SI Session 3.3

List the types of hormones down below, examples of each, and where their receptors would be

Peptide: receptor in plasma membrane

- GnRH, OT

Protein: receptor in plasma membrane

- PRL (prolactin)

Glycoprotein: receptor in plasma membrane

(8%) FSH, LH (1-2%)

(30%) hCG: human Chorionic Gonadotropin - from human placenta - Preg test

(45%) eCG: equine chorionic Gonadotropin - from mare's endometrial cups

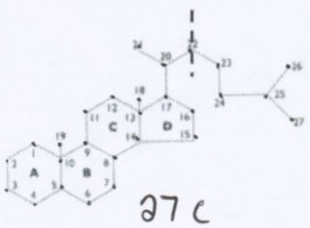
What's special about glycoproteins?

AS carbohydrate % ↑, half life ↑

What portion of the glycoprotein makes it unique?

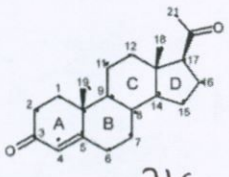
β-subunit - they all have the same α-subunit

Steroids: receptor in nucleus and plasma membrane



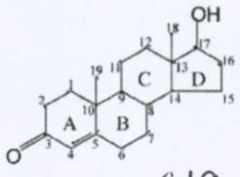
27 C

Cholesterol



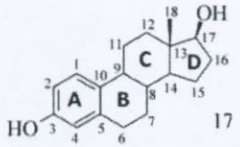
21C

Progesterone



C19

Testosterone



C18

Estrogen

Explain the steroid biosynthetic pathway:

Cholesterol —CYP11A1 (side-chain cleavage)→ Pregnenolone —CYP17 (HSD3β)→ Progesterone … —CYP17→ Androstenedione —HSD17β→ Testosterone —CYP19A1 (Aromatase)→ Estrogen

