

Animal Physiology

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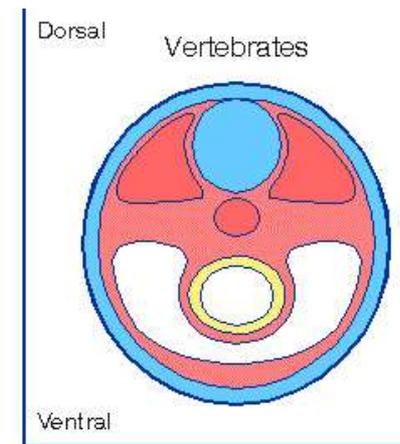
Organization in Living Organisms.

- A key concern in living organisms is maintaining **homeostasis**.
 - **Homeostasis** is the term for when an organism maintains constant internal conditions in regards to temperature, pH, salinity, etc.
- Bodily substances in animals are categorized in a few levels.
 - The most basic unit of life is the **cell**.
 - A group of similar cells that perform the same function is called **tissue**.
 - A group of different kinds of tissues that coordinate their actions into a main primary function is called an **organ**.
 - A group of organs and tissues that work together to maintain homeostasis in the body are called a **system**.
 - There are 11 major systems in the body.



Levels of Organization

- When an egg cell is fertilized by a sperm cell, there is no differentiation of the cells – at first, all of the cells are identical to each other.
- However, as cells divide, three distinct layers of cells begin to form.
- These layers include...
 - **Ectoderm** – skin and nervous system
 - **Mesoderm** – muscular system, connective tissue, and skeleton, kidneys, cardiovascular system, and reproductive organs,
 - **Endoderm** – digestive tract, respiratory system, and bladder.



Germ layers	
Endoderm	gut, liver, lungs
Mesoderm	skeleton, muscle, kidney, heart, blood
Ectoderm	skin, nervous system



Specialization

- The development of the three layers in cells is beneficial – it enables cells to form groups that specialize in specific functions.
 - It would never work to have every cell try to perform every function – there are simply too many functions and too much complexity in an animal's body.
 - Having cells specialize and differentiate into specific tissue enables the body to become more complex than simpler organisms.
- As cells specialize and differentiate, they will turn into one of 4 kinds of tissue – **epithelial, connective, muscular, and nervous tissue.**

