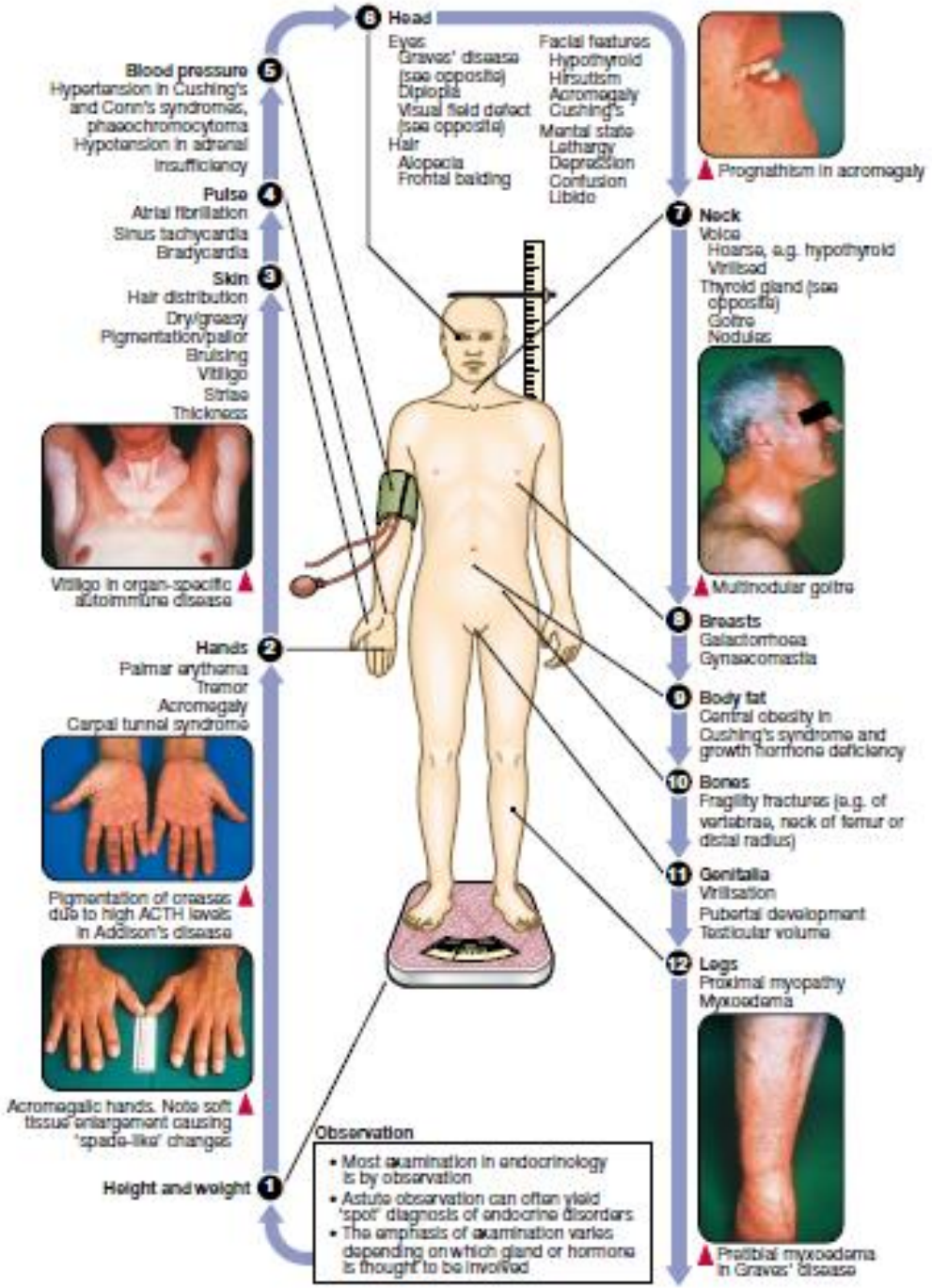
Introduction to Endocrinology

Dr. Haidar F. Al-Rubaye

- 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 diseases are common, particularly those of the thyroid gland, reproductive system and β-cells of the pancreas
- Other diseases are relatively rare