CYP11A1 (side-chain cleavage): found in all steroidogenic cells

CYP17 (3β-HSD): found in theca/Leydig cells

CYP19A1 (Aromatase): found in granulosa/brain

Lipids: receptor in plasma membrane

- Arachidonic acid = precursor

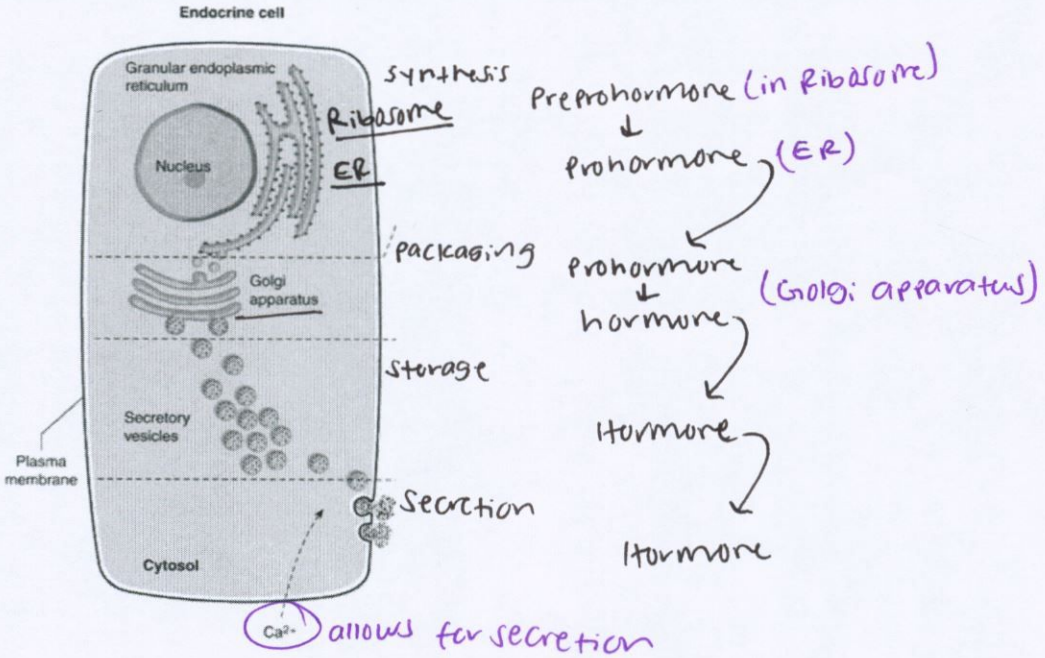
PGE2 = vasodilation, maintains CL

PGF2a = vasoconstriction, causes CL regression

Biogenic Amines: - derived from tyrosine and tryptophan

- dopamine, norepinephrine, epinephrine, histamine, serotonin, melatonin

Briefly describe the synthesis of Peptide/Protein/Glycoprotein synthesis



Hormones that regulate reproduction:

Gland	Hormone	Chemical Class	Principle Function
Ovary	Estrogen(s)	Steroid	Mating behavior; secondary sex characteristics; maintenance of female duct system
	Testosterone	Steroid	Precursor of estrogen
	Inhibin	Protein	Inhibits the release of FSH from anterior pituitary
	Progesterone	Steroid	Maintains pregnancy; mammary growth; inhibits myometrial contractions
	Relaxin (Sow CL)	Protein	Expands the pelvis; dilation of cervix for parturition
Testis	Androgens (Testosterone)	Steroid	Male mating behavior; spermatogenesis; maintenance of male duct system
	Inhibin	Protein	Inhibits the release of FSH from anterior pituitary
Adrenal Cortex	Glucocorticoids Corticosteroids (Cortisol)	Steroid	Induction of parturition by fetus; milk synthesis; stress responses
Placenta	Human Chorionic Gonadotropin	Glycoprotein	LH-like involvement with establishment of pregnancy in women; supports & maintains CL
	Equine Chorionic Gonadotropin	Glycoprotein	FSH-like (some LH) activity; immunological protection of foal during pregnancy; formation of accessory CLs
	Progesterone	Steroid	*see ovary section
	Relaxin (Cow and Ewe)	Protein	Relaxation/dilation of cervix for parturition
	Placental Lactogen	Glycoprotein	Maintains CL; stimulates mammary growth & milk secretion
Uterine Endometrium	Prostagladin F2a (PGF2A) & PGE	FA/Lipid	Causes regression of CL; stimulates myometrial contractions; Ovulation
Seminal Vesicles	Prostagladin F2a (PGF2A)	FA/Lipid	stimulates myometrial contractions – transport of sperm up FRT
Liver	Insulin-like Growth Factors (IGF-1 and IGF-2)	Protein	Stimulates steroidogenesis; mammary growth; fetal growth

Gland	Hormone	Chemical Class	Principle Function
Pineal	Melatonin	Biogenic Amine	Controls seasonal reproduction in mare and ewe
Posterior Pituitary	Oxytocin**storage not production*	Peptide	Stimulates myometrial contractions for transport of sperm; parturition; milk let-down
Anterior Pituitary	Follicle Stimulating Hormone (FSH)	Glycoprotein	Stimulate follicle growth, estrogen production, spermatogenesis in males
	Luteinizing Hormone	Glycoprotein	Stimulates ovulation; supports CL formation and progesterone secretion; stimulates testosterone synthesis by Leydig cells of the testis
	Prolactin (PRL)	Protein	Stimulates milk synthesis; regulate metabolism for milk synthesis; effect maternal behavior
	Growth Hormone (GH)	Protein	Stimulates milk synthesis through IGF-1 secretion
	Adrenalcorticotropic Hormone (ACTH)	Protein	Release of corticosteroids and glucocorticoids from adrenal cortex initiate parturition
Hypothalamus	Gonadotropin Releasing Hormone (GnRH)	Peptide	Stimulates release of LH and FSH from anterior pituitary
	Dopamine	Biogenic Amine	Inhibits release of prolactin
	Corticotropic Releasing Hormone (CRH)	Peptide	Stimulates ACTH
	Growth Hormone Releasing Factor (GHR)	Peptide	Stimulates release of Growth Hormone
	Oxytocin	Peptide	Produced by hypothalamus, released by posterior pituitary

