

3-1-M Details

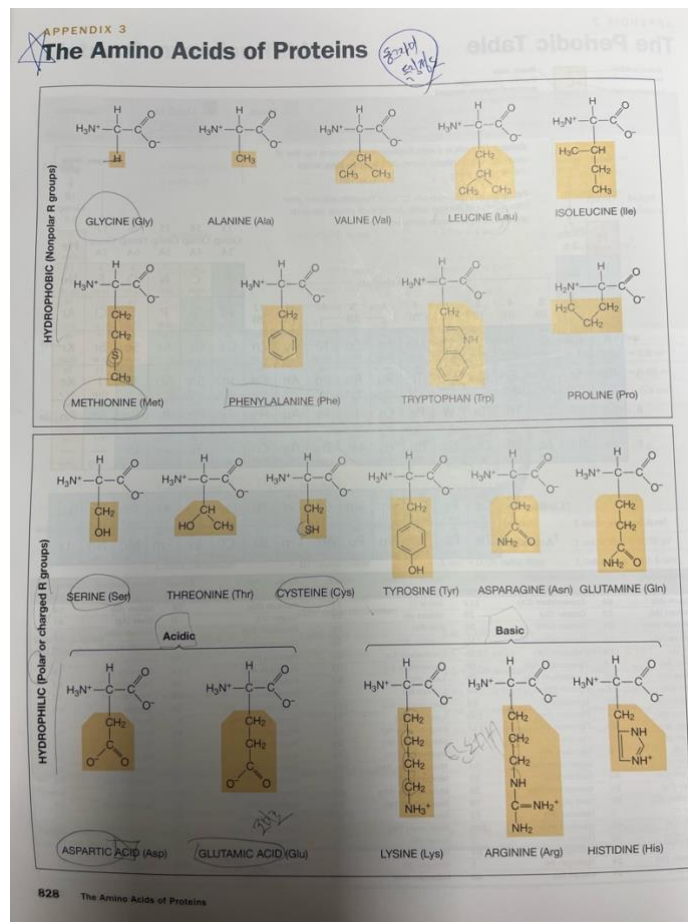
Campbell Biology: Concepts & Connections 9E (Taylor et al.)

Chapter 3 Molecules of Cells

- **organic compounds:** carbon-based molecules, usually contain hydrogen atoms
- **“A molecule’s shape usually determines its function.”**
- **How carbon skeletons vary:** Length, Double Bonds, Branching, Rings
- **Isomer:** same formula but different structural arrangements → 그래서 function 이 다름.
 - **Structural isomers:** 아예 구조가 다름.
 - **Geometric isomers:** 한 쪽이 상하 바뀜
 - **Enantiomers:** 거울형.
 - ex) L-Dopa / D-Dopa: 방향만 다른데 다른 작용.
- **hydrocarbon:** a molecule consisting of only carbon and hydrogen.
 - 석유의 주성분, 세상의 에너지 주요 성분
 - hydrocarbons are rare in living organisms, but hydrocarbon chains are found in regions of some molecules. (e.g.: fat)
- **Functional groups**
 - most of them are hydrophilic (except Methyl group)
 - **hydroxyl group:** OH
 - alcohols
 - **carbonyl group:** C=O
 - simple sugars: carbonyl + hydroxyl
 - **carboxyl group:** COOH
 - can act as an acid by contributing an H^+ to the solution and thus becoming ionized
 - **amino group:** NH_2
 - can act as a base by picking up an H^+ from a solution and becoming ionized
 - amino group 가진 organic compound: **amine**
 - amino acids: amino + carboxyl group
 - **phosphate group:** OPO_3^{2-}
 - usually ionized.
 - compounds with phosphate groups: **organic phosphates** (often involved in energy transfers)
 - **methyl group:** CH_3
 - methylated compound (DNA 의 구성물질) → expression of genes
 - ex) Sex hormones: Male & Female → Functional group 만 다름.
 - Testosterone: Carbonyl + Methyl
 - Estradiol: Hydroxyl
- **Macromolecules:** Carbohydrates, lipids, proteins, and nucleic acids
 - large size
 - 대부분 monomer 들이 모여서 만들어진 polymer 로 만듦. (Lipid 빼고)
- **Dehydration reactions:** monomer 들이 모여서 물 내놓고 bonding

