The Reproductive System & Conception (Outline)

• Structures and functions of components of the male and females reproductive systems.
• Steps of Spermatogenesis and Oogenesis
• Role of hormones in controlling the menstrual cycle.
• Events of fertilization and conception
• Common methods of contraception
• Agents of the most common sexually transmitted diseases
Human Cells

Gametes:
- sperms and eggs
- haploid

Zygote
- diploid

Somatic cells:
- body cells
- diploid

Germ cells:
- gonad cells that produce gametes
- diploid
Stages of the Human Life Cycle

• Development - the process of forming an adult from a single-celled embryo, a diploid zygote

• Gametes are haploid sex cells
  – Sperm - male
  – Oocyte – female
  – https://www.youtube.com/watch?v=_5OvgQW6FG4 (5:42 minutes)
Reproductive system components of both sexes

• Gonads-
  – One pair where gametes are formed

• Tubular structures or ducts
  – for gametes to pass through

• Secretions

• Structures for copulation (having sex/intercourse)
The Male Reproductive System

- Urinary bladder (excretory system)
- Seminal vesicle (behind bladder)
- Prostate gland
- Bulbourethral gland
- Urethra
- Scrotum
- Glans of penis
- Erectile tissue of penis
- Vas deferens
- Epididymis
- Testis
Figure 27.4B

http://www.youtube.com/watch?v=ovB0pjRXGsA

Rectum
(digestive system)

Seminal vesicle

Vas deferens

Ejaculatory duct

Prostate gland

Bulbourethral gland

Anus
(digestive system)

Testicle

Testis

Scrotum

Urethra
(excretory system)

Glans of penis

Prepuce/foreskin

Urinary bladder
(excretory system)

Pubic bone
(skeletal system)

Erectile tissue

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The Male Reproductive System

- **Gonads- testes** produce sperm and male hormones
- **Male gamete- sperm**
- **Tubular structures-**
  - **Seminiferous tubules**- in the testis where germ cells divide to form sperms
  - **Epididymis** maturation and storage of sperms
  - **Vans deferens**- duct connects to urethra

- **Glands**- Produce fluids to carry and protect sperm
  - **Seminal vesicles**-
  - **Prostate gland**-
  - **Bulbourethral gland**-

- **Penis**
The Male Reproductive System

• Glands- Produce fluids to carry and protect sperm

- **Seminal vesicles**- most of the fluid of the semen contains alkaline fluid, proteins, fructose and potassium.

- **Prostate gland**- about thirty percent of the semen: proteins and hormones aid sperm cells by providing a protective and fluid medium as they make their way through the vagina for fertilization.

- **Bulbourethral gland**- viscous pre-ejaculate mucus secretion to lubricate the urethra for spermatozoa to pass through, and to help flush out any residual urine or foreign matter
The Female Reproductive System

- Gonads- **ovaries**
- Female gamete- **Oocyte**
- Tubular structure- Oviducts, Fallopian or uterine tubes
- Muscular structure- uterus and its lining (endometrium), and cervix
- Vagina
Figure 27.3A

- Oviduct
- Ovaries
- Follicles
- Corpus luteum
- Wall of uterus
- Endometrium (lining of uterus)
- Cervix (“neck” of uterus)
- Vagina

Ovulation

https://www.youtube.com/watch?v=nLmg4wSHdxQ
The Female Reproductive System

- Released oocyte picked by the finger-like projections of Fallopian/uterine tubes.
- Fertilization occurs in the Fallopian/uterine tubes
- A sperm-fertilized oocyte continues to the uterus where it divides and develops
- An unfertilized oocyte is expelled, with the uterine-lining via the menstrual flow

• Hormones control the cycle of oocyte development
The formation of gametes (sperm and egg cells)

- **Spermatogenesis** occurs continuously in seminiferous tubules.