8 Head
Eyes
Graves' disease (see opposite)
Diplopia
Visual field defect (see opposite)
Hair
Alopecia
Frontal balding
Facial features
Hypothyroid
Hirsutism
Acromegaly
Cushing's
Mental state
Lethargy
Depression
Confusion
Libido
5 Blood pressure
Hypertension in Cushing's and Conn's syndromes, phaeochromocytoma
Hypotension in adrenal insufficiency
4 Pulse
Atrial fibrillation
Sinus tachycardia
Bradycardia
3 Skin
Hair distribution
Dry/greasy
Pigmentation/pallor
Bruising
Vitiligo
Striae
Thickness
Vitiligo in organ-specific autoimmune disease
2 Hands
Palmar erythema
Tremor
Acromegaly
Carpal tunnel syndrome
Pigmentation of creases due to high ACTH levels in Addison's disease
Acromegalic hands. Note soft tissue enlargement causing 'spade-like' changes
1 Height and weight
Observation
• Most examination in endocrinology is by observation
• Astute observation can often yield 'spot' diagnosis of endocrine disorders
• The emphasis of examination varies depending on which gland or hormone is thought to be involved
Prognathism in acromegaly
7 Neck
Voice
Hoarse, e.g. hypothyroid
Virilised
Thyroid gland (see opposite)
Goitre
Nodules
Multinodular goitre
6 Breasts
Galactorrhoea
Gynaecomastia
9 Body fat
Central obesity in Cushing's syndrome and growth hormone deficiency
10 Bones
Fragility fractures (e.g. of vertebrae, neck of femur or distal radius)
11 Genitalia
Virilisation
Pubertal development
Testicular volume
12 Legs
Proximal myopathy
Myxoedema
Pretibial myxoedema in Graves' disease

Clinical Assessment of Patients with suspected Endocrine Disorders

Observation

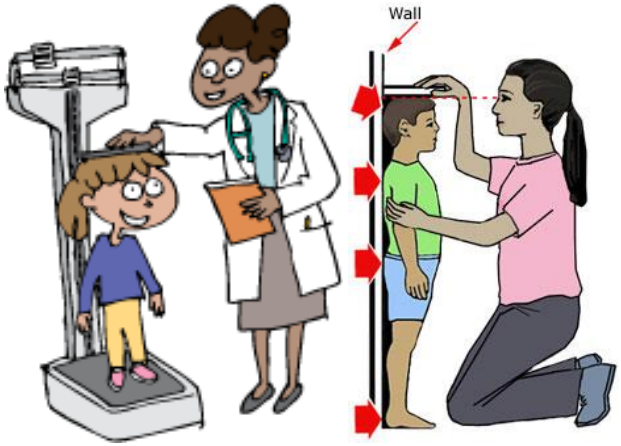
1- Most examination in endocrinology is by observation

2- Astute observation can often yield ‘spot’ diagnosis of endocrine disorders

3- The emphasis of examination varies depending on which gland or hormone is thought to be involved

Clinical Assessment of Patients with suspected Endocrine Disorders

Height & weight



- **Increased weight**, hypothyroidism, Cushing's
- **Weight loss**, hyperthyroidism, adrenal insufficiency
- **Increased height**, growth hormone overproduction
- **Short stature**, growth hormone deficiency, genetic disorders

Clinical Assessment of Patients with suspected Endocrine Disorders

Hands

- **Palmar erythema- Thyrotoxicosis**
- **Tremor- Thyrotoxicosis**
- **Acromegaly**
- **Carpal tunnel syndrome- hypothyroidism**

