Outline

• Male Reproductive System
  – Testes and Sperm
  – Hormonal Regulation

• Female Reproductive System
  – Genital Tract
  – Hormonal Levels
  – Uterine Cycle
  – Fertilization and Pregnancy
    • Control of Reproduction
    • Infertility
Male Reproductive System

- Male gonads, **testes**, are suspended in scrotum.
  - Sperm are produced in testes and mature in **epididymis**.
  - Travel to **vas deferens** for storage.
  - Ejaculate from urethra.
- Semen composed of sperm and secretions form the seminal vesicles, prostate gland, and bulbourethral glands.
Male Reproductive System - back

- Enlargement common in older men
- Benign prostate hyperplasia
- Can also stem from prostate cancer
- Increases pressure on urethra, resulting in increased back-up of urine from bladder, potentially back ureter into kidneys
Orgasm in Males

- **Penis** has a long shaft and an enlarged tip, glans penis.
  - During sexual arousal, autonomic nerve impulses cause erectile tissue to fill with blood.
  - Contractions that expel seminal fluid from the penis are part of the physiological and psychological manifestations of the male orgasm.
  - Around 400 million sperm contained in 3.5 ml of semen.
The Testes

- Testes begin to develop inside the abdominal cavity and descend into the scrotal sacs during last two months of fetal development.
  - Scrotum helps regulate temperature of testes.
  - Testes packed with seminiferous tubules with cells undergoing spermatogenesis.
    - Androgens secreted by interstitial cells in between seminiferous tubules.

The Testes

- Mature sperm have three distinct parts.
  - Head.
    - Nucleus covered by acrosome.
  - Middle Piece.
    - Provide energy for movement.
  - Tail.
    - Flagellum for movement.
Testis and Sperm

Spermatogonia

Supporting cell

Spermatogonium (46 chromosomes)

Slide number: 2

Wall of seminiferous tubule

Lumen of seminiferous tubule

Developmental sequence
Spermatogonia

Slide number: 3

Supporting cell

Primary spermatocyte (46 chromosomes)

Spermatogonium (46 chromosomes)

Developmental sequence

Lumen of seminiferous tubule

Wall of seminiferous tubule

Spermatogonia

Slide number: 4

Supporting cell

Secondary spermatocyte (23 chromosomes)

Primary spermatocyte (46 chromosomes)

Spermatogonium (46 chromosomes)
Spermatogonia

Supporting cell

Spermatid (23 chromosomes)

Secondary spermatocyte (23 chromosomes)

Primary spermatocyte (46 chromosomes)

Spermatogonium (46 chromosomes)

Lumen of seminiferous tubule

Wall of seminiferous tubule

Developmental sequence

Sperm cells (23 chromosomes)

Spermatid (23 chromosomes)

Secondary spermatocyte (23 chromosomes)

Primary spermatocyte (46 chromosomes)

Spermatogonium (46 chromosomes)

Supporting cell

Sperm cells (23 chromosomes)

Spermatid (23 chromosomes)

Secondary spermatocyte (23 chromosomes)

Primary spermatocyte (46 chromosomes)

Spermatogonium (46 chromosomes)
Spermatogenesis involving meiotic divisions

Slide number: 2

Primary spermatocyte

(46 chromosomes)

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Spermatogenesis involving meiotic divisions

Slide number: 3

Primary spermatocyte

First meiotic division

(46 chromosomes)

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Spermatogenesis involving meiotic divisions

Slide number: 4

Primary spermatocyte
First meiotic division
(23 chromosomes)

Secondary spermatocyte
(23 chromosomes)

(46 chromosomes)

Spermatogenesis involving meiotic divisions

Slide number: 5

Primary spermatocyte
First meiotic division
(23 chromosomes)

Secondary spermatocyte
Second meiotic division
(23 chromosomes)

(46 chromosomes)
Spermatogenesis involving meiotic divisions

Slide number: 6

Primary spermatocyte
First meiotic division
(23 chromosomes)
Secondary spermatocyte
Second meiotic division
(23 chromosomes)
Secondary spermatocyte
Spermatids
(23 chromosomes)
Spermatids
(23 chromosomes)
Sperm cells
(23 chromosomes)

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Slide number: 7

Primary spermatocyte
First meiotic division
(23 chromosomes)
Secondary spermatocyte
Second meiotic division
(23 chromosomes)
Secondary spermatocyte
Spermatids
(23 chromosomes)
Sperm cells
(23 chromosomes)

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Hormonal Regulation in Males

- Hypothalamus secretes gonadotropin-releasing hormone (GnRH).
  - Stimulates anterior pituitary to secrete:
    - Follicle-stimulating hormone (FSH).
      - Promotes sperm production.
    - Luteinizing hormone (LH).
      - Controls testosterone production.
      » Testosterone is essential for reproductive organs and male secondary sex characteristics.

