Thyroid and Pancreatic Hormones

Topics for today:

- Review of pituitary hormones
- Structure of thyroid gland
- Thyroid and parathyroid hormones
- Pancreatic endocrine tissue
- Action of insulin and glucagon
- Control of fed and fasted states

Anterior Pituitary hormones

- TSH
- ACTH
- growth hormone
- FSH
- luteining hormone
- prolactin
Effects of anterior pituitary hormones

- **TSH** - stimulates release of hormones from thyroid
- **ACTH** - stimulates release of hormones from adrenal cortex
- **growth hormone** - stimulate growth of somatic tissues
- **FSH** - stimulates gamete formation and follicle development
- **luteining hormone** - affects corpus luteum & Leydig cells
- **prolactin** - stimulates development of mammary ductules

Hypothalamus control of anterior pituitary

Hypothalamus secretes releasing factors which control anterior pituitary

Releasing factors from hypothalamus:
- CRF
- TSHRF
- STRF
- FSHRF
- LHRF
- PIF

Thyroid gland

Gross anatomy of thyroid

Histology of thyroid functional unit

Forms thyroxine

Storage of thyroxine

Releases calcitonin
Synthesis and storage of thyroxin

1. Follicle cells synthesize tyrosine-containing thyroglobulin (TGB) which is moved into colloidal space and iodinated.
2. MIT and DIT are then formed on TGB and joined to yield triiodothyronine (T₃) and tetraiodothyronine (T₄).
3. TSH causes TGB movement back into follicle where T₃ and T₄ are removed and then secreted

Thyroid gland hormones & effects

**Thyroxine**  
(amino acid derivative)

![Thyroxine structure](image)

**Thyroxine has multiple effects:**
- lipid mobilization & oxidation
- increased glucose uptake
- increased glycogen synthesis
- increased protein synthesis
- increased cardiac output
- elevated body temperature
- increased bone growth
- promotes neural development

*Act as a “permissive” hormone in that it permits other hormones to exert their full effect*

Thyroid gland hormones & effects

**Calcitonin** - a peptide hormone

**effects of calcitonin:**
- decreased plasma calcium level
- increased calcium deposition in bone matrix
- reduced Ca absorption in GI tract
- increased Ca excretion in urine
Posterior view of thyroid gland

Parathyroid glands
four masses of tissue on back of thyroids

Parathyroid hormone

Parathyormone - a peptide hormone

effects of parathyormone:

• increased plasma calcium level
• increased calcium mobilization from bone
• induced Ca absorption in GI tract
• increased Ca reabsorption from kidney tubules

The pancreas

exocrine tissue

pancreatic duct

endocrine tissue
(Islets of Langerhans)
Endocrine secretions of pancreas

alpha cells secrete glucagon (hyperglycemia factor)

beta cells secrete insulin (hypoglycemia factor)

delta cells secrete somatostatin (growth suppression)

• How is insulin related to type I diabetes?
• How is insulin related to type II diabetes?

Pancreatic hormone effects

Insulin - peptide hormone
  - associated with the ‘fed’ state

Physiologic effects of insulin:

• promotes glucose uptake via GLUT-4 transporter
• high glucose uptake by muscle & adipose tissue
• stimulation of glycolysis and glycogen synthesis
• stimulation of pentose phosphate pathway
• stimulation of synthesis and storage of triglycerides
• stimulation of protein synthesis

GLUT-4 recruitment

GLUT-4 cycles between plasma membrane and intracellular vesicles containing the receptor.
Increased insulin causes rapid cycling to plasma membrane, resulting in 10- to 30-fold increase in glucose uptake.
Insulin levels during absorptive and postabsorptive states

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<th>insulin</th>
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Pancreatic hormone effects

**Glucagon** - peptide hormone associated with the "fasted" state

**Physiologic effects of glucagon:**

- increases blood glucose level
- stimulates glycogen breakdown
- stimulates gluconeogenesis

Exercise increases insulin sensitivity such that fewer insulin receptors are needed.
Glucagon levels during absorptive and postabsorptive states

Hormone oscillations in absorptive and postabsorptive states

Topic for Tuesday:
Adrenal Hormones