

Protein

Chemistry

Food Unit

Protein Functions

- Building blocks of cells
 - Muscle cells
 - Skin cells
 - Organ cells (liver, kidney, lung, etc)
 - Blood cells
 - Nerve cells
 - etc

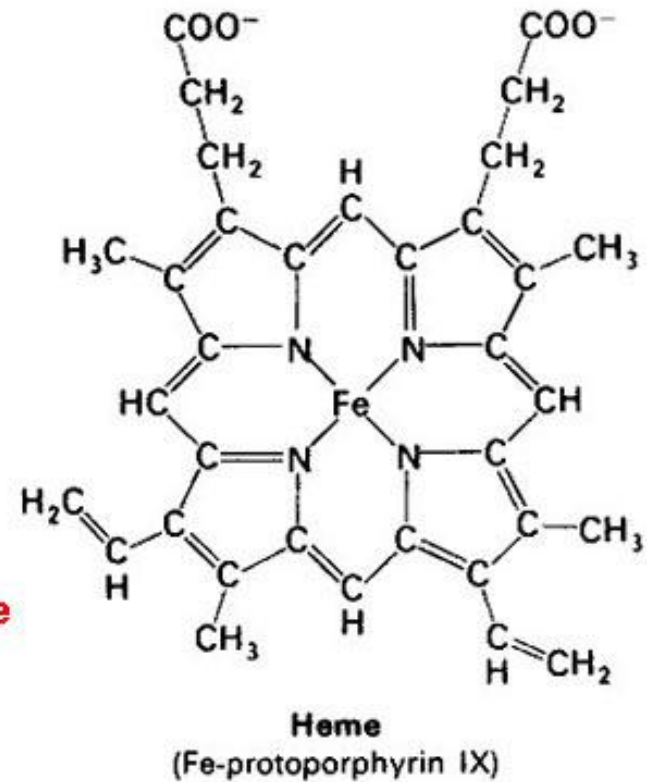
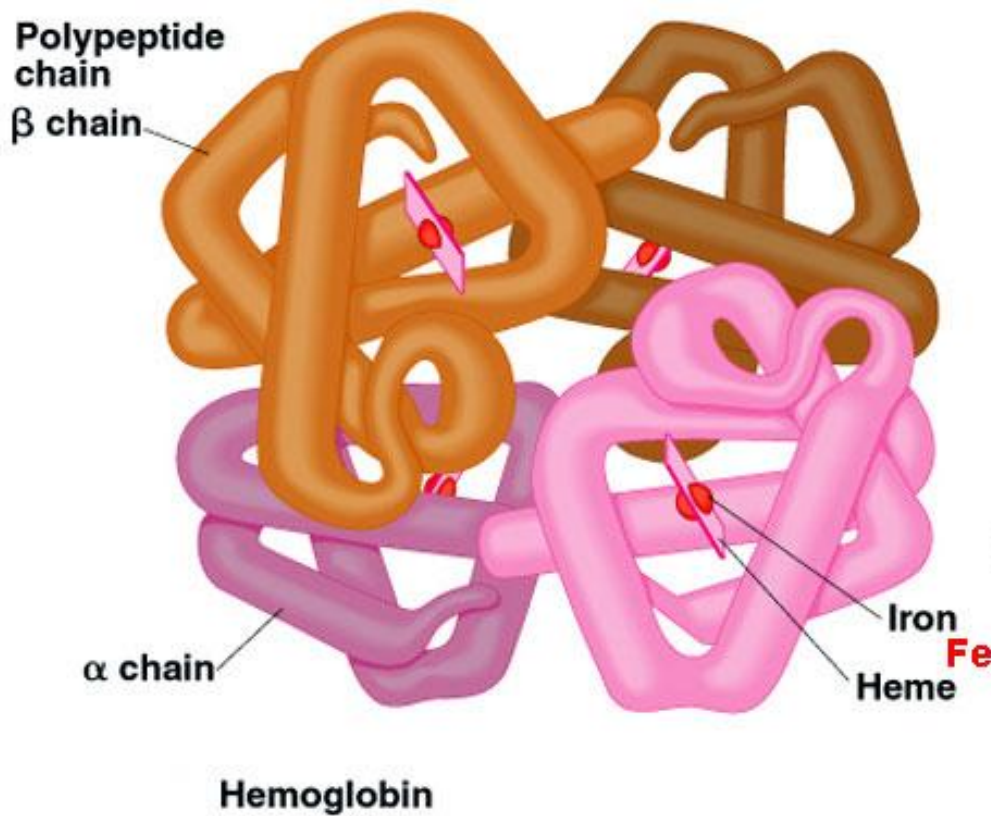
Protein Functions (cont)

- Enzymes (digests food)
 - Enzymes are catalysts, which start a reaction and make it go faster
- Chemical Synthesis: assemble other molecules
 - Special proteins build DNA, fats, and new proteins
- Burn for energy

