**Course code: ZOO 536**

**Course name: Animal Physiology II**

**Submitted By: Ms Prabhjot Kaur**

**Dept.: Zoology**

**Topic: Parathyroid gland and Adrenal gland**

**Parathyroid** **Gland**

**Introduction**

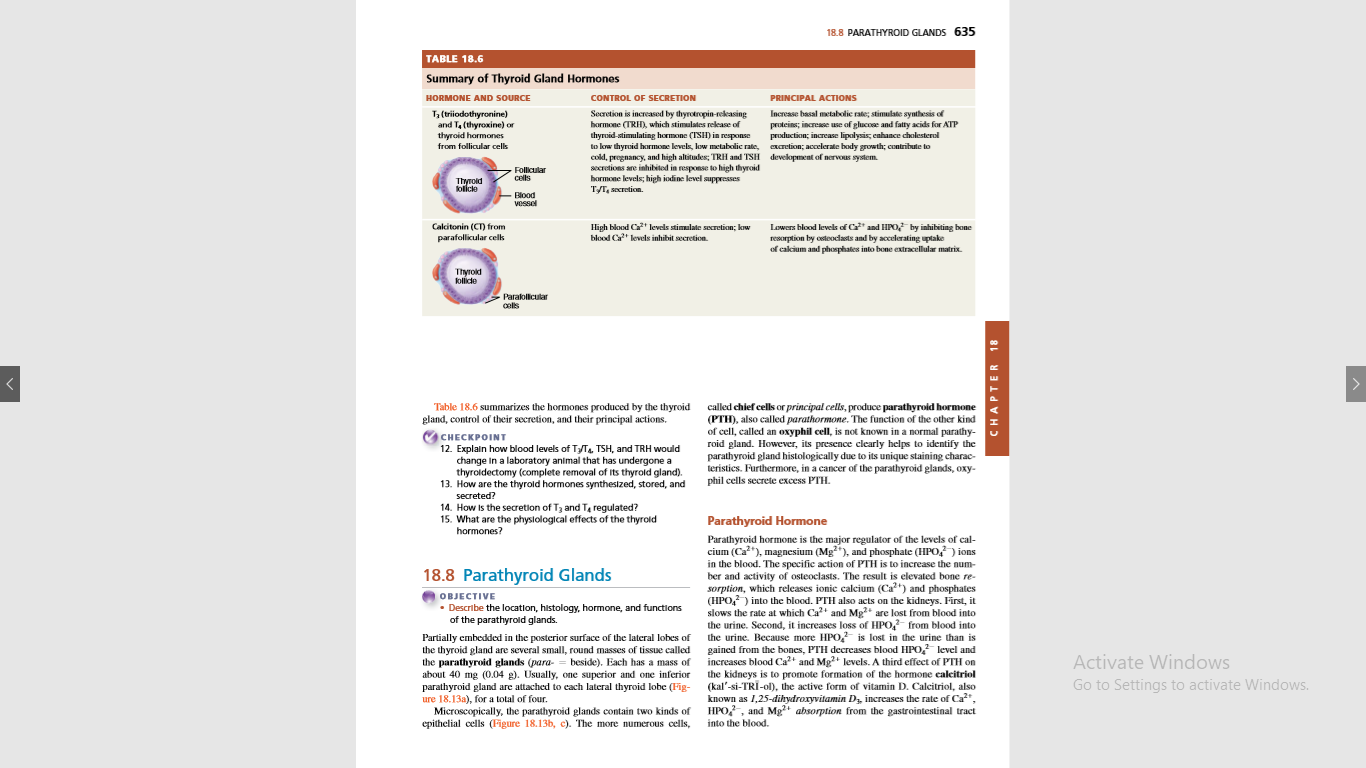
* Partially embedded in posterior surface of the lateral lobes of thyroid gland, are round masses of tissue
* Usually one superior & one inferior gland attached to each lateral lobe, total is four in number
* It contains two types of epithelial cells: more numerous chief/principal cells & less numerous oxyphil cells
* Chief cells produce Parathyroid hormone (PTH) or Parathormone
* Role of oxyphil cells is unknown , but helps in identification of parathyroid gland histologically

