Various endocrine organs and functions of each

Hypothalamus (control/-integrator)	releasing hormones to the anterior pituitary (blood communication) and direct connection to posterior pituitary (nerve communication)
Pineal gland	sleep
Pituitary gland	1st hormones to body organs
Pancreas	Insulin and glucagon
Thyroid gland	Parafollicular cells, high blood calcium, storage of calcium in bone
Parathyroid gland	low blood calcium, parathyroid hormone (pth), release calcium into blood from bone

Pituitary gland

Adrenal glands	stress response, blood pressure response, blood osmolarity, sex hormones
Thyroid gland	follicular cells, release thyroid hormone (t3 and t4) to increase metabolism and body temperature
Mammary gland	secretion of milk for offspring

Pituitary gland (cont)

Testes	make and release testosterone
Ovaries	make and release estrogen and progesterone
Melanocytes	makes melanin, protection from UV rays
Ductus deferens	orgasm response, semen
Uterine and vaginal muscles	orgasm response, childbirth
Liver	blood sugar regulation and storage, growth hormone signaling to muscle and bone
Bone	growth hormone cycle
Muscle	growth hormone cycle, glucose storage
Kidneys	water and blood pressure

Steroid and non-steroid hormone mechanisms

What are characteristics of steroid hormones?

> lipid so they enter the cell and go into the nucleus and target DNA to make new proteins

What are characteristics of a non-steroid hormone?

> do not enter cell, interact with surface proteins -> secondary messenger internally in the cell to cause response (signaling cascade)

T3T4 production for thyroid gland (hypothalamus)

Temp/metabolism feedback loop

Low metabolism - low T3T4, low body temp

T3T4 production for thyroid gland (hypothalamus) (cont)

TRH -> TSH -> follicular cells release the follicle containing T3 and T4 -> increase metabolism

Thyroid Follicular Cells and Parafollicular Cells

Parafollicular	High calcium
Follicular	Low metabolism (T3 and T4)

Layers of Adrenal Gland

Cortex

	Zona glomerulosa	stress response - cortisol
	Zona fasciculata	low blood volume - aldosterone
	Zona reticularis	DHEA and androstenedione, precursors to sex hormones

Medulla — stress response - epinephrine and norepinephrine

Basic Knowledge for Multiple Choice

Know the effects of the renin-angiotensin--aldosterone system and how it regulates blood volume and blood pressure in detail

Know how ACE inhibitors work

Know how ADH works and how it regulates blood osmolarity and blood pressure

Diabetes mellitus (I and II) effects on bg

Type I	no production of insulin
Type II	we may or may not make insulin and body cells no longer respond to insulin - insulin resistance
Insulin beta cells use glucose so we can't control high glucose levels	Low levels can cause diabetic coma

Endocrine Pathology

Hypert-hyr-oidism	High thyroid activity - weight loss, etc., cushing's syndrome, insomnia, hyperactivity	
Hypoth-yroidsim	A lack of temp. control, weight gain, hair loss, lethargy, etc.	
Diabetes	sugar in urine (sweet urine)	
	Insipidus	Kidneys processing too quickly, water goes through too fast, excessive urination, dehydr-ation
	Mellitus	insulin issues

Endocrine System

What are the similarities of the endocrine and nervous systems?

> Both control systems (homeostasis and other)

What are some differences of the nervous and endocrine systems?

> Mode of communication (endo- hormones nerv- electrial signals)
> Speed of response (endo- slow nerv- fast)
> Duration of change/response (endo- longish term nerv- gone fast)

Blood Glucose Feedback Loop

Stimulus	Increased blood glucose
Sensor/In tegrator	Pancreatic Beta cells
Hormone Released	Insulin
Effector	Liver and skeletal muscle
Response	Liver and skeletal muscle uptake glucose -> glycogen
Result	Decrease In blood glucose and return to homeostasis

Growth Hormone Feedback Loop

Stimulus	Low blood glucose, sleep, or stress
Sensor/Integ-rator	Hypothalamus
Hormone Released	GHRH
Target	Anterior Pituitary Somato-tropes

Growth Hormone Feedback Loop (cont)