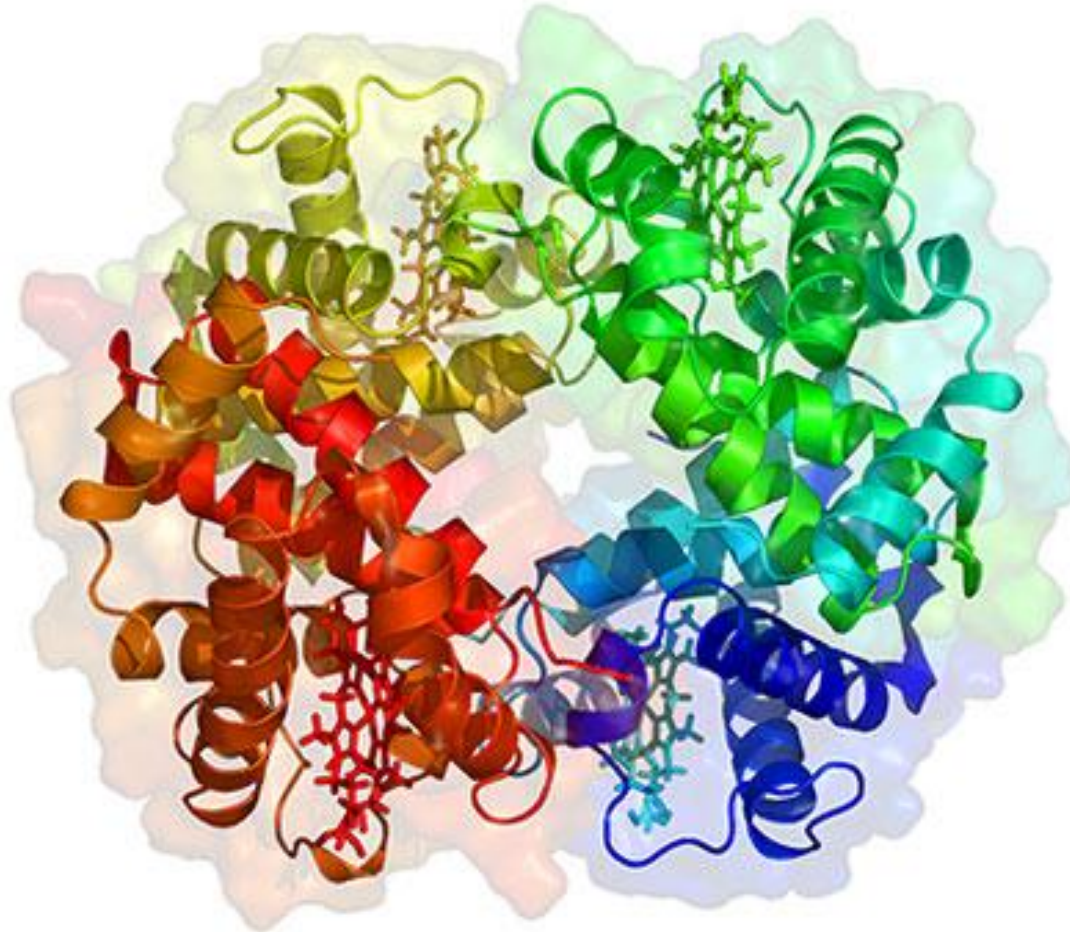
Protein Functions (cont)

- Cellular signaling / regulation
 - Ex: blood clotting
- Cellular transport
 - Carry nutrients and other molecules in and out of cells
- Immune system functions
- Structural components: hold cells together, hold organs together, etc

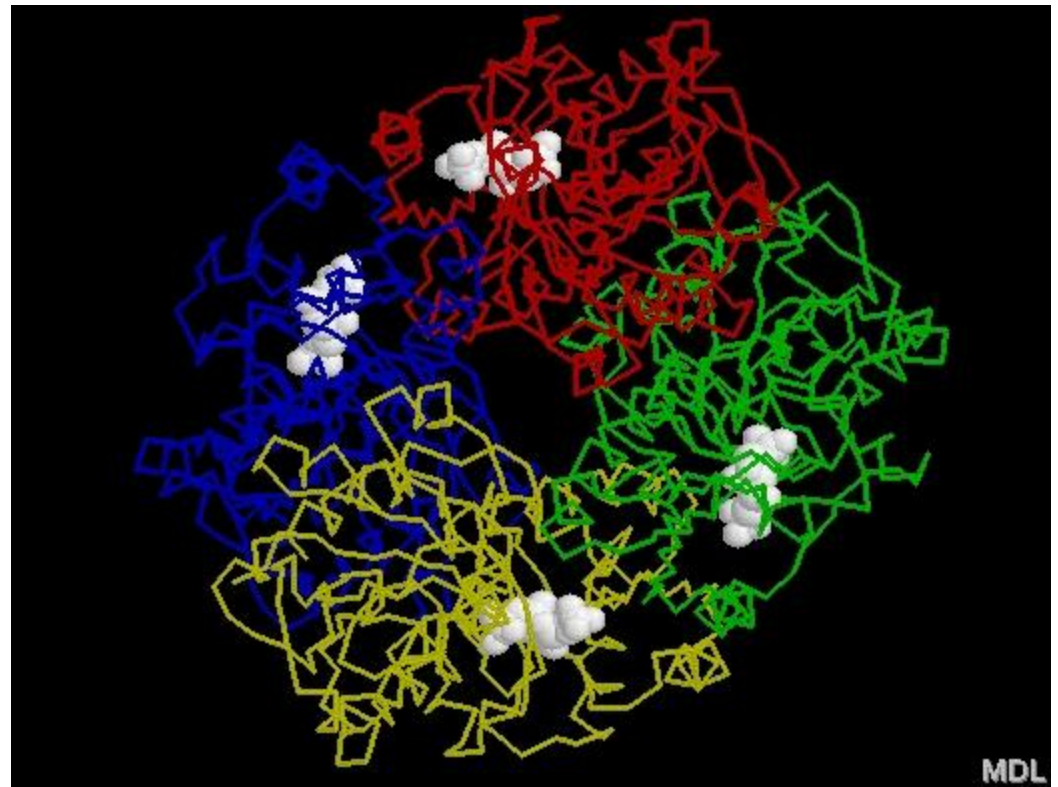
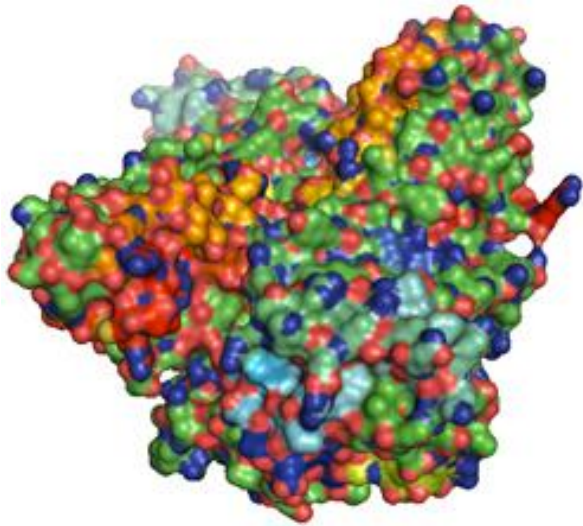
Hemoglobin (blood protein)