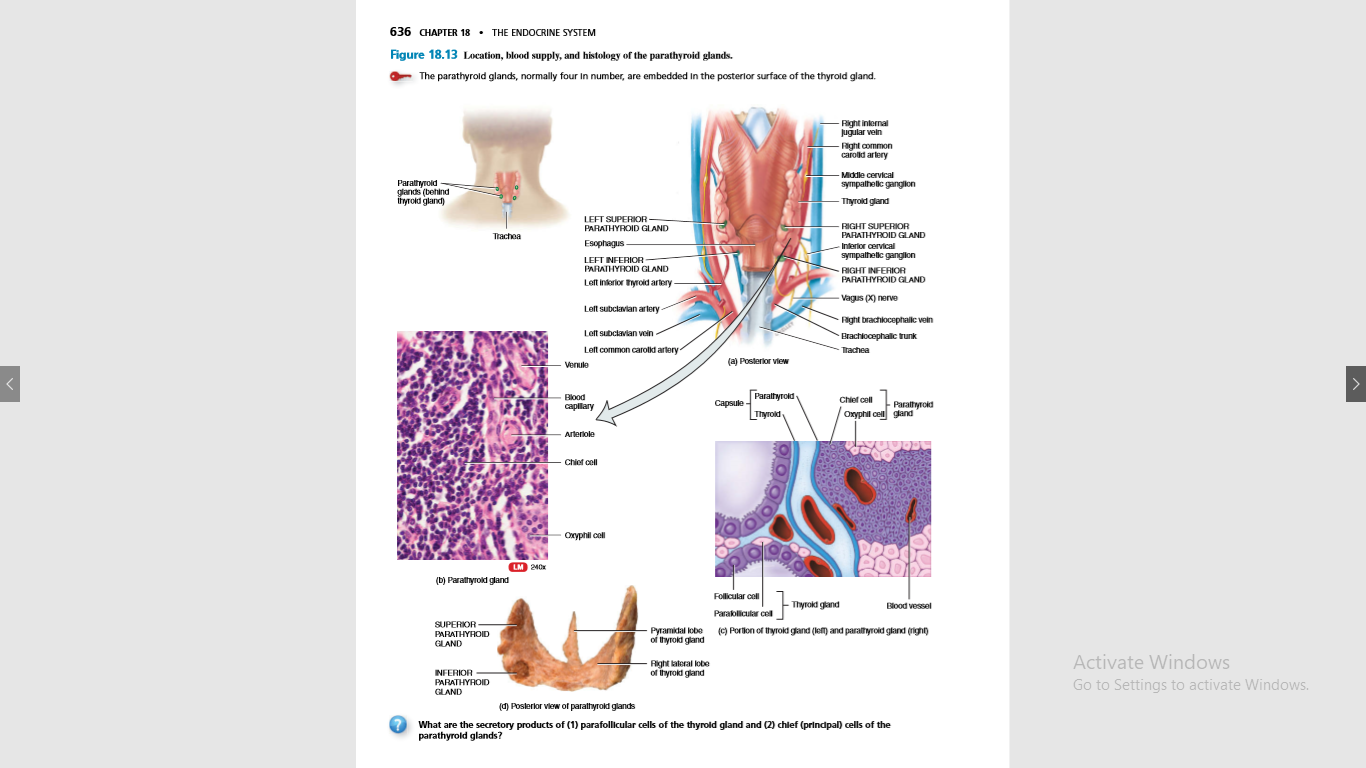
Parathyroid hormone

* It is the major regulator of the levels of calcium, magnesium & phosphate ions in the blood.
* PTH increase the number & activity of osteoclasts results in elevated bone resorption which release ionic Ca2+ & HPO4+ into the blood
* PTH also acts on Kidneys, it slows the rate at which calcium & magnesium are lost from blood into urine, secondly it increases the loss of phosphate ion from blood into urine ( as more is lost in urine than is gained from bones)
* Third effect is on kidneys to promote formation of calcitriol (active form of vitamin D), which increases the absorption of calcium. Magnesium & phosphate from gastro intestinal tract.

**Control**

Blood calcium level directly controls the secretion of both calcitonin and parathyroid hormone via negative feedback loops

1. A higher than normal level of calcium in blood stimulates parafollicular cells of thyroid glands to release more calcitonin
2. Calcitonin inhibits the activity of osteoclasts which decrease the blood calcium level
3. A lower calcium level in blood stimulates chief cells to release more PTH
4. PTH promotes resorption of bone extracellular matrix, which release calcium into blood and slows loss of calcium in the urine, raising blood level of calcium
5. PTH stimulates kidneys to synthesize calcitriol, which stimulates increased absorption of calcium in the GI tract