List some synthetic hormones under these classifications

Prostaglandins: Estrumate, Lutalyse, In-Synch, ESTRO-PLAN

GnRH: Cystorelin, Fertagyl, Factrel, Sucromate, Ovacyst

Progesterone: CIDR (controlled internal drug release), Matrix, Regumate, MGA

Other: PG600, Improvest, Estradiol, Follitropin, Pulset

What factors affect the strength of hormone action?

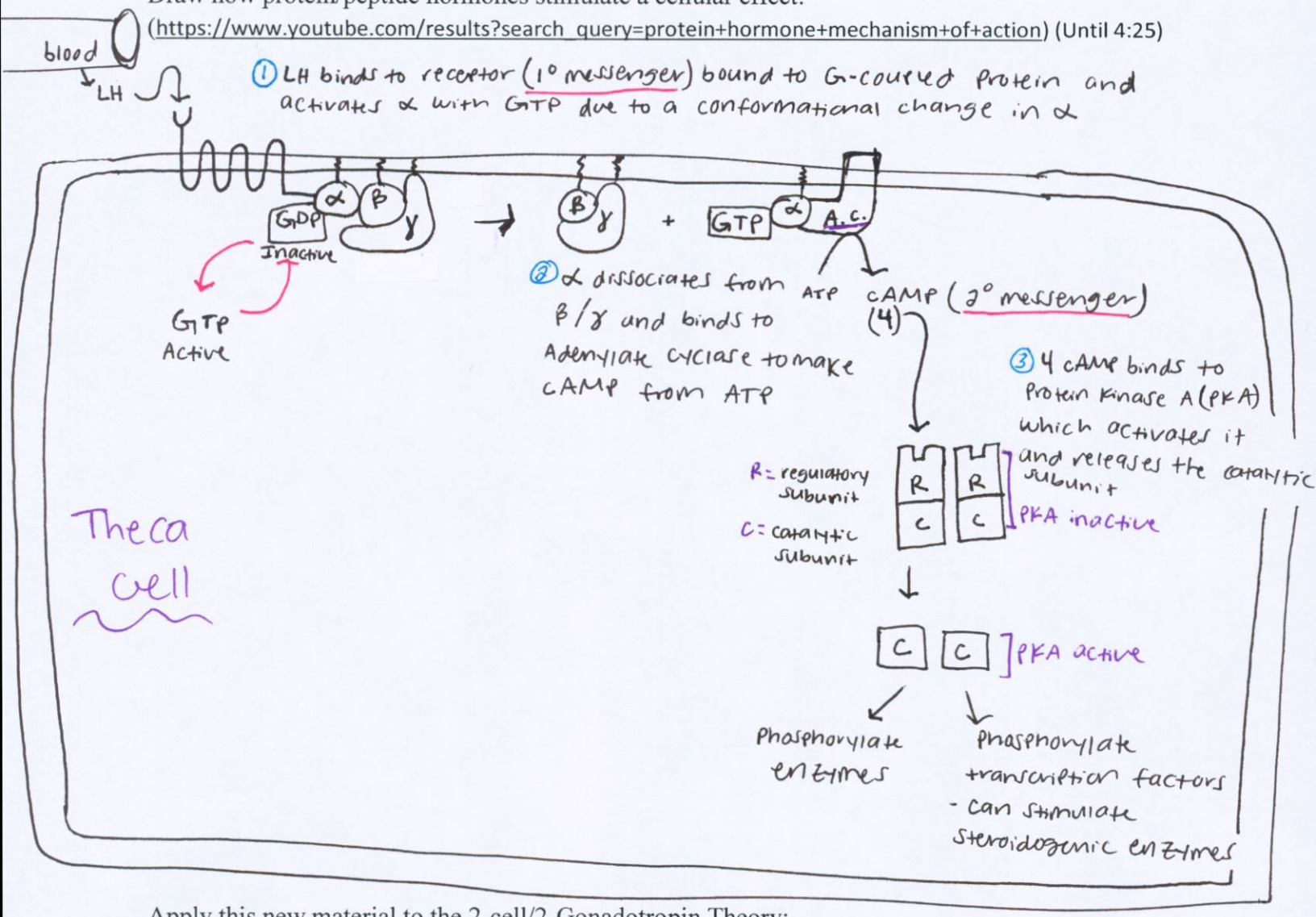
Pattern/duration of secretion, half life, receptor density, Receptor-Hormone Affinity

