### Adrenal medulla

- Innervated, developed from neural tissue — direct from spinal cord, synapse directly on the Chromaffin cells
- Large cells arranged in cords, supported by reticular fibre network
- Sinusoidal capillaries between each cord, parasympathetic ganglion cells
- The parenchymal cells are **chromaffin cells**; these are modified sympathetic postganglionic neurons (no axons or dendrites, specialised in secretion)
- **Chromaffin cells** contain electron-dense granules containing **catecholamines** – either **epinephrine** or **norepinephrine**
- Catecholamines within the granules are bound to proteins called **chromatogranins**

### Clinical note

- Disorders of the adrenal cortex can be hypofunctional or hyperfunctional
- Patients treated with corticoids for a prolonged period of time shouldn’t suddenly stop taking them; secretion of ACTH is inhibited, so the cortex will not produce corticoids, causing severe drops in Na+/K+

### Cushing syndrome

- Tumour of adrenal cortex - increased production of glucocorticoids
- Usually due to a pituitary adenoma (>90%); excessive ACTH
- Precocious puberty in boys, and hirsuitism and virilisation in girls

### Conn syndrome

- Tumour producing excessive aldosterone

### Addison disease

- Destruction of adrenal cortex; adrenocortical insufficiency
- Failed secretion of glucocorticoids and mineralocorticoids

### Carcinomas of the adrenal cortex

Very rare; 90% produce steroids associated with endocrine glands

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*Taken from Mescher, Junqueira’s Basic Histology: Text and Atlas, Twelfth Edition.*
Parathyroid glands

- Four small glands located behind the thyroid gland (but not attached), embedded in the thyroid gland capsule
  - Some people can have up to eight
- Same blood supply as the thyroid
- Two types of cells present
  - Chief (principal) cells: cytoplasm filled with granules of parathyroid hormone (PTH), which regulates Ca\(^{2+}\) levels
  - Oxyphil cells: smaller, clustered cells, abnormal shaped mitochondria
- PTH targets osteoblasts, which respond by producing osteoclast-stimulating factor (RANK-L) to increase the number and activity of osteoclasts – promotes resorption of Ca\(^{2+}\) into the blood (negative feedback to reduce PTH)
  - Also stimulates Vit D synthesis in GI tract, which promotes Ca\(^{2+}\) absorption
- So PTH and calcitonin have opposing roles in regulating Ca\(^{2+}\) levels
- PTH also targets renal tubule cells to increase Ca\(^{2+}\) reabsorption

Clinical note

Iodine deficiency goitre
- Low iodine diet prevents thyroid hormone synthesis, causing increased TSH production and increased growth of the thyroid gland

Foetal hypothyroidism
- Can cause cretinism (retarded physical and/or mental development)

Adult hypothyroidism
- From disease of thyroid gland (e.g. autoimmune disease, Hashimoto disease, impairing function) or secondary due to pituitary/hypothalamic failure
- Cold intolerance, weight gain, lose outer third of eyebrow, hair thinning, lethargy constipation, mental fog

Hyperthyroidism
- Graves disease – autoimmune response, Abs to TSH receptors
- Inflammation and growth of the extraocular adipose tissue – bulging eyes (exophthalmos; antibodies cross-react on optic nuclei), also decreased body weight, tachycardia, heat intolerance

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