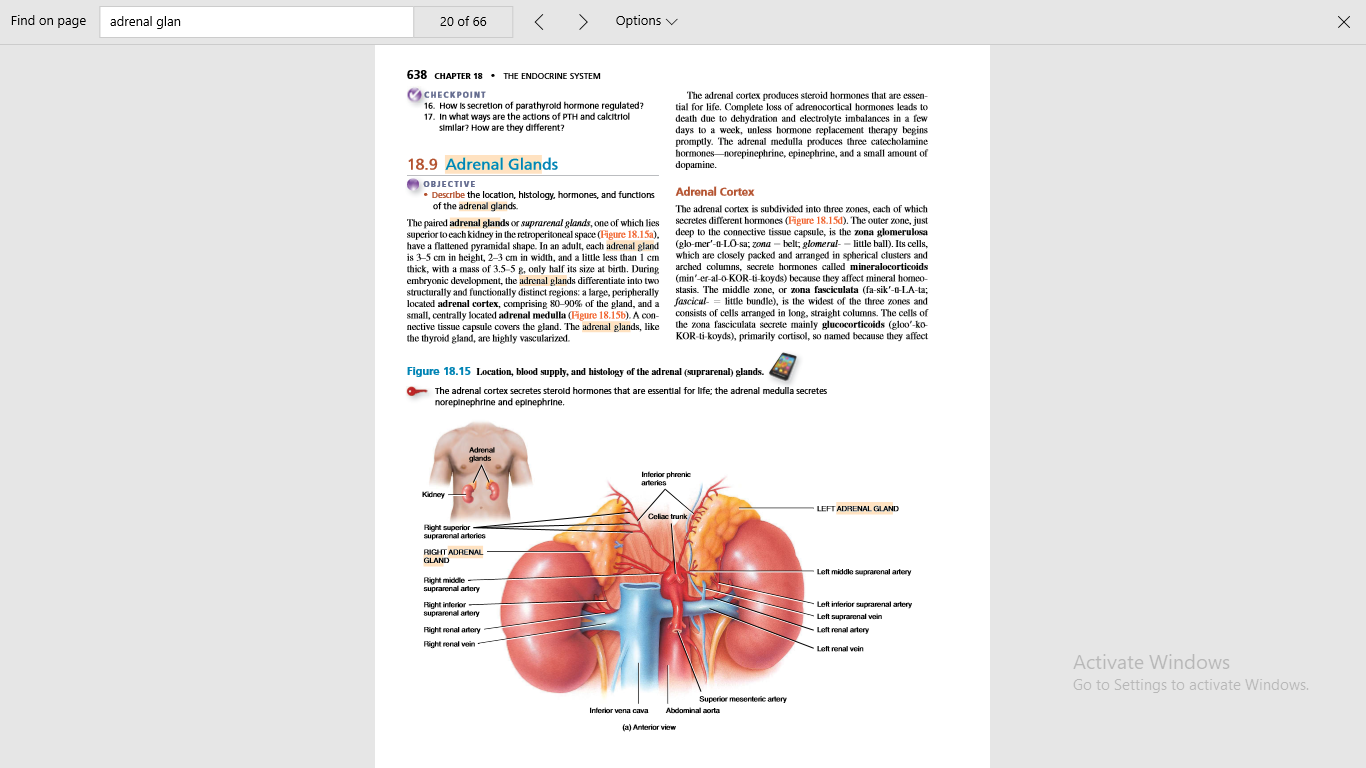
**Adrenal Glands**

**Introduction**

* Paired glands, lies superior to each kidney in the retroperitoneal space and have flattened pyramidal shape
* During embryonic develpoment, they differentiate into 2 structurally & functionally distinct regions a large peripherally located cortex (80-90%) and small adrenal medulla
* A connective tissue capsule covers the gland
* They produce steriod hormones that are essential for life
* They produce 3 catecholamines-norepinephrine, epinephrine & small amount of dopamine

Adrenal cortex:

