Sex: Hormonal and Neural Basis (Ch 12)

- Brief review of hormones
  - Hormone types
  - Gonadal (steroid) Sex Hormones

- Sexual Development and Differentiation
  - Development of the **Body**
  - Hormonal regulation of in utero development
  - Sexually Stereotyped Behaviours
  - Development of the Male and Female **Brain**

chem msg → bloodstream from one part of body 2 another

·goes everywhere in body but only affects where receptor are

chain

Peptide and Amine Hormones

membrane

Outside of cell

Inside of cell

Configurational change

Membrane-bound hormone receptor

Peptide hormone

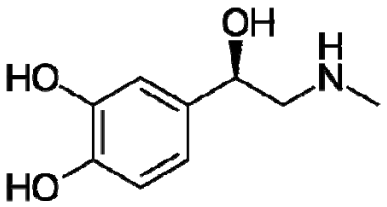
changes 2 purple shape after it connects

activates enzymes in cell

Second messengers (eg cAMP, cGMP)

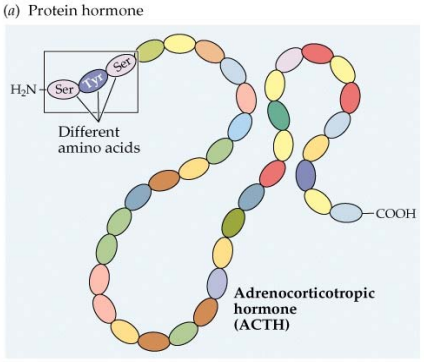
go do stuff; Δ activity in cell

one molecule



Adrenaline

Multiple effects
- Alter protein synthesis
- Alter metabolism of cell
- Alter neural activity
  - Ion channels



-Amino acid chain or derived from single amino acid

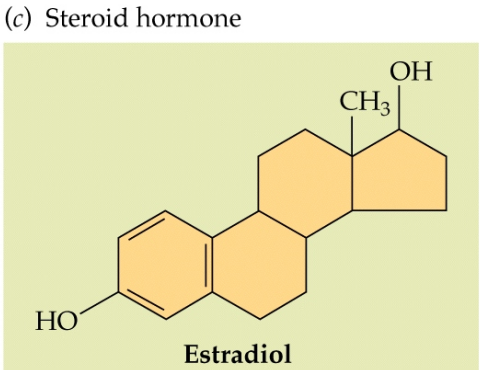
-Big molecules and/or water soluble; cannot enter cells easily