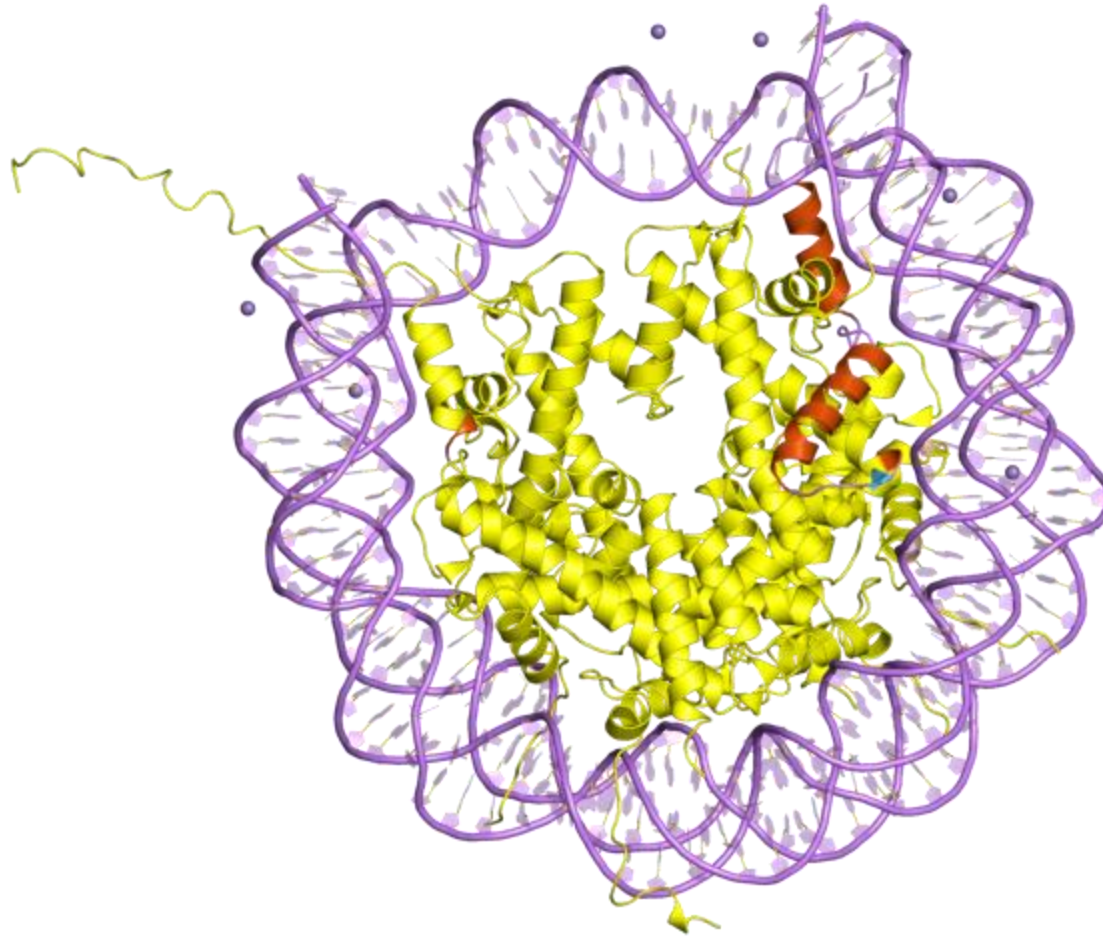
Hemoglobin Structure (again)



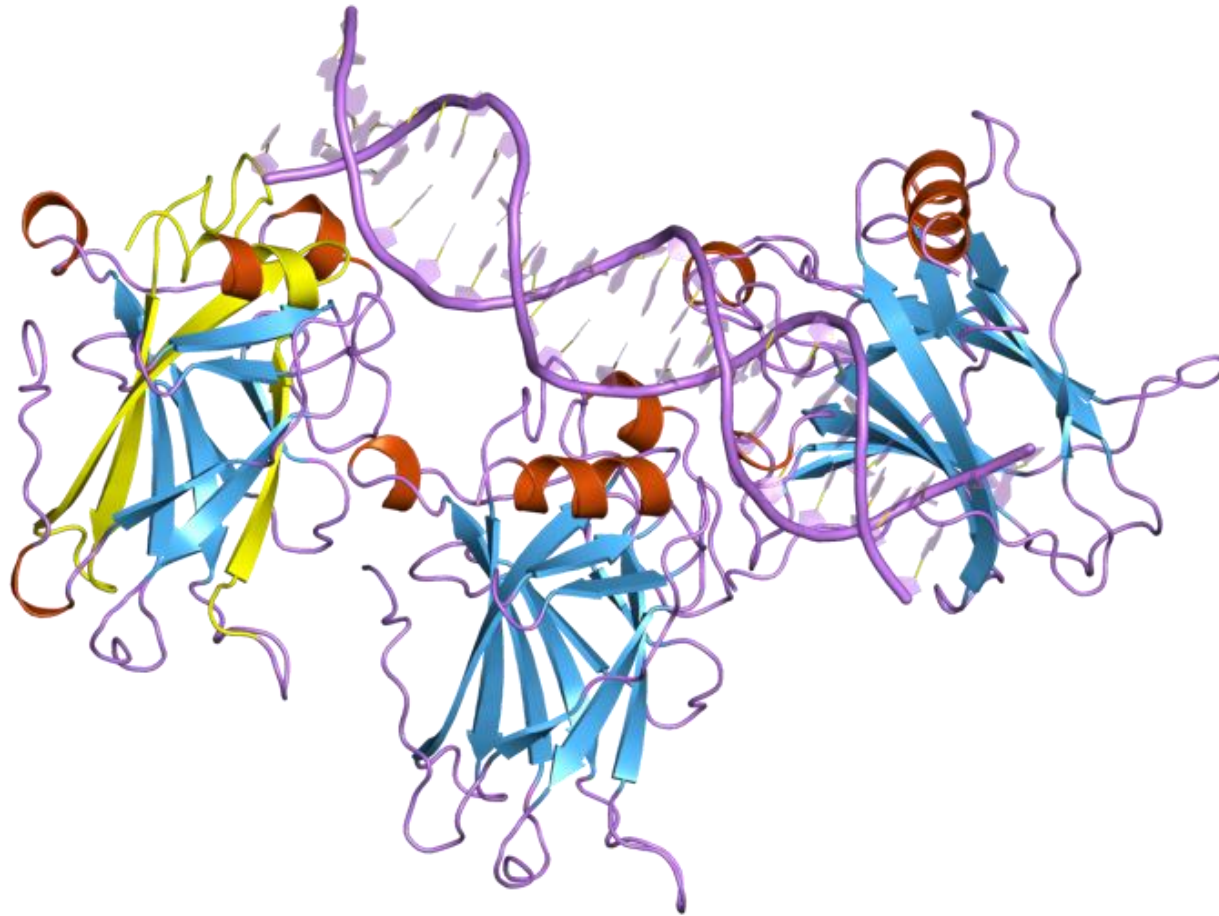
Phosphofructokinase (helps you burn sugar in glycolysis)