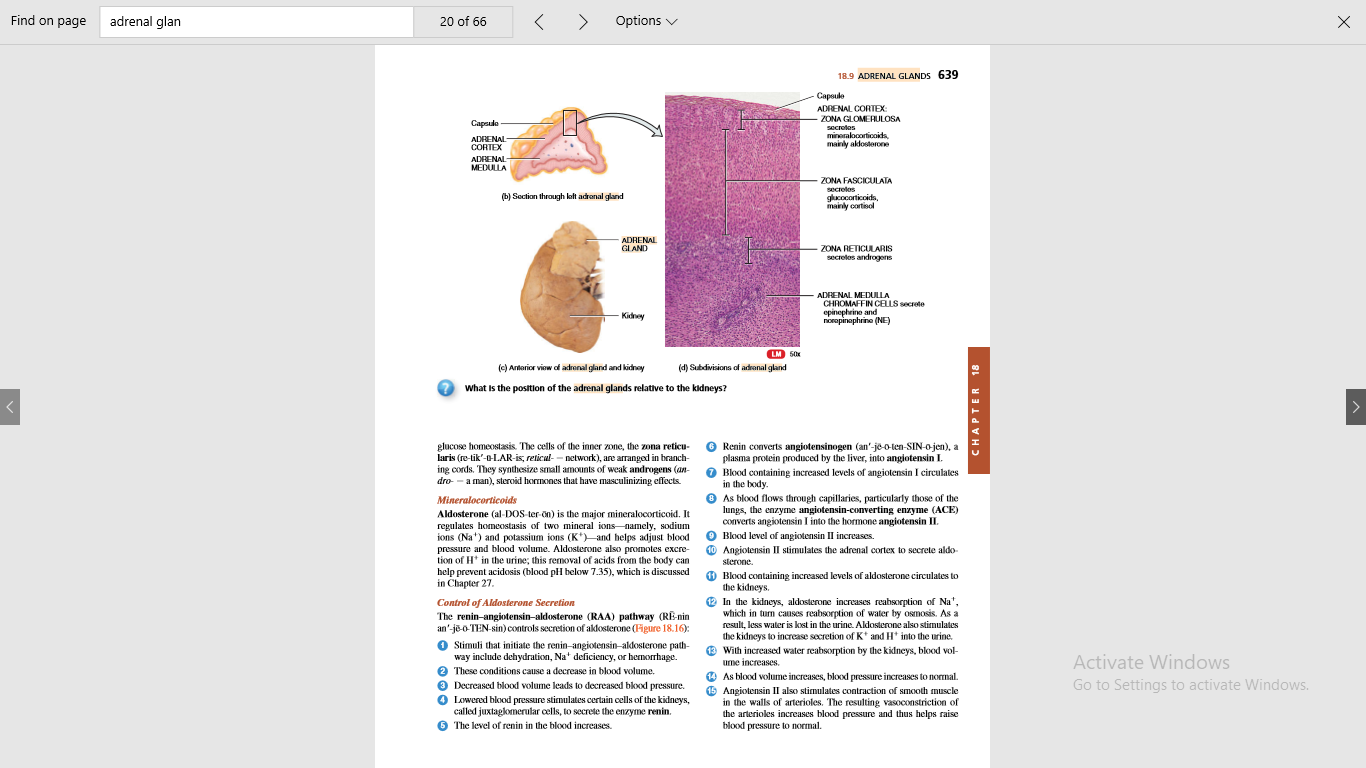
* It is subdivided into 3 zones each of which secretes different hormones
* The outer zone is connective tissue capsule, zona glomerulosa. Its cells are closely pacakged and are arranged into columns, secretes hormone called mineralocorticoids effects mineral homeostasis
* The middle zone or zons fasciculata, widest of three zones and consists of cells arranged in long, straight columns, secretes mainly glucocorticoids effects glucose homeostasis
* Inner zone, the zona reticularis are arranged cords, synthesise small amount of weak androgens, have masulinizing effects



Mineralocorticoids:

* Aldosterone is the major mineralocorticoid, rgulates homeostasis of 2 mineral ions-namely, sodium & potassium ions & helps adjust BP & blodd volume.
* Promotes excretion of hydrogen ion in urine
* The renin-angiotensin-aldosterone/RAA pathway controls secretion of aldosterone

1. Dehydration, sodium deficiency or hemorrhage stimulate/initiate renin-angiotensin-aldosterone pathway
2. These conditions cause decrese in blood volume
3. Decreased blood volume leads to decreased blood pressure
4. Lowered blood pressure stimulates kidneys called juxtaglomerular cells to secrete enzyme renin
5. Renin converts angiotensinogen into angiotensinI
6. Angiotensin-converting enzyme (ACE) converts angiotensin I into hormone angiotensin II
7. Angiotensin II stimulates adrenal cortex to secrete aldosterone
8. Aldosterone in kidneys imcreases reabsorption of sodium, which causes reabsorption of water by osmosis also increase the secretion of potassium & hydrogen ion
9. With increased water reabsorption by kidneys, blood vol increases
10. As Blood vol increases, BP increases to normal
11. Angiotensin II stimulates contraction of smooth muscle in walls of arterioles. Vasoconstriction of arterioles increase BP & thus helps raise BP to normal

 **Glucocorticoids**

* Glucocorticoids include cortisol (90%), corticosterone & cortisone
* Control of glucocorticoids secretion via negative feedback control

