- **Palisade mesophyll cells:** special cells found in a leaf that absorb light for photosynthesis.
- **Nerve cells:** special cells in the nervous system of animals that transmit impulses.
- **Red blood cells:** special cells in the blood of vertebrates that transport oxygen.
- **Sperm and egg cells:** reproductive sex cells in organisms used in sexual reproduction of organisms.

THE PARTS OF A CELL:
Cell membrane:

- outermost structure of a cell.
- protects the cell against injuries of substances that may harm or kill it.
- controls the passage of substances going out or into the cell.
- separates the cell from its environment.

Protoplasm: all materials included by the cell membrane. It is divided into two parts:

1. **Nucleoplasm** (the nucleus).
2. **Cytoplasm** (the material found between the cell and nuclear membranes).

Nucleus:

- Structure: contains DNA (genes, chromosomes). It is surrounded by the nuclear membrane (with large pores).
- Function: controls everything that occurs inside the cell.

Cytoplasm:

- yellowish material in which all life processes occur.
- found between the cell and nuclear membrane.

CYTOPLAMIC INCLUSIONS (ORGANELLES):

Endoplasmic reticulum (ER):

- Structure: a network of interconnected membranes.
- Function: transports substances all over the cell.

Ribosomes:
-Structure: tiny granules (spheres) found in the cytoplasm.
- Function: make proteins for the cell.

Golgi apparatus (Golgi body):

- Structure: set of flat sacs, one on top of another.
- Function: absorbs and packages substances for being exported out of the cell.

Lysosome:

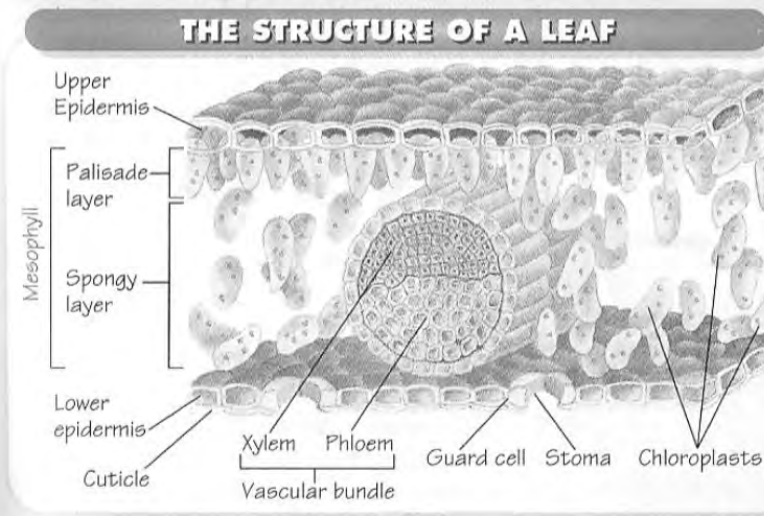
- Structure: tiny spherical body filled with fluids.
- Function: digests food particles.

Mitochondrion:

temperature to maximize the photosynthetic rate of plants.

OVERCOMING LIMITATIONS WHEN GROWING PLANTS FOR FOOD OR OTHER USES:

1. Irrigation: providing enough water is important to grow good plants (vegetables, fruits, etc.).
2. Fertilization: a good supply of minerals (N, P, K – macronutrients – and B, Fe, Mg, Ca – micronutrients –).
a. Soil: macronutrients are added to the soil.
b. Foliar: micronutrients are sprayed to leaves. Nitrate ions (NO_3^-) are important to produce amino acids needed in protein synthesis. Without nitrate ions, plants cannot produce proteins needed to grow, so they are dwarf. Magnesium is an important mineral in the chlorophyll molecule, so its deficiency affects the making of chlorophyll which is needed in photosynthesis. Without it, leaves turn yellow and photosynthesis is lowered.
3. Pesticides:
a. Insecticides: substance that kills insects that eat plants.
b. Fungicides: substance that kills fungi that attack plants.
4. Weeding: weeds (undesirable plants that grow in a plantation) compete with crops for food, water, minerals, and light; therefore they have to be controlled.



