SI Test Prep Exam 2

What are the 2 stages of the luteal phase?

Metestrus and Diestrus

Match the following terms to the definition:

B Luteinization C Luteolysis D Luteolytic A Luteotropic

"-tropic" = to assist

a. Something that stimulates an action to develop/maintain the CL
b. Process where granulosa and theca cells are transformed into luteal cells (terminal differentiation)
c. Luteal tissue undergoes regression/cell death
d. Something that promotes luteolysis

Describe Large Luteal Cells:

- from granulosa cells
- round nucleus/abundant mitochondria
- produce 85% P_4
- produce relaxin and oxytocin
- have $PGF_{2\alpha}$ receptor
- Hypertrophy (2-fold increase) = ↑ in size

What's the job of Oxytocin?

Signals for $PGF_{2\alpha}$ from the uterus for luteolysis

Describe Small Luteal Cells:

- from theca cells
- irregular nuclei
- has oxytocin receptor
- produce P_4
- Hyperplasia (5-fold increase) = ↑ in #

(T)/F: The Corpus Luteum has a high metabolic demand?

Consumes 2-6x more O_2/unit weight than liver, kidney, and heart

How does a luteal cell produce progesterone?

- Chol. imported ~~by~~ LDL (carrier) and transported to mitochondria
- LH binds to LH receptor on plasma membrane which stimulated Adenylate Cyclase which promotes conversion of ATP → cyclic AMP (cAMP)
- cAMP protein kinase enzymes promotes entry of Chol. to mitochondria
- Mitochondria enzymes convert chol. → pregnenolone
- Pregnenolone travels to smooth ER and is converted to P_4

Explain the difference between functional and structural luteolysis

Functional: (always 1st) = ↓ in P4 production

- Uterine $PGF_{2\alpha}$ binds on LLC = ↑ in OT
- $PGF_{2\alpha}$ signaling = ↓ in LDL receptors on luteal cells and ↓ in LH receptors

Structural: (6-10 hrs after functional) = luteal cell death (apoptosis)

- endothelial (blood cells) and SLC die first
  - LLC die second
- immune cells digest/remove fragments

T(F) The testes are warmer than the body to allow for sperm motility.

- Kept outside of body
- 4-6°C less than body temp is required for spermatogenesis

The scrotum consists of four major layers. What are they?

① Scrotal skin: lots of sweat glands

② Tunica Dartos: smooth muscle layer beneath skin.
- smooth muscle = sustained muscle contraction to change location/scrotal surface area (thickness)

③ Scrotal Fascia: fatty/membranous layer (insulation)

④ Parietal vaginal Tunic: 1st peritoreum layer taken into scrotum

List the scrotal properties that contribute to thermoregulation

- Location of testis: outside of body/away from body = air circulation
- Low insulation: thick skin, low sub Q fat, or hair
- Sweat glands: scrotal skin richly equipped with them = evaporative cooling
- Thermoreceptors: nerves in scrotum control response to temp. of testes

What are 3 unique structures/characteristics/methods used to maintain the cooler temperature of the testes?

1. Scrotum - sweat glands / insulating fascia
2. Pampiniform plexus - counter-current heat exchange cools blood
3. Tunica dartos (involuntary, smooth muscle = sustained contractions) and cremaster muscle (voluntary, skeletal muscle = NOT sustained) for manipulation of testis location

The parenchyma is composed of the tubule and the interstitial components

Sertoli cells] tubule compartment, analogous to granulosa cell

a. Have follicle stimulating hormone receptors
b. Are the only somatic cells in tubule compartment
c. Are "nurse cells" for spermatogenesis
d. Form part of the blood testis barrier
e. All of the above

Leydig cells] interstitial compartment, analogous to theca cell

a. Are in the accessory sex glands
b. Have estrogen receptors
c. Produce testosterone
d. All of the above

The rete tubules are located within the mediastinum (connective tissue core) of the testes and transport spermatozoa and fluid from the seminiferous tubules to the efferent ducts

The tube that connects the testes to the pelvic urethra is known as

a. Efferent ducts
b. Rete tubules
c. Oviduct
d. Ductus deferens

What term is used to describe the condition where the testes fail to descend into the scrotum?

Cryptorchidism

T/F Bilateral cryptorchidism produce fertile spermatozoa

Unilateral can

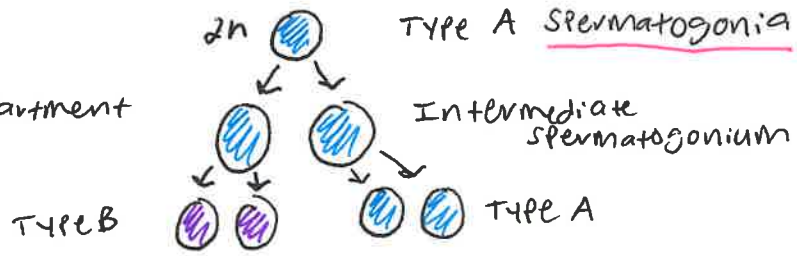
Is testosterone still produced in cryptorchids?