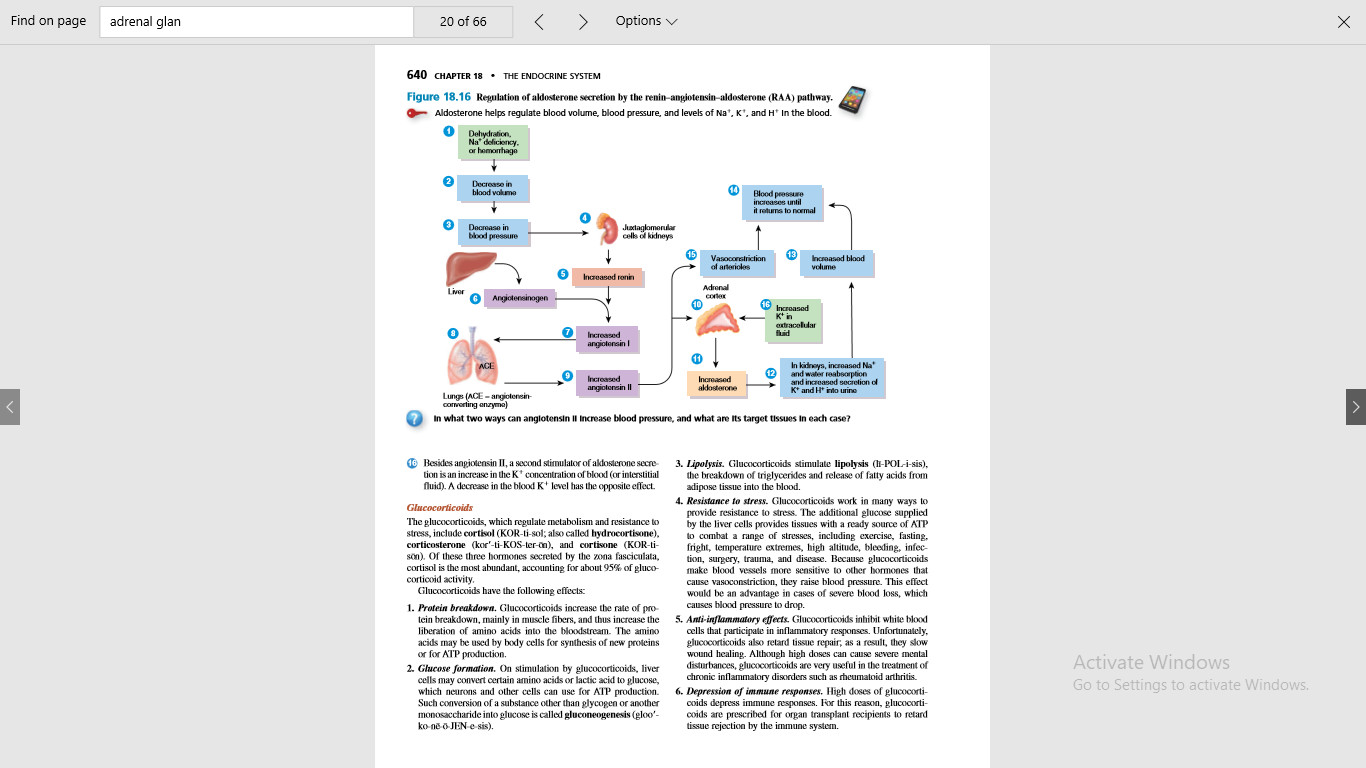
1. Low blood levels of glucorticoids, mainly cortisol stimulate neurosecretory cells in hypothalmus to secrete corticotropin-releasing hormone (CRH)
2. CRH promotes release of ACTH from anterior pitutiary
3. ACTH stimulates glucocorticoid secretion

Effects of glucocorticoids:-

* Protein breakdown: It increase the rate of protein breakdown, mainly in muscle fibres. The amino acids are used for protein synthesis or ATP

Production

* Glucose formation: Liver cells convert certain amino acids or lactic acid to glucose
* Lipolysis: It stimulates break down of triglyserides & release of fatty acids from adipose tissue
* Resistance to stress: liver cells provide tissue with source of ATP to combat a range of stresses
* Anti-infflamatory effects: Inhibit WBC which participate in inflammatory responses, retards tissue repair and wound healing
* Depression of immune responses: it depresses immune response therefore are prescribed for organ transplant recipients.

  
 **Androgens**

* In both males & females adrenal cortex secretes weak androgens called dehydroepiandrosterone (DHEA)
* In males their effect is insignificant & in females promotes libido and converted into estrogens

**Adrenal Medulla**

* Chromaffin cells produce epinephrine(80%) & norepinephrine(20%)
* Intensifies sympathetic responses, in stressful situations & during exercise.
* Hormones augment fight-or-flight response by increasing heart rate, output of the heart, increases BP & also increases blood flow to heart, liver, skeletal muscles, dilate airways to the lungs & increase blood levels

