Endocrinology **Dr Yasameen Alsaffar**

Lec 1

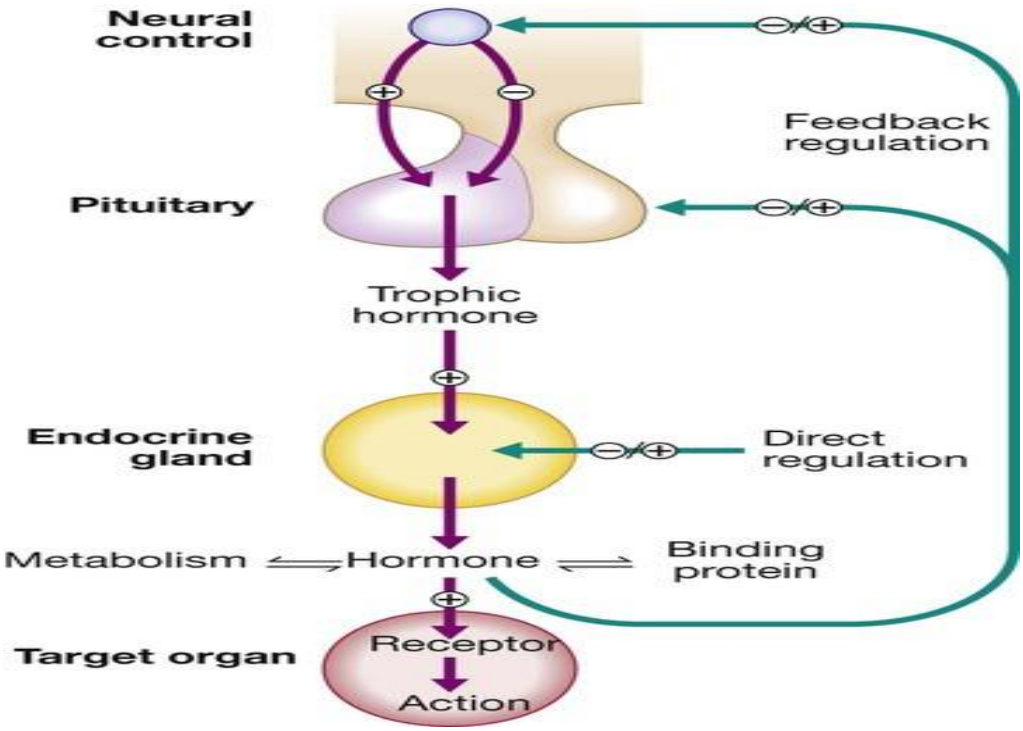
Introduction

Endocrinology concerns the synthesis, secretion and action of hormones. These are chemical messengers released from endocrine glands that coordinate the activities of many different cells. Endocrine diseases can therefore affect multiple organs and systems.

Some endocrine disorders are common, particularly those of the thyroid, parathyroid glands, reproductive system and β cells of the pancreas.

Functional anatomy and physiology

Some endocrine glands, such as the parathyroids and pancreas, respond directly to metabolic signals, but most are controlled by hormones released from the pituitary gland. Anterior pituitary hormone secretion is controlled in turn by substances produced in the hypothalamus and released into portal blood, which drains directly down the pituitary stalk. Posterior pituitary hormones are synthesised in the hypothalamus and transported down nerve axons, to be released from the posterior pituitary. Hormone release in the hypothalamus and pituitary is regulated by numerous stimuli and through feedback control by hormones produced by the target glands (thyroid, adrenal cortex and gonads). These integrated endocrine systems are called ‘axes’.



A wide variety of molecules can act as hormones, including peptides such as insulin and growth hormone, glycoproteins such as thyroid-stimulating hormone, and amines such as noradrenaline (norepinephrine). The biological effects of hormones are mediated by binding to receptors. Many receptors are located on the cell surface.

Endocrine pathology

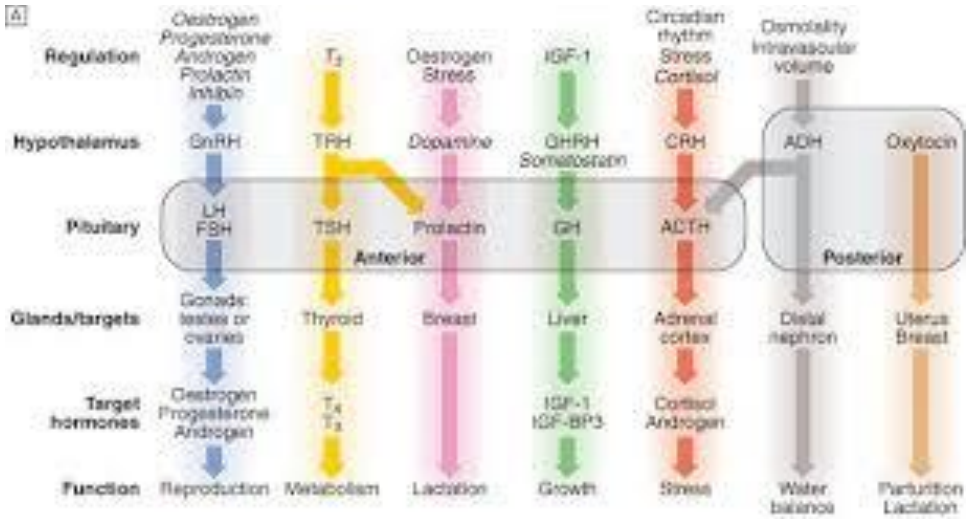
For each endocrine axis or major gland, diseases can be classified as Pathology arising within the gland is often called ‘primary’ disease (e.g. primary hypothyroidism in Hashimoto’s thyroiditis), while abnormal stimulation of the gland is often called ‘secondary’ disease (e.g. secondary hypothyroidism in patients with a pituitary tumour and thyroid-stimulating hormone deficiency). Some pathological processes can affect multiple endocrine glands these may have a

