SI Test Prep Exam 3 Answers

The Zona Pellucida stays with the embryo until it reaches the uterus. The blastocyst hatches from here.

Match the following terms to the correct definition:

(B)Totipotent (C)Pluripotent (A)Multipotent

a. Have the ability to form a limited range of cells and tissues appropriate to their location (muscle cells for smooth and striated muscle, blood cells for RBC, WBC, and platelets, etc.)
b. Have the ability to form all cell types of the conceptus = stem cells
c. Have the ability to form several types of all three germ layers (ectoderm, mesoderm, endoderm) but not the whole organism

Once the blastocyst enters the uterus between day 7-9 of gestation, the inner cell mass differentiates into three germ layers. Which germ layer does the reproductive system develop from?

Mesoderm= reproductive system, muscular, skeletal, and cardiovascular system, kidney, and urinary ducts

The ectoderm gives rise to the nervous system, skin, and hair. Which component of the reproductive system develops from this germ layer?

Ectoderm= hypothalamus, anterior and posterior pituitary, CNS, sweat glands, hair, hooves

What organs are derived from the endoderm?

Endoderm= primordial germ cells, digestive/endocrine systems, lungs, liver, pancreas

The Posterior Pituitary

a. Only stores oxytocin
b. Developed from the roof of the mouth (develops from floor of brain instead)
c. Uses the hypothalamo-hypopseal portal system
d. Is the neurohypophysis
e. **Both A and D**

The Anterior Pituitary

a. Produces LH and FSH
b. Develops from the roof of the mouth (gives rise to Rathke's pouch)
c. Receives chemical messengers via the hypothalamo-hypopseal portal system
d. Is the adenohypophysis
e. **All of the above**

Why does the y chromosome drive primary sex determination?

SRY gene is on Y chromosome which stimulates male repro system to develop

- Sertoli cells: secrete AMH (Anti-Mullerian Hormone)
- Leydig cells: produce Testosterone
- No SRY gene = No AMH = female tract develops

During the first 15% of gestation, the primordial germ cells develop while the yolk sac is still present. The primordial germ cells them migrate by ameboid movement to what location in the embryo?

a. Hindgut
b. Gonadal Ridge
c. Mesentery

List and describe the three distinct renal systems:

Pronephros (Pronephric kidney): non-functional primitive form of kidney

Mesonephros (Mesonephric kidney): functional, intermediate kidneys- produce urine that drains into mesonephric ducts:

- Mesonephric duct= Wolffian duct= forms epididymis/vas deferens in males
- Paramesonephric duct= Mullerian duct= forms oviduct, uterus, cervix, and portions of the cranial vagina in females

Metanephros (Metanephric Kidney): final kidney form- gonads increase in size along with this

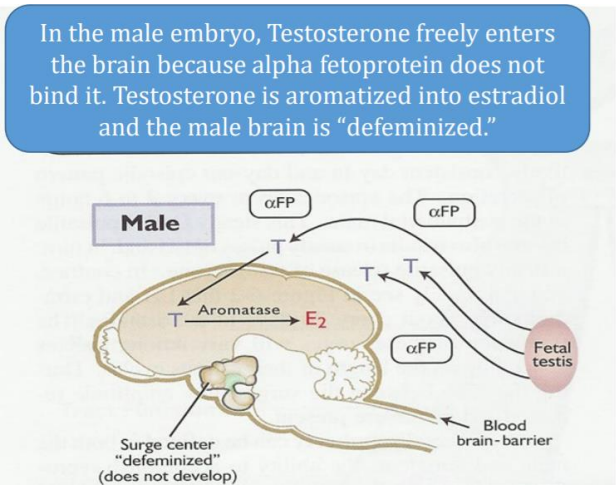
Draw Phenotypical Sexual Differentiation

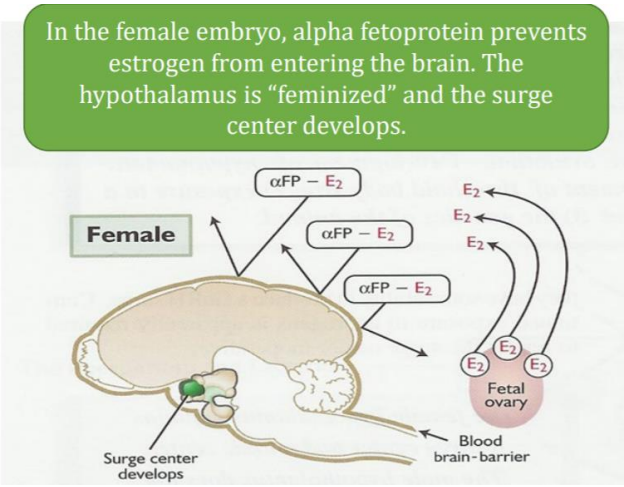
	Indifferent Gonads (first 5 weeks)	
(Genetic sex)	XY	XX
(Gonadal sex)	Testes (6^{th}-7^{th} week)	Ovaries (9^{th} week)
	Sertoli & Leydig cells	No AMH= No T
(Phenotypic sex)	Male Genitalia	Female Genitalia

