

# Lectures and Learning Objectives

Below are the learning objectives for each of the lectures.

## Endocrine Control Systems

- Define endocrine, paracrine, autocrine, and exocrine systems, define neuro-secretory cells by giving a few examples.
- List major categories of hormones and give several examples that belong to each class.
- List important factors that determine hormone levels in circulation.
- Explain cellular actions of hormones via membrane and nuclear receptors, including an understanding of the rates by which these processes can affect cells.
- Define basal secretion and stimulated secretion of endocrine glands.
- Describe negative and positive feedback system using an example.
- Explain with examples neuroendocrine integration.

## Neuroendocrinology and the Posterior Pituitary Gland

- Recall anatomical, biochemical, and functional evidence showing intimate relationships between hypothalamus and neurohypophysis.
- Describe how hormones are sensed by the neurons of the hypothalamus, and the role that the blood brain barrier and transport mechanisms play.
- Recall how the central nervous system can integrate with the hypothalamus and modify both hormonal secretions and executive function.
- Describe the differences in how hypothalamic signals are passed to the posterior and anterior pituitary glands.
- List the known hypothalamic hormones which cause release (and release-inhibition) of anterior pituitary hormones, including their acronyms.
- Name two major posterior pituitary hormones in man, name their chemical category, and succinctly describe their secretory mechanism.
- Describe cellular actions of vasopressin in terms of site of actions, receptors, and cellular signals.
- Discuss briefly aquaporin water channels and relation to vasopressin.
- Predict what the changes are expected in urine volume and osmolality and in ECF volume when vasopressin synthesis or secretion is severely impaired. Predict what will happen to water intake. Explain why there can be transient diabetes insipidus following a whiplash injury, and the rationale for therapy during this time.
- Describe the control of vasopressin release.
- Describe the function of oxytocin with respect to delivery and lactation.

## Endocrine and Hypothalamic Control of Appetite

- Describe the appetite-regulating hormones secreted from the gut, how they are regulated and under what conditions they are released.
- Describe the AgRP/POMC circuit and its relationship to both circulating factors and neuropeptides.
- Understand the relationship between adipose mass and appetite regulation, including how adipokines are regulated and what role they play.
- List the effects of insulin on appetite and what the neurological targets of insulin are.
- Describe the role of the blood-brain barrier in the regulation of appetite and how it is altered in obesity.
- Describe how hypothalamic feeding circuits integrate with other pleasure and reward circuits in the brain.
- Explain how neuroendocrine obesity differs from idiopathic obesity and how they might be treated in different ways.

## Endocrine Control of Growth

- List the hormones important for growth at key times in a person's life.
- Describe the functions of human growth hormone on growth (bones and soft tissues), and on metabolism, and the regulation of its secretion. Explain what "rhGH" means.
- State the "dual effector hypothesis" for GH actions, and the relative roles of GH and IGF-1 in growth control.
- Describe the interactions among all the key growth-regulating hormones at key times of a person's life: in utero, neonatally, childhood, puberty, adulthood, and senescence.

## Adrenals and Stress Hormones

- Name three zones in the adrenal cortex and major regulator(s) of each zone.
- Name three steroidogenesis pathways and their major products.
- Explain briefly the physiological mechanism of adrenogenital syndrome.
- Describe the physiological actions and roles of aldosterone.
- Explain briefly the renin-angiotensin system.
- Describe the negative feedback regulation of aldosterone and its relationship to blood volume/blood pressure homeostasis.
- Describe hepatic and extrahepatic metabolic actions of glucocorticoids. Discuss their relationship.
- State the major findings caused by adrenal hypersecretion of mineralocorticoids.

- State the major findings caused by adrenal hypersecretion of glucocorticoids.
- Name the major hormones secreted from the adrenal medulla. Discuss the differences of epinephrine (epi) and norepinephrine (NE) in cardiovascular actions (physiological levels).
- List the major metabolic actions of catecholamines.
- Contrast the thresholds for actions vs. plasma levels of epi and NE under common conditions, like exercise, and in the disease pheochromocytoma

## **Pancreatic Hormones and Metabolic Control**

- Name the cell types of the Islets of Langerhans and name the hormones secreted by them.
- Describe the main targets and functions of glucagon.
- List the major factors that stimulate or inhibit glucagon and insulin.
- Describe the important physiological roles of insulin.
- List the major actions of insulin in muscle, adipose tissue, and liver.
- Explain briefly the mechanism of glucose uptake into the muscle.
- Name the tissues in which insulin facilitates glucose uptake and those in which insulin does not facilitate glucose uptake.
- List the major factors that stimulate or inhibit insulin secretion.
- Draw an oral glucose tolerance test (oGTT) (glucose, insulin, and glucagon levels) and explain the conditions and describe what is occurring and why. Explain how the two hormones act to promote glucose homeostasis in the plasma and in the key target tissues for each of these hormones.
- State which nutrient storages are preferably used for short-term regulation of energy metabolism if no nutrients are available from the GI tract.
- Discuss the hormones involved, fuel storage capacity, fuel storage consumption, and glucose (or fatty acid) levels during 1) the postprandial period, 2) the post-absorptive period, 3) fasting.
- List the insulin-counteracting hormones and their roles in glucose homeostasis. Discuss the hormones involved in minute-to-minute regulation and long-term regulation of glucose homeostasis.

## **Clinical Case “A”**