# Systemic effects of some hormones in endocrine system

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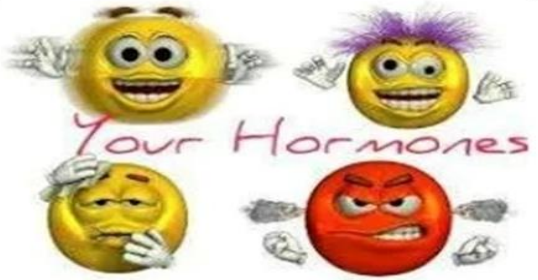
# Introduction :



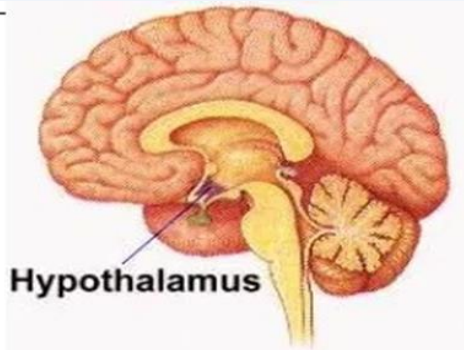

- A hormone is a chemical substance of an endocrine gland. They are chemical messengers responsible for coordinating certain body functions.
- Endocrine glands, which are also called ductless glands, deposits the hormones into the blood stream.
- The blood, on its turn, carries the hormones to every part of the body.

The endocrine system consists of major organs and tissues that secrete hormones into the bloodstream which then act on tissues distant from their origin.

Central endocrine glands :Hypothalamus and the pituitary gland

Peripheral endocrine glands : Pancreas, thyroid, adrenal, parathyroid, gonadal, intestinal, thymus and pineal glands

# Hypothalamus:




The hypothalamus has a significant role in homeostatic regulation.

The hypothalamus gland regulates the anterior pituitary gland, water balance, autonomic nervous system, regulation of eating/drinking behavior and reproductive system, as well as the generation and regulation of circadian rhythms.

It fulfills this regulatory role through the release of several small peptide hormones, including

Thyrotropin-releasing hormone,

Growth hormone releasing hormone,

Somatostatin,

Gonadotropin-releasing hormone and

Corticotropin-releasing hormone,

Catecholamine hormone,

Dopamine

# Pituitary gland:

- Pituitary gland hormones are essential for reproduction, growth, metabolic homeostasis, responses to stressors and blood volume regulation.
- The secretion of both anterior and posterior pituitary hormones is controlled by the hypothalamus.
- Posterior pituitary hormones (e.g. vasopressin and oxytocin) are synthesized in neuronal cell bodies in hypothalamic nuclei, transported to nerve terminals in the posterior pituitary and then released in response to neural activity originating in the hypothalamus

# Effects of central endocrine glands on periodontium:

The reason for this effect on periodontium is related to the inability to discriminate between the direct effects of the hypothalamic or pituitary hormones vs. successive hormone effects and/or complementary, antagonistic or pleiotropic actions of additional hormones and/or secondary metabolic consequences occurring in periodontal tissues.

# Growth hormone:

- Protective influence of growth hormone in the periodontium
- In one case– control study examining attachment loss in patients with growth hormone deficiency, subjects with untreated congenital growth hormone deficiency had a statistically greater prevalence of periodontitis (odds ratio = 17.4

Britto et al Periodontal disease in adults with untreated congenital growth hormone deficiency: a case control study. *JCP* 2011: 38: 525–531)

The presence or absence of growth hormone appeared to affect periodontal tissues, suggesting that the presence of growth hormone reduced the development of destructive periodontal diseases.

