Lecture Outline

- The Basics
  - Gametogenesis
  - Gender determination
- The Pituitary-Gonad Axis
- Female Reproductive Physiology
  - Ovarian Cycle
  - Uterine Cycle
  - Hormonal control and changes
- Male Reproductive Physiology

Male Reproductive Physiology

Basic Functions

- Function
  - Produce, maintain & transport viable spermatozoa
    - Testes
    - Epididymis
    - Ductus deferens
    - Accessory glands
      - Prostate
      - Seminal vesicles
      - Bulbourethral glands
  - Hormone production that
    - develops secondary sexual characteristics
    - Involved in feedback mechanisms relating to spermatogenesis

Male Reproductive Physiology

Testes

- Site of Sperm production
  - Divided into lobules, each with seminiferous tubules.
  - Seminiferous tubule functions to
    - Maintain environment for spermatogonia by the basal lamina and the Sertoli cells
    - Sertoli cells separate the lumen from the basal lamina and create a blood-testis barrier
    - Creates three compartments
      » Lumen – low glucose, high K+
        & steroid hormones
      » Basal compartment – the baso-lateral side of the sertoli cells & containing the developing spermatogonia
      » Interstitial fluid space – below the basal lamina and contains the Leydig cells
  - Produce hormones/paracrines
    - From Sertoli cells
    - From Leydig cells

Male Reproductive Physiology

Testis

- Sertoli cells
  - Produce hormones & paracrines involved with control of hypothalamus-pituitary-gonad axis and the testes directly
    - Anti-Müllerian Hormone (AMH)
      - Secreted during embryogenesis
      - Prevents development of the Müllerian ducts
    - Inhibin & activin
      - Regulate FSH release from anterior pituitary
        » inhibin decreases FSH release
        » activin increases LH function & increases FSH release
    - Androgen Binding Protein (ABP)
      - Binds to testosterone and DHT, reduces the loses due to diffusion resulting in an increase in testicular testosterone levels
    - Estradiols & Aromatase
      - Support spermatogenesis
Male Reproductive Physiology

Testis

- Sertoli cells, cont...
  - GDNF (glial derived neurotrophic factor) & ERM transcription factor
    - Maintenance of the stem cell line
- Leydig cells
  - Produce androgens
    - Testosterone, androstenedione and dehydroepiandrosterone (DHEA)
      - Increase spermatogenesis
      - Influence secondary sexual characteristics
    - Stimulated to produce androgens by luteinizing hormone (LH)
      - FSH increases the response to LH by Leydig cells

Male Reproductive Physiology

Accessory Gland Function

- Job of the accessory glands is to
  - Secret semen fluid (99% of semen volume)
    - Components of seminal fluid
      - Mucus
      - Water
      - Nutrients
      - Buffers
      - Enzymes
      - Prostaglandins
      - Zinc
    - Accessory Glands
      - Prostate
      - Seminal vesicles
      - Bulbourethral glands

Spermatogenesis Hormonal Control Flow Chart

Male Reproductive Physiology

Testes

- Inhibin
- LH
- FSH
- Spermatogonium
- Spermatocyte
- Sertoli cell
- Androgen-binding protein (ABP)
- Testosterone (T)
- To body for secondary effects
- Inhibits Sertoli cell and spermatogenesis
- LH increases the response to FSH by Leydig cells
- FSH increases the response to LH by Leydig cells
Male Reproductive Physiology

Accessory Gland Function

<table>
<thead>
<tr>
<th>Mucus</th>
<th>Lubricant</th>
<th>Bulbourethral glands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Provides liquid medium</td>
<td>All accessory glands</td>
</tr>
<tr>
<td>Buffers</td>
<td>Neutralize acidic environment of the vagina</td>
<td>Prostate, bulbourethral glands</td>
</tr>
<tr>
<td>Nutrients</td>
<td>Nourish sperm</td>
<td>Seminal vesicles</td>
</tr>
<tr>
<td>Fructose</td>
<td></td>
<td>Seminal vesicles</td>
</tr>
<tr>
<td>Citric acid</td>
<td></td>
<td>Prostate</td>
</tr>
<tr>
<td>Vitamin C</td>
<td></td>
<td>Seminal vesicles</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td></td>
<td>Epididymis</td>
</tr>
<tr>
<td>Enzymes</td>
<td>Glut semen in vagina, then liquefy the clot</td>
<td>Seminal vesicles and prostate</td>
</tr>
<tr>
<td>Zinc</td>
<td>Unknown; possible association with fertility</td>
<td>Unknown</td>
</tr>
<tr>
<td>Prostaglandins</td>
<td>Smooth muscle contraction, may aid sperm transport</td>
<td>Seminal vesicles</td>
</tr>
</tbody>
</table>

From Table 26-3

Male Reproductive Physiology

The sexual response

- Remember
  - Function of the reproductive system is to reproduce
  - Males contribution is
    - Deliver viable sperm into the vagina
    - Requires a complex neural reflex – the erection reflex
      - Creates changes in vascular condition within the penile arterioles
        - Initiated by erotic stimuli (visual, auditory, tactile, cerebral)
        - The parasympathetic division of the ANS causes vasodilation of the penile arterioles
        - Erectile tissue fills with blood creating an erection
    - Emission & Ejaculation during climax
      - Emission is the movement of sperm from vas deferens into the urethra adding seminal fluid along the way, this is under sympathetic control
      - Ejaculation is the expulsion of semen due to strong muscular contractions – this is a spinal reflex

Male Reproductive Physiology

Erection Reflex Pathway
Male Reproductive Physiology
The sexual response

- Emission & Ejaculation during climax
  - Emission is the movement of sperm from vas deferens into the urethra adding seminal fluid along the way; this is under sympathetic control
  - Ejaculation is the expulsion of semen due to strong muscular contractions – this is a spinal reflex
    » Started with the contraction of the bulbospongiosus muscle

- Disorders
  - Erectile dysfunction (ED)
  - Premature ejaculation
  - Prolonged ejaculation / anorgasmic