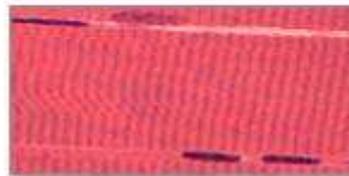
Four types of tissue



Connective tissue



Epithelial tissue



Muscle tissue

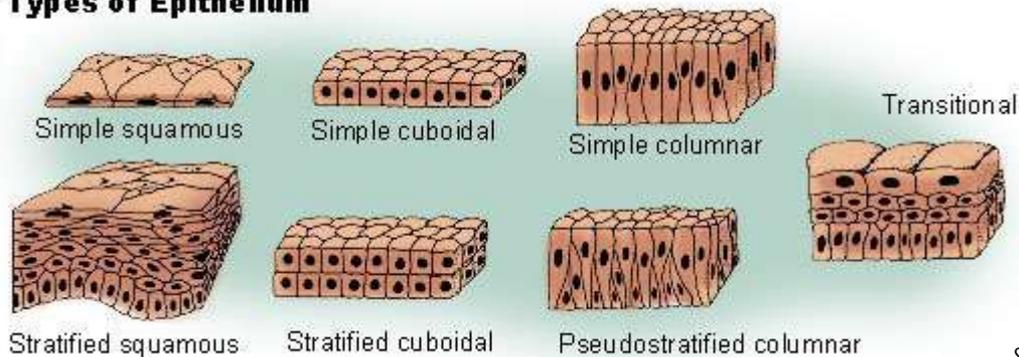


Nervous tissue

Epithelial Tissue

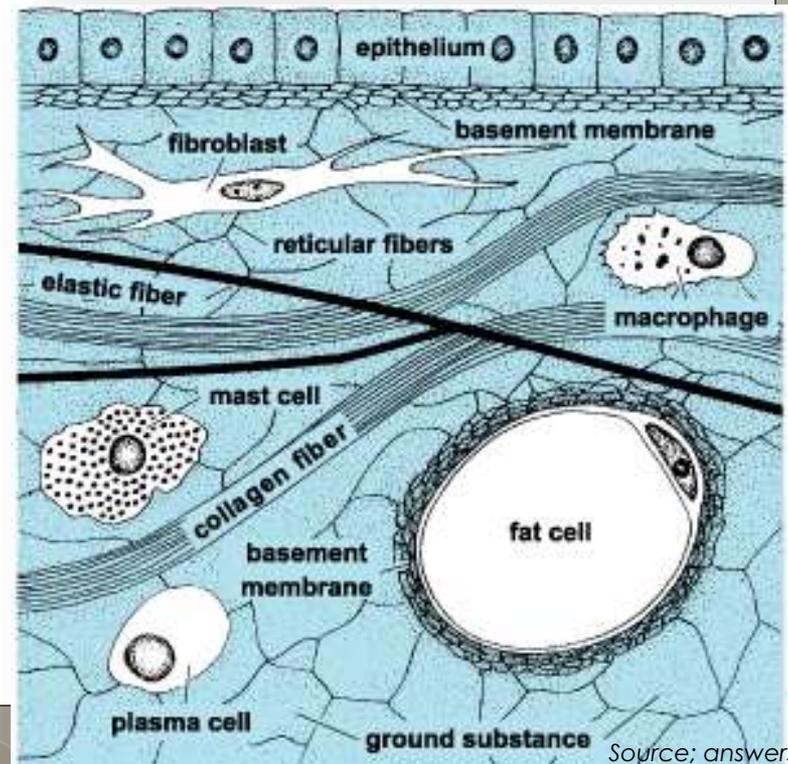
- **Epithelial Tissue** forms the skin and the lining of the organs in most animals.
- Epithelial tissue serves several functions:
 - **Protection** – surface epithelial tissue (such as the skin) keeps the ‘bad stuff’ out and the ‘good stuff’ in.
 - Some epithelial tissue like the respiratory tract is also lined with cilia (microscopic hairs) that can move impurities away from the tissue.
 - **Absorption** – the gut is lined with epithelial tissue in order to acquire nutrients from food.
 - **Secretion** – glandular epithelium is what is responsible for the release of substances such as hormones, saliva, milk, etc.

Types of Epithelium



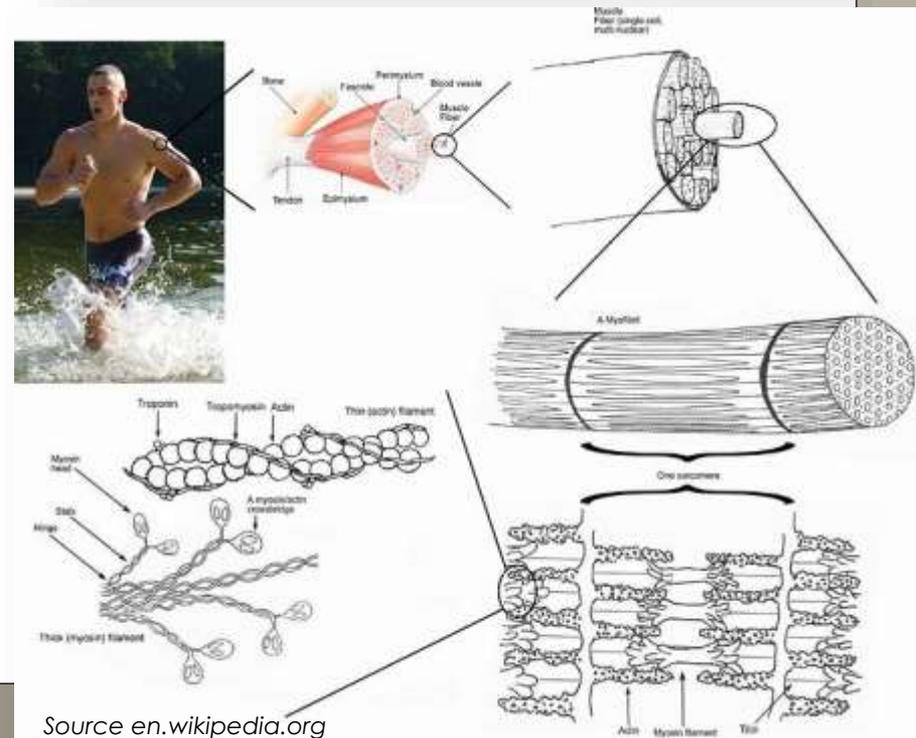
Connective Tissue

- **Connective** tissue serves several functions, including –
 - **Structural** – it can hold body parts together
 - It can **fill empty spaces** in the body.
 - **Energy** – adipose tissue stores fat
 - **Protection**: it protects susceptible body parts,
 - **Transport**: Connective tissue can transport materials throughout the body.
- Examples of connective tissue include bone, fat (adipose), cartilage, and blood.



