Endocrine system includes 8 major glands.

1. Pituitary (master gland) – Anterior Hormones: Growth Hormone, ACTH, Thyroid Stimulating, FSH, Luteinizing, Prolactin (release of milk). Posterior Hormones: ADH and Oxytocin.
2. Parathyroid – Hormone: Parathyroid Hormone – Stimulates calcium release by bones which will lower calcium levels.
3. Adrenal – Medulla is EPI & Nor-EPI. Cortex is Corticoids (steroids) Anti-inflammatory response.
4. Pancreas – Glucagon (stimulates liver glycogenolysis which changes glycogen to energy), Insulin (Stimulates cellular uptake of glucose), and Somatostatin (Suppresses secretion of glucagon and insulin).
5. Ovary – Estrogen (maturing the eggs), Progesterone (Changes uterus for pregnancy).
   Testicles – Testosterone (Develops sperm cells, and male characteristics).
6. Thyroid – T3 & T4 (Stimulates basal cell metabolism), Calcitonin (stimulates calcium uptake in bones will increase calcium levels).
7. Thymus – Thymosin (Stimulates white blood cells to develop T lymphocytes).
8. Hypothalamus – targets anterior pituitary – Tells the pituitary to stimulate growth hormone release and inhibiting, corticotrophin via ACTH, and luteinizing and FSH release. Look at it this way, the hypothalamus manages the anterior pituitary gland.

All hormones operate on a feedback system. They are either positive or negative. Example of positive feedback: Childbirth oxytocin stimulates labor contractions. Negative feedback is most commonly used to maintain homeostasis. Example: After you eat a candy bar – glucose enter blood stream. Increase glucose stimulates insulin release. When blood sugar levels drop pancreas stops producing insulin.

- Hormones are chemical messengers released into the blood stream.
- Endocrine glands are ductless meaning they secrete directly into circulation. Resulting in widespread results.

- Exocrine glands (gall bladder) use ducts and tend to have a local affect.
- Hormone means “to set into motion”
- Hormones help maintain homeostasis.
- Homeostasis is a balance within upon contact changes.
- Metabolism is the sum of cellular process that provides energy, growth and repair.

Diabetes Mellitus

- Glucose is the only substance that brain cells can use readily for an energy source.
- 8 million people have diabetes and another 8 million are not aware they have it.
- Diabetes “siphon” Mellitus “honey sweet”.
- Glucose metabolism
- Know your signs and symptoms of diabetic emergencies. Chart is in textbook. For example DKA is hot, dry, skin with kussmauls.

<u>Anabolism</u> is the building from simple to complex structures. Example: Taking up extra glucose (if available) and storing it as glycogen, taking glucose as a needed component to make proteins etc…. We only build if we have a surplus of glucose. This takes energy to do.
<u>Catabolism</u> is the breaking down of metabolism. Taking stored fat cells as glycogen or breaking down the protein and taking the glucose part back for example. This does not take energy. Glycogenolysis

When glucose is not readily available glucagon stimulates release of glycogen and catabolism of stored fat. This maintains homeostasis. As this continues for a longer than usual time (starvation) the glycogen turning to fatty

acid energy and the body cannot keep up with eliminating the acid. More acetoacertic acid builds with acetone and hydroxybutyric acid all known as ketone bodies (Ketosis) Like seen in DKA.

Normal blood sugar is 80 to 120 mg/dL.

- Hypoglycemia is true diabetic emergency. When the brain is out of sugar onset of combative behavior followed by shock is acute. (Insulin Shock)
- Hyperglycemia take 12 to 24 hours for onset. When insulin levels and catabolism fails as acids rise DKA is present with the 3 P's

1. Polyuria-Once sugar levels are above 180 mk/dl sugar is secreted in the urine (glycosuria. To maintain homeostasis fluid from the body (plasma) is pulled into the urine (osmosis) resulting in osmotic diuresis.