Hormone Released	GH
Effector	Liver, bones, muscles, fat cells
Response	Increase blood glucose, cell growth and proliferation, bone length, muscle mass, lipolysis. Decrease glucose uptake
Result	Return to homeostatic blood glucose levels and growth and repair of the body

Calcium Feedback Loop (High)

Stimulus	Increased blood Ca^{2+}
Sensor/In-tegrator	Parafollicular cells in thyroid gland
Hormone released	Calctionin
Effectors	Osteoblasts
Responses	Osteoblasts activity increases = put calcium into bone
Result	Blood calcium level decreases back to normal

Calcium Feedback Loop (Low)

Stimulus	Decreased blood Ca^{2+}
Sensor/Integrator	Parathyroid glands
Hormone released	PTH

Calcium Feedback Loop (Low) (cont)

Effectors	Osteoclasts, kidneys, intestines
Responses	Osteoclasts degrade bone matrix which releases calcium into blood, kidney (reabsorb Ca) targets liver which releases Vit. D. Vit D to intestines absorb more calcium
Result	Calcium blood return to normal range

Calcium Feedback Loop (Low)

Stimulus	Decreased blood Ca^{2+}
Sensor/In-tegrator	Parathyroid glands
Hormone released	PTH
Effectors	Osteoclasts, kidneys, intestines
Responses	Osteoclasts degrade bone matrix which releases calcium into blood, kidney (reabsorb Ca) targets liver which releases Vit. D. Vit D to intestines absorb more calcium
Result	Calcium blood return to normal range

Metabolism Feedback Loop

Stimulus	Decrease in T3 and T4 concentrations
Sensor/In tegrator	Chemo and temp receptors, Hypothalamus
Hormone Released	Hypothalamus releases TRH
Target	Anterior pituitary
Hormone released	TSH
Target	Thyroid gland (follicular cells)
Hormone released	Thyroid gland released T3 and T4
Effector	Body tissues
Response	Increased metabolic activity
Result	Return to homeostatic body temperature, increase in energy

Lymphatic System

What are characteristics of the lymphatic system?	Vessels, nodes, and accessory organs filled with water like fluid
What is the purpose of the lymphatic system?	To return free fluid in the body back to the blood, houses and matures the WBC

Function of Lymphatic sys. & Accessory

Vessels	Vessels, trunks, ducts	Absorption of interstitial fluid and transport-ation of lymph
Nodes	Structures that house and allow for storage of an maturation of lymphocytes	Monitor lymph fluid for pathogens
Thymus	where T cells mature	
Spleen	Were we send red blood cells to be recycled , storage of WBC	
Lacteals	in the intestine microvilli fat absorption	
MALT	nodules to monitor incoming solutes for pathogens, in mucosa	

Lymph Drainage

Right lymphatic duct	right lymphatic vessels of the right facde, right neck, right arm, right axillary and cervical lymph nodes

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Lymph Drainage (cont)

Left lymphatic duct aka thoracic duct	All remaining lymph vessels and nodes of the upper body and the total lower body. Left cervical, left axillary, l+r iliac, l+r inguinal lymph nodes

Role of the lymphatic sys. in immune response

House and mature many white blood cells, we transport WBC from tissues back into circulation, nodes monitor cells and pathogens that travel through

Erythrocyte recycling

Break down old RBC with the spleen and liver, dispose of bilirubin as bile, reuse iron to make new RBC

Blood

What are general characteristics of blood?

> Fluid, proteins, cells

Functions of blood

Trans port-ation	Gases, nutrients, hormons, WBCs (immune response throughout the body)

Blood recipient prob and erythroblastosis fetalis

Agglutination with the wrong type blood - destroy blood, death

Blood recipient prob and erythroblastosis fetalis (cont)

Mother is Rh- and has been exposed to positive blood/antigen, has made antibodies against Rh+, will attack fetus

Clotting Disorders

Lack of platelet production = no clot = thrombocytopenia

Hemophilia - genetic disorder that stops/-lacks conversion of clotting factors

Thrombus and Embolus

Thrombus	Clot forming where it does not belong, usually in an artery with cholesterol crystal deposits
Embolus	Thrombus dislodging from the clot, can block a vessel somewhere else in the body, I.e. pulmonary embolus