Muscle Tissue

- **Muscle** tissue is the only kind of tissue that can contract, or change in size.
 - This is due to the fact that muscle tissue contains actin and myosin proteins that overlap and can 'pull' into each other.
- There are three kinds of muscle tissue:
 - 1. **Smooth** – smooth muscle is involuntary and is primarily found in the intestines and blood vessels.
 - 2. **Skeletal**– skeletal muscle is voluntary (usually) and long (skeletal muscle cells are the length of the entire muscle).
 - 3. **Cardiac** – cardiac muscle is found in the heart; it is involuntary.



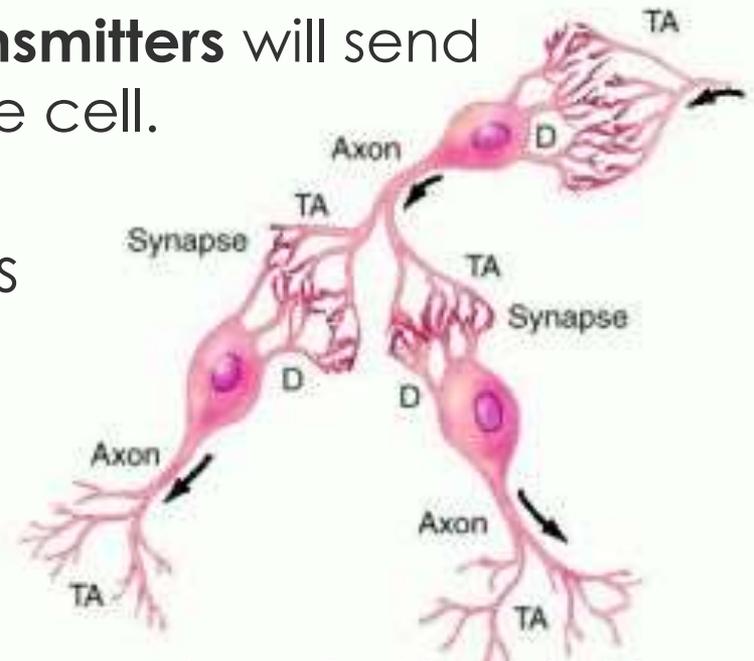
Source en.wikipedia.org



Nervous Tissue

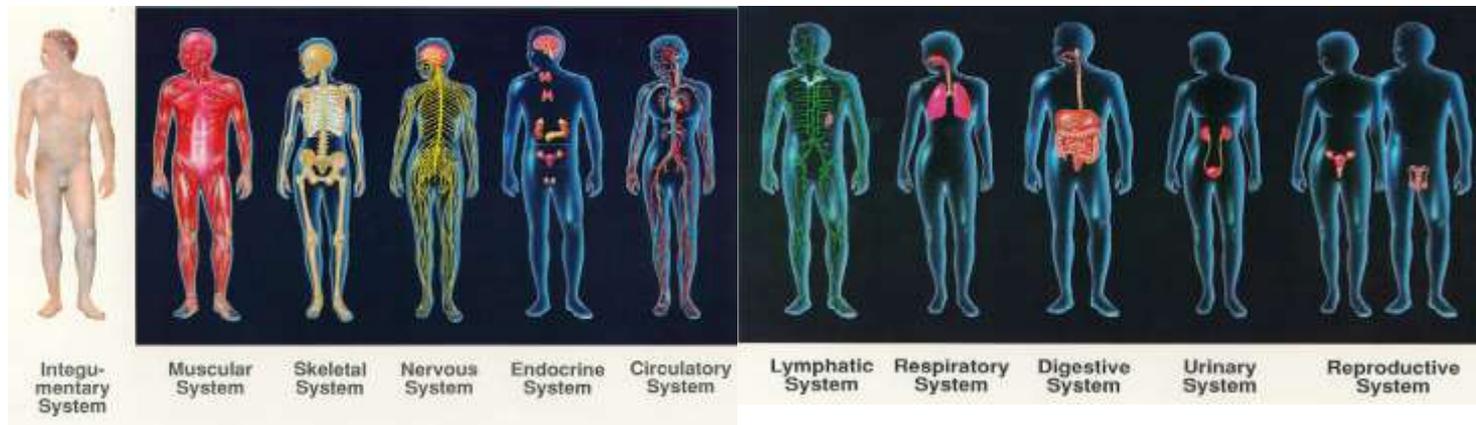


- **Nervous** tissue can create electrical signals using sodium and potassium in order to signal the rest of the body.
 - Changing sodium/potassium levels create changes in the electrical charge of the cell.
 - Biochemicals called **neurotransmitters** will send signals from nerve cell to nerve cell.
- Nervous system tissue includes the brain, spinal chord, and peripheral nerves in the skin and other organs.