2. Polydipsia-Excessive thirst due to fluid loss.

3. Polyphagia-Excessive hunger sensation/stigmatization (Not truly hungry)

4. Kussmauls-Present to adjust Ph levels. Helps to compensate for metabolic acidosis.

Type I (insulin dependent or juvenile onset)Cause unclear. Virus attacks Beta cells of pancreas resulting in inadequate insulin levers or no insulin production.

- These are the patient who experience true diabetic emergencies much more serious than type 2.

Type II (adult onset or non-insulin dependent)

1. Obesity (excessive carbohydrate intake) is most common cause. Supple and demand of insulin production.

2. Other causes: age, trauma, infection, cancer.

- Treatment: Weight loss & exercise, then oral insulin/pancreas stimulating drugs (examples are glipizide and glyburide – remember "ide") finally place on insulin if not manageable.
- Glucagon should be considered when IV D50 cannot be given to hypoglycemic patients.

Hyperglycemic Hyperosmolar Nonketonic Acidosis (HHNK)

- Silent killer no ketone respirations. Blood sugar levels over 1000 mg/dL. DKA is only around 300 to 600 mg/dL. Associated with Type II diabetes.
- 40-70% mortality. Most common when elderly loved ones are not visited or cared for.

- Substantial hyperglycemia causing osmotic diuresis and water intake is not adequate to replace fluid loss.
- Summary: A gradual exposure to hyperglycemia is present resulting in chronic dehydration from eliminating the sugar because glycogen and fatty acids are always being uses in addition to insulin. Since they are both providing energy (glycogen and insulin) the kenotic state is not present.

Thyroid Disorders

- Hyperthyroidism
- Thyrotoxicosis
- Hypothyroidism
- Myedema

Graves' Disease

1. 95% of thyroid storms are patients with Graves'
2. Onset about 20s to 30s
3. Autoimmune origin. Stimulates excessive thyroid tissue production resulting in a larger thyroid hormone release.
4. Protruding eyeballs and goiter.
5. Care: If in a thyroid storm (adrenergic) the use of Beta Blockers might help suppress the sympathetic response. Corticoid therapy helpful in reducing T4.

Thyrotoxic

1. Thyroid storm

2. Fatal within as few as 48 hours if untreated.

3. May be causes by overdose of thyroid medications.

4. Acute increase in hyperthyroidism cause unknown.

5. Fever 106 degrees, irritability, tachycardia, hypotension, diarrhea.

6. Care: Corticoids, Beta blockers, fluid support.

Hypothyroidism

1. Can be congenital or acquired

2. Creates low metabolic state.

3. Body fails to thrive when faced with infections, cold etc…

4. Over time the thickening of connective tissue in the skin, heart, and other tissue takes place called myxedema coma

5. Triggered by central nervous system depressants, or infection, trauma etc…

6. Symptoms: Subtle at start, slower mental function, cold intolerance, constipation, thinner hair, enlarged tongue, skin that looks like dough.

7. Care: Myxedema main concern. Heart failure, Required intubation, limit fluid IV intake because usually electrolytes are off.

Adrenal Gland Disorders

- Cushing's syndrome
- Addison's disease

Cushing's Syndrome

Hyperadrenalism middle aged patients. Women more than men.

Could be caused by abnormal anterior pituitary gland function. Produce excess cortisone results. Also being treated recently with corticoids (prednisone).

Long term exposure of cortisol produces metabolic changes. Protein breakdown takes place. Atherosclerosis and hypercolesterol are common. Diabetes may develop over time.

Signs: Weight gain from chronic cortisol release. Moon Face and upper back enlarged (buffalo back). Delay healing, Women develop facial hair.

Care: Higher incident of cardiac disease, hypertension, and stroke. No real care in EMS.

Addison's Disease

1. Corticol destruction over time. It most commonly seen in populations with TB.

2. Autoimmune disease so Graves' and Addison go together.

3. Destruction of adrenal cortex. Causes major disturbance in water and electrolyte balance in the body.

4. Signs: Weakness, fatigue, decreased appetite. Hyperpigmentation of skin.

5. Care: Monitor cardiac, blood sugar levels, fluid replacement.