- **Oogenesis** occurs in the ovaries and begins before birth
Spermatogenesis

- **Spermatogenesis occurs in seminiferous tubules.**

  - **Primary spermatocytes**
    - are formed by mitosis
    - they divide by meiosis I to produce secondary spermatocytes.

  - **Secondary spermatocytes**
    - divide by meiosis II to produce round spermatids,
    - spermatids differentiate into elongate sperm, and
    - mature sperm are released into seminiferous tubules.
Developing sperm cells (haploid) 

Sperm cells (haploid) 

Mature sperm released into center of seminiferous tubule
Oogenesis

- **Oogenesis** begins before birth, diploid germ cells in each follicle begin meiosis.
  - Each month about one *primary oocyte*, present at birth arrested in prophase of meiosis I, resumes meiosis.
  - A *secondary oocyte* arrested at metaphase of meiosis II is ovulated.
  - Meiosis of the ovum is completed after fertilization.
Figure 27.5B_1

Before birth

Germ line
Diploid cell

Many Follicles

Differentiation and onset of meiosis I

Primary oocyte
(arrested in prophase of meiosis I; present at birth)

Primary oocyte within follicle

2n

4n

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Growing follicle

Mature follicle

Completion of meiosis I and onset of meiosis II

Ruptured follicle

Secondary oocyte (arrested at metaphase of meiosis II; released from ovary)

After first menstrual period, menarche

First polar body
Figure 27.5B_3

- Ovulated secondary oocyte
  - First polar body
  - Secondary oocyte (arrested at metaphase of meiosis II; released from ovary)
  - Entry of sperm triggers completion of meiosis II
  - Second polar body
  - Mature egg (ovum)

- Ruptured follicle
- Corpus luteum
- Degenerating corpus luteum
Role of Hormones in synchronizing cyclic changes in the ovary and uterus

• About every 28 days
  – Brain regions and endocrine glands
    ○ hypothalamus signals the anterior pituitary to secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH)
    ○ trigger the growth of a follicle and ovulation, the release of an oocyte.
Role of Hormones in synchronizing cyclic changes in the ovary and uterus

- After ovulation, the ovarian follicle becomes the corpus luteum.
- The corpus luteum secretes **estrogen** and **progesterone** to
  - stimulate thickening of the endometrium
  - prepare the uterus for implantation of the embryo
  - inhibit the hypothalamus, reducing FSH and LH secretion
Role of Hormones in synchronizing cyclic changes in the ovary and uterus

• If fertilization happens
  – the thickening of the endometrium is maintained and menstruation does not occur

• If fertilization doesn’t happen
  – menstruation is triggered
  – the hypothalamus and pituitary stimulate development of a new follicle
**Table 27.6**

**HORMONES OF THE OVARIAN AND MENSTRUAL CYCLES**

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Secreted by</th>
<th>Major Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Releasing hormone</td>
<td>Hypothalamus</td>
<td>Regulates secretion of LH and FSH by pituitary</td>
</tr>
<tr>
<td>Follicle-stimulating hormone</td>
<td>Pituitary</td>
<td>Stimulates growth of ovarian follicle</td>
</tr>
<tr>
<td>(FSH)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leuteinizing hormone (LH)</td>
<td>Pituitary</td>
<td>Stimulates growth of ovarian follicle and production of secondary oocyte; promotes ovulation; promotes development of corpus luteum and secretion of other hormones</td>
</tr>
<tr>
<td>Estrogen</td>
<td>Ovarian follicle</td>
<td>Low levels inhibit pituitary; high levels stimulate hypothalamus; promotes growth of endometrium</td>
</tr>
<tr>
<td>Estrogen and progesterone</td>
<td>Corpus luteum</td>
<td>Maintain endometrium; high levels inhibit hypothalamus and pituitary; sharp drops promote menstruation</td>
</tr>
</tbody>
</table>
Human Development

• Human development begins with fertilization in the oviduct.