electrical charge assoc. w/ them

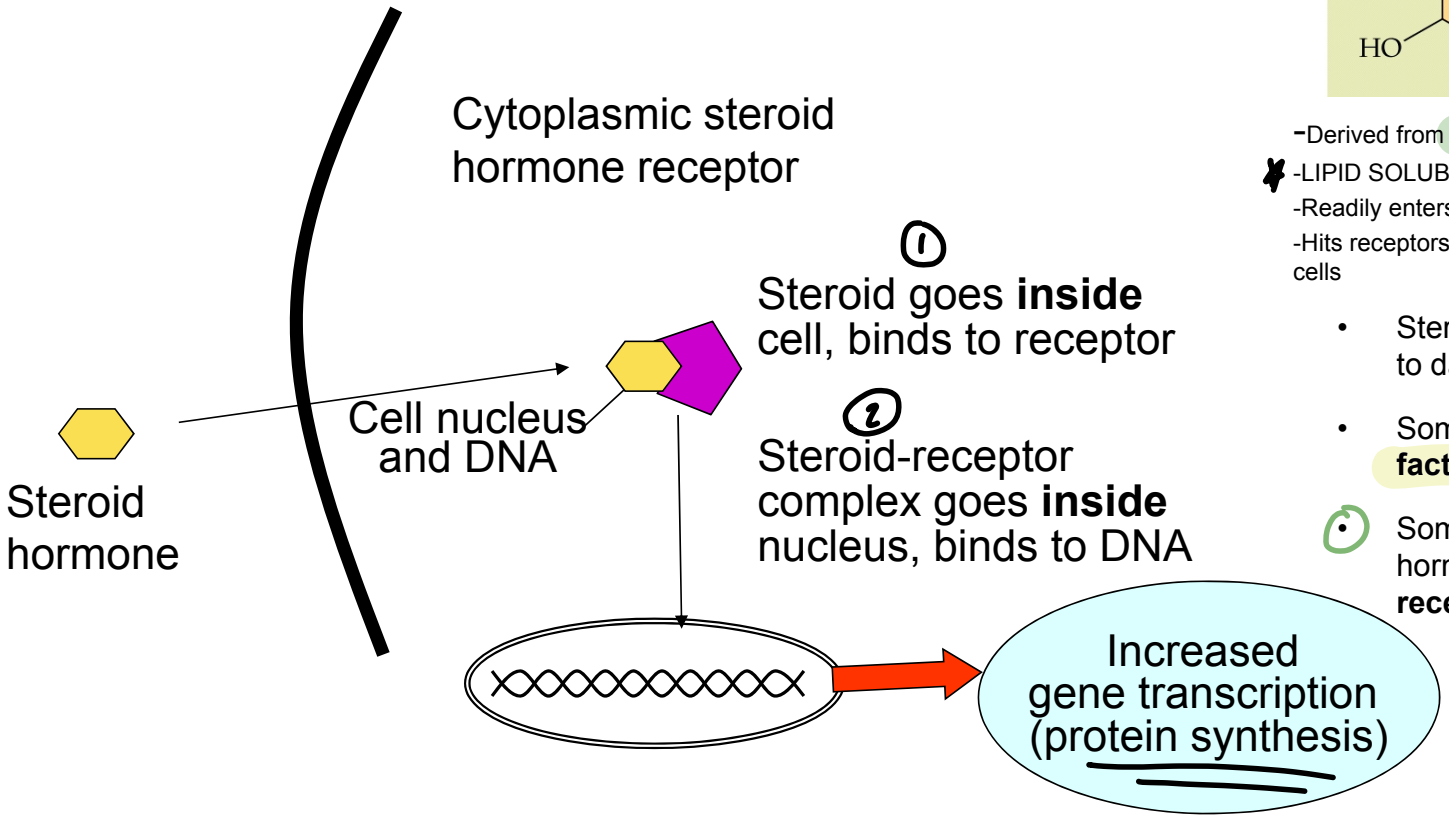
-Hits receptors on outside of cell that are bound to the membrane

•Relative to steroid hormones, these hormones act quickly (second to minute timescale)

Steroid Hormones



- Derived from cholesterol
- -LIPID SOLUBLE – how they are able to get in
- -Readily enters cells
- -Hits receptors both on outside ***and inside*** of cells



- Steroids work on a slow time frame (hours to days) – LONG lasting effects
- Some require a **steroid receptor co-factor,** which can alter its effect
  another protein that can stick to receptor hormone
- Some steroid may also work like peptide hormones by acting on **membrane bound receptors** in brain

would be faster

dictates what part of DNA to go 2

variation in effect caused by:

- diff receptor
- diff hormone
- diff cofactor

alter proteins expressed in diff cell types

Gonadal (Sex) Hormones

- STEROID hormones, two main classes
- **Androgens:** testosterone (T) most common
  - Dihydrotestosterone: another androgen, much more potent form of T super concentrated ver. (dish soap? lol)
- **Estrogens:** Estradiol most common

Where do they come from?

