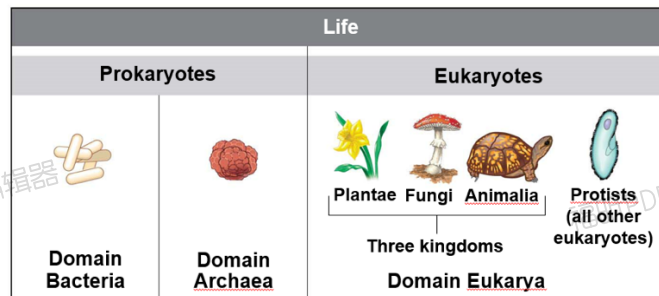


# Chapter 1. Introduction: biology today

- **The properties of life**
  - 1) **Order:** all living things exhibit complex but ordered organization.
  - 2) **Regulation:** the environment outside an organism may change drastically, but the organism can adjust its internal environment, keeping it within appropriate limits.
  - 3) **Growth and development:** information carried by DNA controls the pattern of growth and development in all organisms.
  - 4) **Energy processing:** organisms take in energy and use it to perform all of life's activities; they emit energy as heat.
  - 5) **Response to the environment:** all organisms respond to environmental stimuli.
  - 6) **Reproduction:** organisms reproduce their own kind.
  - 7) **Evolution:** reproduction underlies the capacity of populations to change (evolve) over time.
- **Species:** a group of organisms that live in the same place and time and have the potential to interbreed with one another in nature to produce healthy offspring.
  - ✧ **Taxonomy:** the branch of biology that names and classifies species, is the arrangement of species into a hierarchy of broader and broader groups.
- **The three domains of life:** bacteria, archaea, eukarya



- 1) **Prokaryotic cells:** relatively small and simple cells that lack a nucleus or other compartments bounded by internal membranes.
  - 2) **Eukaryotic cells:** relatively large and complex cells that contain a nucleus and other membrane-enclosed compartments.
    - ✧ **The domain Eukarya in turn includes three smaller divisions called kingdoms:** plantae, fungi, Animalia.
  - 1) **Plants:** produce their own sugars and other foods by photosynthesis.
  - 2) **Fungi:** are mostly decomposer, obtaining food by digesting dead organisms and organic wastes.
  - 3) **Animals:** obtain food by ingesting (eating) and digesting other organisms.
- **Evolution**
    - 1) **Natural selection:** in the struggle for existence, those individuals with heritable traits best suited to the local environment are more likely to survive and leave the greatest number of healthy offspring. Therefore, the traits that enhance survival and reproductive success will be represented in greater numbers in the next generation.
    - 2) **Artificial selection:** the purposeful breeding of domesticated plants and animals by humans.
  - **Information flow**
    - 1) **Genes:** hereditary units of information consisting of specific sequences of DNA passed on from the previous generation.
    - 2) **Genome:** the entire set of genetic information that an organism inherits.

## Classification of Living Things

domain, kingdom, phylum, class, order, family, genus, species,

## Chapter 2. Essential chemistry for biology

### Chapter 3. The molecule of life

- O, C, H, N—make up about 96% of the weight of the body.

**Quantity elements:** Ca, P, K, Na, Cl, S, Mg

**Trace elements:** Mn, Fe, Co, Cu, Zn, Se, Mo, I

- **Radioactive isotope:** isotope in which the nucleus decays spontaneously, shedding particles and energy.
  - **Chemical bonding:** ionic bonds, covalent bonds, hydrogen bonds.
    - ✧ **Polar molecule:** one with an uneven distribution of charge that creates two poles, one positive pole and one negative pole.
  - **Alternative ways to represent a molecule:** molecular formula, electron configuration, structural formula, space-filling model, ball-and-stick model.
  - **Four properties of water:**
    - 1) The cohesion nature of water;
    - 2) The ability of water to moderate temperature;
    - 3) The biological significance of ice floating;
    - 4) The versatility of water as a solvent.
    - ✧ **Evaporative cooling:** when a substance evaporates (change from a liquid to a gas), the surface of the liquid that remains cools down.
- 

- **Lipids:** hydrophobic. fats and steroids

1) **Fats:** the major form of long-term energy storage in animals.

- ✧ Most animal fats are saturated
- ✧ Plant oils contain mostly unsaturated fats, having fewer hydrogens in the fatty
- ✧ Trans fats are a type of unsaturated fat that is bad for health.

2) **steroids:** including cholesterol(胆固醇) and the sex hormones.

- **Protein:** a polymer of amino acid monomers.

1) **Amino acid:** consists of a central carbon atom bonded to four covalent partners.

- ✧ a carboxyl group (-COOH).
- ✧ an amino group (-NH<sub>2</sub>).
- ✧ a hydrogen atom.

The variable component of amino acids is called the side chain (or R group, for radical group); it's attached to the fourth bond of the central carbon.

2) **Peptide bond:** the bond that joins adjacent amino acids.

3) **Polypeptide:** the long chain of amino acids.

4) **Shape:** the shape of a protein determined its function.

- **Nucleic acids:** macromolecules that store information and provide the instructions for building proteins.

1) **DNA:** deoxyribonucleic acid. Takes the form of a double helix.

2) **RNA:** ribonucleic acid.

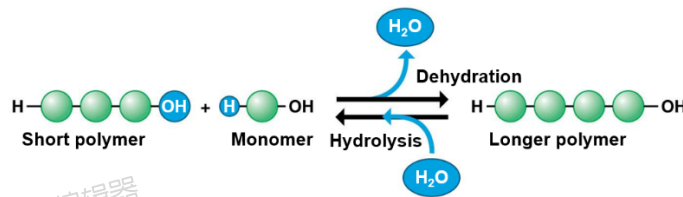
3) **Gene:** a unit of inheritance encoded in a specific stretch of DNA that programs the amino acid sequence of a polypeptide.

4) **Nucleotides(核苷酸):** monomers(单体).

- ✧ At the center of each nucleotide is a five-carbon sugar, deoxyribose in DNA and ribose in RNA;
- ✧ Attached to the sugar is a negatively charged phosphate group containing a phosphorous atom bonded to oxygen atoms;
- ✧ Attached to the sugar is nitrogen-containing base made of one or two rings.
- ✧ Each DNA nucleotide has one of four possible nitrogenous bases: adenine (A), guanine (G), cytosine (C), thymine (T).

5) **Sugar-phosphate backbone:** a repeating pattern of sugar-phosphate-sugar-phosphate, with the bases (A,T,C,G) hanging off the backbone like appendages.

- **Polymers:** large molecules made by stringing together many smaller molecules (monomers).
- **Dehydration reaction, hydrolysis (水解)**



- **Large molecules:** carbohydrates, lipids, proteins, nucleic acids

Large Biological Molecules	Functions	Components	Examples
Carbohydrates	Dietary energy; storage; plant structure	<p>Monosaccharide</p>	<b>Monosaccharides:</b> glucose, fructose; <b>disaccharides:</b> lactose, sucrose; <b>polysaccharides:</b> starch, cellulose
Lipids	Long-term energy storage (fats); hormones (steroids)	<p>Components of a triglyceride</p>	<b>Fats (triglycerides);</b> <b>steroids</b> (testosterone, estrogen)
Proteins	Enzymes, structure, storage, contraction, transport, etc.	<p>Amino acid</p>	<b>Lactase</b> (an enzyme); <b>hemoglobin</b> (a transport protein)
Nucleic acids	Information storage	<p>Nucleotide</p>	DNA, RNA

cellulose: 纤维素  
glycogen: 糖原

