Bio& 242 A&P
Unit 4 / Lecture 1B

Hormones Released from the Anterior Pituitary or Adenohypophysis

- **Somatotrophs**
  Human Growth Hormone (hGH)

- **Hypothalamic control**
  hGH releasing hormone
  hGH inhibiting hormone

- **Target Tissues:**
  General body cells, particularly bone, muscle, cartilage, and the liver.
Hormones Released from the Anterior Pituitary or Adenohypophysis

**Hormone affects:**

1. promotes the synthesis of insulin-like growth factors
2. Controls normal growth patterns by increasing protein synthesis, lipolysis, ATP production, and carbohydrate metabolism
3. In adults, it help maintain muscle and bone mass and promote healing and tissue repair

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Hormones Released from the Anterior Pituitary or Adenohypophysis

**Hypo-secretion:**

During childhood causes pituitary Dwarfism

**Hyper-secretion:**

During childhood causes Gigantism

During Adulthood causes Acromegaly: Enlargement of the small bones of the hand and feet

Enlargement of the cranium, nose, and lower jaw

Tongue, liver, and kidneys become enlarged
Pituitary Dwarfism

Dwarfism is a condition in which the growth of the individual is very slow or delayed. Decreased bodily growth is due to hyposecretion of hGH. The end result is a proportionate little person, because height as well as growth of other structures are also decreased.

Can be caused by gene mutations:
Appears to be disruption on different areas of chromosome 3 and 7. Some studies have isolated defects for the production of pituitary hormones to the short arm (the "p" end) of chromosome 3 at a specific location of 3p11. Other studies have found changes on the short arm of chromosome 7.

Or tumors:
Most commonly craniopharyngioma (a tumor near the pituitary gland), children and adolescents.
Symptoms: headaches, vomiting, problems with vision (double vision), excessive drinking behaviors (polydipsia) and sleep disturbances may be common.

Pituitary Gigantism

Hyper secretion of human growth hormone (hGH) before the end of adolescence. People with pituitary gigantism can truly be giants. They can sometimes end up over 7 or 8 feet in height.

Typically caused by an adenoma (tumor) of the pituitary.
Acromegaly

- Results from hypersecretion of growth hormone (GH). Usually the excess GH comes from benign, or noncancerous, adenoma (tumor) of the pituitary.
- Acromegaly is most often diagnosed in middle-aged adults.
- If not treated, acromegaly can result in serious illness and premature death.
- Because of its slow and often “sneaky” onset, it often is not diagnosed early or correctly.

Other symptoms of acromegaly

- joint aches
- thick, coarse, oily skin
- skin tags
- enlarged lips, nose, and tongue
- deepening of the voice due to enlarged sinuses and vocal cords
- sleep apnea—breaks in breathing during sleep due to obstruction of the airway
- excessive sweating and skin odor
- fatigue and weakness
- headaches
- impaired vision
- abnormalities of the menstrual cycle and sometimes breast discharge in women
- erectile dysfunction in men
- decreased libido
Hormones Released from the Anterior Pituitary or Adenohypophysis

**Thyrotrophs:**
Thyroid Stimulating Hormone (TSH)

**Hypothalamic Control**
Thyrotropin Releasing Hormone (TRH)

**Target Tissue**
Follicular cells of the Thyroid gland

**Hormone affects:**
Controls the production of T3 and T4

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**Thyroid Gland**

**Follicular cells:**
T3 and T4

**Target Tissue:**
Almost all body tissues

**Hormone effects:**
Increases body metabolism
Increases gluconeogenesis
Increases glycolysis
Increases lipolysis
Increased basal metabolic rate (BMR)
Increases heart rate and force of contraction
Thyroid Gland

_Hypothyroidism:_
_endemic goiter:_ (due to I2 deficiency)
_Myxedema:_ bagginess under the eyes and swelling of the face.
_Arteriosclerosis:_ due to increase in blood cholesterol
_Cretinism:_ extreme hypothyroidism during infancy and childhood

Symptoms of Hypothyroidism

-Fatigue
-Weakness
-Weight gain or increased difficulty losing weight
-Coarse, dry hair
-Dry, rough pale skin
-Hair loss
-Cold intolerance (you can't tolerate cold temperatures like those around you)
-Muscle cramps and frequent muscle aches
-Constipation
-Depression
-Irritability
-Memory loss
-Abnormal menstrual cycles
-Decreased libido
Thyroid Gland

- **Hypothyroidism**
  Cretinism: Physical and mental growth and development is greatly retarded

- **Hyperthyroidism**
  Toxic goiter
  Graves Disease with exophthalmos
  occurs when your immune system mistakenly attacks your thyroid gland and causes it to overproduce the hormone thyroxine.

Symptoms of Graves’ disease

Graves’ disease, also known as toxic diffuse goiter, is the most common cause of hyperthyroidism in the United States

Common symptoms of hyperthyroidism:
- nervousness or irritability
- fatigue or muscle weakness
- heat intolerance
- trouble sleeping
- hand tremors
- rapid and irregular heartbeat
- frequent bowel movements or diarrhea
- weight loss
- goiter
Grave’s ophthalmopathy

Occurs when cells from the immune system attack the muscles and other tissues around the eyes. The result is inflammation and a buildup in tissue and fat behind the eye socket, causing the eyeballs to bulge. In rare cases, inflammation is severe enough to compress the optic nerve that leads to the eye, causing vision loss.

