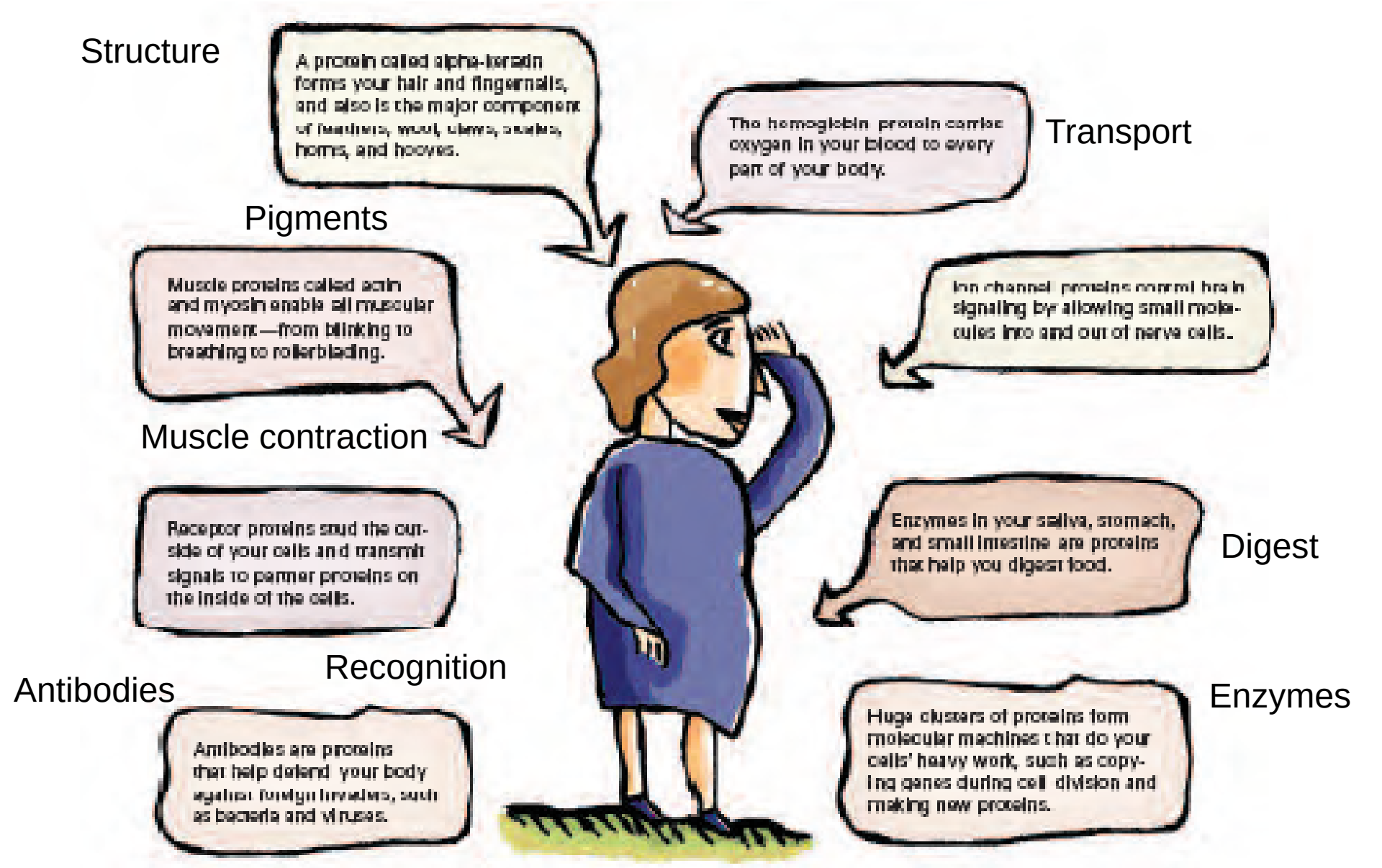
Genes Provide Instructions for Making Proteins



