2.13 Endocrine System

496. a – b + c + d + e +
Hormones are secreted directly into the blood from ductless glands. They exert their influence on specific target organs that are situated at some distance from the site of tissue have specific hormones. The secretion or inhibition of hormone secretion may be under neural influence. Nerve cells that secrete hormones are called neurosecretory neurons. Some hormones are secreted into and transported to a certain degree by the lymph.

497. a + b – c + d + e -
Cells that synthesize steroid hormones typically contain an abundance of lipid droplets, well developed, smooth endoplasmic reticulum and mitochondrial with tubular cristae.

498. a + b – c – d – e +

499. a + b + c – d + e +
The so called APUD series of hormone are all polypeptides. Despite being produced by cells that have a mechanism to synthesize polypeptides, are rough endoplasmic reticulum is relatively sparse. These APUD cells usually have a large number of storage granules.
ACTH, MSH, insulin and glucagons are all produced by APUD cells

500. a – b – c + d – e -

501. a + b + c – d – e +
Neurosecretory hormones are secreted by specific neurons in the hypothalamus. Oxytocin and vasopressin are synthesized in specific hypothalamic neurons and transported down the axons to the neurohypophysis, where they are stored. Both these hormones are small peptides (octapeptide amides).

502. a – b + c – d + e +
The hypothalamo-neurohypophyseal portal system is composed of venous blood, which transports factors and hormones from the hypothalamus, via the capillary bed of the median eminence, to the sinusoidal capillaries of the adenohypophysis, where the secretory cells are stimulated to secrete their hormones.

503. a – b + c + d + e -
The pars nervosa of the hypophysis (neurohypophysis) develops as a downgrowth from the base of the brain and is of neural origin. The neurohypophysis is in vascular contact with the hypothalamus by means of the portal system. Pituicytes and Herring bodies are found in the pars nervosa.

504. a + b + c + d + e -

505. a – b + c + d + e -
The secretory cells of the pars distalis of the hypophysis (adenohypophysis) include acidophils, basophils and chromophobes. At least six hormones are secreted by the cells of the pars distalis. The pars distalis develops in the fetus as the ectodermal invagination from the roof of the mouth (Rathke's pouch). The adenohypophysis has a rich blood supply including large numbers of sinusoids.

506. a + b + c – d + e +

507. a + b – c + d + e +
The thyroid gland originates from embryonic endoderm in the midline of the developing pharynx. It secretes the hormones thyroxine (T_4) and tri-iodothyronine (T_3), which are important in the control of basal metabolic rate. Iodide is essential for the formation of these thyroid hormones. Absence of iodide in the diet or inhibition of thyroxine synthesis by chemicals such as thiourea, potassium thicyanate or propyl-thiouracil, results in the development of goiter. The functioning of the negative feedback system in these cases results in persistant hypersecretion of TSH by the adenohypophysis and consequent thyroid enlargement. The thyroid gland is not essential to life and its absence after surgery replacement thyroid hormones can be administered therapeutically. PAS-positive thyroglobulin is stored extracellularly in the lumina of the thyroid follicles.

508. a – b + c + d + e -
The hormones secreted by the thyroid gland into the blood are tri-iodothyronine (T_3) and thyroxine (T_4) from the thyroid follicular cells and the hypercalcemic hormone, calcitonin, from the C ('parafollicular') cells.

509. a + b + c + d + e -
The colloid in thyroid follicles stains PAS-positive owing to the glycoprotein content of the thyroglobulin. The follicular colloid may stain either acidophilic or basophilic. When the colloid is strongly basophilic it is believed that the follicle is in a state of intense metabolic activity.

510. a + b + c – d + e -
Thyroid follicular cells appear squamous when they are hypoactive and this indicates low levels of TSH in the circulating blood. This may result from hypophysectomy or as a result of the effects of negative feedback following the administration of large amounts of thyroxine.

511. a – b + c + d + e +
The C cells ('parafollicular' cells) of the thyroid never come in direct contact with the lumina of follicles, but are always separated from the lumina by part of a follicular cell. Typically the C cells are more basally situated when they occur in follicles. C cells are stained well using silver impregnation methods. The C cells secrete the hormone, calcitonin, which is a polypeptide with 32 ammo acids and which functions to reduce blood calcium levels. The C cells show all the typical

ultra-structural and cytochemical features of the APUD cells. The C cells develop in the embryo in the ultimobranchial bodies remain separate structures, in mammals the ultimobranchial bodies and C cells become incorporated within the thyroid gland.