Pigmentation of creases due to high ACTH levels in **Addison's disease**

Acromegalic hands.
Note soft tissue enlargement causing 'spade-like' changes

Clinical Assessment of Patients with suspected Endocrine Disorders

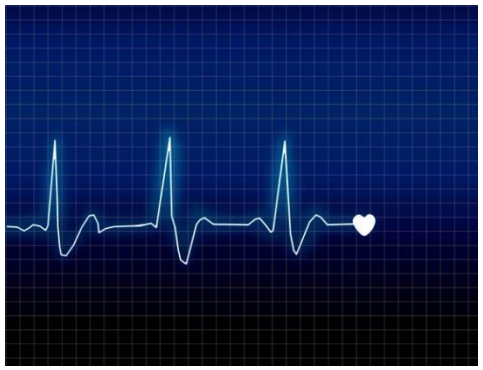
Skin

- Hair distribution
- Dry/greasy
- Pigmentation/pallor
- Bruising
- Vitiligo
- Striae
- Thickness

Vitiligo in organ-specific autoimmune disease

Clinical Assessment of Patients with suspected Endocrine Disorders

Pulse



- Atrial fibrillation
- Sinus tachycardia
- Bradycardia

Blood pressure

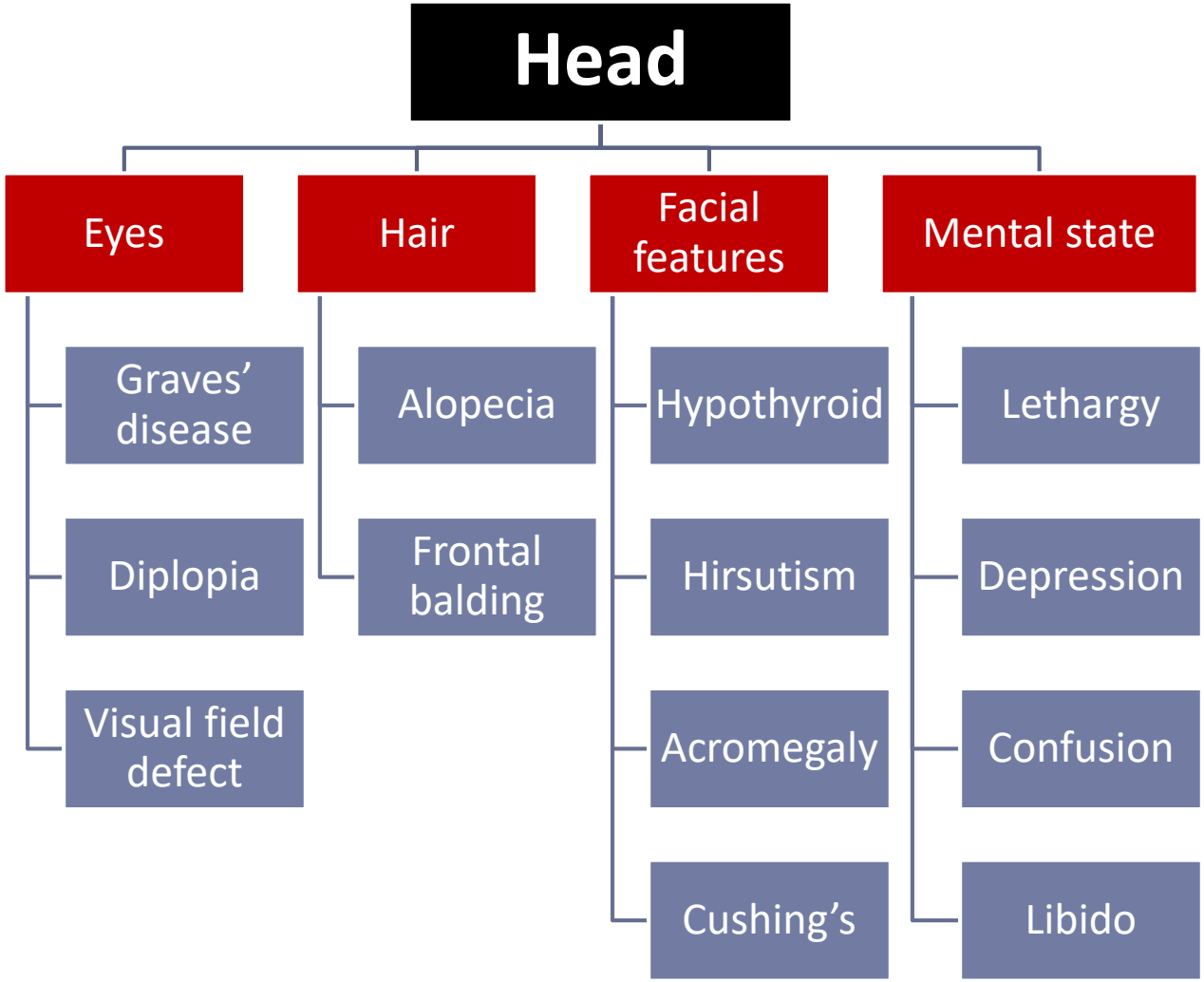
Hypertension

in Cushing's & Conn's syndromes, phaeochromocytoma

Hypotension

in adrenal insufficiency

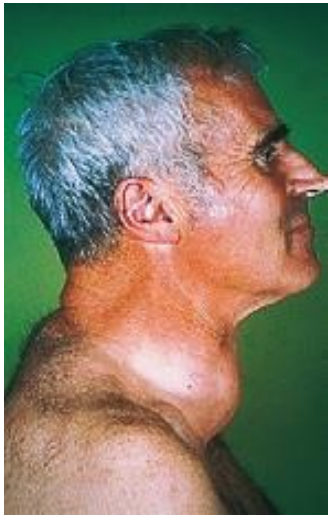
Clinical Assessment of Patients with suspected Endocrine Disorders



Clinical Assessment of Patients with suspected Endocrine Disorders

Voice

