- List each major human endocrine gland and its function. I recommend making flashcards for this.
    - Pineal = circadian
    - Hypothalamus = tropic hormones
    - Pituitary = ADH, oxytocin- communicates with hypothalamus
    - Thyroid = metabolism and metabolic rate
    - Adrenal glands = stress, fight or flight
    - Pancreas = blood sugar
    - Ovaries/testes = reproduction
- Why do hormones have different effects on different cells?
    - The effect depends on the type of receptor that the hormone binds to in the particular cell
    - And/or the signalling pathway that is triggered
- Describe the different effect that adrenaline has on different cell types:
    - Adrenaline binds beta receptors in the liver, triggering one kind of intracellular protein change, to increase blood sugar
    - Adrenaline binds beta receptors in the smooth muscle, triggering another kind of intracellular protein change, to dilate capillaries
    - Adrenaline binds alpha receptors in the muscle surrounding intestinal capillaries to constrict capillaries
- Describe the steps of a simple hormonal pathway. Give an example.
    - Stimulus triggers hormone release from endocrine cell, hormone travels to target cells and causes a response, triggering a negative feedback loop
    - Example:
        - Low pH in the duodenum
        - Sensed by the S cells of the duodenum
        - Triggers release of secretin
        - Secretin stimulates pancreatic cells
        - Pancreas releases bicarbonate into the duodenum
- What kind of hormone is involved in a complex pathway? Define this term.
    - Tropic hormone: a hormone that targets other endocrine glands, causing release of more hormones
- Be able to list three complex endocrine axes.
    - Hypothalamus/pituitary/thyroid system
    - Hypothalamus/anterior pituitary/adrenal cortex
- What two endocrine organs are the master regulators of many different hormonal axes?
    - The hypothalamus and pituitary
- Describe the role of the hypothalamus. What does it do (two key functions)?
    - The hypothalamus is a master regulator that translates nervous system input to hormone signalling output
    - Neurosecretory cells secrete two posterior pituitary hormones: ADH and oxytocin
    - The hypothalamus also controls the activity of the anterior pituitary, causing it to release its own hormones

- Describe the anatomical connection between the hypothalamus and pituitary:
    - The neurohypophysis, or posterior pituitary, is actually just a projection of hypothalamic neurons.
- What is the neurohypophysis/posterior pituitary? What does it do?
    - It is a collection of neurons that are part of the hypothalamus
    - It produces simple hormonal signals:
        - It secretes ADH, which stimulates water reabsorption in the kidney
        - It secretes oxytocin
- Define tropic and nontropic hormone. What tissue/organ type does each type of hormone target?
    - Tropic: targets another endocrine tissue, causing it to release another hormone
    - Nontropic: has a direct physiological effect on a non-endocrine tissue
- What does the adenohypophysis do? How is it regulated?
    - Adenohypophysis releases both non-tropic and tropic hormones
        - Nontropic
            - Prolactin
            - Melanocyte stimulating hormone
            - Growth hormone
        - Tropic
            - Reproductive:
                - Follicle stimulating hormone
                - Luteinizing hormone
            - Thyroid
                - thyreoStimulin hormone
            - Adrenal
                - Adrenocorticotropic hormone
    - Regulated by releasing and inhibiting hormones from the hypothalamus
- Name three major hormonal axes that are controlled/initiated by the hypothalamus:
    - HPG axis, HPT axis, HPA axis
- When we say that a hormonal axis controls “growth”, what physiological growth processes are we actually talking about (3)?
    - Protein synthesis and cell division
    - Energy expenditure (catabolism)
    - Levels of circulating metabolites
- What hormonal systems are involved in regulating growth, and what physiological process does each control (3)?
    - Growth hormone and insulin-like growth factor
        - Controls anabolism in cartilage and muscle, catabolism in fat tissue
    - The hypothalamus/pituitary/thyroid hormone axis
        - Modulates basal metabolism
    - Insulin/glucagon
        - Control levels of circulating blood glucose/glucose uptake by cells
- What stimulus causes release of growth hormone?