- **hydrolysis:** 물 넣으면 monomer 들이 분리
- enzyme 이 빠르게 해주고 도와줌.
- A cell makes a large number of polymers from a small group of monomers.
 - Proteins: 20 different amino acids
 - DNA: four kinds of nucleotides
- The monomers used to make polymers are universal.
- **Carbohydrates:** the class of molecules that range from small sugar molecules to large polysaccharides
 - **Monosaccharides:** monomers of carbohydrates
 - **Glucose / Fructose:** 서로 isomer, 6 carbons long
 - main fuel molecules for cellular work
 - used as raw material for making other kinds of organic molecules
 - many of them form rings
 - **Disaccharide:** two monosaccharide monomers 가 붙은 것.
 - **Maltose:** glucose + glucose
 - **Sucrose:** glucose + fructose
 - **Oligosaccharides:** 3~10 monomers, cell recognition
 - **Polysaccharides:** 많이 모인 거
 - **Starch:** storage polysaccharide in plants, consists of long chains of glucose monomers
 - **Glycogen:** glucose storage of animals
 - **Cellulose:** forms plant cell walls
 - Animals do not have enzymes that can hydrolyze the glucose linkages in cellulose.
 - Cellulose that passes unchanged through the digestive tract: **insoluble fiber**
 - Some microorganisms do have enzymes that can hydrolyze cellulose.
 - Cows and termites 들이 이런 microorganisms 를 가지고 있음.
 - Decomposing fungi also digest cellulose
 - **Chitin:** exoskeleton, cell walls of fungi
 - usually hydrophilic
- **Lipids:** a diverse group of molecules that are hydrophobic
 - long-term energy storage, contain twice as much energy as a polysaccharide
 - not polymers (not built from similar monomers)
 - **Fats:** glycerol + fatty acids * 3
 - **unsaturated fatty acid:** double bond of carbon atoms, kink, liquid at room temperature
 - **saturated fatty acid**
 - **trans fat:** created when hydrogen is added to unsaturated fat
 - **Phospholipids:** the major components of cell membranes
 - Phosphate group + glycerol + fatty acids * 2
 - **Steroids:** the carbon skeleton containing four fused rings
 - **Cholesterol:** a common component of the cell membrane, 다른 것의 template
- **Protein:** a polymer of amino acids
 - involved in nearly every dynamic function
 - enzymes, transport, defensive, signal, receptor, contractile, structural, storage
 - **globular protein:** 둥그렇게

- immunoglobulin, enzymes, albumin
- **Fibrous protein:** 실 모양
 - keratin, collagen, elastin
- **Denaturation:** Excessive heat → loses its specific shape and, as a result, its function
- **Chaperonins:** protein molecules that assist in the proper folding of other proteins
 - 보호막 같은 것. 거기에 polypeptide 가 들어가서 외부 영향 안 받고 correctly fold 되게.
- **Amino acids:** amino group + carboxyl group + R (remainder)
 - **Essential Amino Acids**(따로 섭취해야 하는 것): Leucine, Methionine, Phenylalanine, Cysteine
 - **Non-essential Amino Acids**(몸에서 만들어지는 것): Serine, glutamic acid
 - Amino acid 가 모여서 peptide bond → polypeptide
 - 봐야 할 Amino acids
 - Hydrophobic: Glycine, Methionine, Phenylalanine
 - Hydrophilic: Serine, Cysteine, Aspartic Acid, Glutamic Acid



- **Primary Structure:** Amino Acid 순서
- **Secondary Structure:** hydrogen bonds along the backbone of the polypeptide chain, coiling or folding
 - alpha helix, beta pleated sheet
- **Tertiary Structure:** interactions between R groups → 3 차원
- **Quaternary structure:** Two or more polypeptide chains associate.
 - Collagen

- **Nucleic Acid**

- **Gene**: discrete unit of inheritance → amino acid sequence 정함.
- **Gene** 들이 모여서 **DNA (deoxyribonucleic acid)**
 - Double helix
- 다른 종류의 Nucleic Acid: **RNA (ribonucleic acid)**
 - single polynucleotide strand
- Central Dogma: Gene (DNA 의 일부) 가 RNA 로 Transcription, 그게 protein 으로 translation
- DNA and RNA are composed of monomers called **nucleotides**
 - nucleotide 가 모이면 polynucleotide → repeating sugar-phosphate backbone
 - five-carbon sugar → Ribose / Deoxyribose
 - Phosphate group
 - nitrogenous base: adenine, thymine, cytosine, guanine, uracil (RNA)
 - functions: Genetic material, Energy currency (ATP), secondary messenger (cAMP, cGMP)

Chapter 4 A Tour of the Cell (진짜 사소한 디테일을 중심으로)