Hormonal Control of Testes
Female Reproductive System

- Female gonads are paired **ovaries**.
  - **Oogenesis** is the production of an egg.
  - **Ovulation** is the process of an egg bursting from an ovary and entering an oviduct.

The Genital Tract

- **Oviducts** extend from uterus to ovaries.
  - Fertilization usually occurs in **oviducts**.
    - Developing embryo arrives in the uterus after several days and implants in the lining of the uterine wall (**endometrium**).
  - Oviducts join the **uterus** at its upper end, and at the lower end the cervix enters the **vagina**.
External Genitals

- External female genital organs collectively called **vulva**.
  - Labia majora - Large skin folds.
  - Mons pubis - Prominence under pubic hair.
  - Labia minora - Small skin folds.
  - Glans clitoris - Contains erectile tissue.
Orgasm in Female

- Upon sexual stimulation, labia minora, vaginal wall, and clitoris become engorged with blood.
  - Labia majora enlarge, redden, and spread away from the vaginal opening.
  - **Clitoris** plays a significant role in female sexual response.
    - Orgasm occurs at height of sexual response.
      » Walls of uterus and oviducts rhythmically contract.
Anatomy of ovary and follicle

1. Primary follicles contain ovocyte and stage producing the sex hormone estrogen.

2. Secondary follicles contain secondary ovocytes and produce sex hormones estrogen and progesterone.

3. Granulosa (Graafian) follicle develops.

4. Ovulation. The secondary ovocyte is released.

5. Corpus luteum produces the sex hormones progesterone and some estrogen.

Oogenesis: from ovary to zygote

1. First polar body (n)
2. Primary oocyte (2n)
3. First polar body (n)
4. Secondary oocyte (n)
5. Completion of meiosis II
6. Second polar body (n)
7. Egg (n)
8. Fusion of sperm nucleus (n) and egg nucleous (n)
9. Zygote (2n)
Female Hormone Levels

- The **ovarian** cycle.
  - Development of a **vesicular follicle, ovulation**, and development of **corpus luteum**.
- Under control of FSH and LH.
  - **Follicular Phase** - FSH promotes development of an ovarian follicle.
  - **Luteal Phase** - LH promotes development of corpus luteum.
Uterine Cycle

- Twenty-eight day cycle.
  - Days 1-5 - Menstruation.
  - Days 6-13 - Proliferative phase.
  - Day 14 - Ovulation.
  - Days 15-28 - Secretory phase.

Female Hormone Levels
Fertilization and Pregnancy

• Following implantation, the placenta originates from maternal and fetal tissues.
  – Placenta produces human chorionic gonadotropin (HCG) which maintains the corpus luteum in the ovary until the placenta begins its own production of progesterone and estrogen.

Estrogen and Progesterone

• Estrogen and progesterone:
  – Foster development of reproductive organs.
  – Maintain uterine cycle.
  – Bring about female secondary sex characteristics.
• During menopause, usually between age 45 and 55, the uterine cycle ceases, and the ovaries no longer produce estrogen and progesterone.
Control of Reproduction

• Birth control methods.
  – Abstinence.
  – Birth control pills.
  – Intrauterine device.
  – Diaphragm.
  – Male condom.
  – Contraceptive implants.
  – Morning after pills.

Infertility

• Infertility is defined as the failure of a couple to achieve pregnancy after one year of regular, unprotected intercourse.
  – Estimated 15% of all couples.
    • Female causes.
      – Blocked oviducts.
      – Endometriosis.
    • Male causes.
      – Low sperm count.
      – Sperm abnormalities.
Assisted Reproductive Technologies

- Artificial Insemination by Donor (AID).
- In Vitro Fertilization (IVF).
- Gamete Intrafallopian Transfer (GIFT).
- Surrogate mothers.
- Intracytoplasmic Sperm Injection (ICSI).

Homeostasis

- Sex hormones:
  - Stimulates fat deposition.
  - Influence bone growth and density.
  - Produce growth of skeletal muscle.
  - Exert feedback control over hypothalamus.
  - Influence cardiovascular health.
Review

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