Organs & Organ Systems

- Organs are made up of the four kinds of tissue.
 - This tissue will form an organized structure such as a sheet, tube, strip, layer, etc.
- Organs together will form Systems, or a collection of organs that serve a specific function.

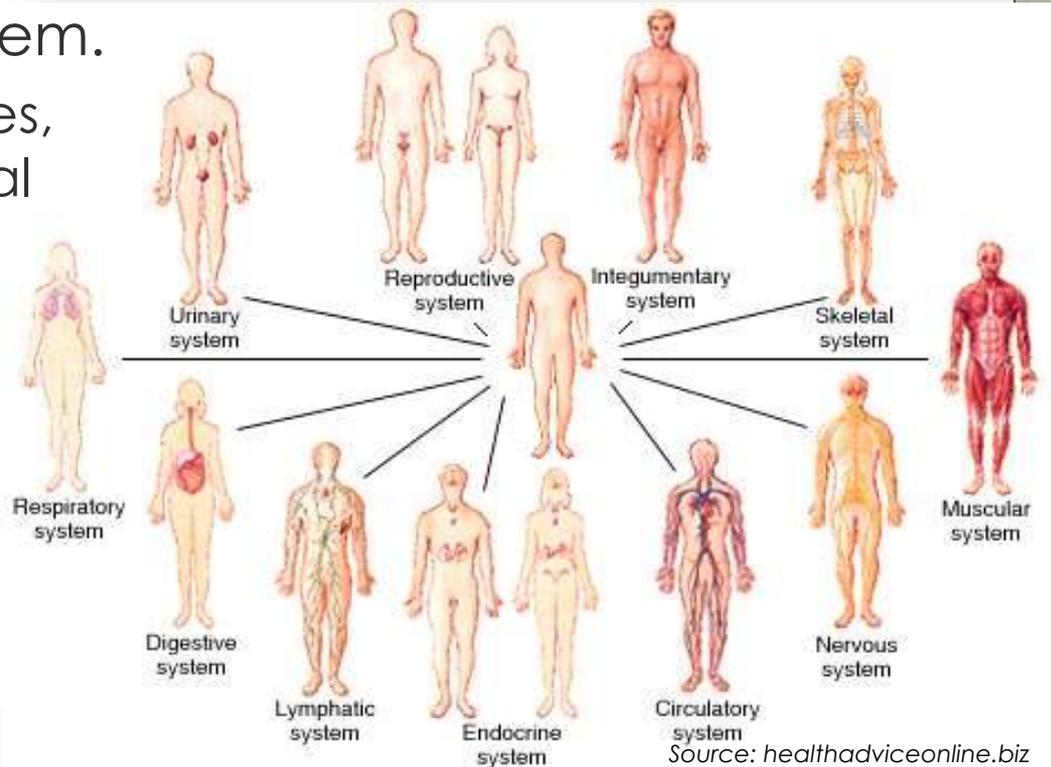


Source: aarcara.wordpress.com



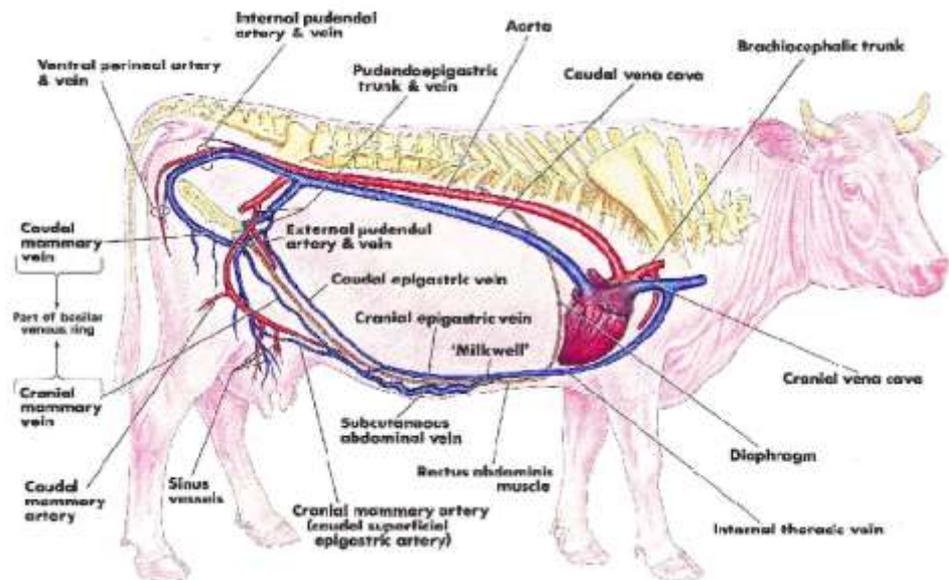
The 10 Systems of the Body

- There are 10 organ systems in the animal body.
 - These include the 1) circulatory, 2) respiratory, 3) digestive, 4) urinary, 5) musculoskeletal, 6) immune, 7) nervous, 8) endocrine, 9) reproductive, and 10) integumentary system.
 - Note: in some cases, the musculoskeletal system could be considered two separate systems, for a total of 11.