Hoarse, e.g. hypothyroid, Virilised



Thyroid gland

Goitre

Nodules

Breasts

Galactorrhoea

Gynaecomastia

Clinical Assessment of Patients with suspected Endocrine Disorders

Body fat

Central obesity in Cushing's syndrome and growth hormone deficiency

Bones

Fragility fractures (e.g. of vertebrae, neck of femur or distal radius)

Genitalia

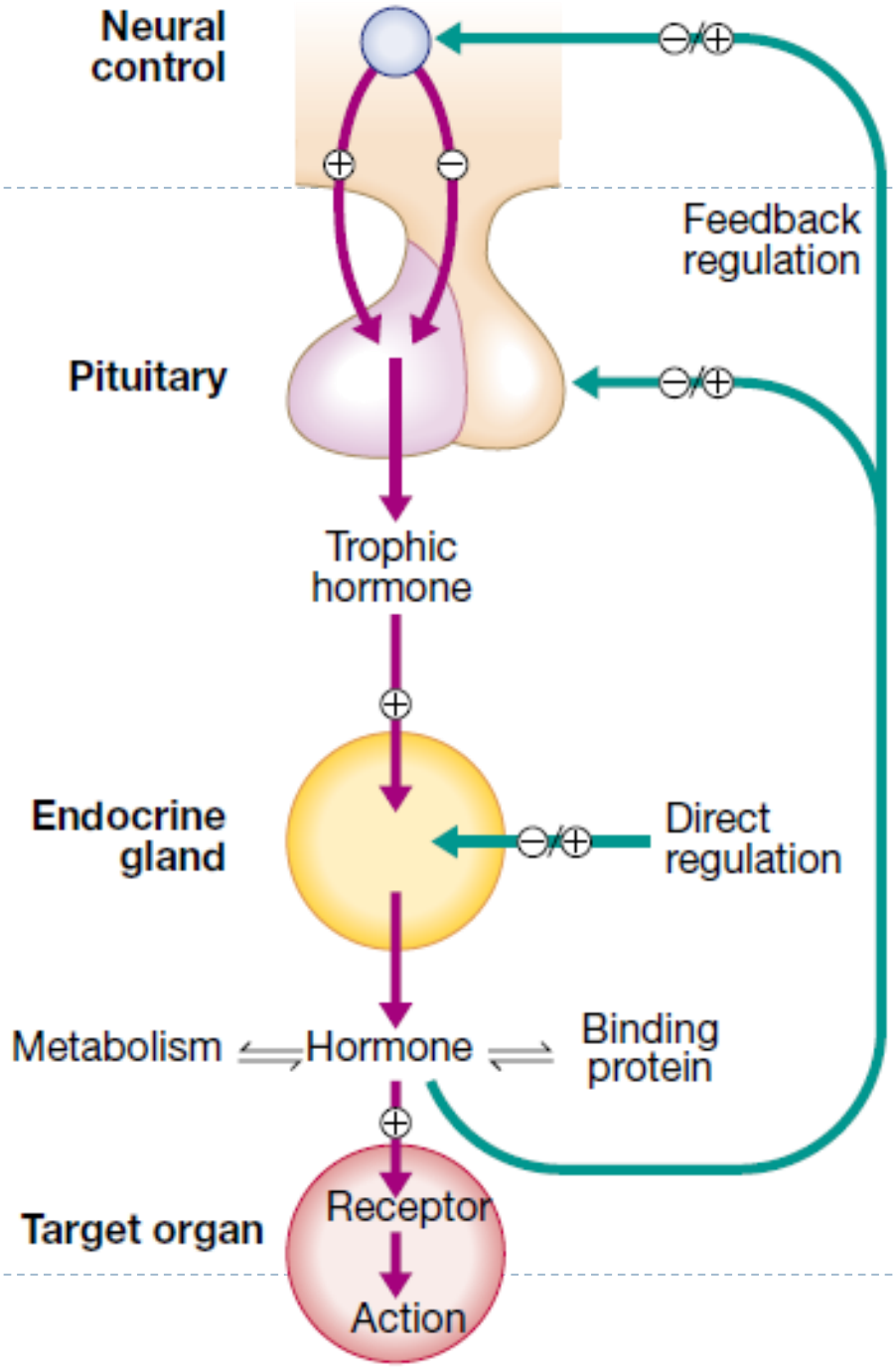
Virilisation, Pubertal development, Testicular volume