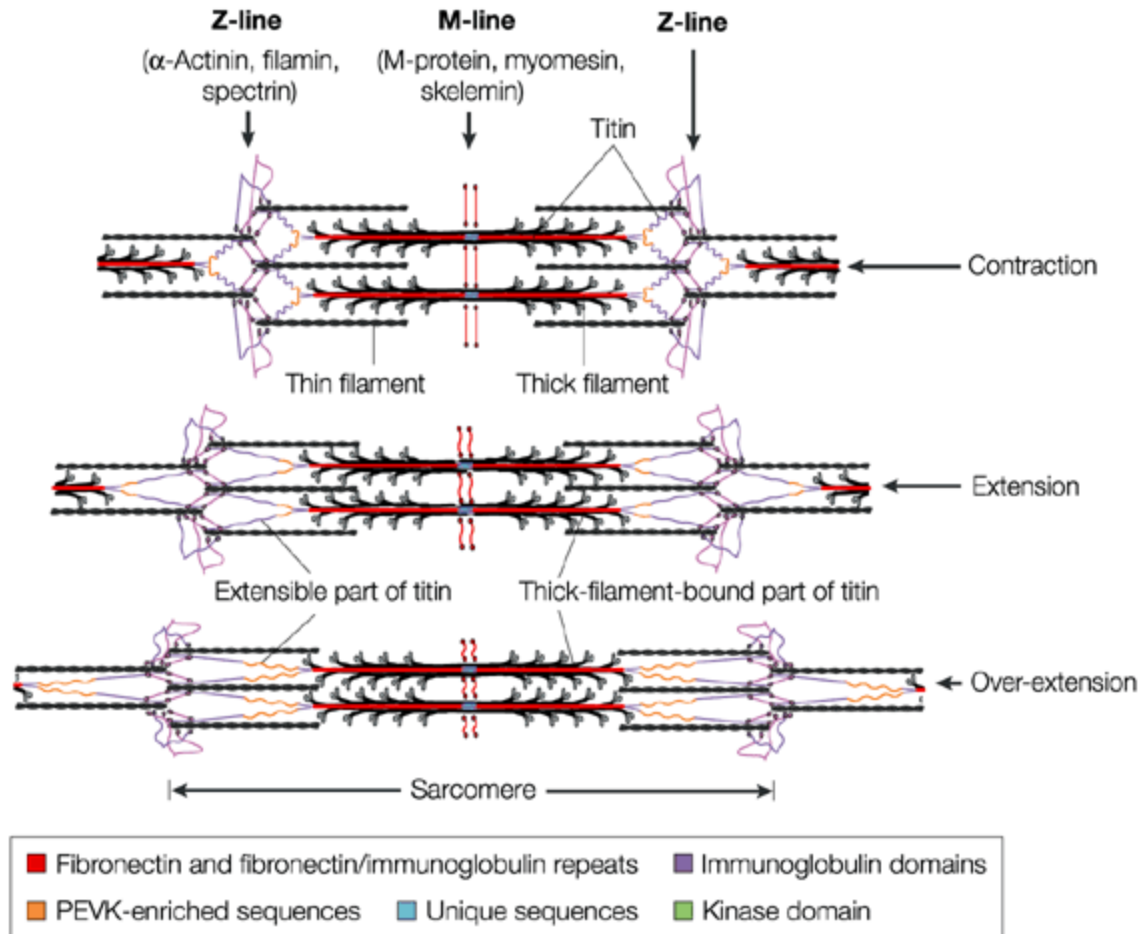
Nucleosome Protein (holds DNA together in a chromosome)



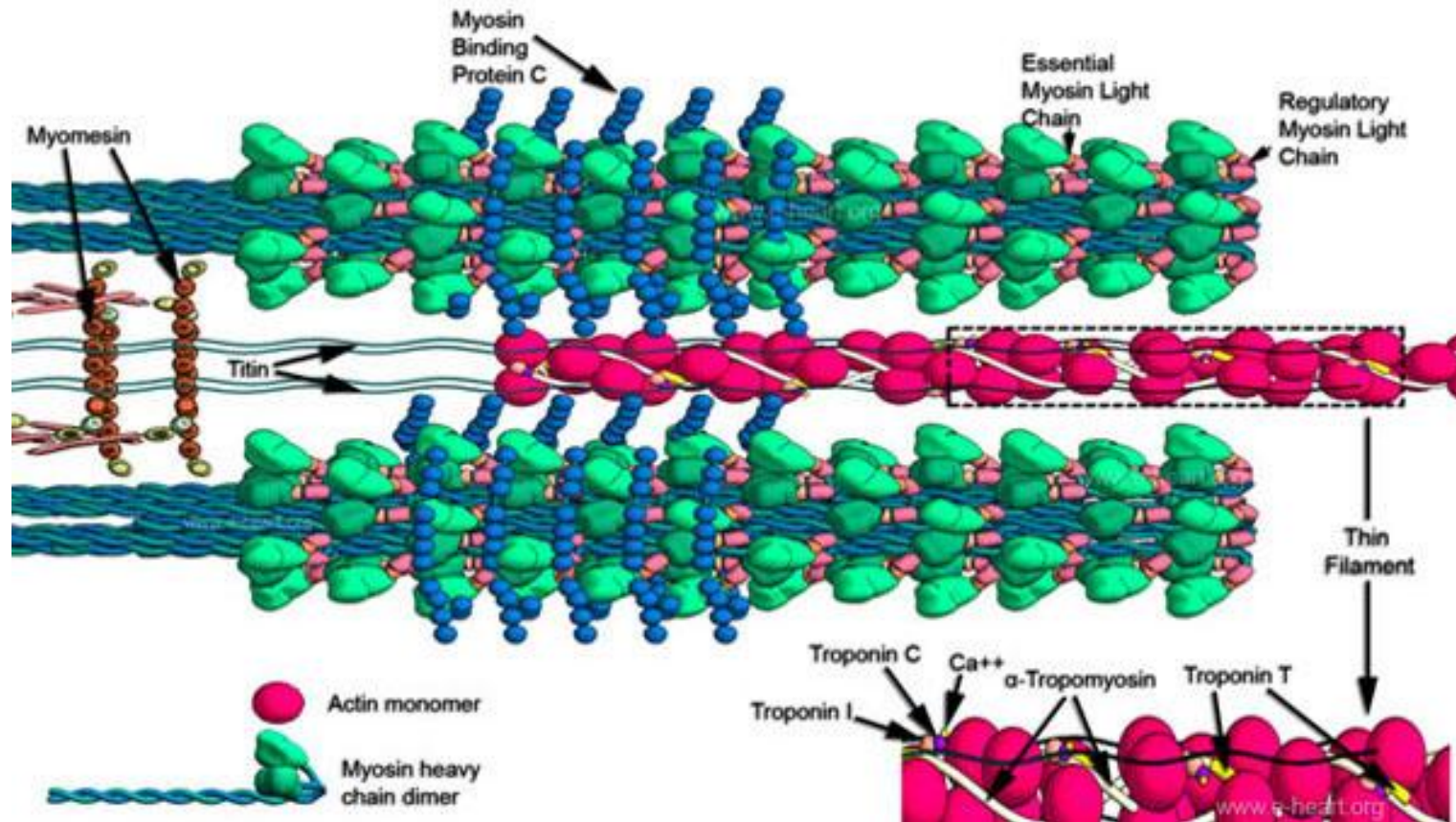
P53: a protein that regulates the cell cycle