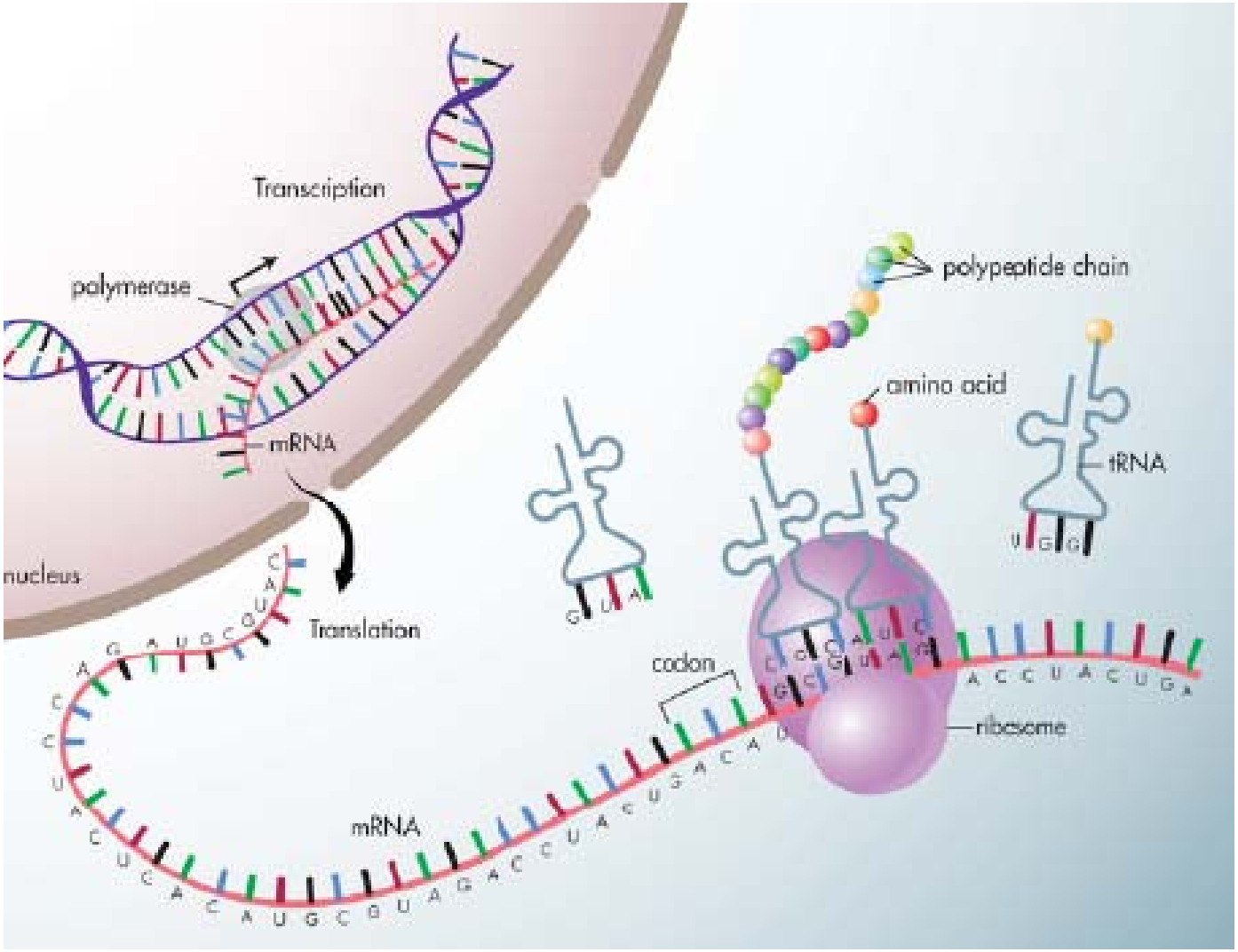
Proteins Have Function