In regard to gingival diseases, case reports has noted hereditary gingival fibromatosis in patients with growth hormone deficiency

# Peripheral endocrine glands:

## Thyroid gland hormones:

The thyroid gland produces two families of hormones:

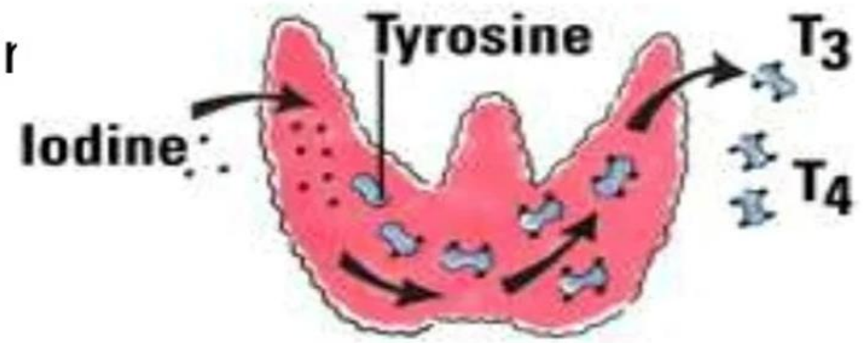
The single modified amino-acid thyroid hormones:

Thyroxin

Triiodothyronin

The polypeptide:

Calcitonin



- Thyroxine and triiodothyronine are a-amino acid derivatives of tyrosine.

These thyroid hormones have three unique properties:

- (i) they contain iodine,
- (ii) they have no specific target tissue but exert effects in virtually every cell type, and
- (iii) their concentrations in the blood are relatively constant.

- The classical mechanism of action involves binding to an intracellular receptor to form a hormone–receptor complex and subsequent binding of the complex to DNA to alter the rate of gene transcription.

**Functions:**

- Oxygen consumption and energy expenditure under resting conditions,
- Increased heat production, heart rate and force of myocardial contraction, thus increasing cardiac output

# Calcitonin:

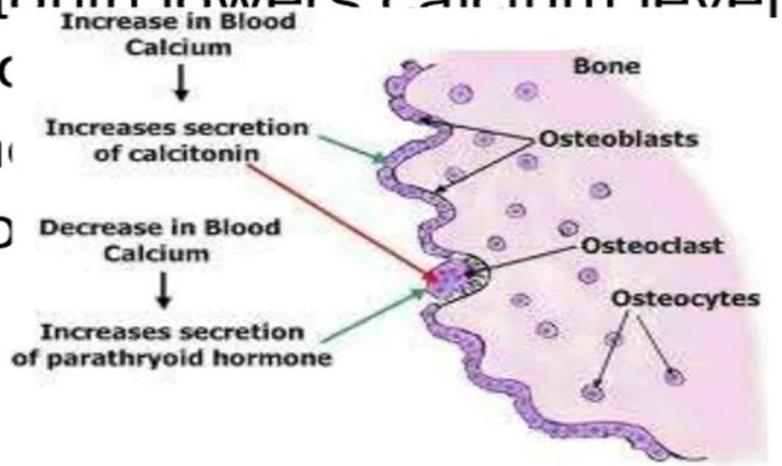
- Calcitonin, a 32-aminoacid polypeptide hormone, is in the regulation of calcium and phosphorus concentrations in the blood and it is the antipode of parathyroid hormone.

- More specifically, calcitonin lowers calcium levels in the serum by inhibitic

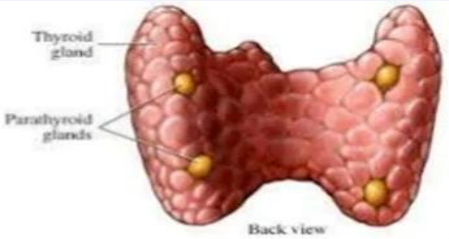
(i) osteoclast activity , an

(ii) renal tubular resorptio

of calcium.



# Parathyroid gland hormo




- The parathyroid is usually found as a set of four small endocrine glands on the posterior surface of the thyroid gland.
- Parathyroid hormone is a peptide hormone secreted by the parathyroid glands, and this hormone is essential for calcium regulation.