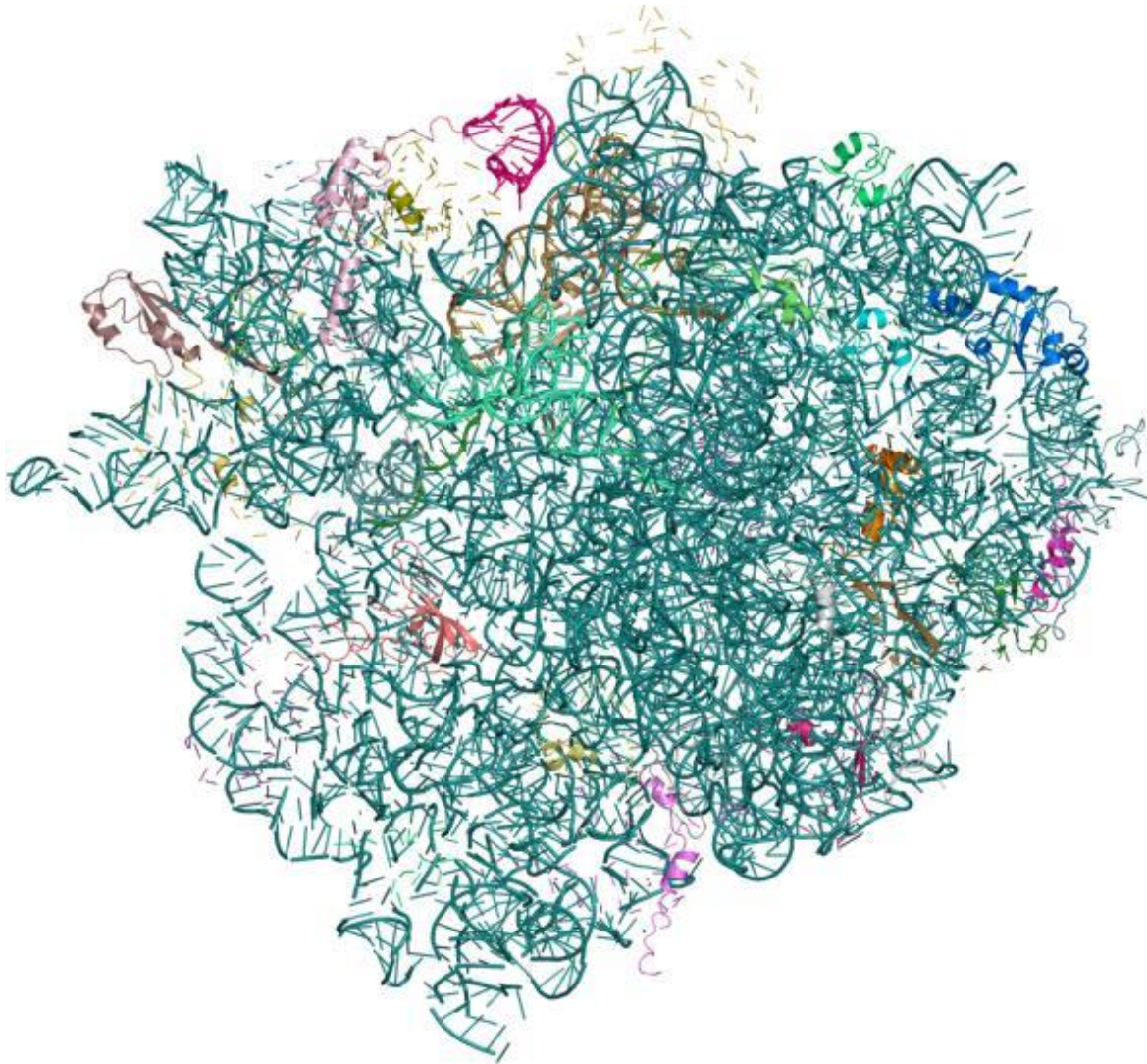
Titin (muscle protein)



Titin (muscle protein)



A ribosome: a collection of proteins that assembles other proteins.



Question

- How can proteins perform so many different functions?