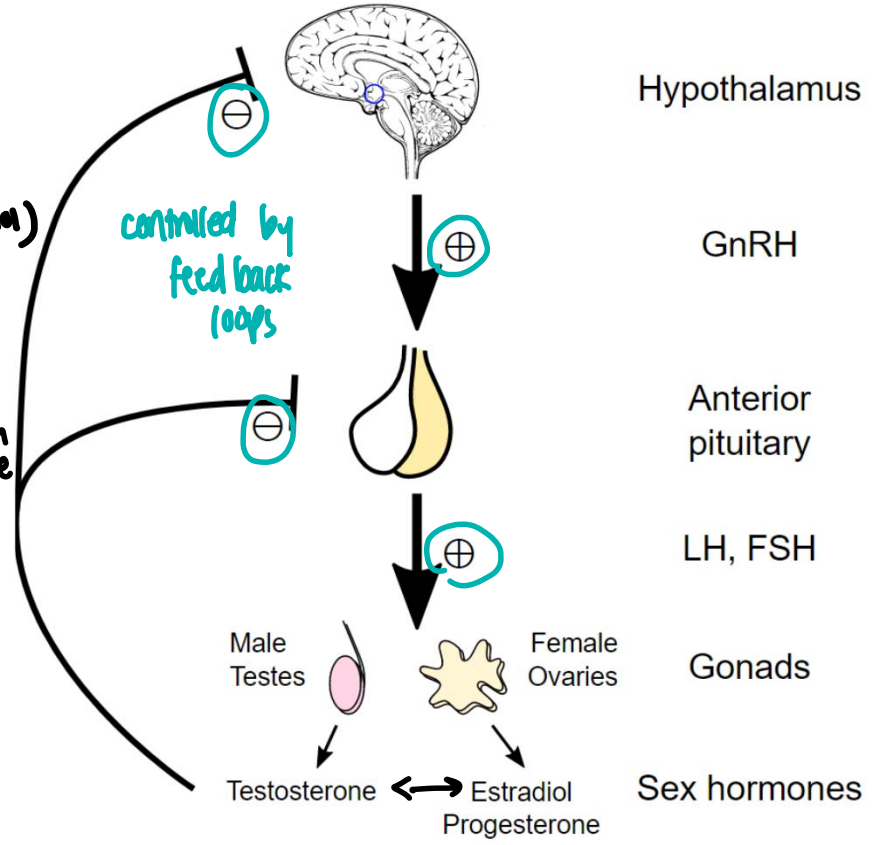
glands

- ***Ovaries:** release much more estrogens than androgens
- **Testes** release much more androgens than estrogens

both produce both

- Adrenal Cortex also releases small amounts of these sex hormones as well
  - Adrenal corticosteroid secretion (aka stress hormones) inhibits androgen release

fight or flight behaviors

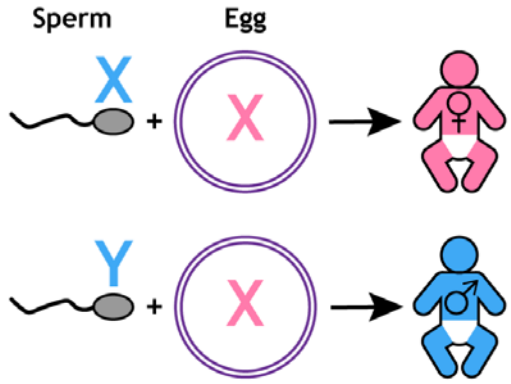


easy to convert T ↔ E

Where do we come from?

