**Hormonal Regulation of the Stress Response and Blood Sugar (9.3)**

Adrenal Glands: located on top of the kidneys and are composed of three layers:

Inner layer, adrenal medulla (middle layer), adrenal cortex (outer layer)

**Adrenal Medulla**: regulates short-term stress response

* produces epinephrine (adrenaline) & norepinephrine (noradrenaline) which have a similar response as stimulation of the sympathetic n.s.
* regulates short-term stress response or *fight-or-flight response* by increasing metabolism
* Stress🡪sympathetic n.s. neurons send a signal from hypothalamus to the adrenal medulla to produce epinephrine & norepinephrine (also an excitatory neurotransmitter-but when released from here it acts as a hormone)🡪 causes increase in breathing rate, heart rate, blood pressure, blood flow to the heart and muscles and conversion of glycogen to glucose in the liver, pupils dilate, decrease of blood to the extremities.
* Epinephrine acts quickly-therefore used in life-threatening conditions (cardiac arrest, anaphylactic shock)
* Rapid release of the hormones since it is under nervous system control

**Adrenal Cortex:** regulates long-term stress response

* Produces glucocorticoids (e.g. cortisol-inc. blood sugar), mineralocorticoids (e.g. aldosterone-increase blood pressure), and gonadocorticoids (small amounts of female & male sex hormones)
* **Cortisol**: steroid hormone synthesized from cholesterol. If DANGER sensed🡪hypothalamus secretes a releasing hormone 🡪which stimulates the ant. pit. gland to secrete **ACTH** 🡪 which targets the adrenal cortex 🡪 releases cortisol.
  + Causes an inc. in bl. glucose levels by promoting the breakdown of muscle protein into amino acids which can get turned into glucose.
  + Promotes the breakdown of fat cells-also releasing glucose
  + Inc. cortisol blood levels causes negative feedback on the hypothalamus and the anterior pituitary
  + Acts as an anti-inflammatory by suppressing the actions of the immune system.
  + Sustained levels of cortisol (in chronic stress) can impair thinking, damage the heart, inc bl pressure, lead to diabetes, inc susceptibility to infection, can cause early death

**Aldosterone:**

* stimulates the kidneys to increase the absorption of sodium into the blood, which increases the concentration of solutes in the blood, which increases water retention in the kidneys, increasing blood pressure
* Conditions: Addison’s disease-inadequate secretion of mineralocorticoids and glucocorticoids causes hypoglycemia, sodium & potassium imbalances, rapid weight loss, increased urine output, decrease in blood pressure, may be fatal in a few days if not treated.

Hormones of the Pancreas:

Much of the pancreas secretes digestive enzymes into the small intestine, but it can also function as an endocrine gland.

*Islets of Langerhans:* pancreatic endocrine cells that secrete two antagonistic hormones:

* Insulin-secreted by beta cells-job is to decrease the level of blood glucose
* Glucagon-secreted by alpha cells-job is to increase the level blood glucose

Both hormones are regulated by negative feedback mechanism.

P409 Fig. 9.20

EAT: glucose moves from intestinal tract into the blood🡪inc. bl. glu. 🡪beta cells secrete insulin🡪 which circulates and acts on specific receptors to make the target cells more permeable to glucose🡪 especially effect muscle & liver cells where the glucose is converted into glycogen for storage, or other cells as an energy source🡪 once levels of glu in the bl. decrease so too does the insulin release.

EXERCISE/FASTING: dec. bl. glu. levels🡪alpha cells release glucagon🡪 it stimulates the liver to convert glycogen back into glucose which moves into the blood.

HMK:

Read p410-413:

* What is Diabetes Mellitus?
* What is hyperglycemia? Identify some of its short & long-term effects on the body
* Identify and distinguish between the two types of Diabetes Mellitus
* Identify Banting & Bests contribution to the study of Diabetes
* P413: 24,5,8,9