Answer

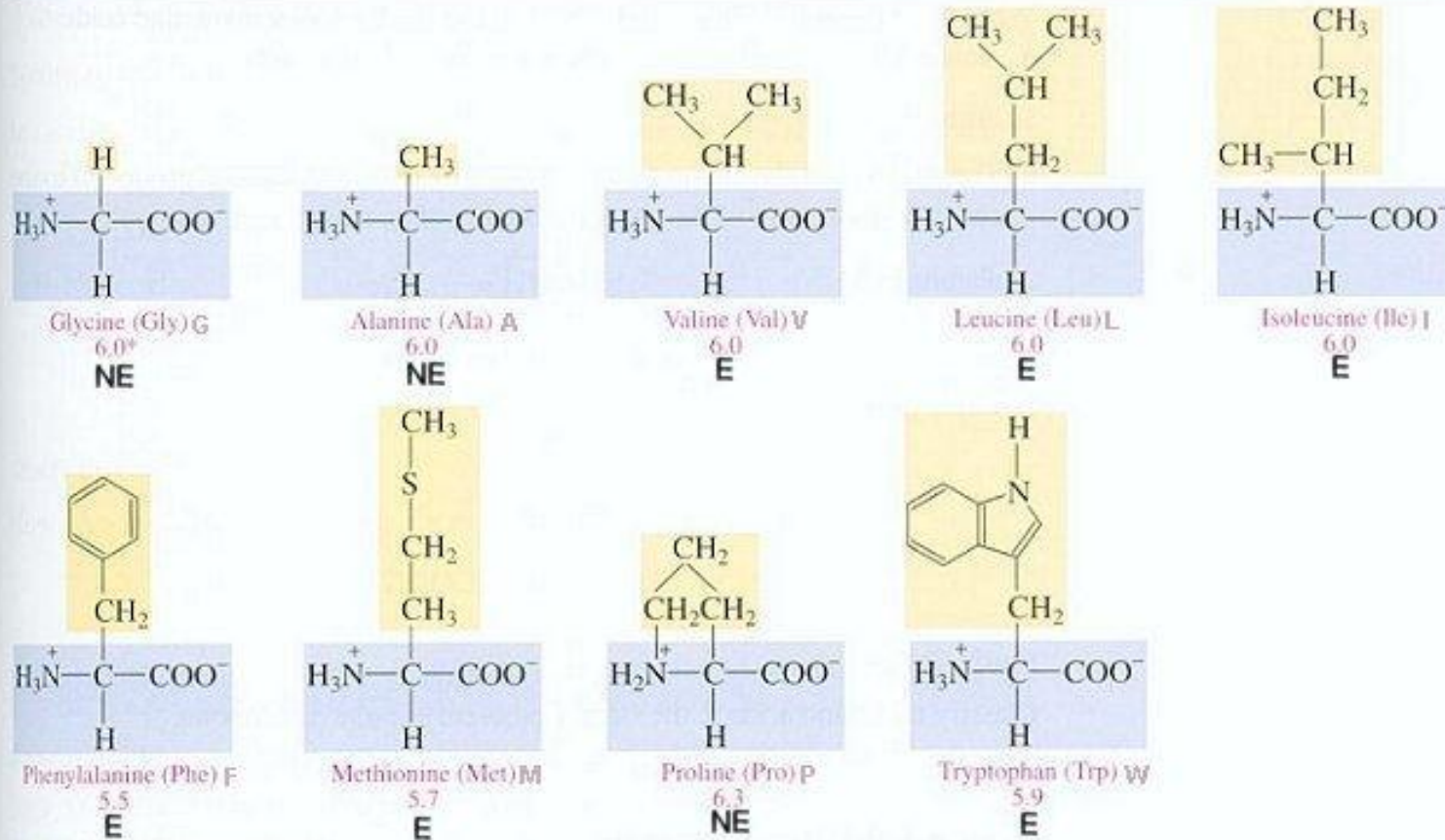
- They are made up of different combinations of amino acids. Different sequences have completely different structure and function.

By the way:

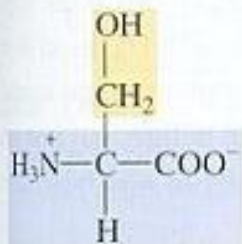
- What is DNA for?
 - DNA records the sequence of proteins. The 4 letters of DNA (in 3 letter chunks) are translated into the 20 or so types of amino acids.

Amino Acids

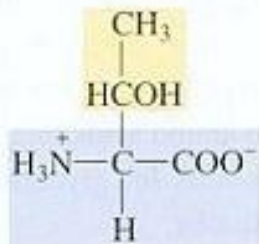
Nonpolar Amino Acids



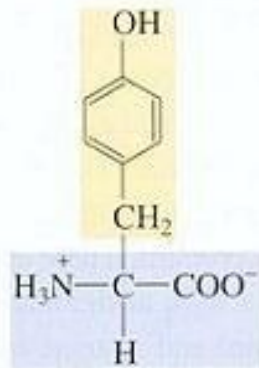
Polar Amino Acids (Neutral)



