

B.Sc. Vet. Sc. & AH; Level-2, Semester-I; Jan-Jun/2020
Course Title: **Endocrine Physiology**; Course Code: **ANHP 215**
Theory; Credit Hour: 1
Dept. of Anatomy, Histology & Physiology
Sher-e-Bangla Agricultural University

Course Outline

Introduction: Definition of endocrine physiology, endocrinology, hormones, glands and receptors. Function: General and specific functions of hormones. Classification: hormones, gland and receptors
Biosynthesis: Biosynthesis of steroid hormones and peptides hormones. Sources of hormones: Hypothalamus, anterior pituitary, posterior pituitary, thyroid gland, parathyroid gland, pancreas, adrenal glands, gonads, pineal gland, corpus luteum, uterus and placenta. Mode of actions: Steroid hormones and peptide hormones. Transport and regulation: Transport of hormones and regulation of hormone.
Interrelation: Interrelation between endocrine and nervous system, difference between endocrine system and other system.
Hormone involve in reproductive physiology, common birth facts in animals: Female- Estrus cycle, oogenesis, ovulation, CL formation, pregnancy, parturition, lactation, milk letdown. Male: Capacitization, spermatogenesis, erection, ejaculation.

References:

1. Clinical Anatomy and Physiology for Veterinary Technicians –by Thomas Colville & Joanna M. Bassert, (2015, Elsevier)
2. **Anatomy and Physiology of Farm Animals, 8th Edition- by Anna Dee Fails & Christianne Magee**
3. Anatomy and Physiology of Domestic Animals- by R. Michael Akers & D. Michael Denbow
4. Functional Anatomy and Physiology of Domestic Animals - by William O. Reece
5. **Dukes Physiology of Domestic Animals –by William O. Reece**
6. <https://accessmedicine.mhmedical.com/content.aspx?bookid=507§ionid=42540501>
7. https://en.wikivet.net/Anatomy_and_Physiology

Introduction

Physiology: (*physis*= 'nature, origin', and *logia*= 'study of') is the scientific study of the functions and mechanisms which work within a living system.

The focus of physiology is on how organisms, organ systems, organs, cells, and biomolecules carry out the chemical and physical functions that exist in a living system.

Central to an understanding of physiological functioning is the investigation of the fundamental biophysical and biochemical phenomena, the coordinated homeostatic control mechanisms, and the continuous communication between cells.

The **physiologic state** is the condition occurring from normal body function, while **the pathological state** is centered on the abnormalities that occur in animal diseases, including humans.

Endocrine Physiology:.....?

The **endocrine system** is a chemical messenger system comprising feedback loops of hormones released by internal glands of an organism directly into the circulatory system, regulating distant target organs.

Endocrinology (from *endocrine* + *-ology*) is a branch of biology and medicine dealing with the endocrine system, its diseases, and its specific secretions known as hormones. It is also concerned with the integration of developmental events proliferation, growth, and differentiation, and the psychological or behavioral activities of metabolism, growth and development, tissue function, sleep, digestion, respiration, excretion, mood, stress, lactation, movement, reproduction, and sensory perception caused by hormones. Specializations include behavioral endocrinology and comparative endocrinology.

The endocrine system and the nervous system share the work of controlling and coordinating all the intricate parts and functions of the animal body. Put most simply, the two systems each help maintain **homeostasis** (balance) in the body. They constantly send instructions to the rest of the body, telling it how to respond to changes in internal and external conditions.

Gland is a group of cells/ single cell in an animal's body that synthesizes substances (such as hormones) for release into the bloodstream (endocrine gland) or into cavities inside the body or its outer surface (exocrine gland).

Hormones are chemical messengers produced by endocrine glands and secreted directly into blood vessels. They travel in the bloodstream to all parts of the body and produce effects only when they bind to their particular receptors in or on cells.