Circulatory System

- The purpose of the circulatory system is to transport blood, hormones, nutrients, and waste throughout the body.
- It consists of the heart, arteries, veins, capillaries, and the blood.
- It carries nutrients to the cells and waste away from the cells.

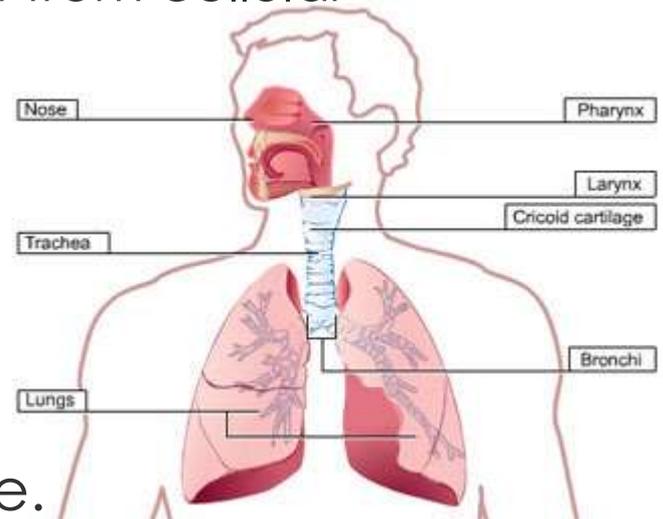


Source: ucd.ie



Respiratory System

- The function of the respiratory system is to add oxygen to the body and take away carbon dioxide.
 - Oxygen is needed for cellular respiration – it carries away waste products from the process of producing ATP (the source of energy for the cells)
 - Carbon dioxide is a waste product from cellular respiration.
- The respiratory system also helps to regular the concentration of hydrogen ions in the blood.
- This system includes the lungs, bronchi, larynx, pharynx, and nose.

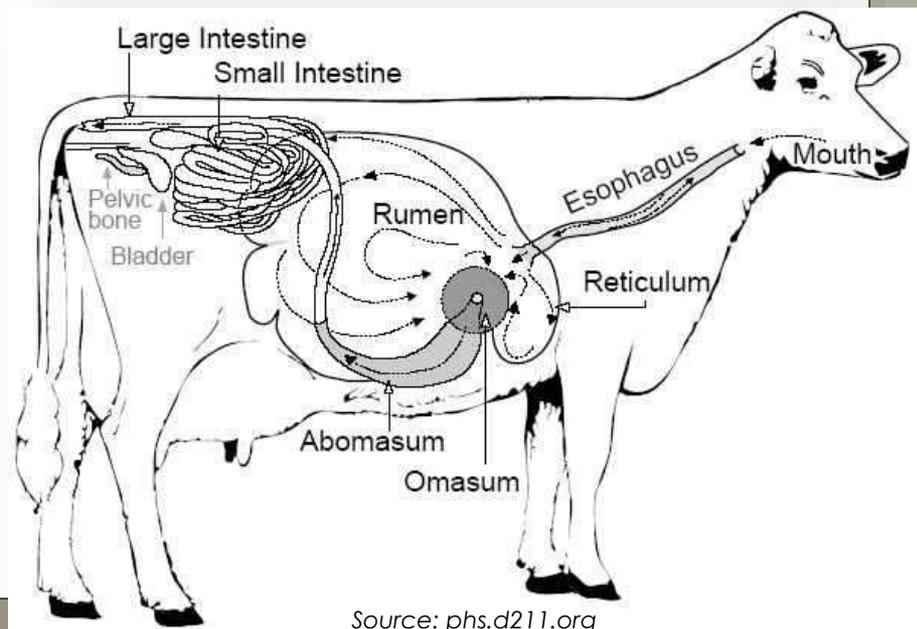


Source: alpha1health.com



Digestive Tract

- The purpose of the digestive tract is to absorb organic nutrients (carbohydrates, fats, protein), salts, and water from food and expel unused waste products from the body after nutrient absorption.
- This system consists of the mouth, pharynx, esophagus, stomach chambers, small and large intestines, salivary glands, pancreas, liver, and gallbladder.