    - Secretion of GH-releasing hormone from anterior pituitary
- Explain the three effects of growth hormone. Classify each effect as tropic or nontropic. Explain how its three effects are interrelated.
    - Promotes catabolism (breakdown of macromolecules) in storage tissues (liver, fat). Nontropic.
    - Promotes protein anabolism (construction of new proteins). Nontropic.
    - Stimulates release of insulin-like growth factor. Tropic.
        - This makes cells divide and grow, causing tissues like muscle to grow
    - Interrelated:
        - Catabolism mobilizes energy and macromolecule building blocks, fuelling overall growth in target tissues via anabolism and the effects of IGF1
- What will happen with too much growth hormone? Not enough growth hormone?
    - Gigantism/dwarfism
- How does the body regulate growth hormone levels (negative feedback loop)?
    - Higher levels of growth hormone and insulin-like growth factor 1 inhibit the release of growth-hormone releasing hormone, thus reducing the production of growth hormone and IGF1
- Describe the steps of the hypothalamus-pituitary-thyroid axis (could be a good place for a flow chart). What does the final hormone do to the body?
    - Hypothalamus releases thyrotropin releasing hormone.
    - Thyrotropin releasing hormone triggers the anterior pituitary to release thyreostimulin hormone.
    - Thyreostimulin causes the thyroid to release triiodothyronine and thyroxine (T3 and T4).
        - T3 is the active form, and it basically speeds everything up: higher basal metabolism, more lipid and glycogen breakdown, more fat and glucose uptake by cells, more cell growth
- How does the body regulate thyroid hormone levels (negative feedback loop)?
    - Higher levels of T3/T4 inhibit the release of more thyrotropin hormone and thyreostimulin hormone, preventing production of more T3/T4.
- What happens with too little thyroid hormone? Too much thyroid hormone?
    - Hypothyroidism (sluggish, cold, weight gain)/ hyperthyroidism (high body temperature, weight loss, sweating)
- What two hormones regulate blood sugar levels?
    - Insulin and glucagon
- Where are they produced?
    - In the pancreas
        - Beta cells produce insulin
        - Alpha cells produce glucagon
- What physiological effect does each hormone have, and what is the mechanism for this effect? What stimulus causes each hormone to be released?

    - Insulin: storage hormone. When circulating glucose is high, insulin is released, which triggers your cells to uptake and store glucose (fat, glycogen). This lowers your blood sugar.
        - Too little insulin, or lack of response to insulin from cells, causes diabetes (either type I or II)
    - Glucagon: released when blood sugar is low. Causes tissues that store sugar to release it into the blood (ex glycogen breakdown).
- Describe insulin/glucagon and blood sugar cycling after you eat a meal. Again, potentially a good place to draw a flowchart for studying purposes.
    - Eat a meal and your blood sugar goes up
    - Insulin is released so that your cells start taking up the blood sugar
    - Time goes by and you use up the blood sugar
    - Low blood sugar levels cause release of glucagon
    - Glucagon causes the liver to breakdown glycogen into glucose and release it back into the bloodstream
    - Blood sugar levels go back to normal
- Explain how the renin-angiotensin-aldosterone axis works. What is the trigger for this hormonal axis? What happens when the axis is triggered? Again, potentially a good place to draw a flowchart for studying purposes.
    - Low perfusion (low amounts of blood flowing through the circulatory system, so low blood pressure/low blood volume), or low levels of salt in primary urine filtrate, or high levels of potassium, trigger the kidney to secrete renin
    - Renin converts angiotensinogen into angiotensin I
        - Angiotensinogen is constantly circulating and is produced by the liver
    - Angiotensin-converting enzyme is released from the lungs and converts angiotensin I into angiotensin II
    - Angiotensin II causes the adrenal gland to produce aldosterone
    - Aldosterone stimulates the kidneys to:
        - Reabsorb salt
        - Reabsorb water
    - This helps bring blood volume and solute concentrations back up to normal
- Describe how the RAA axis and the ADH system are activated in response to a) hyperosmolarity and b) hypovolemia, in order to bring salt and water balance back to normal.
    - Hyperosmolarity:
        - Aka too much salt and too little water
        - Triggers ADH release, causing water to be reabsorbed, diluting the salt and increasing the water
        - Blocks aldosterone release, so that salt is not reabsorbed in the kidneys
    - Hypovolemia
        - Aka too little salt and too little water
        - Triggers ADH *and* aldosterone release, causing water and salt to be reabsorbed by the kidneys