Explain Freemartins:

Freemartin= sterile heifer born to a twin bull. Heifer was exposed to AMH from bull through a shared blood supply and her reproductive system does not develop as a result

There are fundamental differences in the hypothalamus of the male and female. These differences are established prenatally and remain throughout the reproductive life of both sexes. In the area below, draw a diagram to explain the differences in the hypothalamus between a male and female:





Match the following terms to the correct definition:

(C)Autocrine (A)Endocrine (B)Paracrine

a. Distant signaling with use of the circulatory system
b. Signaling to nearby/adjacent cells
c. Self-signaling

The presence of Estrogen in the brain causes defiminization of the male hypothalamus.

The hypothalamus surge center has 3 components and is found (only/both) in the (male/female)

1. PON: Preoptic nucleus
2. SCN: Suprachiasmatic nucleus
3. AHA: Anterior hypothalamic area

The hypothalamus tonic center has 3 components and is found (only/both) in the (male/female)

1. VMN: Ventromedial nucleus
2. ARC: Arcuate nucleus
3. ME: Median eminence

Explain what the Hypothalamo- hypophyseal portal system is and its importance:

Carries hypothalamic hormones to the antierior pituitary without dilution in systemic blood (capillaries→ vein→ capillaries)

Important because: allows for rapid response, allows for a large surface area to deliver hormone, little dilution of hormone as they don't have to travel far= only a trace amount needed to cause a response (Peptide hormones have a short half-life)

List examples for each of the hormone classifications:

Peptide:

- GnRH, OT, PRH (prolactin releasing hormone)

Protein:

- PRL (prolactin)

Glycoprotein:

- FSH (8%), LH (1-2%), hCG= human chorionic gonadotropin (30%). eCG= equine chorionic gonadotropin (45%)

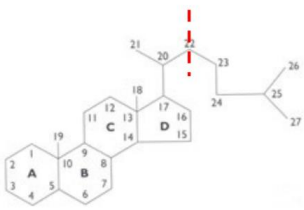
What's special about glycoproteins?

As carbohydrate % increases, half-life also increases (eCG would last the longest)

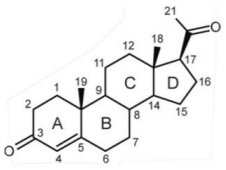
What portion of the glycoprotein makes it unique?

The Beta subunit- they all have the same alpha subunit

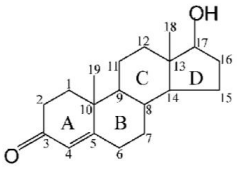
Steroids:



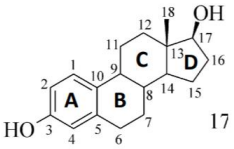
Cholesterol (C27)



Progesterone (C21)



Testosterone (C19)



Estrogen (C18)

Explain the steroid biosynthetic pathway:

Cholesterol CYP11A1 (Side-chain cleavage) Pregnenolone CYP 17 (3B-HSD) Progesterone… CYP 17

Estrogen CYP19A1 (Aromatase) Testosterone HSD17B Androstenedione

Lipids:

