

JINNAH SINDH MEDICAL UNIVERSITY

	Spiral -1
MODULE TITLE	Endocrine system-1
INTRODUCTION	The Endocrine system acts through chemical messengers called hormones that influence growth, development, metabolic activities, tissue function, sexual function, reproduction, sleep, and mood, among other things. Endocrinology is the study of specific secretions known as hormones and their related effects on the body. This module will build the concepts that will be taught in the latter module of Endocrine system-2, in Year-4. This module deals with the normal and abnormal structure and functions of endocrine glands. At the same time, it provides an overview of disease states and medications for those conditions.
RATIONALE	Endocrine disorders like Diabetes Mellitus and Thyroid related diseases are very common in all parts of Pakistan. This module is designed to help the learners develop an understanding of the pathophysiologic basis for these conditions. It also aims to provide basic information about medications which can be used to treat these conditions. 2 nd year students.
TARGET STUDENTS	2 nd year MBBS, 2022
DURATION	4 weeks
MODULE OUTCOMES	By the end of the module, students should be able to: <ul style="list-style-type: none"> • Describe the normal and abnormal development, macro and micro-structures & functions of endocrine glands • Diagnose common endocrine disorders based on clinical presentations and investigation reports • Justify outlines of treatment plans for common endocrine disorders
DEPARTMENTS	Anatomy Biochemistry Physiology
OBJECTIVES	By the end of the module, learners will be able to:

LECTURES

ANATOMY

1. Anatomical overview of all endocrine glands in body

- Classify the glands
- Define endocrine glands
- Describe the location of all endocrine glands in the body
- Discuss the functions of all endocrine organs in the body

2. Gross and development of the Pituitary gland

- Describe the location, relations and external features, and division/components of pituitary gland
- Describe the neurovascular supply of pituitary gland
- Discuss the hypophyseal portal system
- Explain the development of pituitary gland
- Discuss the related clinical conditions & congenital anomalies of the pituitary gland

3. Microscopic anatomy of the Pituitary gland

- Enumerate different parts of adenohypophysis and neurohypophysis
- Discuss the histological features of adenohypophysis and neurohypophysis
- Explain the different cell types and functions of both parts of pituitary gland

4. Review of gross and microscopic anatomy of the Thyroid and Parathyroid glands

- Summarize the location, relations & neurovascular supply of thyroid gland
- Explain the histological features of thyroid and parathyroid glands
- Discuss the types of cells found in the thyroid gland
- Discuss the clinical conditions in relation to thyroid gland
- Describe the cells found in parathyroid gland and their functions

5. Developmental and microscopic anatomy of the Pancreas

- Discuss the histological components of pancreas
- Describe the histological details of parenchyma and lobules of pancreas
- Explain the histology of endocrine component of pancreas
- Discuss different cell types of endocrine pancreas and their functions
- Describe the formation of dorsal and ventral pancreatic bud
- Discuss the development of main pancreatic duct.
- Explain the different congenital anomalies of pancreas

6. Gross and microscopic anatomy of the Adrenal Gland

- Describe the gross anatomical features and location of the adrenal gland
- Discuss the neurovascular supply, and the histological features of adrenal gland
- Describe the cells found in cortex and medulla
- Discuss the clinical conditions in relation to adrenal gland

7. Development and anomalies of the Adrenal Gland

- Explain the embryological origin and development of the adrenal gland
- Discuss the developmental anomalies of the adrenal gland

BIOCHEMISTRY

1. Introduction to Hormones

- Classify hormones according to the mechanism of action, and give examples
- Classify hormone receptors with examples
- Describe the role of second messenger system
- Summarize the hormones of the body with their functions

2. Hypothalamic Hormones

- List the hypothalamic hormones
- Explain the chemical structure and biochemical functions of Hypothalamic hormones
- List the stimulatory and inhibitory hypothalamic hormones
- Discuss the hypothalamic control of pituitary hormones
- Describe the feedback mechanism of hypothalamic hormones
- Describe the mechanism of circadian rhythm

3. Anterior Pituitary Hormones (Growth Hormone)

- List the anterior pituitary hormones
- Explain the chemical nature of growth hormone
- Explain the mechanism of action of growth hormone
- Discuss the synthesis and metabolic effects of growth hormone
- Discuss clinical complications and diseases associated with growth hormone

4. Anterior Pituitary Hormones (ACTH, LH, FSH, TSH and PRL)

- Explain the chemical structure of anterior pituitary hormones
- Describe the mechanism of action and biochemical functions of anterior pituitary hormones
- Discuss the hypothalamic control of pituitary hormones
- Discuss the regulation of anterior pituitary hormone
- Describe the clinical diseases associated with anterior pituitary hormones