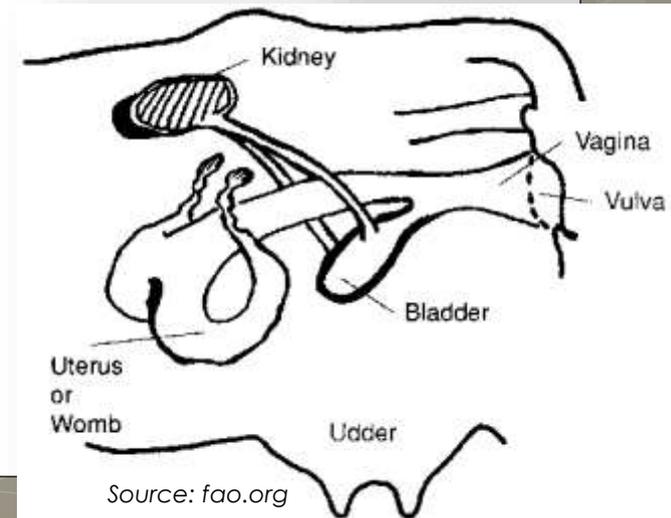
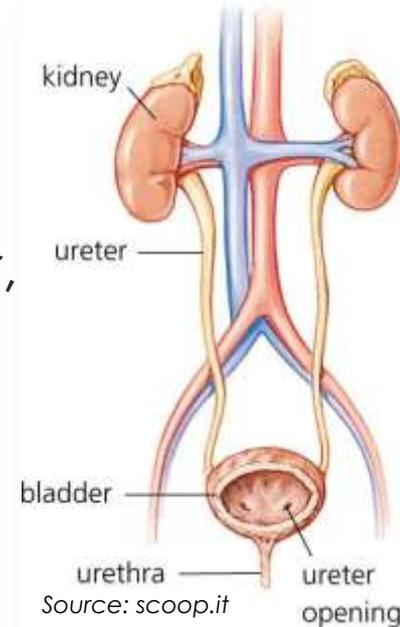


Source: phs.d211.org



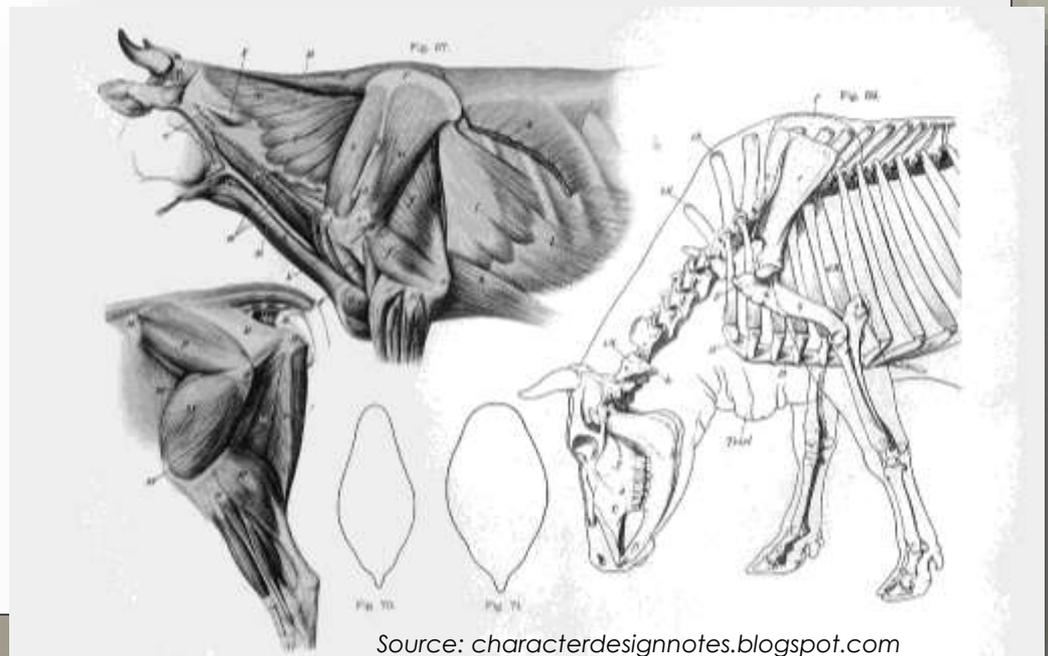
Urinary System

- The urinary system ensures that the osmolarity (salinity level) of bodily fluid is maintained through the controlled excretion of salt, water, and waste.
- If the body's fluids are too dilute, it would cause edema (fluid build-up), low plasma volume, hypotension (low blood pressure), and could cause heart/lung failure (sodium and potassium are needed for nerve transmission).
- If the body's fluids are too concentrated, it would cause dangerously high pressures in the blood and other fluids.
- This system includes the kidneys, ureters, bladder, and urethra.