- More specifically, parathyroid hormone acts on bone, kidneys and intestine, and raises plasma calcium levels so that hypocalcemia can be avoided .
- It also acts to lower the plasma phosphate concentration.
- Parathyroid hormone does not have any direct effect on the intestines; however, parathyroid hormone helps to activate vitamin D, and this vitamin, in turn, directly increases the intestinal absorption of calcium and phosphate.

# Effects of parathyroid gland hormone on the periodontium:

- Primary hyperparathyroidism, resulting principally from adenomas
- Secondary hyperparathyroidism, resulting primarily from chronic renal failure, have been implicated in alveolar bone destruction as a consequence of elevated parathyroid hormone levels.

- In general, increased tooth loss and poor oral hygiene have been associated with hyperparathyroidism .

# Adrenal gland hormones:


- The adrenal glands are located in the retroperitoneum superior to the kidne
- The adrenal glands are composed of two distinct structures: the outer cortex and the inner medulla.

The hormones produced by the adrenal cortex include

- Mineralocorticoid hormones (e.g. aldosterone),
- Glucocorticoid hormones (e.g. cortisol) and
- Gonadal hormones (e.g. dehydroepiandrosterone).

- Aldosterone is primarily involved with regulation of extracellular volume and control of potassium homeostasis and it has also been implicated in enhanced cardiac muscle contraction, increased vascular resistance and decreased fibrinolysis.

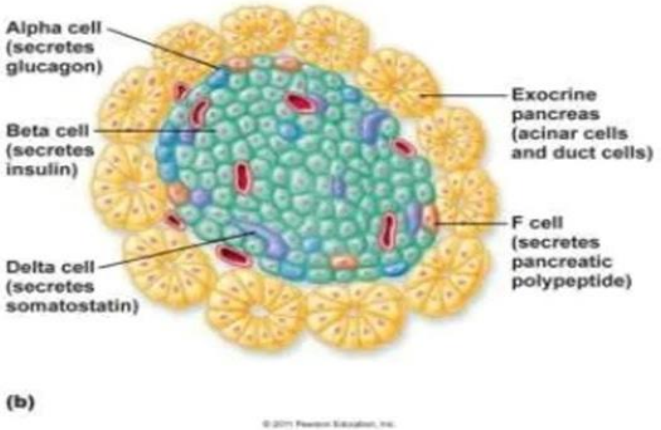
- Cortisol affects numerous physiological processes (e.g. metabolism, inflammation, growth and levels of awareness) and the optimal functioning of body systems requires the circulating cortisol levels be maintained within a relatively narrow range.

- The hormones produced by the adrenal medulla are primarily

  Catecholamines (e.g. epinephrine and norepinephrine).

- Catecholamine secretion is increased by adrenocorticotropic hormone and glucocorticoids but can also be affected by sympathetic nerve stimulation, hypoglycemia, hypoxia, hypercapnia, acidosis, hemorrhage, glucagon, histamine and angiotensin II .

# Pancreatic hormones:




The pancreas secretes hormones,

- Beta-cells (a source of insulin syr
- Alpha -cells (a source of glucagon synthesis) and
- Delta-cells (a source of somatostatin synthesis) .

- They play a major role in carbohydrate and lipid metabolism as well as in the control of energy stores.

- Pancreatic hormone-induced degradation, synthesis via anabolic and catabolic reactions.

# Functions of insulin:

- Insulin lowers the blood levels of glucose, fatty acids and amino acids, and promotes their storage.
- Affect the transport of specific blood-borne nutrients into cells or it can affect enzymatic activity .
- It facilitates glucose transport into most cells, stimulates glycogenesis and inhibits glycogenolysis, and decreases hepatic glucose output by inhibiting glyconeogenesis .

# Glucagon:

- In contrast, glucagon opposes the actions of insulin.
- Glucagon causes an increase in hepatic glucose production and release and thus an increase in blood glucose levels.
- It induces glycogenolysis and stimulates glyconeogenesis. Glucagon also promotes fat breakdown and inhibits triglyceride synthesis .

