

Animal organization

- 1) Life is organized in a hierarchical organizational pattern
 - a) Chemical level- this is the basic building blocks of life. Includes the atoms that make up the compounds like carbohydrates, fats, proteins, salts and so forth.
 - b) Cellular level- all the chemical compounds combined to form the smallest unit of life
 - c) Tissue level- cells that perform the same function
 - d) Organ level- tissues are assembled to perform a larger function
 - e) Organ system level- groups of organs that work together to form a larger function
 - f) Organismal level- all the combined organs come together to form a complete animal
- 2) Body plans
 - a) Symmetry
 - i) Symmetry refers to balance of proportion
 - (1) **Radial symmetry** divides organisms in equal halves more than two times across the center (jelly fish)
 - (2) **Bilateral symmetry** divides the organism in equal halves.
 - (3) **Asymmetry** bodies have no balanced halves
 - b) Scientists use specific terms to describe position or regions of animal bodies
 - i) **Anterior**-head end
 - ii) **Posterior**- tail end
 - iii) **Dorsal** – back side
 - iv) **Ventral**- front (belly)
 - v) **Medial**- more toward the middle of the body
 - vi) **Lateral** – towards the sides
 - vii) **Distal** – further from the midline
 - viii) **Proximal** – nearer the midline
- 3) Development
 - a) All animals (with the exception of organisms that perform budding) form from a specific development sequence.
 - i) An egg is fertilized
 - (1) An exception to this is **parthenogenesis**
 - ii) The **zygote** then begins to divide called **cleavage**
 - iii) **Gastrulation** is the formation of the gut
 - (1) Here different organisms begin to differ
 - (a) All development comes from **germ layers**. Germ layers are undifferentiated cells that will go on to make all of the organs in the body.
 - (i) **Endoderm**=gives rise to the functional linings of the digestive and respiratory tracts as well as to the associated accessory glands and organs (i.e. liver, stomach, pancreas, etc.)
 - (ii) **Mesoderm**= gives rise to the components of the skeletal, muscular, and circulatory systems (not always found in all organisms)

(iii) **Ectoderm**= gives rise to the epidermis of skin and all of the components of the Ectoderm

(b) In some organisms gastrulation is incomplete forming a **blind gut** where the mouth and anus are the same opening.

(i) Seen in sea anemones

(c) Gastrulation also forms with the mouth opening developing first (**protostomes**) or the anal opening developing first (**deuterostomes**)

4) Tissues

a) Although the body is composed of trillions of cells, there are only about 200 different cell types. These cells in turn produce the four principle tissue types:

i) **Epithelial tissues**=covers exposed surfaces; lines internal passageways; and produces glandular secretions.

ii) **Connective tissues**=fills internal spaces; provides structural support, and stores energy

iii) **Muscle tissues**=contracts to produce active movements

iv) **Nervous tissue**=conducts electrical impulses; detects, interprets, and responds to stimuli

v) Relative contribution of the four tissue types to the overall weight of the adult body.

b) Functions of Epithelial Tissues

i) Epithelia provide physical protection. Epithelial tissues protect exposed and internal surfaces from abrasion, dehydration, and destruction by chemical or biological agents.

ii) Epithelia control permeability. Any substance that enters or leaves the body has to cross an epithelial tissue. Some epithelia are relatively impermeable, whereas others are permeable to compounds as large as proteins. Most are capable of selective absorption or secretion. The epithelial barrier can be regulated and modified in response to various stimuli. For example, a callus forms on your hands when you do rough work for an extended period of time.

iii) Epithelia provide sensation. Sensory nerves extensively innervate most epithelia. Specialize epithelial cells can detect changes in the environment and convey information about such changes to the nervous system.

iv) Epithelial cells that produce secretions are called glands. Individual gland cells are often scattered among other cell types in an epithelium that may have many other functions.

c) Examples of epithelial tissues

i) **Squamous** is a flattened looking cell that when it is a single layer is in areas that have a high amount of absorption (lungs) but when it is layered it its very tough and makes up linings for areas that are in contact with the environment (skin).

ii) **Cuboidal** is, as the name implies, cube shaped. Found in areas with absorption of water (kidneys)

iii) **Columnar** is longer than wide and is found in areas where movement of substances is required (stomach, trachea)

iv) **Transitional** these are cells that can change shape to conform with pressure (bladder)

d) Functions of Connective Tissues

i) Establish a structural framework for the body.

- ii) Transport fluids and dissolved materials.
 - iii) Protect delicate organs.
 - iv) Support, surround, and interconnect other types of tissue.
 - v) Store energy reserves, especially in the form of triglycerides.
 - vi) Defend the body from invading microorganisms.
- e) Examples of connective tissue
- i) Blood
 - ii) Bone
 - iii) Cartilage
 - iv) Adipose (fat)
 - v) Dense regular (tendons)
 - vi) Dense irregular (dermis of skin)
- 5) Organ systems (note* not all of the structures listed under each system may be present in every animal)
- a) **Integumentary system**=composed of skin, hair, and nails; external support and protection of the body and temperature regulation.
 - b) **Skeletal system**=composed of bones; internal support and flexible framework for body movement, forms blood cells, and stores minerals.
 - c) **Muscular system**=composed of muscles attached to the skeleton; locomotion, support, and body heat production.
 - d) **Respiratory system**=composed of the lungs, trachea, larynx and nasal passages; exchange of respiratory gases, such as oxygen and carbon dioxide, between the air and circulating blood.
 - e) **Nervous system**=composed of the brain, spinal cord, and peripheral nerves; directs immediate response to stimuli, usually by coordinating the activities of other organ systems.
 - f) **Circulatory system**=composed of heart and blood vessels; internal transport of nutrients and oxygen to body cells while wastes and carbon dioxide are transported away from body cells.
 - g) **Lymphatic/Immune system**=composed of the lymph nodes, spleen, thymus gland, bone marrow, and tonsils; houses the immune system cells of the body, provides protection against infection and disease, transports tissue fluid (called lymph) and absorbs fats.
 - h) **Endocrine system**=composed of hormone secreting glands such as the thyroid, pituitary, adrenal gland, pancreas, pineal, etc.; secretion of hormones that direct long-term changes in the activities of other organ systems.
 - i) **Urinary system**=composed of the kidneys, ureters, urinary bladder, and urethra; filters the blood to remove nitrogenous wastes, eliminates excess water, salts, and waste products, and controls pH and electrolyte balance.
 - j) **Digestive system**=composed of the salivary glands, esophagus, stomach, small intestine, large intestine, liver, and gallbladder. Intake, breakdown, and absorption of food in order to acquire nutrients, minerals, vitamins and water and the elimination of feces.
 - k) **Reproductive system**=composed of ovaries, uterus, vagina, and mammary glands in females AND the testes, scrotum, prostate gland, seminal vesicles and penis in the male; production of sperm and egg as well as secretion of sex hormones and copulation.