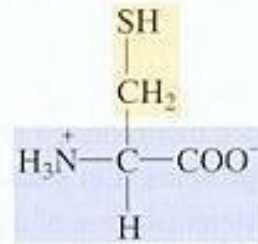
Serine (Ser) S
5.7
NE



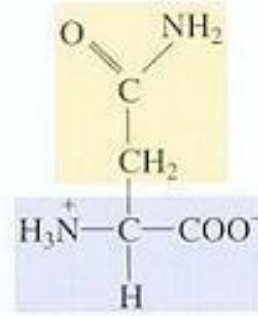
Threonine (Thr) T
5.6
E



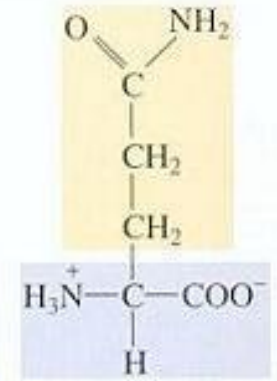
Tyrosine (Tyr) Y
5.7
NE



Cysteine (Cys) C
5.1
NE



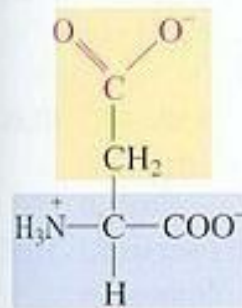
Asparagine (Asn) N
5.4
NE



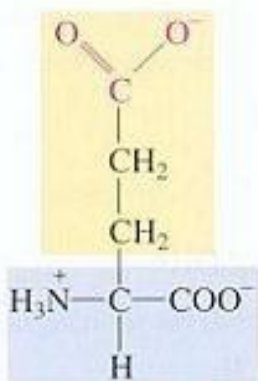
Glutamine (Gln) Q
5.7
NE

Acidic Amino Acids

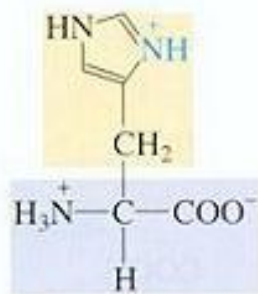
Basic Amino Acids



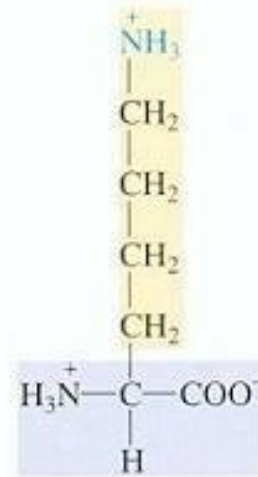
Aspartic acid (Asp) D
2.8
NE



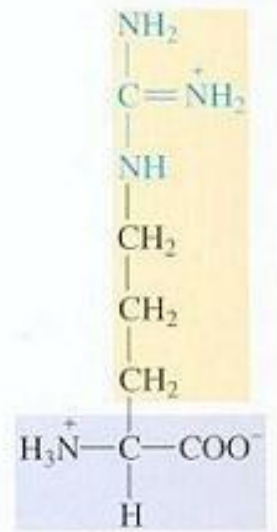
Glutamic acid (Glu) E
3.2
NE



Histidine (His) H
7.6
E



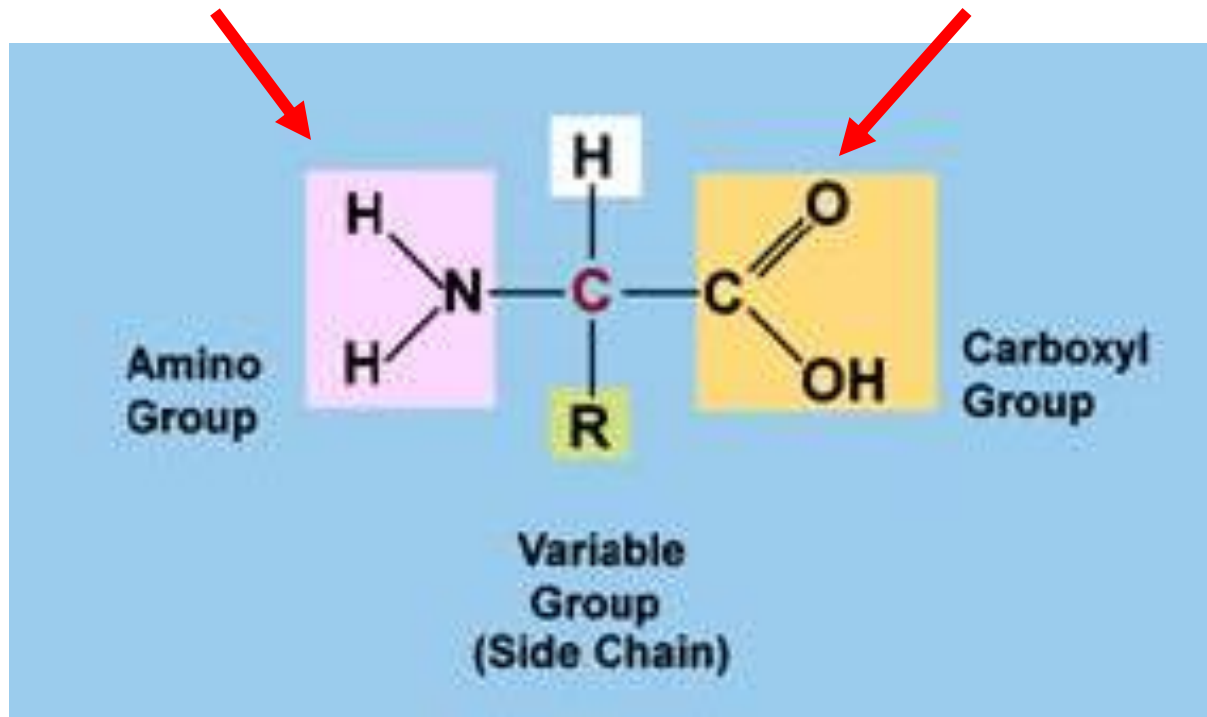
Lysine (Lys) K
9.7
E



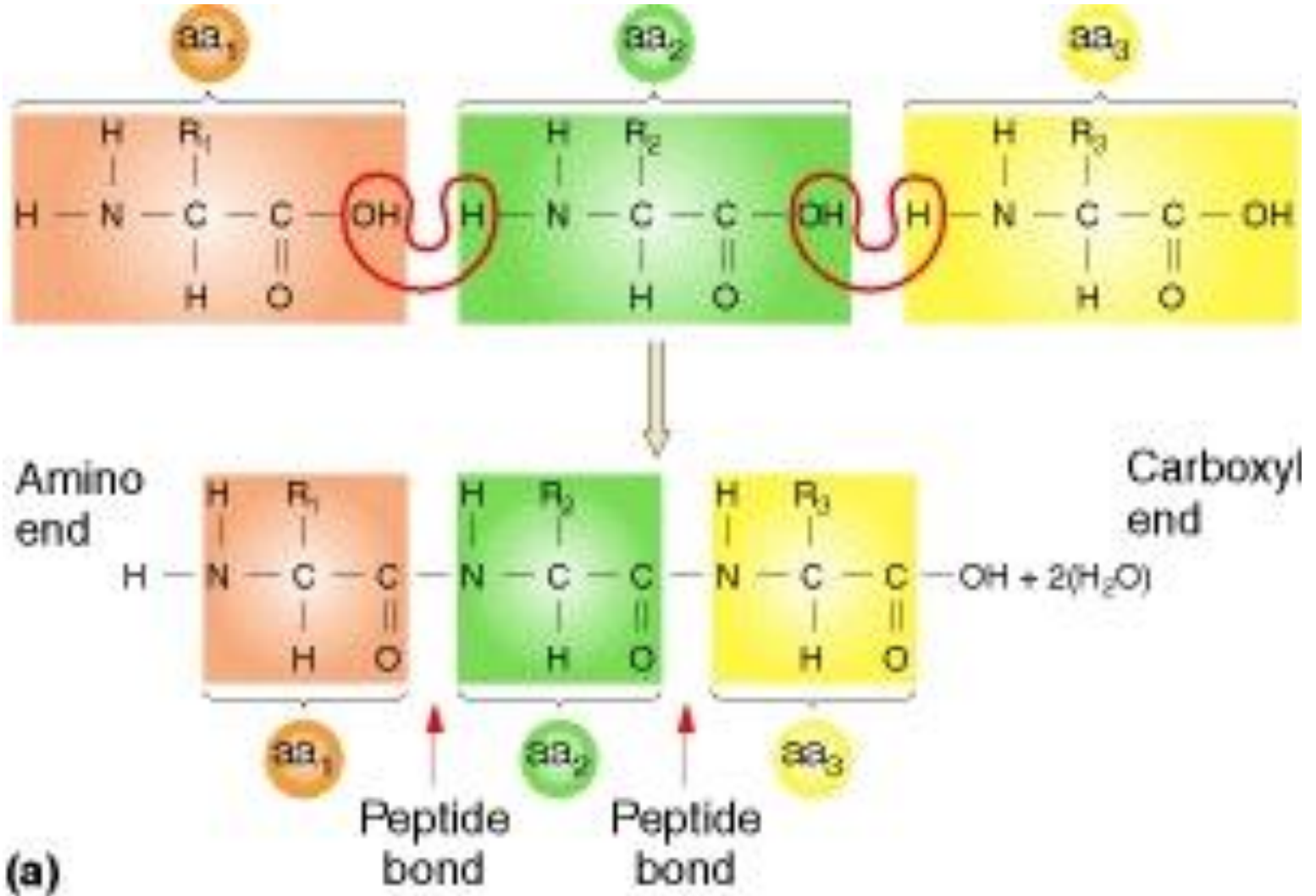
Arginine (Arg) R
10.8
NE

Amino Acids

- They have two groups:
an amino group & an acid group.



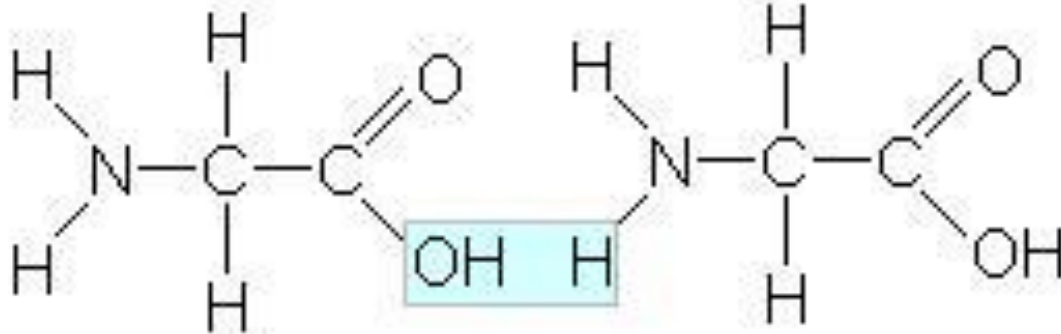
How amino acids combine



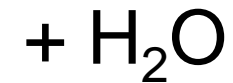
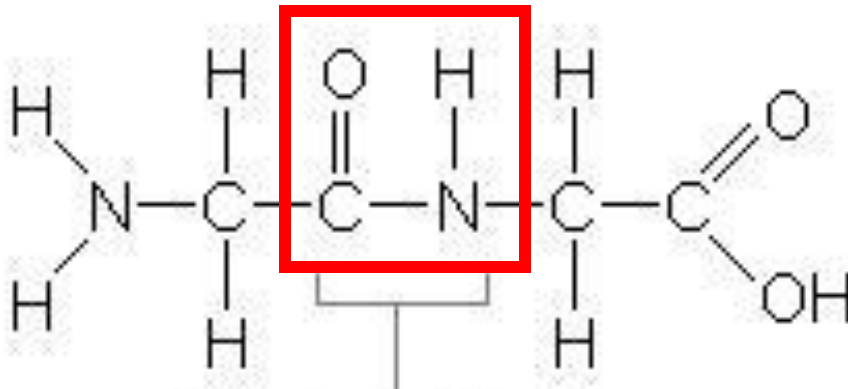
Peptide Bond: a new functional group

Amino Acid

Amino Acid



Dipeptide
(protein)



Peptide Bond

A molecule of water is removed from two glycine amino acids to form a peptide bond.

Protein in your Diet

- Energy: 4 Cal/g
- How much protein do you need?
 - Depends on age, gender, exercise, etc.