Yes - but thermoregulation is hindered

Draw and explain the 3 phases of spermatogenesis (occurs within seminiferous tubule)

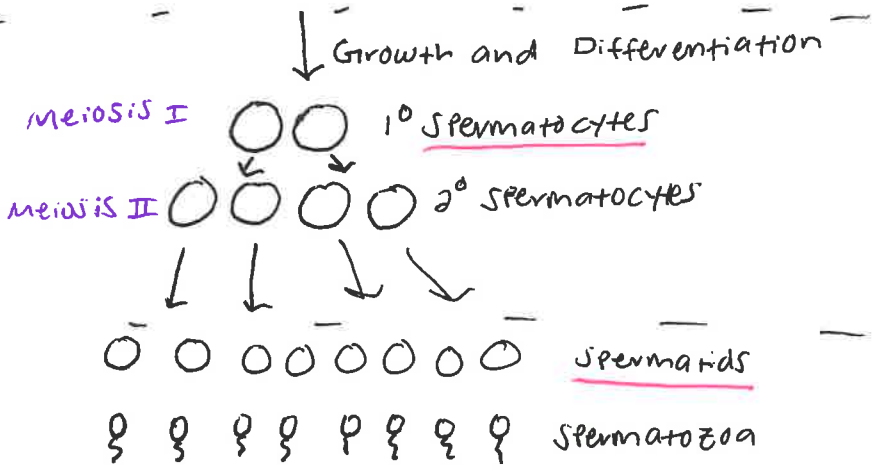
① Proliferation phase: mitotic divisions

- Type A = dormant, renew stem cells
- Type B = migrates through adluminal compartment



② Meiosis phase:

- Meiosis I: genetic diversity via DNA replication / crossing over
  - Produces 2° spermatocytes
- Meiosis II: produces 1N spermatids



③ Differentiation phase:

morphological changes = NO cell divisions

Spermination: release by Sertoli cells into seminiferous tubules

I. Golgi Phase: packaging of enzymes in the proacrosomic vesicle; making acrosome. Golgi apparatus receives proteins and lipids from ER, it modifies, sorts, concentrates, and packs them into sealed vesicles
- centrioles (develop into tail) move opposite pole to Golgi

II. Cap phase: granules flatten to form "cap" over nucleus, primitive tail forms

III. Acrosomal phase: sperm head takes shape - nucleus begins to elongate, acrosome spreads over 2/3 of nucleus, chromatin condenses, extension of flagellum, mitochondria migrate towards neck

IV. Maturation phase: results in spermatid with motile potential
- DNA becomes compact and sperm is inert

(epididymus = post gonadal development)

Describe the 3 portions of the epididymis and their functions

- Caput (head) = fertilization factors added, sperm not motile/fertile and still have proximal cytoplasmic droplet
- Corpus (body) = decapacitation factors added (army gear), some motility/fertility and cytoplasmic droplet should be moving down
  - acquire ability to bind to oocyte
- Cauda (tail) = forward moving motility factors added, express "swimming" factors, high fertility, distal cytoplasmic droplet
  - sperm stored in cauda have a lowered pH, low O_2/high CO_2, high K/Na ratio to reduce metabolism

What are the 4 functions of the epididymis?

1. Transport sperm from caput to cauda by pressure of new sperm, smooth muscle contraction, and sexually stimulated cauda contractions
2. Concentration of sperm by fluid absorbed by efferent ducts and fluid absorbed in caput
3. Maturation of sperm - undergo biochemical/physical changes to gain motility/fertility factors by ↑ in specific gravity (lose H_2O = more dense), condensed nucleus
4. Storage of sperm in cauda - only 1/2 of sperm make it here,

What is capacitation?

Secretions within cervix, uterus, and oviduct remove coating on sperm so that they may fertilize the oocyte

What are the 3 parts of the penis?

- Base (root) = attachment point
- Shaft = main portion of penis
- Glans penis = heavily populated with nerves

List types of penile tissue and the species associated with each:

- fibroelastic: sigmoid flexure allows penis to be inside body until an erection occurs
  - retractor penis muscle maintains "S-shape"
  - Bull (rotates ccw 300° @ ejaculation)
  - Boar (↓tum = flaccid, ↓returns = erect)
  - Ram (filiform appendage = sprays semen around fornix vagina)
  - Deer
- Musculovascular: lots of erectile tissue, little connective tissue
  - Stallion, dog, human

Name the muscles associated with the penis: single muscle

- Bulbocavernosus (bulbospongiosus) - empties extra-pelvic part of urethra
- Ischiocavernosus - paired muscles - compress crura/stores return of blood
- Retractor penis - paired muscles - maintain sigmoid flexure in fibroelastic penis

Testosterone has a negative feedback on GnRH/LH/FSH

List the parts of the sperm head and their function

- Nucleus (haploid): condensed DNA stabilised by disulfide bonds until fertilization occurs - Inactive
- Acrosome (similar to lysosome): enzymes facilitate sperm penetration of oocyte - hyaluronidase, Acrosin, corona penetrating enzymes, upper 2/3 of sperm head
- plasma membrane; little cytoplasm remain in sperm, surrounds tail
- Apical ridge: indicates viability, not present = sperm death - binds to E.P.
- post acrosomal ridge: where sperm attaches head to Vitelline membrane of oocyte during fertilization

Cycle of Seminiferous Epithelium

Species:	Length of Time: (days)
Bull	13.5
Boar	8.3
Ram	10.1
Stallion	12.2

How long is a bull's length of spermatogenesis in days?

lol (Boar = 34; Ram/Stallion = 49)

What would a producer look out for in their male species?

daily sperm production, scrotal circumference/size, motility, morphology

What's the difference between primary and secondary sperm abnormalities?

1°: arise in testes due to faulty differentiation

2°: arise in epididymis due to faulty transit and/or maturation

Spermatids are most sensitive to heat stress. Why?

undergoing morphological change