5. Posterior Pituitary Hormones

- List the posterior pituitary hormones
- Explain the synthesis chemical structure of posterior pituitary hormones
- Describe the mechanism of action, biochemical functions of posterior pituitary hormone
- Discuss the hypothalamic pituitary axis of posterior pituitary hormones
- Discuss the regulation of posterior pituitary hormone
- Describe the clinical diseases associated with posterior pituitary hormones

6. Thyroid Hormones

- List the Thyroid hormones
- Discuss the cells type and production of thyroid hormones
- Explain the synthesis and chemical structure of Thyroid hormones
- Describe the mechanism of action and metabolic functions of Thyroid hormones
- Discuss the hypothalamic pituitary axis of Thyroid hormones
- Discuss the regulation of Thyroid hormones and feedback mechanism
- Describe the clinical diseases and complication associated with Thyroid hormones

7. Parathormone: Serum Calcium Regulation

- List the hormones regulating serum calcium (Parathormone, Calcitriol and calcitonin)
- Explain the synthesis chemical structure of Parathormone
- Describe the mechanism of action, metabolic functions (on GIT, Skeleton & Kidneys), and regulation of Parathormone
- Describe the role of 1,25-dihydroxy vitamin D in calcium homeostasis
- Describe the role of Calcitonin in calcium regulation
- Describe the clinical diseases and complication associated with Parathormone

8. Pancreatic Hormones

- List the pancreatic hormones (Insulin, glucagon and somatostatin)
- Explain the synthesis and chemical structure of pancreatic hormones
- Describe the mechanism of action, metabolic functions, and regulation of pancreatic hormones
- Describe the clinical diseases associated with pancreatic hormones

9. Blood Glucose Regulation

- Explain the regulation of blood glucose
- Discuss the tissues which regulate fuel metabolism in blood glucose level
- Describe the mechanism of metabolic regulation of blood glucose
- Discuss the biochemical complications of hypoglycemia and hyperglycemia

10. Blood Glucose: Diabetes Mellitus (DM) and its complications

- Classify diabetes mellitus
- Differentiate between Type I and Type II diabetes mellitus
- Describe the biochemical causes of development of diabetes mellitus
- Discuss the factors responsible for metabolic changes in DM
- Discuss the clinical significance of diabetes mellitus and its complications
- Discuss the diagnostic investigations for diabetes mellitus

11. Adrenal hormones: Glucocorticoids

- List the adrenal cortex hormones
- Explain the synthesis chemical structure of glucocorticoids
- Describe the mechanism of action and metabolic functions of glucocorticoids
- Discuss the regulation of glucocorticoids
- Describe the clinical diseases and complications associated with glucocorticoids

12. Adrenal hormones: Mineralocorticoids

- Explain the synthesis chemical structure of mineralocorticoids
- Describe the mechanism of action, metabolic functions, and regulation of mineralocorticoids
- Describe the clinical diseases and complication associated with mineralocorticoids

13. Adrenal hormones: Adrenal medullary hormones

- List the adrenal medullary hormones
- Explain the synthesis and chemical structure of adrenal medullary hormones
- Describe the mechanism of action and metabolic functions of adrenal medullary hormones
- Discuss the regulation of adrenal medullary hormones

- Describe the clinical diseases and complication associated with adrenal medullary hormones

PHYSIOLOGY

1. Introduction to Endocrinology: Control and feedback of hormones

- Define hormone, target cell and receptor
- Contrast the term endocrine, paracrine and autocrine
- Classify hormones
- Describe the concept of second messenger
- Explain the principles of negative and positive feedback of hormonal secretion

2. Hypothalamus and anterior pituitary hormones

- Name hypothalamic factors that control secretion of anterior pituitary hormones
- Name various cells of anterior pituitary responsible for synthesis of hormones
- Describe the functions and regulation of GH, FSH, LH, ACTH, TSH and prolactin
- Explain the hypothalamic hypophyseal portal system

3. Functions of Growth Hormone and associated disorders

- Describe the functions and regulation of growth hormone
- Describe the disorders associated with hypo and hyper secretion of GH

4. Hormones of Posterior Pituitary and related disorders

- Describe the secretion of oxytocin and ADH
- Explain the mechanism of action and regulation of oxytocin and ADH

5. Functions of Thyroid hormones

- Explain the formation and secretion of T₃ and T₄
- Discuss the importance of iodine metabolism and iodine pump
- Describe actions of thyroid hormone on development and metabolism and associated disorders
- Describe the role of Thyroid stimulating hormone (TSH) on thyroid hormone regulation