genetic basis (such as organ-specific autoimmune endocrine disorders and the multiple endocrine neoplasia (MEN) syndromes) or be a consequence of therapy for another disease (e.g. following treatment of childhood cancer with chemotherapy and/or radiotherapy).

Classification

Classification of endocrine disease

Hormone excess	Primary gland over-production
	Secondary to excess trophic substance
Hormone deficiency	Primary gland failure
	Secondary to deficient trophic hormone
Hormone hypersensitivity	Failure of inactivation of hormone
	Target organ over-activity/hypersensitivity
Hormone resistance	Failure of activation of hormone
	Target organ resistance
Non-functioning tumours	



The principal endocrine ‘axes’. Some major endocrine glands are not controlled by the pituitary. These include the parathyroid glands (regulated by calcium concentrations, p. 661), the adrenal zona glomerulosa (regulated by the renin–angiotensin system, p. 665) and the endocrine pancreas. Italics show negative regulation. (ACTH = adrenocorticotrophic hormone; CRH = corticotrophin-releasing hormone; FSH = folliclestimulating hormone; GH = growth hormone; GHRH = growth hormone-releasing hormone; GnRH = gonadotrophin-releasing hormone; IGF-1 = insulin-like growth factor-1; IGF-BP3 = IGF-binding protein-3; LH = luteinising hormone: T3 = triiodothyronine; T4 = thyroxine; TRH = thyrotrophin-releasing hormone; TSH = thyroid-stimulating hormone; vasopressin = antidiuretic hormone (ADH))

Investigation of endocrine disease

Biochemical investigations play a central role in endocrinology. Most hormones can be measured in blood but the circumstances in which the sample is taken are often crucial, especially for hormones with pulsatile secretion, such as growth hormone; those that show diurnal variation, such as cortisol; or those that demonstrate monthly variation, such as oestrogen or progesterone. Some hormones are labile and need special collection, handling and processing requirements, e.g. collection in a special tube and/or rapid transportation to the laboratory on ice. Local protocols for hormone measurement should be carefully followed. Other investigations, such as imaging and biopsy, are more frequently reserved for patients who present with a tumour.

Timing of measurement
• Release of many hormones is rhythmical (pulsatile, circadian or monthly), so random measurement may be invalid and sequential or dynamic tests may be required
Choice of dynamic biochemical tests
• Abnormalities are often characterised by loss of normal regulation of hormone secretion • If hormone deficiency is suspected, choose a stimulation test • If hormone excess is suspected, choose a suppression test • The more tests there are to choose from, the less likely it is that any single test is infallible, so avoid interpreting one result in isolation
Imaging
• Secretory cells also take up substrates, which can be labelled • Most endocrine glands have a high prevalence of 'incidentalomas', so do not scan unless the biochemistry confirms endocrine dysfunction or the primary problem is a tumour
Biopsy
• Many endocrine tumours are difficult to classify histologically (e.g. adrenal carcinoma and adenoma)

Examples of non-specific presentations of endocrine disease
Symptom

Most likely endocrine disorder(s)

1. Lethargy and depression Hypothyroidism, diabetes mellitus, hyperparathyroidism, hypogonadism, adrenal insufficiency and Cushing's syndrome.
2. Weight gain Hypothyroidism, Cushing's syndrome

3. Weight loss Thyrotoxicosis, adrenal insufficiency, diabetes mellitus.
4. Polyuria and polydipsia Diabetes mellitus, diabetes insipidus, hyperparathyroidism, hypokalaemia (Conn's syndrome)
5. Heat intolerance Thyrotoxicosis, menopause
6. Palpitation Thyrotoxicosis, phaeochromocytoma
7. Headache Acromegaly, pituitary tumour, phaeochromocytoma Muscle weakness (usually proximal) Thyrotoxicosis, Cushing's syndrome, hypokalaemia (e.g. Conn's syndrome), hyperparathyroidism, hypogonadism
8. Coarsening of features Acromegaly, hypothyroidism

Thank you