Define an agonist vs. an antagonist

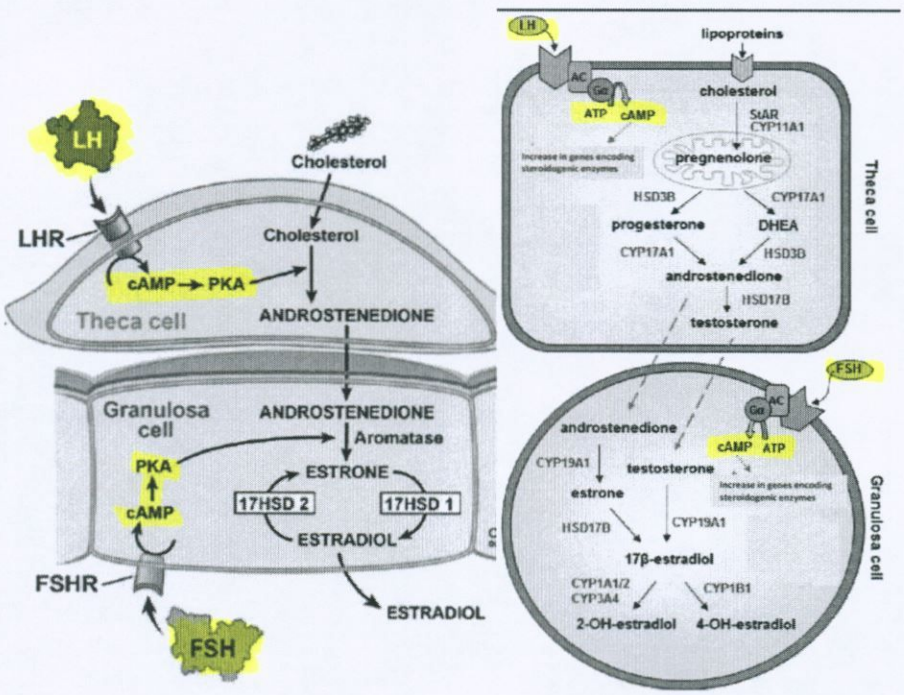
Antagonist - does NOT initiate a biological response upon binding to its receptor

