NOTES: CH 5, part 2: Proteins and Nucleic Acids

5.4 - Proteins have many structures, resulting in a wide range of functions

● Proteins account for more than 50% of the dry mass of most cells

● Protein functions include:

● _____
● _____
● _____/_____
● _____
● _____
● _____
● _____
● catalysis of reactions (_____)

● an enzyme is a type of protein that acts as a catalyst, _____

PROTEINS:

● consist of 1 or more polypeptide chains folded and coiled into specific conformations

● ***Polypeptide chains*** = _____

-arranged in _____

-linked by _____

-range in length from a few to 1000+

AMINO ACIDS:

● _____

● structure of an amino acid (SKETCH):

- _____
- _____
- _____
- _____

-variable R group (side chain)

● Cells use _____ to make thousands of proteins

● linked together by _____ (links the carboxyl group of 1 amino acid to the amino group of another; requires dehydration / condensation)

PROTEIN STRUCTURE:

● a protein's _____ (3-D shape)

Four levels of protein structure:

1) Primary structure:

● _____ (forms the "backbone" of a protein)

-determined by _____

-a slight change can affect a protein's conformation and function (e.g. sickle-cell hemoglobin)

-can be sequenced in the laboratory (insulin)

2) Secondary structure:

● _____ of a protein's polypeptide backbone

● stabilized by H-bonds between peptide linkages _____ (NOT the amino acid side chains)

ALPHA HELIX = _____ stabilized by H-bonding between every 4th peptide bond (3.6 amino acid/turn)

BETA PLEATED SHEET = sheet of antiparallel chains folded into "_____"

3) Tertiary Structure:

● irregular contortions of protein due to bonding _____ (R groups) _____ _____

4) Quaternary Structure:

● association of 2 or more protein subunits to form a single functioning molecule (i.e. _____ and _____)

Protein Form and Function

● A functional protein consists of one or more polypeptides twisted, folded, and coiled into a unique shape

● The sequence of amino acids determines a protein's three-dimensional formation

● **A** _____

Protein Conformation

● determined by physical and chemical environmental conditions

● **DENATURATION**: process that alters a protein's native conformation and hence its biological activity

- _____
- _____
- chemical agents that disrupt H-bonding
- transfer to an organic solvent
- _____

Protein Denaturation:

● ***A denatured protein is misshapen and therefore biologically inactive***

The Protein-Folding Problem

● It is hard to predict a protein's conformation from its primary structure

● Most proteins probably go through several states on their way to a stable conformation

● Chaperonins are protein molecules that assist the proper folding of other proteins

5.5 - NUCLEIC ACIDS!!

5.5 - Nucleic acids _____

● The amino acid sequence of a polypeptide is programmed by a unit of inheritance called a _____

● _____, a nucleic acid

● **Two types of nucleic acids:** **1) DNA** **2) RNA**

The Roles of Nucleic Acids

● There are two types of nucleic acids:

- _____ (**DNA**)
- _____ (**RNA**)

● DNA directs synthesis of messenger RNA (mRNA) and, through mRNA, controls protein synthesis

● Protein synthesis occurs in _____

1. **DNA = Deoxyribonucleic acid**

● encodes the instructions for amino acid sequences of proteins

● is copied and passed from one generation of cells to another

2. **RNA = Ribonucleic acid**

● functions in the actual _____ coded for by DNA

● carries the encoded information to the ribosomes; carries the amino acids to the ribosome; a major component of ribosomes

_____ ➔ _____ ➔ _____

Structure of Nucleic Acids

● polymers of monomers called _____

● Each nucleotide consists of: Sketch one nucleotide in the space below:

1. **Pentose** (5-carbon sugar)
   - _____
   - _____
2. **Phosphate group** (attached to #5 carbon on sugar)
3. **Nitrogenous base**
   - -purines (double ring)
   - -pyrimidines (single ring)

● The portion of a nucleotide without the phosphate group is called a _____

● nucleotides are joined together by _____ (between phosphate of one nucleotide and the sugar of the next)

● results in a backbone with a repeating pattern of sugar-phosphate-sugar-phosphate...

The DNA Double Helix

● A DNA molecule has two polynucleotides spiraling around an imaginary axis, forming a _____

● One DNA molecule includes many genes

● The nitrogenous bases in DNA form hydrogen bonds in a complementary fashion:

_____ , _____

DNA & Proteins as Tape Measures of Evolution

● genes and their products (proteins) document the hereditary background of an organism

● linear sequences of DNA are passed _____; 2 siblings have greater similarity in their DNA than do unrelated individuals…

● it follows, that **2 closely related species** would _____ & protein sequences than 2 distantly related species would…

● that is the case!!!

● example: **the β chain of human hemoglobin:**

● this chain contains **146 amino acids**

-humans & gorillas _____

-humans & frogs _____

● ***Molecular biology has added a new "tape measure" with which we can study evolutionary relationships!!***