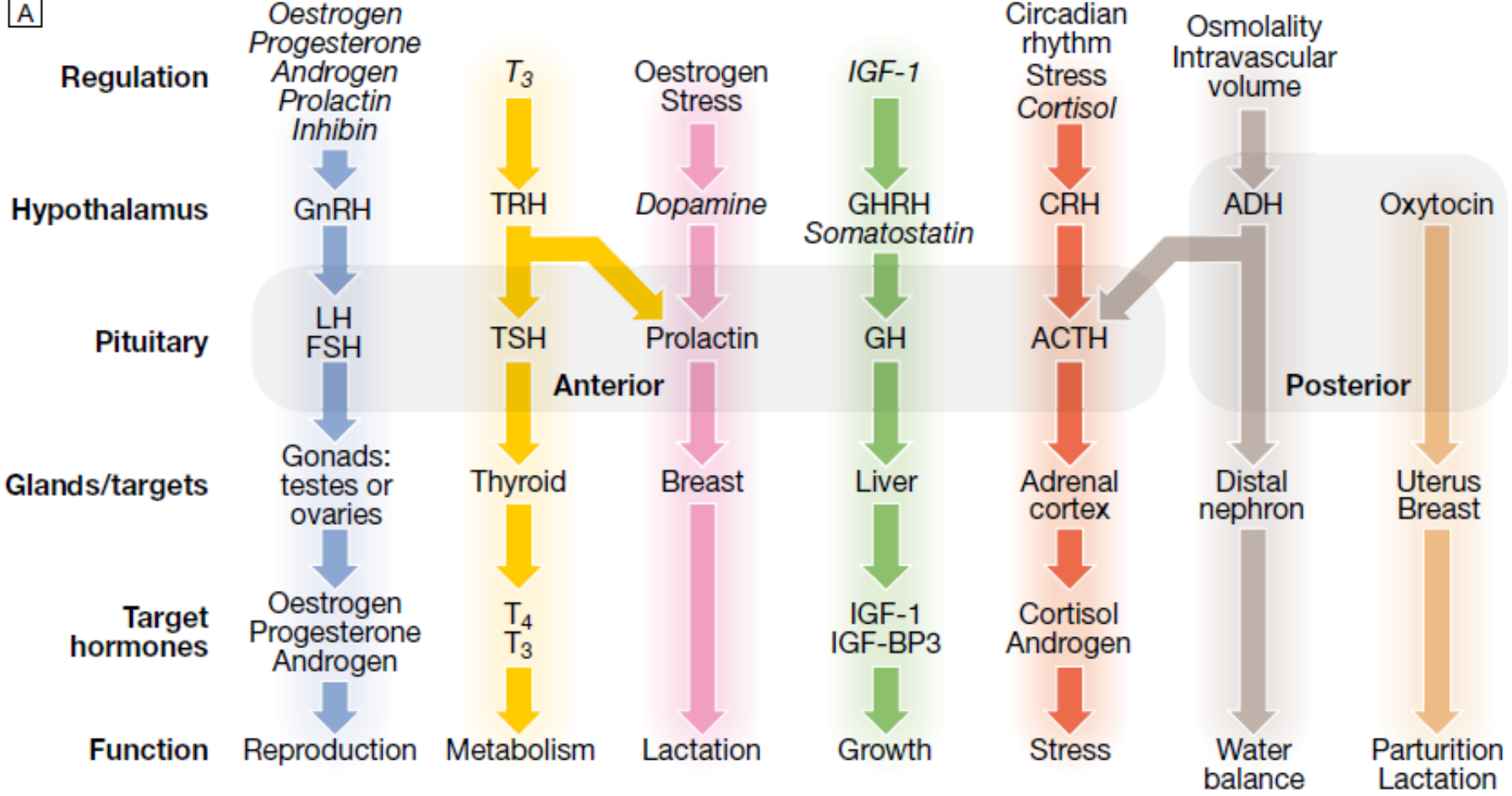
Legs

Proximal myopathy, Myxoedema

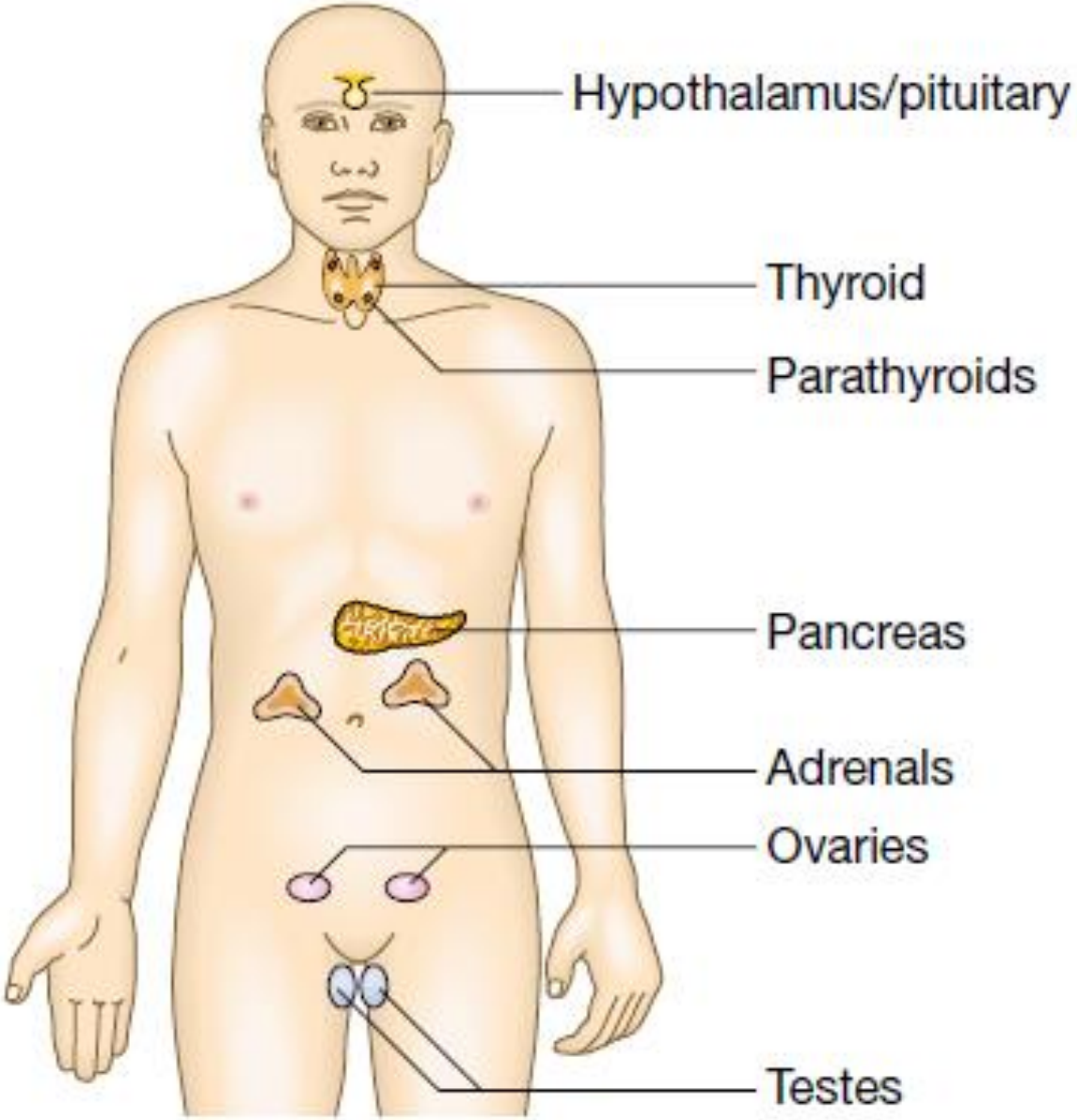
Functional anatomy and physiology

- 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).


Neural control
Feedback regulation
Pituitary
Trophic hormone
Endocrine gland
Direct regulation
Metabolism
Hormone
Binding protein
Target organ
Receptor
Action



The principal endocrine ‘axes’



The principal endocrine glands

Endocrine pathology

Primary disease

- Pathology arising within the gland
- e.g. primary hypothyroidism in Hashimoto's thyroiditis

Secondary disease

- abnormal stimulation of the gland
- e.g. secondary hypothyroidism in patients with a pituitary tumour and TSH deficiency

Endocrine pathology

Two types of endocrine disease affect multiple glands

organ-specific autoimmune diseases (which are common)	Multiple Endocrine Neoplasia (MEN) syndromes (which are rare).

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

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
  - **Diurnal variation-** such as cortisol
  - **Monthly variation-** such as oestrogen or progesterone.
- Other investigations such as imaging and biopsy are usually reserved for patients who present with a tumour.

Principles of endocrine investigation

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