6. Functions of Parathyroid (PTH) and Calcitonin hormone (Calcium homeostasis)

- Describe the synthesis of parathyroid and calcitonin hormone
- Explain the effects of parathyroid hormone on calcium balance
- Describe the factors that regulate the activities of osteoclasts and osteoblasts
- Describe the relationship between PTH and active form of vit D
- Explain the regulation of calcitonin secretion
- List the disorders associated with calcium homeostasis (tetany, Chvostek's sign)

7. Hormonal secretion of the Pancreas (Insulin)

- Explain the synthesis of insulin
- Describe the insulin receptor
- Explain the role of insulin in maintaining blood glucose concentration
- Differentiate between neurogenic and nephrogenic diabetes insipidus

8. Hormonal secretion of the Pancreas (Glucagon, somatostatin)

- Describe principal actions of glucagon and its regulation

- Explain the functions of somatostatin on blood glucose

9. Adrenal cortex (Functions of Glucocorticoids)

- Explain the synthesis of glucocorticoid hormones
- Identify the actions of glucocorticoids on metabolism and target cells
- Discuss the mechanism for regulation of glucocorticoid secretion
- Describe the disorders associated with glucocorticoid hormones (Addison's disease, Cushing syndrome)

10. Adrenal cortex (Functions of Mineralocorticoids)

- Define Aldosterone escape, Primary Aldosteronism and Androgenital Syndrome
- Explain the mechanism of action of mineralocorticoids
- Discuss the mechanism of actions of aldosterone and its regulation

11. Adrenal Medulla (secretion, function and disorders)

- Explain the mechanism of secretion and actions of medullary hormones
- List the types of adrenergic receptors and their functions on target organs
- Enumerate consequences of over and under secretion of medullary hormones (pheochromocytoma)

TUTORIALS

BIOCHEMISTRY

1. Pituitary hormones (Gigantism, Acromegaly, Dwarfism etc)

- Discuss the clinical importance of Pituitary hormones
- Correlate the laboratory investigations with relevant clinical conditions

2. Thyroid & adrenal hormones (Goiter, Hypothyroidism & Hyperthyroidism, Addison's diseases etc.)

- Discuss the clinical importance of thyroid & adrenal hormones
- Correlate the laboratory investigations with relevant clinical conditions

3. Pancreatic hormones

- Discuss the clinical importance of pancreatic hormones
- Correlate the laboratory investigations with relevant clinical conditions

4. Diabetes Mellitus Tests

- Enumerate the biochemical tests to detect Diabetes Mellitus
- Describe the diagnostic criteria of Diabetes correlated with their laboratory investigations

PRACTICALS

ANATOMY

1. Histology of Pituitary gland

- Identify the slide of Pituitary gland

Jinnah Sindh Medical University
Study Guide- Endocrine System-1 MBBS Year-2, 2022

- Describe the microscopic features of pituitary gland

2. Histology of Thyroid and Parathyroid gland

- Identify the slide of Thyroid and Parathyroid gland
- Discuss the microscopic features of Thyroid and Parathyroid gland

3. Histology of Pancreas

- Identify the slide of Pancreas
- Explain the microscopic features of Pancreas

4. Histology of Adrenal gland

- Identify the slide of Adrenal gland
- Describe the microscopic features of Adrenal gland

BIOCHEMISTRY

1. Thyroid function tests

- Identify the chemical tests and bio-techniques to estimate the functions of the thyroid glands
- Correlate the laboratory investigations with relevant clinical conditions

2. Blood glucose estimation by glucometer

- Enumerate the chemical tests to detect diabetes mellitus
- Describe the diabetes diagnostic criteria
- Outline the method for estimation of blood glucose by glucometer
- Describe the principle of glucometer
- Perform blood glucose estimation by glucometer
- Correlate the laboratory investigations with relevant clinical conditions

3. Oral Glucose Tolerance Test (OGTT)

- Explain the significance of OGTT and glucose challenge tests (GCT)
- Explain the method of performance of OGTT and GCT
- Perform OGTT and GCT
- Interpret the results of Oral Glucose Tolerance Test & GCT
- Estimate urine glucose with urine glucose reagent strip
- Correlate the laboratory investigations with relevant clinical conditions

INTERNAL ASSESSMENT	Internal assessment carries 20% weightage in the final examination. It may be in the form of: <ul style="list-style-type: none"> • MCQs, assignments, stages/sub-stages, projects, quiz or OSPE. • Continuous monitoring of attendance and practical assessment in short groups
FINAL EXAMINATION	MCQs and OSPE (observed + un observed)