Steps of Hemostasis (basic steps)

Vascular spasms	let a ton of blood in the area to provide platelets
Platelet plug	platelets start to stick together and adhere to endothelium and CT
Coagul-ation	1. Prothrombin activator released by damage 2.PA converts prothrombin into thrombin 3. Thrombin converts fibrinogen into fibrin (insoluble - not dissol-vable)

Anemia and Polycythemia

Anemia	low O2 to tissues
Hemorr-hagic anemia	caused by blood loss
Hemolytic anemia	excessive RBC destruction with low hematopoiesis
Aplastic anemia	bone marrow is not functioning enough (during and after chemo)
Iron deficient	not enough iron to make hemoglobin
Sickle Cell anemia	inherited Hb mutation
Polycy-themia	high RBC - blood is too viscou-s/thick dec. O2 delivery to tissues, lead to clots

Components of blood and plasma

Plasma	proteins (albumins [most abundant], globulins, fibrin-ogen), water, solutes (ions, waste, gases, regulation molecules/hormones)
Formed elements	cells and others
Erythrocyte	transportation of gases
Leukocytes	Immune response
Platelets	Blood clotting

RBC Count

Low RBC	Tired/lethargy, dizziness/light headedness, increased heart rate, headaches, shortness of breath, pale skin
Extra RBC but not too high	Blood doping, inc. O2 carrying capacity, decreases fatigue, inc. performance
High RBC (low plasma - dehydr-ation)	Fatigue, shortness of breath, insomnia, itchy skin

Hematocrit

% of formed elements specifically RBC
Estimate of oxygen carrying capacity

Hematopoiesis Feedback Loop

Stimulus	Decreased O2 to tissues
Sensor/in tefrator	Kidney
Signal released	Erythropoietin
Effector	Spongy bone - red bone marrow
Response	Make RBC
Result	Inc. delivery of O2 to tissues back to homeostasis

Hematopoesis

Making of blood cells - different-iation of stem cells	Myeloid stem cells (makes RBC, platelets, basophils, eosinophils, neutrophils, monocytes). Lymphoid stem cells (lymphocytes)
Red bone marrow	in spongy bone

Structure of Hb Subunits

Alpha chains x2
Beta chains x2
Each chain forms around an iron molecule (Fe) (1 Heme = chain + Fe)
4 heme = hemoglobin
1 heme carries 1 O2
1 hemoglobin - carries 4 O2

Hb binding affinity for O2 and CO2

Lungs	pH - high pH -> inc. O2 affinity and binding	Temp - cold -> inc. O2 affinity and binding	Partial Pressure - lots of O2 -> inc. O2 affinity and binding

Hb binding affinity for O2 and CO2 (cont)

Body tissues	pH - low pH -> dec. O2 affinity and binding allow CO2 binding	Temp - lots of metabolism inc. heat -> dec. O2 affinity and binding allow CO2 binding	Partial Pressure - lots of CO2 -> dec. O2 affinity and bonding

Facts for RBCs

About 44% of blood
4-7million/mm^3 in an adult
Live for about 120 days
Anucleate at maturity

Purpose of RBC Shape

Biconcave	increases surface area to increase diffusion fro transp-ortation
How does sickle cell anemia affect the shape?	changes the surface area of the cell, changes the Hb folding, holding/transporting less material, the hook shape can get stuck together more easily causing clots

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Lymphocytes	
B cells	antibody making memory cells, pathogens we have come across before (bacteria, virus, etc.)
T cells	memory cells that target the cells or other pathogens that are foreign directly
NK cells	cancer killers, destroy abnormal cells

Leukocytes	
Neutro-phils	innate immunity, bacterial infection
Lympho-cytes	adaptive immunity
Monocytes	innate immunity, but will follow b cell orders or antibody flags, macrophage, usually stay in peripheral tissues
Eosino-phils	innate immunity, parasites
Basophils	damage identifying cells, increase inflammation and blood flow to damaged but not bleeding areas