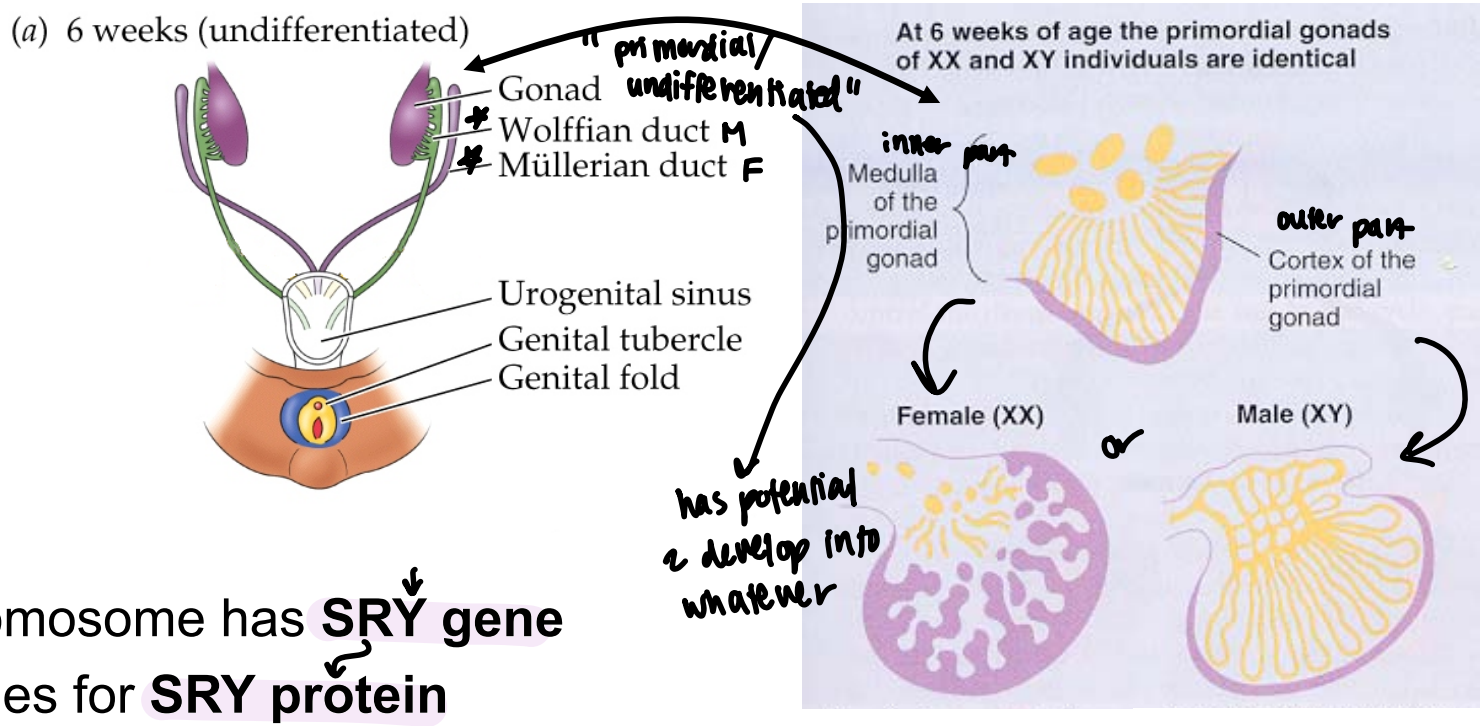
- Sexual Development (*in utero*)

- You learned in high school biology that the two sexes are determined genetically
- XX = female XY =male
- So if you have a Y chromosome, you are going to be a male, and if you don't you are going to be a female, right?



NOT THAT SIMPLE!

Sexual Development (Gonadal)