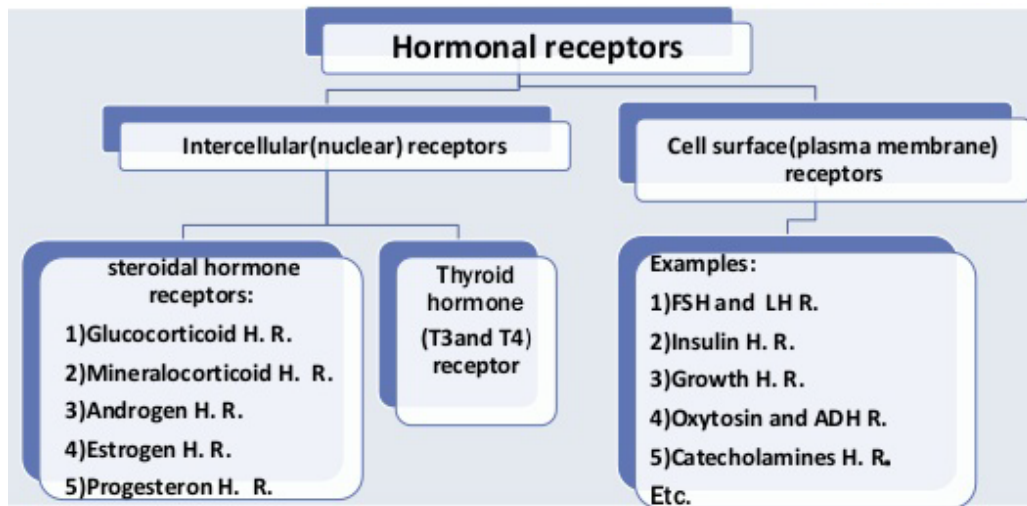
Five major functions of hormones

- a) Regulate metabolic processes (e.g. thyroid hormones)
- b) Control the rate of chemical reactions (e.g. growth hormone).
- c) Aid in the transport of substances across the cell membrane of target cells (e.g. insulin and glucagon).
- d) Regulate water and electrolyte balances (e.g. antidiuretic hormone, calcitonin, and aldosterone).
- e) Play a vital role in reproduction, growth and development (e.g. estrogens , progesterone, and testosterone).

Receptors are chemical structures, composed of protein, that receive and transduce signals that may be integrated into biological systems. These signals are typically chemical messengers, which bind to a receptor, they cause some form of cellular/tissue response, e.g. a change in the electrical activity of a cell.

Hormone receptor is a receptor molecule that binds to a specific hormone. Hormone receptors are a wide family of **proteins** made up of receptors for thyroid and steroid hormones, retinoids and Vitamin D, and a variety of other receptors for various ligands, such as fatty acids and prostaglandins.

There are two main classes of hormone receptors. **Receptors for peptide hormones** tend to be cell surface receptors built into the plasma membrane of cells and are thus referred to as trans membrane receptors. An example of this is insulin. **Receptors for steroid hormones** are usually found within the cytoplasm and are referred to as intracellular or nuclear receptors, such as testosterone. Upon hormone binding, the receptor can initiate multiple signaling pathways, which ultimately leads to changes in the behavior of the target cells.



Types of Hormones

Peptide

- Water-soluble
- Bind to receptors on plasma membrane & triggers signal transduction pathway
- Affects protein activity already present in cell
- Rapid response
- Short-lived
- Eg. oxytocin, insulin, epinephrine

Steroid

- Lipid-soluble
- Enters cell & binds to intracellular receptors
- Causes change in gene expression (protein synthesis)
- Slower response
- Longer life
- Eg. androgens (testosterone), estrogen, progesterone, cortisol

Recent classification of hormones

Endocrine action: the hormone is distributed in blood and binds to distant target cells.

Paracrine action: the hormone acts locally by diffusing from its source to target cells in the neighborhood.

Autocrine action: the hormone acts on the same cell that produced it.



TYPES OF GLANDS

(Classification)

There are the following groups:

1. Exocrine glands:

- Pass secretions through a duct system to a body surface
- Secretions are normally *enzymes*

2. Endocrine glands:

- Pass secretion directly into blood or lymph (internal secretion)
- Secretions are normally *hormones*

3. Mixed glands: These have both exocrine and endocrine components.

Classification of Endocrine glands

- Two types of endocrine glands can be recognized based on the arrangement of their cells:
- **Cords** interspersed between dilated blood capillaries eg, adrenal gland, parathyroid, anterior lobe of the pituitary.
- **Vesicles or Follicles** filled with noncellular material eg, the thyroid gland.

Types of Exocrine glands

- a. According to the number of secreting cells
 - **unicellular glands** – a single cell is a complete gland. Good example is a Goblet cell (mucous cell).
 - **Multicellular glands** – each gland is formed by more than one cell, examples are Parotid (salivary) glands and Pancreas.

Classification of Glands

Based on the Mode of Secretion

- **Merocrine Gland**- No loss of Cytoplasm-e.g. most of the **compound glands e.g. Pancreas**
Also known as Eccrine or Epicrine
- **Apocrine Gland**- Partial loss of cytoplasm-e.g. **lactating mammary gland, sweat glands in the axilla and external genitalia**
- **Holocrine Gland**- Complete loss of cytoplasm e.g. **sebaceous and tarsal gland**
- **Cytocrine Gland**- Cells are released as secretion. e.g. **Testis (spermatozoa)**

Exocrine Glands and Secretion Types

- **Merocrine**
 - Sweat glands
- **Apocrine**
 - Mammary glands
- **Holocrine**
 - **Sebaceous glands**