512. a + b + c + d + e +
Parathyroid glands, despite their small size, are essential to life and their total removal results in tetany. The parathyroid glands develop from the 3rd and 4th pharyngeal pouches. There are typically four parathyroid glands, though frequently many more may be present. Normally the parathyroids are found embedded in thyroid glands, but separated from the thyroid follicles by a thin connective tissue capsule.

513. a – b + c – d + e +
Parathyroid glands secrete parathyroid hormone (PTH or 'parathormone') in response to low calcium levels in body fluids. PTH facilitates the absorption of calcium through the small intestinal wall and also enhances lamellar bone resorption. The kidneys are a further target organ for PTH action. There is no known hypophyseal tropic hormone involved in the regulation of PTH.

514. a + b – c + d – e +
Normal parathyroid glands of adults have chief (principal) cells, oxyphil cells and fairly abundant interstitial fat cells.

515. a + b – c + d – e +
Oxphils cells only appear at age 4 to 7 and increase in number in old age. They are strongly acidophilic owing to their large accumulations of mitochondria. These oxyphil cells do not normally have any secretory granules. The function of oxyphil cells is unknown, though it is generally accepted that they develop from chief cells. Many mammals do not have oxyphil cells at all in their parathyroid glands.

516. a – b – c + d – e -
Parathyroid hormone is a large polypeptide (84 amino acids).

517. a + b + c – d – e -

518. a – b + c + d + e +

519. a – b + c + d – e +
Insulin and glucagons are produced in the islets of Langerhans. The alpha (A) cells secrete glucagon. These cells, which are fewer in number than the bets (B) cells, are situated more peripherally in the islets and have water soluble, alcohol-resistant granules. The beta (B) cells of the islets secrete insulin. They constitute the most abundant cell type in the islets and are mainly centrally situated. At the

electron microscope level the insulin-containing granules frequently are seen to contain crystalloids.

520. a + b – c – d + e -

521. a – b – c + d + e +
The adrenal cortex secretes mineralocorticoids (from the zona glomerulosa) and glucocorticoids (from the zona fasciculate). The secretory cells of the adrenal cortex are of mesodermal origin. Their hormones are steroids and the cells show the typical ultrastructural features of steroid-secreting cells including an abundance of lipid droplets, mitochondria with tubular cristae and well-developed, smooth endoplasmic reticulum.

522. a + b – c – d + e -

523. a – b + c – d + e +
The zona fasciculate of the adrenal cortex is supplied with arterial blood only, which flows mainly in sinusoids. Cortisol is a glucocorticoid hormone secreted by cells of the zona fasciculate in response to the adenohypophyseal hormone, ACTH.

524. a + b – c – d + e +
Mineralocorticoids are steroid hormones produced by cells of the zona glomerulosa of the adrenal cortex. They are involved in the homeostasis of sodium and their release in affected by angiotensin II levels. Secretion of mineralocroticoids is apparently independent of ACTH.

525. a + b + c + d + e +
The fetal or provisional cortex is found between the adrenal cortex and the medulla in the form of cords of cells. At birth it is better developed than the permanent cortex, though it involutes rapidly. It is believed that the fetal cortex responds to chorionic gonadotropin to secrete sulfated conjugates of androgens, which are converted by the placenta to active forms of androgens or estogens that pass into the maternal blood stream.

526. a + b + c + d + e -

527. a + b + c + d – e +
The cells of the adrenal medulla are derived from embryonic neuroectoderm. They are irregular epithelioid cells innervated by preganglionic sympathetic nerve fibers (unlike other secretory cells in the body, which are innervated by postganglionic fibers). The cells of the adrenal medulla include catecholamine-secreting cells (epinephrine and norepinephirne) and sympathetic ganglion cells.

528. a – b + c + d + e +

The so-called chromaffin reaction stains catecholamine-producing cells of the adrenal medulla. The procedure involves the addition of potassium bichromate to the fixative solution. A positive reaction results in the formation of brown granules within cells.

529. a + b + c + d + e +

The pineal body is covered by pia mater and is surrounded by cerebrospinal fluid. The pineal body contains secretory cells (pinealocytes), which are weakly basophilic. These c ells have a rich blood capillary supply and are believed to secrete melatonin and serotonin. The pineal body in humans is believed to produce anti-gonadotropic factors. Tumors destroying pineal tissue in boys can cause precocious puberty. In old age the pineal body often becomes calcified (‘brain sand’), and this is an important topographical marker in the interpretation of X-ray films of the head. In addition to the pinealocytes, the pineal body has abundant neuroglia.