

Lecture Outline for Integrated Basic Health Sciences for Pharmacy

Physiology Component of Module : Cell Biology

Dr J. Mohan
Lecturer,
Physiology Unit,
Department of Preclinical Sciences,
Faculty of Medical Sciences,
UWI, St. Augustine.

Overview of Anatomy and Physiology

- Anatomy – the study of the structure of body parts and their relationships to one another
 - Gross or macroscopic
 - Microscopic
 - Developmental
- Physiology – the study of the function of the body's structural machinery

Physiology

- Considers the operation of specific organ systems
 - Renal – kidney function
 - Neurophysiology – workings of the nervous system
 - Cardiovascular – operation of the heart and blood vessels
- Focuses on the functions of the body, often at the cellular or molecular level

Physiology

- Understanding physiology also requires a knowledge of physics, which explains
 - electrical currents
 - blood pressure
 - the way muscle uses bone for movement

Principle of Complementarity

- Function always reflects structure
- What a structure can do depends on its specific form

Levels of Structural Organization

- Chemical – atoms combined to form molecules
- Cellular – cells are made of molecules
- Tissue – consists of similar types of cells

- Organ – made up of different types of tissues
- Organ system – consists of different organs that work closely together
- Organismal – made up of the organ systems

Integumentary System

- Forms the external body covering
- Composed of the skin, sweat glands, oil glands, hair, and nails
- Protects deep tissues from injury and synthesizes vitamin D

Skeletal System

- Composed of bone, cartilage, and ligaments
- Protects and supports body organs
- Provides the framework for muscles
- Site of blood cell formation
- Stores minerals

Muscular System

- Composed of muscles and tendons
- Allows manipulation of the environment, locomotion, and facial expression
- Maintains posture
- Produces heat

Nervous System

- Composed of the brain, spinal column, and nerves
- Is the fast-acting control system of the body
- Responds to stimuli by activating muscles and glands

Cardiovascular System

- Composed of the heart and blood vessels
- The heart pumps blood
- The blood vessels transport blood throughout the body

Lymphatic System

- Composed of red bone marrow, thymus, spleen, lymph nodes, and lymphatic vessels
- Picks up fluid leaked from blood vessels and returns it to blood
- Disposes of debris in the lymphatic stream
- Houses white blood cells involved with immunity

Respiratory System

- Composed of the nasal cavity, pharynx, trachea, bronchi, and lungs
- Keeps blood supplied with oxygen and removes carbon dioxide

Digestive System

- Composed of the oral cavity, esophagus, stomach, small intestine, large intestine, rectum, anus, and liver
- Breaks down food into absorbable units that enter the blood
- Eliminates indigestible foodstuffs as feces

Urinary System

- Composed of kidneys, ureters, urinary bladder, and urethra
- Eliminates nitrogenous wastes from the body
- Regulates water, electrolyte, and pH balance of the blood

Male Reproductive System

- Composed of prostate gland, penis, testes, scrotum, and ductus deferens
- Main function is the production of offspring
- Testes produce sperm and male sex hormones
- Ducts and glands deliver sperm to the female reproductive tract

Female Reproductive System

- Composed of mammary glands, ovaries, uterine tubes, uterus, and vagina
- Main function is the production of offspring
- Ovaries produce eggs and female sex hormones
- Remaining structures serve as sites for fertilization and development of the fetus
- Mammary glands produce milk to nourish the newborn

Organ Systems Interrelationships

- The integumentary system protects the body from the external environment
- Digestive and respiratory systems, in contact with the external environment, take in nutrients and oxygen

Organ Systems Interrelationships

- Nutrients and oxygen are distributed by the blood
- Metabolic wastes are eliminated by the urinary and respiratory systems

Necessary Life Functions

- Maintaining boundaries – the internal environment remains distinct from the external environment
 - Cellular level – accomplished by plasma membranes
 - Organismal level – accomplished by the skin
- Movement – locomotion, propulsion (peristalsis), and contractility

Necessary Life Functions

- Responsiveness – ability to sense changes in the environment and

respond to them

- Digestion – breakdown of ingested foodstuffs
- Metabolism – all the chemical reactions that occur in the body
- Excretion – removal of wastes from the body

Necessary Life Functions

- Reproduction – cellular and organismal levels
 - Cellular – an original cell divides and produces two identical daughter cells
 - Organismal – sperm and egg unite to make a whole new person
- Growth – increase in size of a body part or of the organism

Survival Needs

- Nutrients – needed for energy and cell building
- Oxygen – necessary for metabolic reactions
- Water – provides the necessary environment for chemical reactions
- Normal body temperature – necessary for chemical reactions to occur at life-sustaining rates
- Atmospheric pressure – required for proper breathing and gas exchange in the lungs

Homeostasis

- Homeostasis – ability to maintain a relatively stable internal environment in an ever-changing outside world
- The internal environment of the body is in a dynamic state of equilibrium
- Chemical, thermal, and neural factors interact to maintain homeostasis

Homeostatic Control Mechanisms

- Variables produce a change in the body
- The three interdependent components of control mechanisms: (see Figure 1.4)
 - Receptor – monitors the environments and responds to changes (stimuli)
 - Control center – determines the set point at which the variable is maintained
 - Effector – provides the means to respond to stimuli

Negative Feedback

- In negative feedback systems, the output shuts off the original stimulus
- Example: Regulation of room temperature (see Figure 1.5)

Positive Feedback

- In positive feedback systems, the output enhances or exaggerates the original stimulus
- Example: Regulation of blood clotting (see Figure 1.6)

Homeostatic Imbalance

- Disturbance of homeostasis or the body's normal equilibrium
- Overwhelming the usual negative feedback mechanisms allows destructive positive feedback mechanisms to take over

END OF OUTLINE