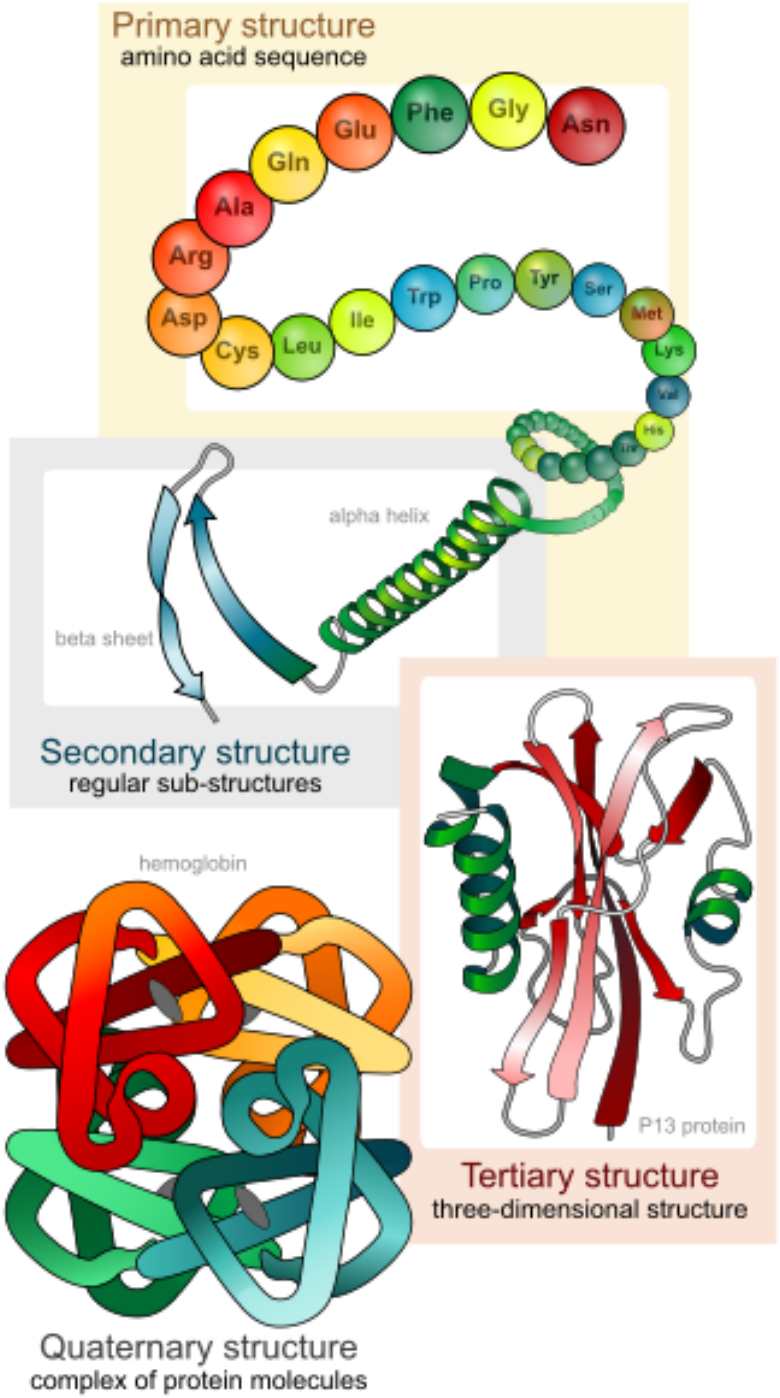
Proteins are the body's worker molecules