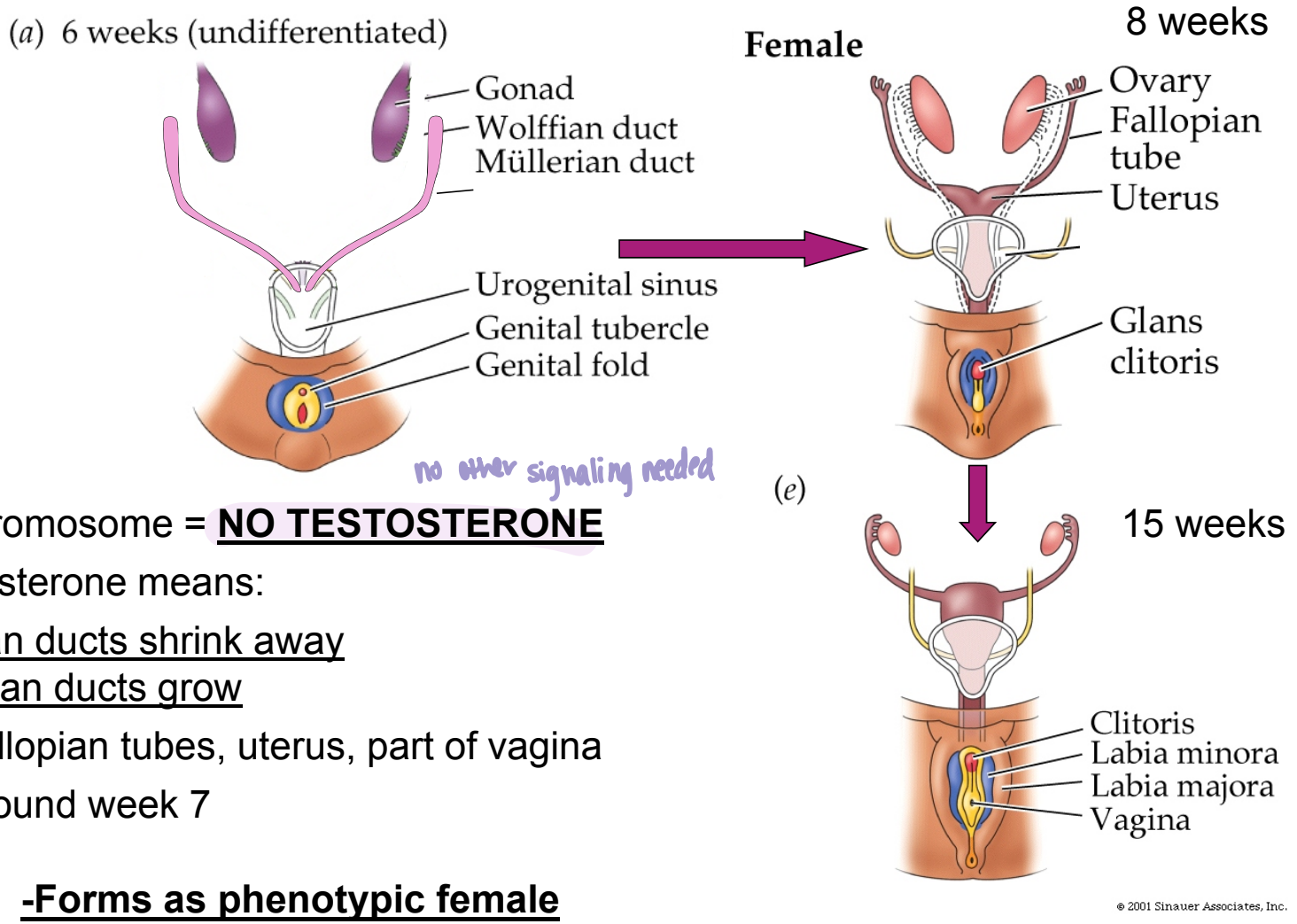
- Y chromosome has **SRY gene**
- Encodes for **SRY protein**
- Shows up @ week 7 of development
- SRY protein causes TESTES formation
- NO SRY = OVARY formation

No SRY= OVARY (from cortex)

Yes SRY= Testes (from medulla)

this is when genes are most important

Female (XX) Sexual Development



"default program" form on their own

- NO Y chromosome = **NO TESTOSTERONE**
- NO testosterone means:
  - -Wolffian ducts shrink away
  - -Mullerian ducts grow
- Forms fallopian tubes, uterus, part of vagina
- Starts around week 7