Agonist - does initiate a biological response upon binding to its receptor

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

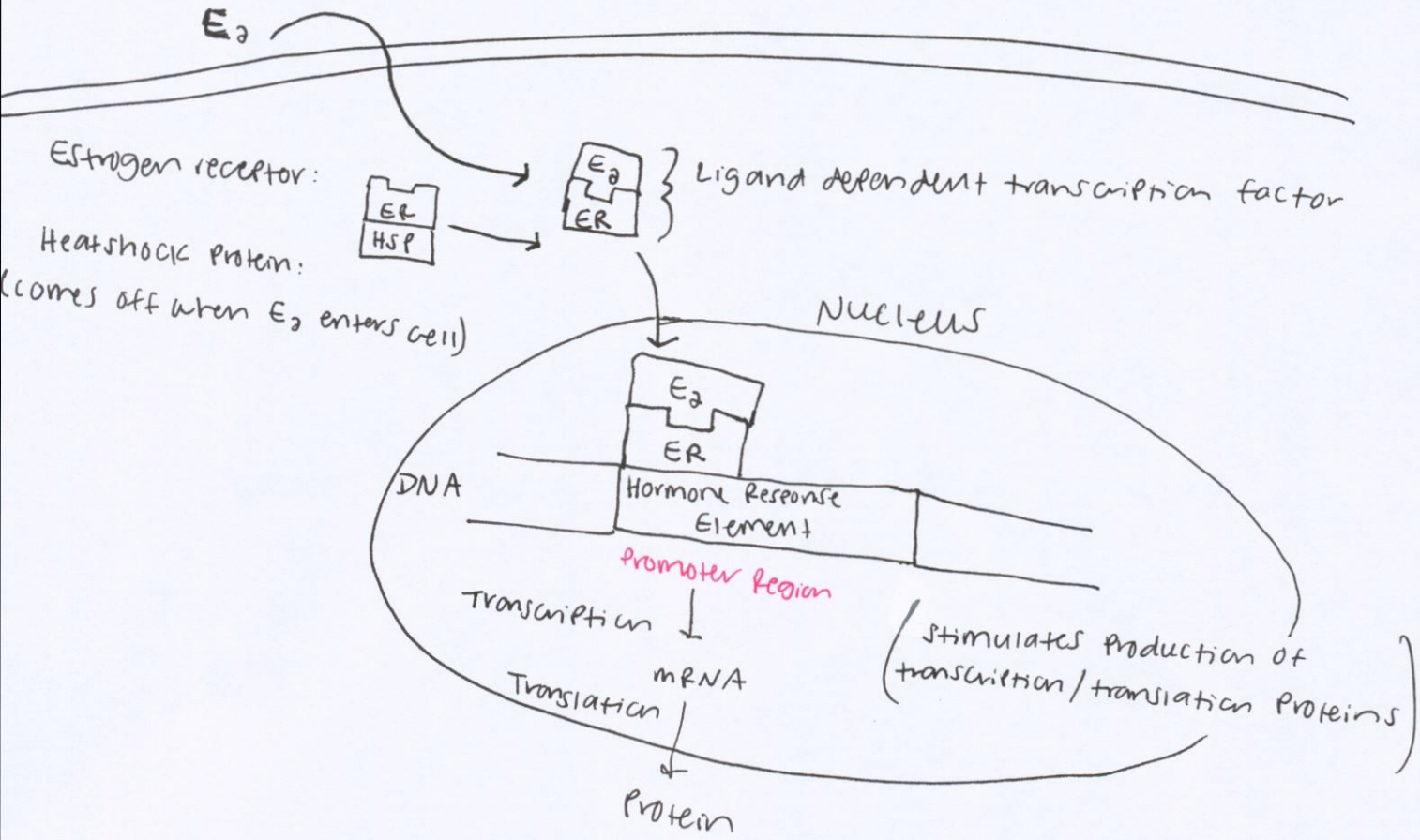


Apply this new material to the 2-cell/2-Gonadotropin Theory:



How do steroid hormones stimulate a cellular effect? What's the difference between a slow and fast response? Use Estrogen as an example and draw this process

- Steroid hormones function by altering gene transcription and protein translation
- Steroids need to travel with a carrier protein (either Albumin or sex hormone binding globulin)
- Steroid/Lipid soluble hormone dissociates from carrier protein and diffuses through plasma membrane



Slow response: Hours to days

- Steroid passes through cell membrane and cytoplasm
- binds to nuclear receptor
- mRNA and protein synthesis

Fast response: seconds to minutes

- Steroid binds to membrane receptors
- Andenylate cyclase activation
- Protein kinase activation
- changes in Ca^{2+} channel permeability