Principles of endocrine investigation

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)

Presenting problems in endocrine disease

- Endocrine diseases present in many different ways and to clinicians in many different disciplines.
- Classical syndromes are described in relation to individual glands in the following Lectures.
- Often, however, the presentation is with non-specific symptoms or with asymptomatic biochemical abnormalities

Examples of non-specific presentations of endocrine disease-1

Lethargy & Depression	Hypothyroidism, diabetes mellitus, hyperparathyroidism, hypogonadism, adrenal insufficiency, Cushing's syndrome
Weight gain	Hypothyroidism, Cushing's syndrome
Weight loss	Thyrotoxicosis, adrenal insufficiency, diabetes mellitus

Examples of non-specific presentations of endocrine disease-2

Polyuria & Polydipsia	Diabetes mellitus, diabetes insipidus, hyperparathyroidism, hypokalaemia (Conn's syndrome)
Heat intolerance	Thyrotoxicosis, menopause
Palpitations	Thyrotoxicosis, phaeochromocytoma
Headache	Acromegaly, pituitary tumour, Phaeochromocytoma

Examples of non-specific presentations of endocrine disease-3

Muscle weakness (usually proximal)	Thyrotoxicosis, Cushing's syndrome, hypokalaemia (e.g. Conn's syndrome), hyperparathyroidism, hypogonadism
Coarsening of features	Acromegaly, hypothyroidism