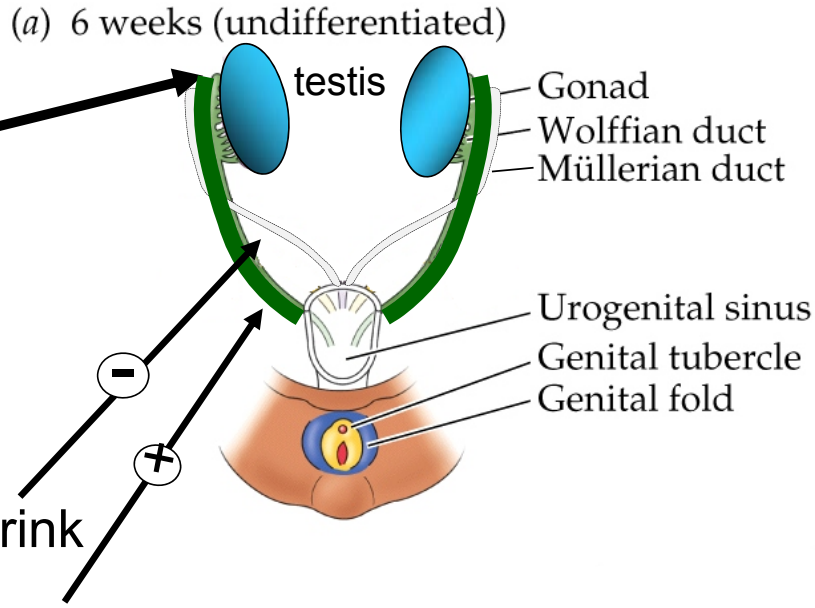
-Forms as phenotypic female

Male (XY) Sexual Development (1)

Y chromosome means:
SRY GENE = SRY PROTEIN

- Testes form and start to make:
  1) Testosterone
  2) Anti-Mullerian hormone (AMH)

- AMH causes Mullerian duct to shrink
- T causes Wolffian ducts to grow



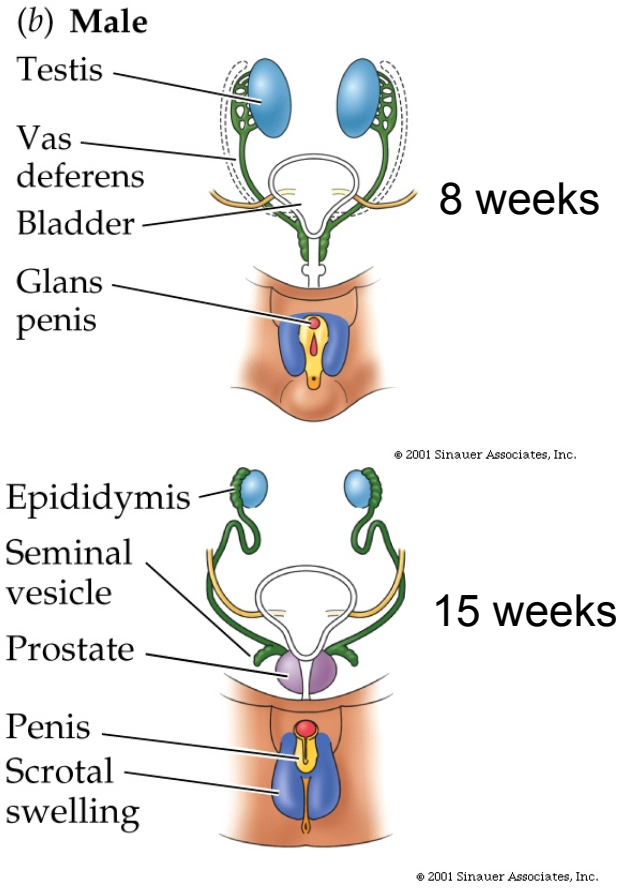
- Occurs around week 7

Male Sexual Development (2)

- T masculinizes other structures through development

  -prostate gland, scrotum, penis

- These effects are aided by dihydrotestosterone (DHT) ★
- Cells in these areas have enzyme 5α-reductase = converts testosterone into DHT enables more growth
- **Forms phenotypic male**



Critical points

- Development into phenotypic male or female controlled by **PRESENCE or ABSENCE of TESTOSTERONE**
- NOT controlled by estrogens

happens on its own

- Genes play a role, but presences/absence of hormones (testosterone) plays an equal or greater role in what you look like when you're born, depending on what's in the blood stream during this **Critical Period** 7-15 wk window
- **Sex chromosome controls sex of the gonad**
- **GONADAL hormones determines sex of rest of the body**