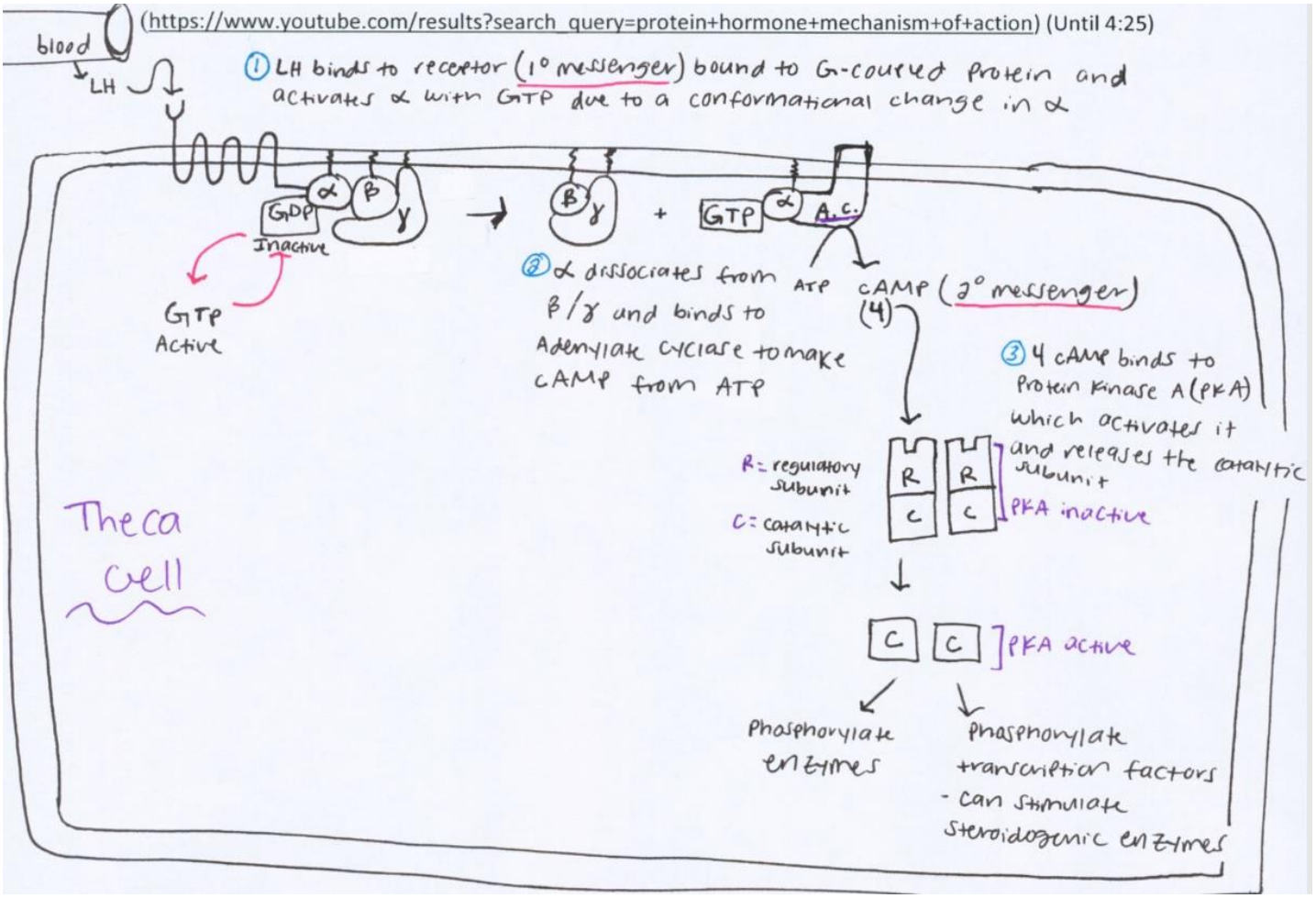
- Arachidonic acid= precursor

PGE2: vasodilation, maintains CL

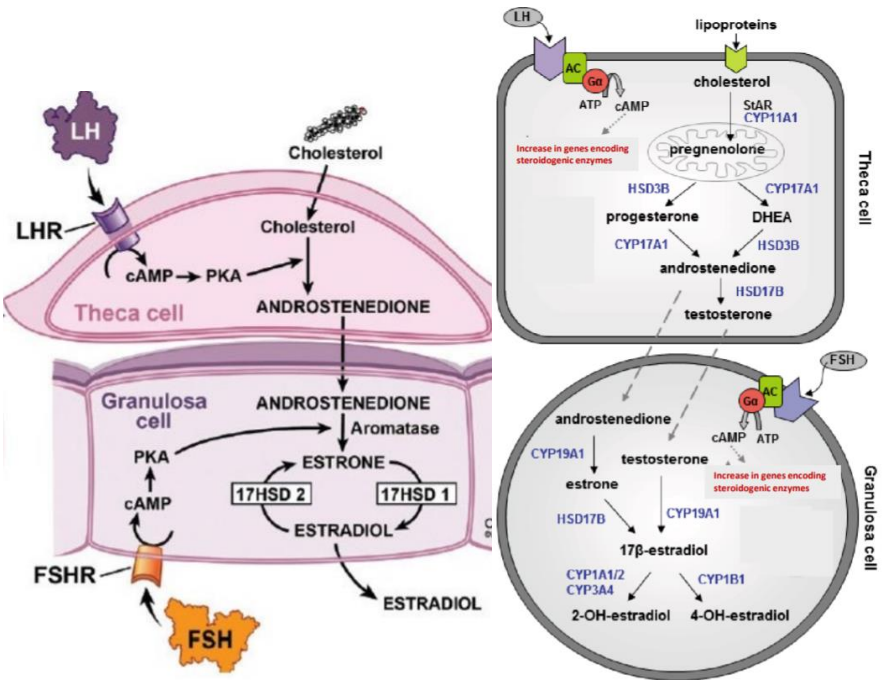
PGF2a: vasoconstriction, causes CL regression