- Who needs the MOST protein?

Essential Amino Acids

- Your cells can make some of the amino acids.
 - The ones your body cannot make are called **essential amino acids**.
 - You can only get them in your food.
- (plants can make all of the amino acids)

Complete Proteins

- Proteins that have enough of all of the amino acids
 - Meats, eggs, dairy, soy

Incomplete Proteins

- Proteins that are missing some essential amino acids (or are very low on some)

Complementary Proteins

- Combinations of incomplete proteins that form a complete protein.
 - Ex: Lentils + Grains

Complementary Proteins

FOODS	LIMITING AMINO ACIDS (low levels, not completely missing)	COMPLEMENTARY FOODS	MENU ITEM EXAMPLES
Legumes: lentils, peas beans	Tryptophan Methionine	Grains, nuts & seeds	Stir-fry veg w/green soybeans, served over brown rice, sesame seeds garnish or Hummus (chickpeas & tahini spread), served with whole wheat pita bread
Grains: wheat, corn, rice, oats barley, rye	Lysine Isoleucine Threonine	Legumes, dairy	Grilled cheddar on whole wheat bread or Cornbread & chili beans, grated cheddar
Nuts & Seeds Almonds, peanuts, sunflower, cashews	Lysine Isoleucine	Legumes	Lentil-walnut loaf, cashew gravy or Fried tofu cubes on mixed salad, peanut-coconut dressing