# Somatostatin:

- Somatostatin is also known as a growth hormone inhibiting hormone and somatotropin release-inhibiting factor.
- Somatostatin is a peptide hormone that affects the digestive system primarily by inhibiting the digestion and absorption of nutrients through suppressing the release of gastrointestinal hormones (e.g. gastrin, cholecystokinin, secretin and motilin).

# Melatonin :

- The pineal gland, also known as the pineal body, conarium or epiphysis cerebri, is a small endocrine gland in the vertebrate brain.
- It produces melatonin, a serotonin derived hormone, which affects the modulation of sleep patterns in both seasonal and circadian rhythms.

# Functions of melatonin:

- Antioxidant property.
- Protection of the mucosa against various irritants.
- Melatonin appears to be an important modulator of the immune system as it enhances the natural and acquired immunity in vivo, and activates monocytes and neutrophils. Melatonin has an anti-inflammatory effect.
- It also stimulates type I collagen synthesis and promotes bone formation.

# Steroid hormones

## Biological actions of estrogen

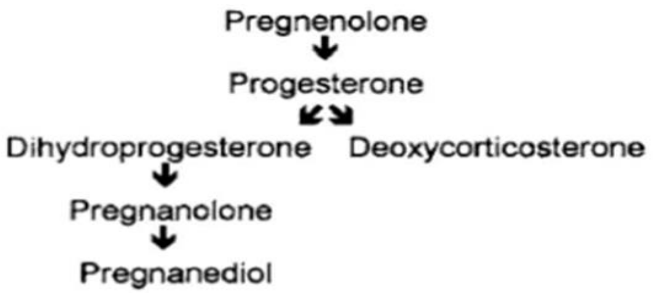
- Development, growth, and maintenance of secondary sex characteristics; uterine growth;
- Pulsatile release of luteinizing hormone (LH) from the central nervous system;
- Thickening of the vaginal mucosa; and
- Cytodifferentiation of stratified squamous epithelium
- Synthesis and maintenance of fibrous collagen
- In male : may be regulation of plasma androgen and estrogen levels as well as sexual behavior

# Effects of estrogen on periodontal tissues:

- Decreases keratinization while increasing epithelial glycogen.
- Increases cellular proliferation in blood vessels.
- Inhibit PMN chemotaxis and stimulates PMNL phagocytosis.
- Suppress leukocyte production from the bone marrow
- Inhibits proinflammatory cytokines released by human marrow cells

- affects salivary peroxidases, which are active against a variety of microorganisms by changing the redox potential
- Reduces Tcell mediated inflammation
- Stimulates the proliferation of the gingival fibroblasts
- Stimulates the synthesis and maturation of gingival connective tissues
- Increases the amount of gingival inflammation with no increase of plaque

# Progesterone:




- naturally occurring proges

secreted by the ovary (main

corpus luteum during the second half of the menstrual cycle),

- synthesis and secretion : stimulated by luteinizing hormone produced in the pituitary gland
- Progestrone receptor occurs in two isoforms : A and B
- Not localised in gingival epithelial cells
- Seen in gingival fibroblasts

# Functions:

during the luteal phase of the menstrual cycle and pregnancy…

- Maintenance of pregnancy (i.e., endometrial gland function, decreased excitability of myometrium and possible effects on the immune system to decrease rejection of the developing fetus).
- Decreases hepatic secretion of VLDL and HDL
- Diminishes insulin action.
- Stimulates the hypothalamic respiratory center
- Elevates basal core body temperature at ovulation

# Effect of progesterone on periodontium:

- **Increases vascular dilatation, thus increases permeability**
- Increases the production of prostaglandins( self limiting process)
- Increases PMNL and Prostaglandin E2 in the Gingival crevicular fluid
- Reduces glucocorticoid anti-inflammatory effect


THANK
YOU