"Puberty begins with a "Kiss"

Draw how protein/peptide hormones stimulate a cellular effect:
(https://www.youtube.com/results?search_query=protein+hormone+mechanism+of+action) (Until 4:25)



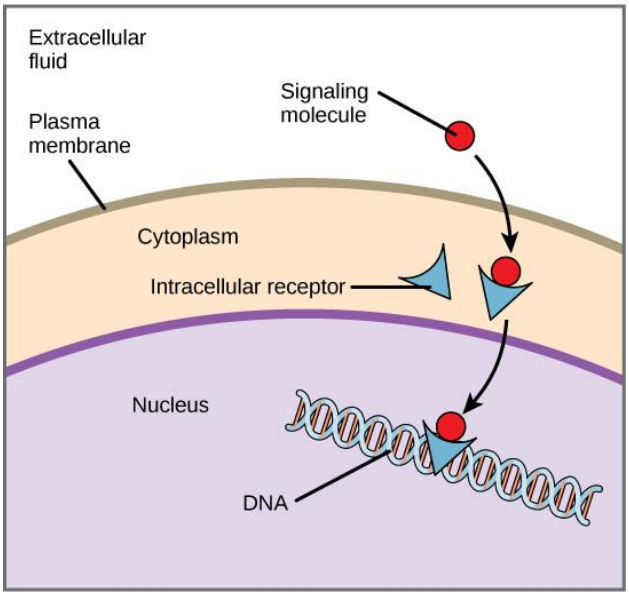
Apply this new material to the 2-cell/2-Gonadotropin Theory:



Explain the difference between a slow and a fast response?

- Slow response (genomic/classical response): steroid hormone binds to intracellular receptor→ (binds to nuclear receptor) genome interaction, increased mRNA/protein synthesis→ In vivo response
    - Takes hours to days
- Fast response (non-genomic): steroid hormone binds to membrane/intracellular receptor→ Adenylate Cyclase activation→ increased secondary messenger and kinase activity→ initiates a cellular response
    - Takes seconds to minutes

What is this signaling cascade an example of? A slow or fast response?



What is puberty? What are the signs of puberty and what does it depend on?

Puberty: the ability to accomplish reproduction successfully (slow progression)

Signs: ovulation, semen production, mating response

Depends on: body size/fatness, environment, social cues, and genetics

What is the key central event of puberty?

GnRH stimulates gonadotropins (LH/FSH) which allow gametogenesis, spermatogenesis, and development of reproductive tissues

Explain Kisspeptin's relationship with GnRH neurons

- Kisspeptin neurons are directly affected by blood glucose, fatty acids, and Leptin which directly communicate with GnRH neurons

What are GnRH neurons influenced by?

- Plane of nutrition: BCS
- Exposure to environmental and social cues: season, opposite sex present, density of group housing
- Genetics: breed variation

What is the limiting factor in attaining puberty?

Quantity of GnRH= limiting factor for male/female puberty attainment

- Pre-puberty: low GnRH/LH/FSH release
- Onset of Puberty: changes to tonic/surge centers
    - Increase in GnRH/LH/FSH
    - Folliculogenesis/spermatogenesis occur
    - Puberty attainment depends on GnRH neuron maturation
        - Need enough GnRH and at the correct frequency
    - Full development of surge/tonic centers

As a follicle increases in size, it produces more and more Estrogen (steroid hormone) which travels in the blood (bound to carrier protein) to the hypothalamus. The tonic (tonic or surge) center first becomes less sensitive to the negative feedback of estrogen. This shift stimulates a higher (higher or lower) frequency of GnRH pulse from the tonic (tonic or surge) center which leads to further growth and development of follicles. Continued follicular growth stimulates concentrations of estrogen above (above or below) the threshold which in turn stimulates the surge (tonic or surge) center of the hypothalamus. Stimulation of the surge (tonic or surge) center of the hypothalamus results in the surge of LH (LH or FSH) thus causing ovulation.

Leptin is

a. Produced by adipocytes/fat cells
b. Indicator of body energy reserves
c. Possess receptors in the hypothalamus
d. All of the above

% Mature weight at Puberty

Dairy cattle	30-40%
Beef Cattle	55-65%
Sheep	40-63%

Y'all are going to destroy this test! Good luck!! 😊