- **Cell Theory**
 - All living organisms are composed of one or more cells
 - Cells are the smallest units of life
 - New cells come only from pre-existing cells by cell division.
- **Microscope 용어들**
 - **Magnification**: the increase in an object's image size compared with its actual size
 - **Resolution**: a measure of the clarity of an image. The ability of an instrument to show two close objects as separate.
 - ex) resolution 이 0.2 micrometer 이다 → 0.2 micrometer 떨어져 있는 것까지 2 개로 구분 가능.
 - 값이 작을수록 resolution 이 좋은 거임.
- **Light Microscope (LM)**
 - Light passes through a specimen, then through glass lenses, and finally light is projected into the viewer's eye
 - up to 1000 times the actual size of the specimen
 - resolution 0.2 μm
- **Electron Microscopes**
 - resolution: 2nm
 - magnify up to 100,000 times
 - **Scanning electron microscope (SEM)**
 - architecture of cell surfaces
 - electron 튕겨나오기
 - **Transmission electron microscope (TEM)**
 - internal cell structure
 - electron transmitted through the sample
- **Prokaryotic cells vs. Eukaryotic cells**
 - Both: **Plasma membrane**, one or more **chromosomes** (carry DNA), **ribosomes**, cytosol, cytoplasm (부르는 용어가 같다)
 - Prokaryotic cells: **nucleoid** 에 DNA coiled. → no membranes surrounded
 - 또, 겉부분에 대부분 cell wall, 어떤 것은 capsule, 어떤 것은 short projections (표면이든 다른 cell 이든 substrate 든 잘 달라붙기 위해서.) long projection → **flagella** (propel a cell through its liquid environment)
 - Eukaryotic cells: membrane-enclosed nucleus, internal membrane 으로 막아진 organelles
- **Endomembrane System**: Many of the internal membranes are part of the system.
 - **nuclear envelope, endoplasmic reticulum, Golgi apparatus, lysosomes, various types of vesicles and vacuoles, and the plasma membrane**
- **Smooth ER**
 - synthesis of lipids, detoxifying enzymes, storage of calcium ions (muscle cells)
- **Rough ER**
 - polypeptide 들어와서 **glycoprotein** 이 된 다음에 **transport vesicle** 로 묶여서 ER 밖으로 (secretory protein)

- membrane-making machine → membrane proteins, phospholipids 만들.
- **Cytoskeleton**
 - The internal movement of cell parts and the swimming or crawling motility of some cells usually involve the interaction of the cytoskeleton with **motor proteins**
 - **Microtubules**: straight, hollow tubes composed of globular proteins called tubulins
 - readily disassembled, tubulin can be reused
 - grow out from a region called the **centrosome + centrioles**
 - Plant cells lack centrosomes with centrioles
 - shape and support the cells, tracks, guide the movement of chromosomes, main components of cilia and flagella
 - **Intermediate filaments**: fibrous proteins
 - reinforce cell shape and anchor some organelles
 - often permanent fixtures
 - outer layer of your skin 에 있는 dead skin cells 에 엄청 많음
 - **Microfilaments**: actin filaments. globular proteins (actin)
 - three-dimensional network
 - cell's shape, cell movement, motor protein 만들.
- **Cilia & Flagella**
 - Flagella propel a cell by an undulating, whiplike motion
 - sperms
 - cilia work more like the oars of a crew boat
 - cells that sweep mucus out of our lungs have cilia
 - 다만 움직임에 유사한 구조
 - 내부구조: 9+2 배열
 - dynein 이 옆 microtubule 를 걸어서 이동 → cross-linking 단백질 때문에 못 미끄러지고 굽는다.
- **Extracellular Matrix (ECM)**: helps holds cells together in tissues and protects and supports the plasma membrane.
 - collagen → 구조 유지
 - ECM 은 glycoprotein 에 붙고 그 뒤에 **integrin** 이라는 membrane protein 에 붙음.
 - integrin: transmit signals, communicate changes occurring outside and inside the cell
- **Cell Junctions**
 - **Tight Junctions**
 - 물질 새는 것 방지
 - **Anchoring Junctions**
 - 세포를 단단히 붙잡음
 - intermediate filaments made of sturdy proteins anchor these junctions in the cytoplasm.
 - **Gap Junctions**
 - channels that allow small molecules to flow through protein-lined pores between cells
 - communicating junctions

Chapter 5 The Working Cell (진짜 사소한 디테일을 중심으로)

- **Exocytosis:** used to export bulky molecules, such as proteins or polysaccharides
- **Endocytosis:** used to import substances useful to the livelihood of the cell
 - **Phagocytosis**
 - engulfment of a particle by wrapping cell membrane around it, forming a vacuole
 - **Pinocytosis**
 - fluid 가 들어오는 거
 - **Receptor-mediated endocytosis**
 - uses receptors in a receptor-coated pit to interact with a specific proteins, initiating the formation of a vesicle.