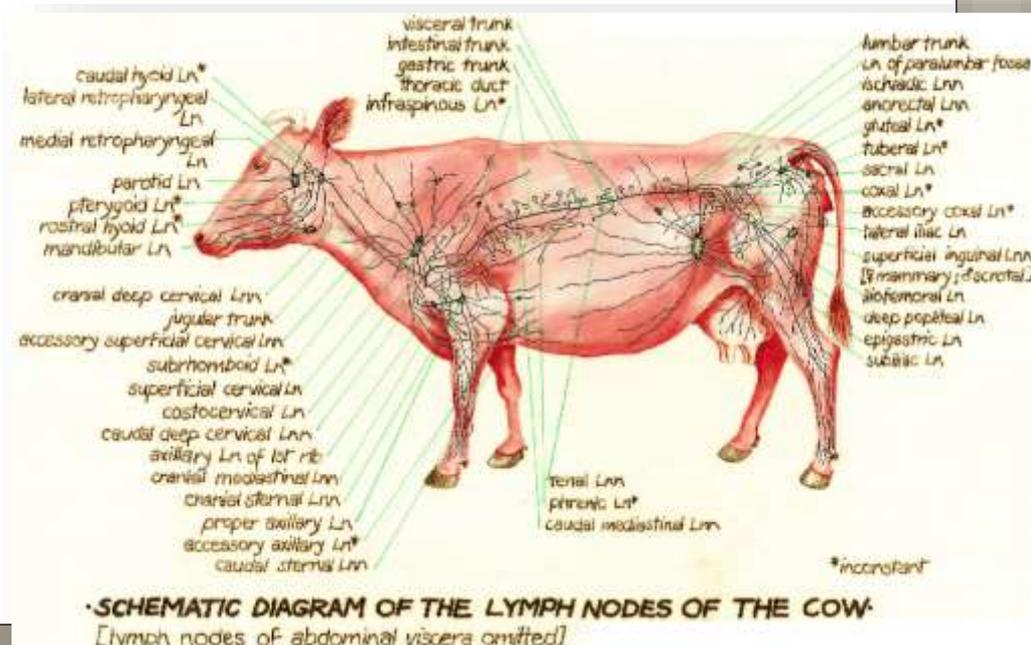
Musculoskeletal System

- The function of this system is to support, protect, and enable movement of the body.
 - The bone marrow also serves as the site of blood cell production.
- The muscles are able to enable movement because of high concentrations of actin and myosin contractile proteins that can allow the muscle cells to shorten or lengthen.
- This system includes the bones cartilage, skeletal muscles, ligaments, tendons, and joints.



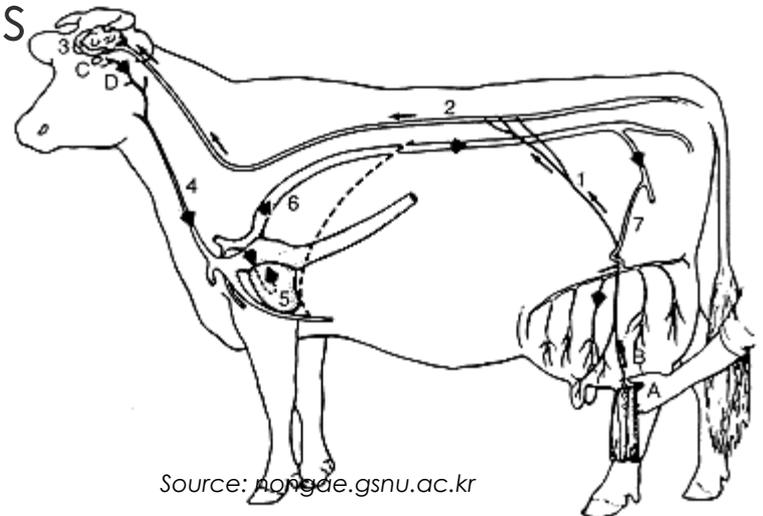
Immune System

- The primary purpose of the immune system is to recognize the difference between the cells of the host animal and invading cells and pathogens.
- The immune system defends against attacking pathogens, returns extracellular fluid to the blood, and enables the formation of white blood cells.
- This system includes the white blood cells, lymph nodes, spleen, and thymus.



Nervous System

- The purpose of the nervous system is to coordinate the activities of the body through the transmission of electrical signals.
- The nervous system also detects changes inside and outside of the body and enables conscious decision-making and action.
- The nervous system includes the brain, spinal cord, nerves, and sensory organs such as the eyes, tongue, etc.