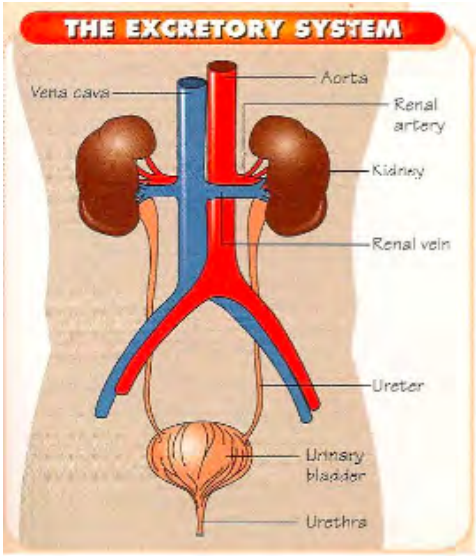
LEAF STRUCTURE: Leaf : photosynthetic organ found in plants (contains chloroplasts
Contains several layers (tissues):
o Epidermis: one celled layer that surrounds and protects the leaf against dehydration and injuries (insect or fungal attack). The upper epidermis contains the cuticle, a waxy layer that covers it and avoids the loose of water. The lower epidermis contains the stoma or stomata, which are the openings through which CO_2 enters the leaf and O_2 leaves the leaf.These openings are controlled each by two guard cells.
o Palisade layer: found beneath the upper epidermis. Contains many chloroplasts, so it performs most of photosynthesis.
o Spongy lager: below the palisade layer, contains few chloroplasts, cells are loose and store water and gases. Carries on little photosynthesis.

MIND:
During photosynthesis plants absorb CO_2 from the air to make food and release O_2 into the air. At night do the opposite. Autotrophs do both processes: photosynthesis and respiration. Heterotrophs only do respiration. Plants

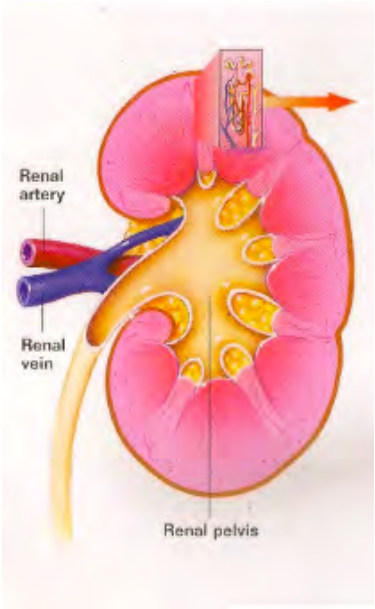
antibodies necessary to fight infections she/he gets. In some cases the body itself attacks and destroys body cells, as in the case of diabetes type I, that occurs when the immune system destroys pancreatic cells that produce insulin, as a result the body does not produce insulin, leading to a diabetic condition. This normally occurs early in childhood, between 2 and 5 years old.

The best way to reduce the spread of infectious diseases is by:
1. hygienic food preparation, food poisoning is still a leading cause of infectious diseases.
2. good personal hygiene that kills pathogens that otherwise will cause an infection when they grow in large populations.
3. waste disposal encourages population growth of pathogens, so residual waters have to be treated to avoid the growth of pathogens.

Topic 13
The elimination of chemical wastes from the body is known as excretion. The lungs, for example, excrete carbon dioxide, a chemical waste produced when energy is captured from food compounds. The skin excretes excess water and salt in sweat.



The kidney:
The kidneys are responsible for removing substances from the blood that are not needed or are harmful. These substances can be divided into four groups:
a. toxins and other substances that are ingested and absorbed but are not fully metabolized by the body, for example, beta pigments in beets, and also drugs.
b. excess water, produced by cell respiration and absorbed from food in the gut.
c. excess salt, absorbed from food in the gut.
d. nitrogenous wastes (mainly urea).



The excretory system in the human body: Human kidney structure

The kidney cells are called nephrons which are the filtering structures. The glomerulus produces the filtrate which contains urea, water, salts, and glucose. Later, the filtrate goes through the process of reabsorption where glucose, most of the water and some salts are reabsorbed into the bloodstream, leading to the concentration of urea in urine as well as the loss of excess water and

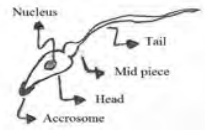
individuals who are different from both parents (are combinations of characteristics found in both parents). Occurs because of meiosis. Results from fertilization (the fusion of gamete nuclei).