Other symptoms of GO

dry, irritated eyes
puffy eyelids
double vision
light sensitivity
pressure or pain in the eyes
trouble moving the eyes

Anterior Pituitary or Adenohypophysis

Corticotrophs

Adrenocorticotropic hormone (ACTH)

Hypothalamic Control

Corticotropic releasing hormone (CRH)

Target Tissue

Adrenal cortex, Zona Fasciculata

Hormone affects:

test control production of glucocorticoids such as cortisol
Adrenal Cortex

**Zona Fasciculata**
Glucocorticoids such as cortisol and cortisone

**Hormone control:**
ACTH

**Target tissue:**
Liver and general body cells

**Hormone affects:**
- helps maintain blood pressure and cardiovascular function
- helps slow the immune system's inflammatory response
- helps balance the effects of insulin in breaking down sugar for energy
- helps regulate the metabolism of proteins, carbohydrates, and fats
- helps maintain proper arousal and sense of well-being

Adrenal Cortex

**Hormone affects:**
Elevated blood glucose levels
Reduction of protein stores in all body cells except the liver
increased plasma protein levels
promote lipolysis and beta oxidation of fat
Helps body recover from stress
Prevention of inflammation
Adrenal Cortex

**Hypo-secretion**

*Addison’s disease* –
Failure to produce adequate levels of cortisol

**Symptoms**

chronic, worsening fatigue, muscle weakness, loss of appetite, weight loss, nausea, vomiting, diarrhea

Other symptoms include:

- low blood pressure that falls further when standing, causing dizziness or fainting
- hyperpigmentation, or dark tanning;
- this darkening of the skin is most visible on scars; skin folds; pressure points such as the elbows, knees, knuckles, and toes; lips; and mucous membranes

Adrenal Cortex

**Hyper-secretion:**

*Cushing’s Syndrome*

**Symptoms**

- Upper body obesity, rounded face, increased fat around the neck, and thinning arms and legs. Children tend to be obese with slowed growth rates.
- Skin, becomes fragile and thin. Bruises easily and heals poorly. Purplish pink stretch marks may appear on the abdomen, thighs, buttocks, arms and breasts.
- Women usually have excess hair growth on their faces, necks, chests, abdomens, and thighs.
Adrenal Cortex

*Zona glomerulosa*
Mineralocorticoids such as Aldosterone

**Hormonal control**
renin-angiotensin pathway
permissive effect of ACTH

**Target tissue**
Principle cells of the DCT and collecting duct

**Hormone affects**
increases reabsorption of Na+ and water

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**Hyper-secretion:**

*Aldosteronism:*
Hypokalemia, increase in extracellular fluid and blood volume, and hypertension, may also have period of muscular paralysis

**Hypo-secretion:**

*Mineralocorticoids deficiency, death occurs in four days to two weeks if untreated*
Overview of the interactions of hormones in response to stress

Adrenal Cortex

**Zona reticularis**

Produces small amounts of androgens, mostly dehydroepiandrosterone (DHEA), DHEA may be converted into estrogens

**Hormone Control:**
Believed to be ACTH

**Target tissue:**
General body cells
Adrenogenital Syndrome

Hyper-secretion:

Precocious puberty is appearance of secondary sexual characteristics in children, before the age of 8 years.
Adrenogenital Syndrome

- In Adult females causes beard growth, deeper voice, masculine distribution of body hair (hirsutism), and growth of the clitoris to resemble a penis.

Endocrine Activity of the Adrenal Cortex

*Hyper-secretion:*

- Picture: Virilizing adrenal hyperplasia in a newborn female baby, DHEA was converted to testosterone

  Condition: Clitoromegaly
Hypopituitarism

Micropenis in a newborn baby boy.
The result of the lack of production of LH and therefore testosterone by the cells of Leydig

- Normal newborn penis is 2.8 to 4.2 cm
- with a circumference of 0.9 to 1.3 cm
- Micro penis: Length less than 1.9 cm

Other Thyroid Hormones

- Parafollicular cells
  - Calcitonin
Parathyroid Hormones

**Principle Cells:** PTH

- Five major actions:
  - 1) Activates and increases the number of osteoclasts, which mobilizes calcium from bone
  - 2) Increases renal tubular reabsorption of calcium
  - 3) Increases conversion of Vitamin D to active dihydroxy form in kidneys
  - 4) Increases urinary phosphate excretion, which reduces calcium loss
  - 5) Increases GI calcium absorption

Interactions of PTH and Calcitonin
Interaction of 2 Pancreatic Hormones

1. Low blood glucose (hypoglycemia) stimulates release of glucagon by alpha cells.
   - Glucagon acts on hepatocytes (liver cells) to:
     - convert glycogen into glucose (glycogenolysis)
     - form glucose from lactic acid and certain amino acids (gluconeogenesis)
   - Glucose released by hepatocytes raises blood glucose level to normal.
2. If blood glucose continues to rise, hyperglycemia inhibits release of glucagon.

3. High blood glucose (hyperglycemia) stimulates release of insulin by beta cells.
   - Insulin acts on various body cells to:
     - accelerate facilitated diffusion of glucose into cells
     - speed conversion of glucose into glycogen (glycogenesis)
     - increase uptake of amino acids and increase protein synthesis
     - speed synthesis of fatty acids (lipogenesis)
     - slow gluconeogenesis
   - Blood glucose level falls.
4. If blood glucose continues to fall, hypoglycemia inhibits release of insulin.