• Cleavage produces a **blastocyst** whose
  – inner cell mass becomes the embryo and the
  – **trophoblast**, the outer cell layer, which
    • attaches to the uterine wall and
    • forms part of the **placenta**

• Gastrulation occurs and organs develop from the three embryonic layers.
Contraception & Abortion

- **Contraception** is the deliberate prevention of pregnancy.
- Several forms of contraception can prevent pregnancy, with varying degrees of success.

- **Abortion** is termination of development after implantation

“American College of Obstetricians and Gynecologists¹, and the US Department of Health and Human Services² endorse the general medical definition of pregnancy as beginning when a pre-embryo completes implantation into the lining of the uterus.”

http://www.arhp.org/publications-and-resources/clinical-fact-sheets/mifepristone-ec
<table>
<thead>
<tr>
<th>Method</th>
<th>Pregnancies per 100 Women per Year*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Used Correctly</td>
</tr>
<tr>
<td>Birth control pill (combination)</td>
<td>0.1</td>
</tr>
<tr>
<td>Vasectomy</td>
<td>0.1</td>
</tr>
<tr>
<td>Tubal ligation</td>
<td>0.2</td>
</tr>
<tr>
<td>Rhythm method</td>
<td>1–9</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>4</td>
</tr>
<tr>
<td>Condom (male)</td>
<td>3</td>
</tr>
<tr>
<td>Diaphragm and spermicide</td>
<td>6</td>
</tr>
<tr>
<td>Spermicide alone</td>
<td>6</td>
</tr>
</tbody>
</table>

*Without contraception, about 85 pregnancies would occur.
Chemical Contraception

• Morning after pill

Plan B One-Step can be used after unprotected sex to prevent pregnancy. contains a progestin hormone:

  o prevent ovulation
  o block fertilization
  o Prevents implantation in the uterus
Chemical Abortion

RU486

• STEP ONE- One drug blocks the hormone *progesterone*. Without progesterone, the lining of the *uterus* breaks down, and pregnancy cannot continue.

• STEP TWO — A second drug. It causes the uterus to empty.
# Common Sexually Transmitted Diseases

## Table 27.7: STDs Common in the United States

<table>
<thead>
<tr>
<th>Disease</th>
<th>Microbial Agent</th>
<th>Major Symptoms and Effects</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacterial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlamydia</td>
<td>Chlamydia trachomatis</td>
<td>Genital discharge, itching and/or painful urination; often no symptoms in women; pelvic inflammatory disease (PID)</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>Neisseria gonorrhoeae</td>
<td>Genital discharge; painful urination; sometimes no symptoms in women; PID</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Syphilis</td>
<td>Treponema pallidum</td>
<td>Ulcer (chancre) on genitalia in early stages; spreads throughout body and can be fatal if not treated</td>
<td>Antibiotics can cure in early stages</td>
</tr>
<tr>
<td><strong>Viral</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genital herpes</td>
<td>Herpes simplex virus type 2, occasionally type 1</td>
<td>Recurring symptoms: small blisters on genitalia, painful urination, skin inflammation; linked to cervical cancer, miscarriage, birth defects</td>
<td>Valacyclovir can prevent recurrences</td>
</tr>
<tr>
<td>Genital warts</td>
<td>Papillomaviruses</td>
<td>Painless growths on genitalia; some of the viruses linked to cancer</td>
<td>Removal by freezing</td>
</tr>
<tr>
<td>AIDS and HIV infection</td>
<td>HIV</td>
<td>See Module 24.13</td>
<td>Combination of drugs</td>
</tr>
<tr>
<td><strong>Protozoan</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trichomoniasis</td>
<td>Trichomonas vaginalis</td>
<td>Vaginal irritation, itching, and discharge; usually no symptoms in men</td>
<td>Antipathozoal drugs</td>
</tr>
<tr>
<td><strong>Fungal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Candidiasis (yeast infections)</td>
<td>Candida albicans</td>
<td>Similar to symptoms of trichomoniasis; frequently acquired nonsexually</td>
<td>Antifungal drugs</td>
</tr>
</tbody>
</table>