How to make a protein

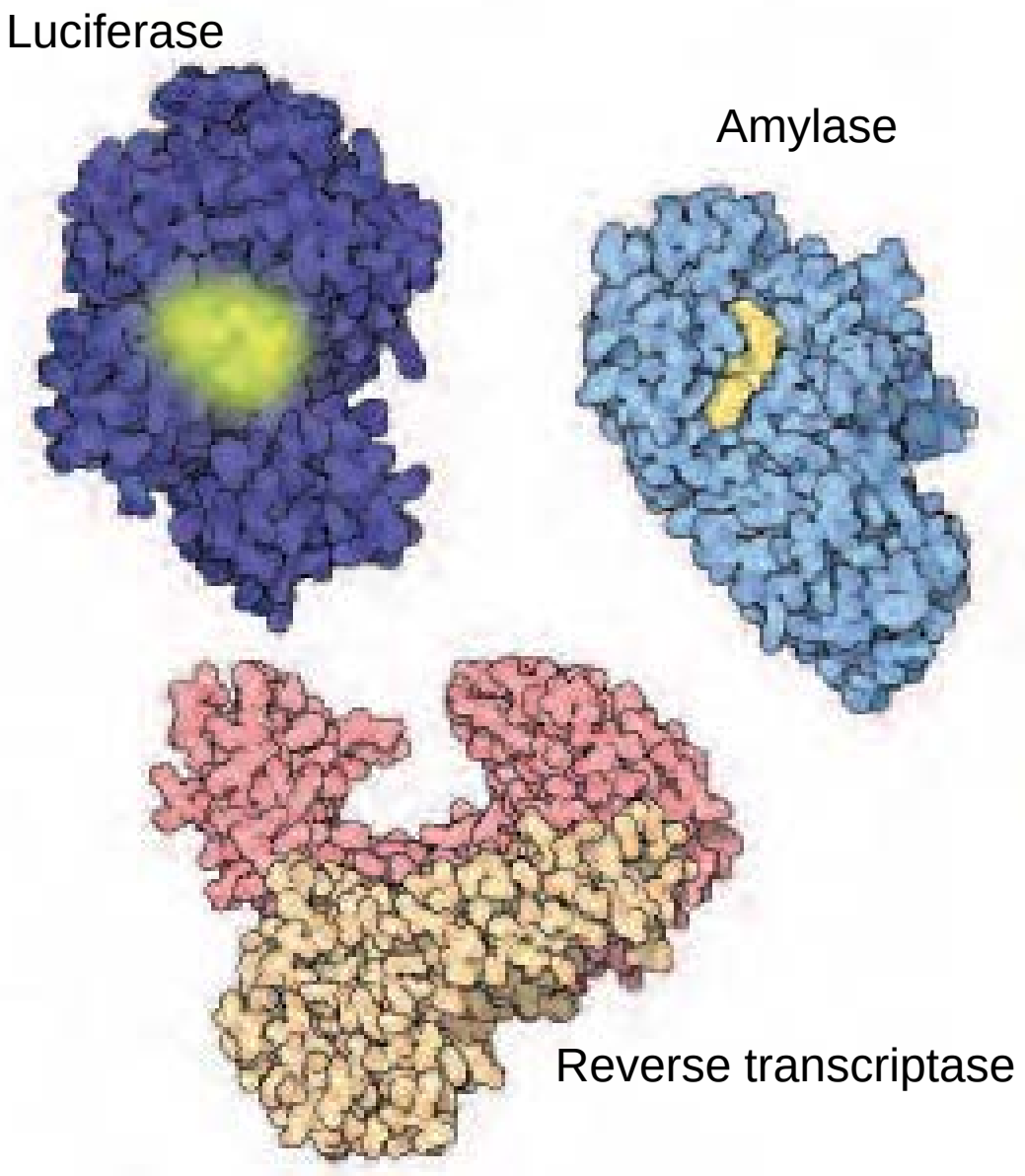


Protein Shape Determines Function

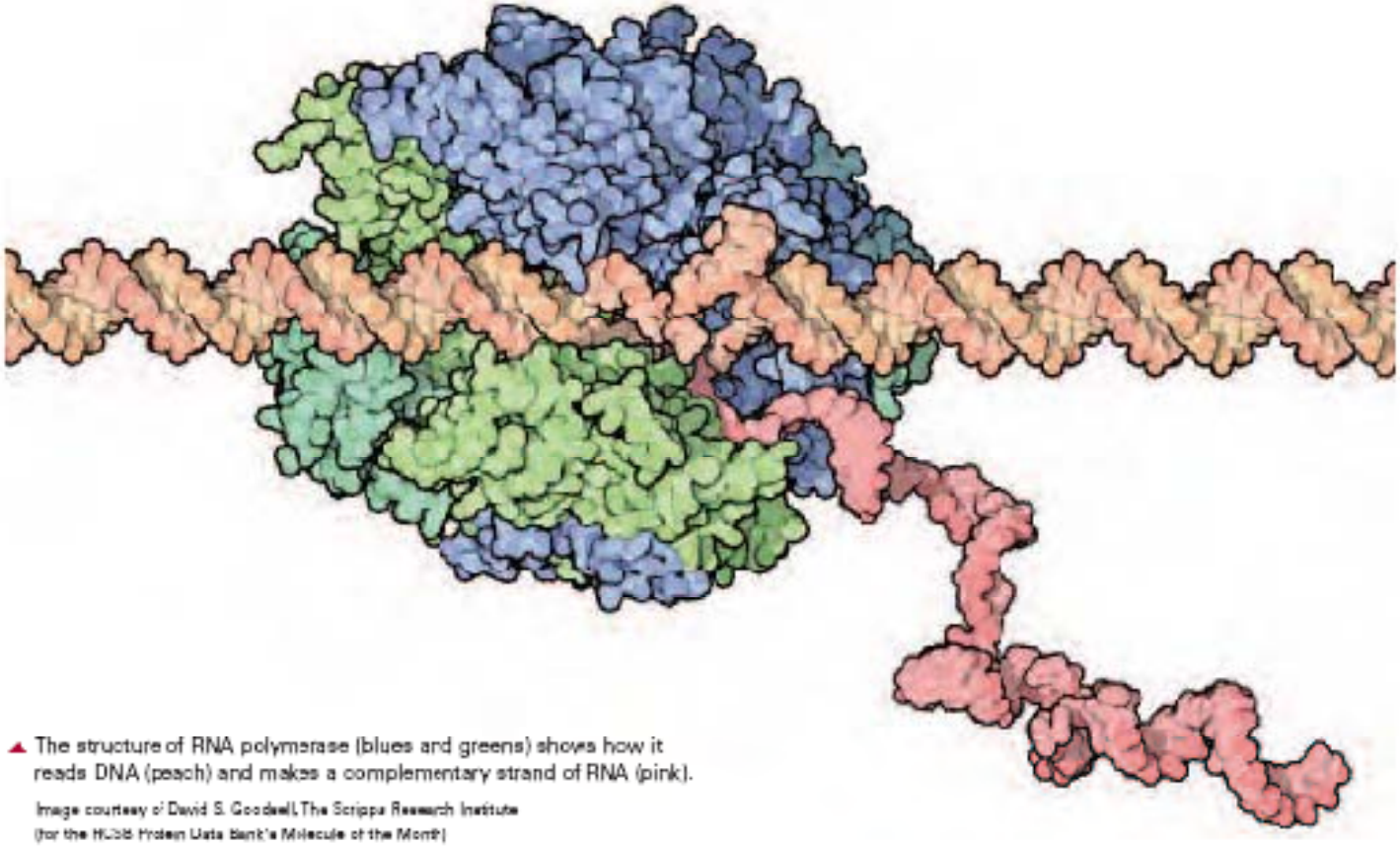


Enzymes

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



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).

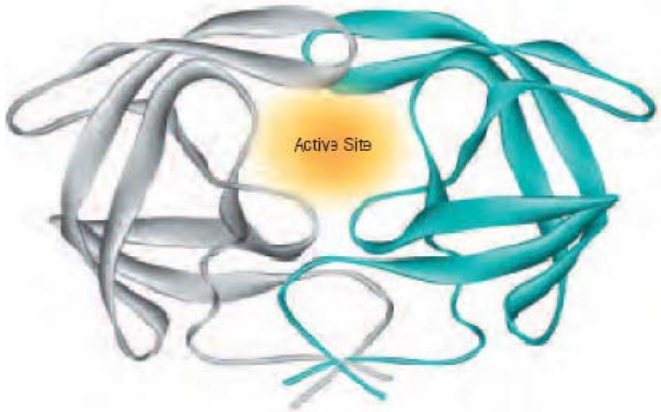