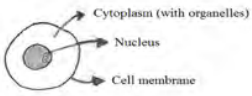
Advantages Of sexual Reproduction	Disadvantages of sexual reproduction
• Produces Variations Individuals can adapt in many different ways. • Evolution is more safe and successful	• Mutate or change Sometimes bad, transmit diseases. • Longer time

Body tissues:

1. **Somatic:** all different body tissues. Cells are **diploid** (2N – contain two sets of chromosomes).
2. **Reproductive or gonads:** tissues that produce sex cells or gametes:
    1. **Female:** ovary, produces eggs, ovule, ovum (ova).
    2. **Male:** testes, produces sperm cells.

Sex cells are **hapoloid** or **nonoploid** (1N – contain one set of chromosomes).





SPERM: motile male gamete. Male sex cell	**EGG:** stationary female gamete. Female sex cell
• Small as it allows it to move quickly and travel long distances quickly • Swims up to the Fallopian tube • Swims very long distances therefore are small do not carry lots of weight nor “luggage” • In humans they produce around 250.000.000 sperm cell per day ivy helps for infertile guys • Andropause	• Egg cell is so big as it stores food for the embryo • Only human cell we can see with the naked eye macroscopic • 1 egg cell a month • Menopause

Fertilization: union of two sex cells. Occurs when the sperm penetrates the egg and both nuclei fuse into one new nucleus. It is divided into two types:

1. **External:** egg and sperm are released directly into water, where fertilization takes place. Some risks exist, especially if the sperm cannot find the egg. Occurs in most fish and amphibians.

c. Omnivores: consumers that feed on both producers and consumers.
d. Necrophagues or Scavengers: consumers that feed on partially decayed consumers.

3. Decomposers: also called saprotrophs. Consumers that decay the remains of organic matter. Decay producers and/or consumers that they find dead. Recycle nutrients in ecosystems, releasing nutrients into de environment.

19.3 Nutrient cycles:
Water cycle:
The continuous process by which water is circulated throughout the Earth and its atmosphere. The Earth's water enters the atmosphere through evaporation from bodies of water and from ground surfaces. Plants and animals also add water vapor to the air by transpiration. As it rises into the atmosphere, the water vapor condenses to form clouds. Rain and other forms of precipitation return it to the Earth, where it flows into bodies of water and into the ground, beginning the cycle again. Also called hydrologic cycle.

Nitrogen cycle:
The continuous process by which nitrogen is exchanged between organisms and the environment. Nitrogen is an essential nutrient, needed to make amino-acids and other important organic compounds, but most organisms cannot use free nitrogen , which is abundant in the atmosphere, making 80% of all gases in the atmosphere. Gaseous nitrogen is broken apart and fixed in the process of nitrogen fixation. Some atmospheric nitrogen is fixed naturally during lightning strikes and some by industrial processes. Cyanobacteria and certain other species of bacteria, especially those living as symbionts in the roots of legumes, fix atmospheric nitrogen biologically in ammonium ions. Ammonia and ammonium ions are also produced by the ongoing decay or organic materials. Ammonia can be absorbed directly by plant cells, and
certain bacteria living in soil and water convert ammonia and ammonium ions into nitrites or nitrates in the process known as nitrification. The nitrates are easily absorbed by plant roots. In this way, nitrogen is passed into the food chain and ultimately returned to the soil, water and atmosphere by the metabolism and decay of plants and animals.

19.4: Population size

Ecological organization levels:
1. Organism.
2. Population.
3. Community.
4. Ecosystem.
5. Biosphere.
Sigmoid curve of population growth:
A pattern of growth in which, in a new environment, the population density of an organism increases slowly initially, in a positive acceleration phase; then increases rapidly approaching an exponential growth rate as in the J- shaped curve ; but then declines in a negative acceleration phase until at zero growth rate the population stabilizes. This slowing of the rate of growth reflects increasing environmental resistance which becomes proportionately more important at higher population densities. This type of population growth is termed ' density dependent ' since growth rate depends on the numbers present in the population. The point of stabilization, or zero