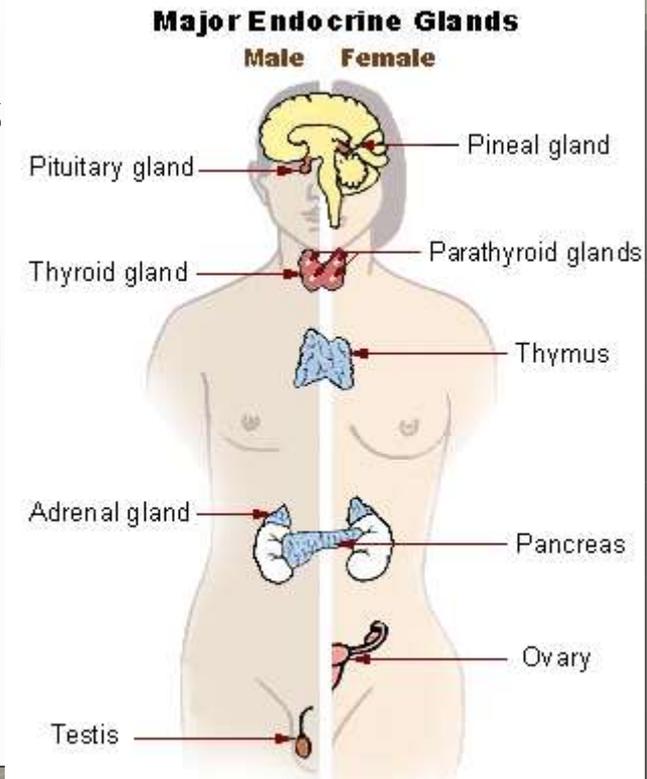


Source: nongae.gsnu.ac.kr



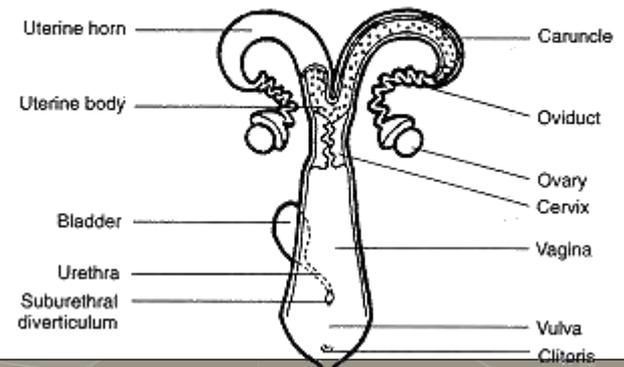
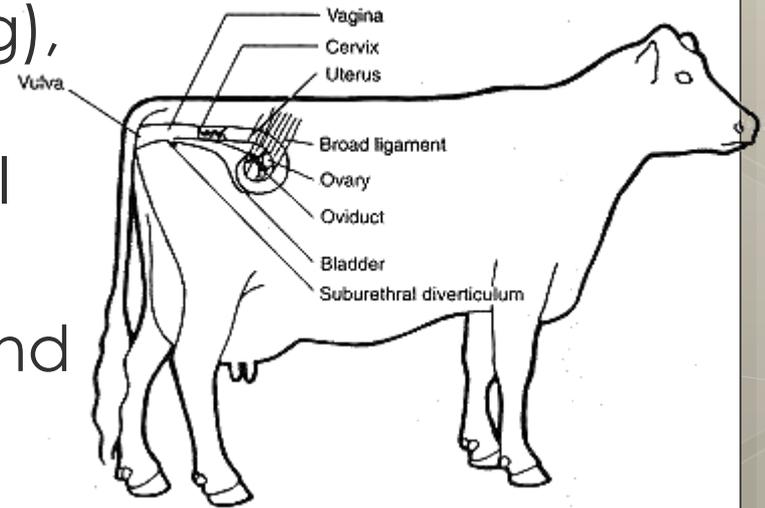
Endocrine System

- The endocrine system regulates and coordinates many different bodily processes, including blood pressure, electrolyte levels, metabolism, growth, etc.
 - Typically these are long processes as opposed to quick changes.
- This system includes all glands that secrete hormones, including the pancreas, hypothalamus, pituitary gland, thyroid gland, intestines, testes/ovaries, etc.



Reproductive System

- The reproductive system produces haploid sex cells (sperm/egg), enables conception, and supports a fertilized egg until the fetus is mature.
- This system includes testes and penis in males and vulva, vagina, cervix, uterus, and ovaries in females.



Integumentary System

- The integumentary system protects against injury, dehydration, and invading pathogens.
- It also aids in the regulation of body temperature.
- This system includes skin, hair, and nails.