Image courtesy of David S. Goodsell, The Scripps Research Institute (for the RCSB Protein Data Bank's Molecule of the Month)

Enzymes speed up chemcial 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

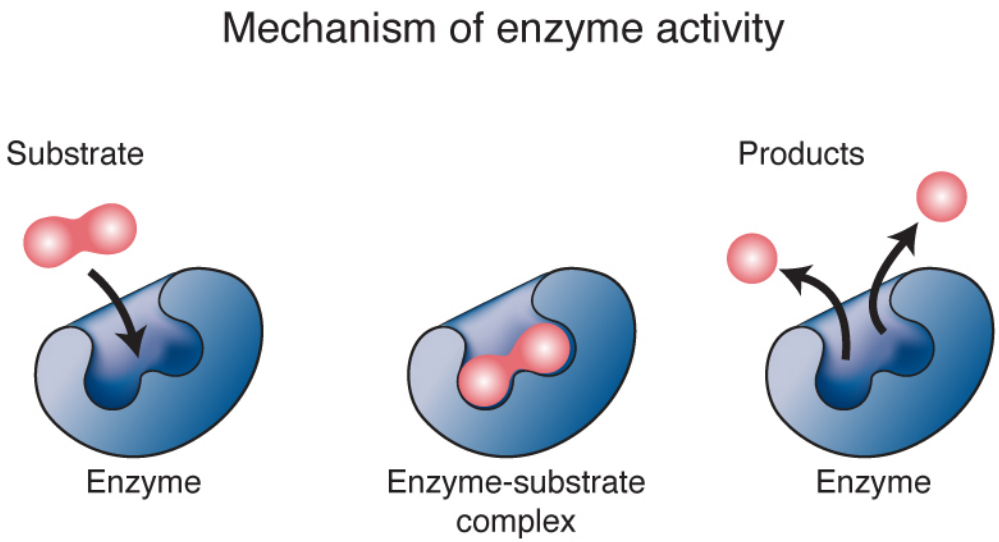
Enzyme does a specific task

- 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)



"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