The Reproductive System & Conception (Outline)

• Structures and functions of components of the male and females reproductive systems.
• Steps of Spermatogenesis with 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
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
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.
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

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The Male Reproductive System

- **Gonads** - *testes* produce sperm and male hormones
- **Male gamete** - *sperm*
- **Tubular structures** -
  - *Seminiferous tubules* - germ cells divide to form sperms
  - *Epididymis* - maturation and storage of sperms
  - *Vas deferens* - duct connects to urethra
- **Glands** - Protect the sperm produce fluids to carry and protect the sperm
  - *Seminal vesicles* - most of the fluid of the semen
  - *Prostate gland* - about thirty percent of the semen
  - *Bulbourethral gland* - viscous pre-ejaculate secretion to prepare the urethra
- **Penis**
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
- Corpus luteum
- Wall of uterus
- Endometrium (lining of uterus)
- Cervix ("neck" of uterus)
- Vagina
- Uterus
- Follicles
The Female Reproductive System

- Released oocyte picked by the fingerlike projections of the uterine tubes.
- A sperm-fertilized oocyte continues to the uterus where it divides and develops
- Otherwise it 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 and
    • 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.
Figure 27.5A_2

Diploid cell

Primary spermatocyte
(diploid; in prophase of meiosis I)

Secondary spermatocyte
(haploid)

Developing sperm cells

Sperm cells
(haploid)

Differentiation and onset of meiosis I

Meiosis I completed

Meiosis II

Differentiation

Mature sperm released into center of seminiferous tubule
Oogenesis

- **Oogenesis** begins before birth when a diploid cell in each developing follicle begins meiosis.
  - Each month about one **primary oocyte** 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

Ovary

Before birth

Diploid cell

Differentiation and onset of meiosis I

Primary oocyte (arrested in prophase of meiosis I; present at birth)
Figure 27.5B_2

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)

First polar body

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

Entry of sperm triggers completion of meiosis II

Secondary oocyte

First polar body

Corpus luteum

Degenerating corpus luteum

Mature egg (ovum)
Hormones synchronize cyclic changes in the ovary and uterus

• About every 28 days
  – the hypothalamus signals the anterior pituitary to secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH)
  – which trigger the growth of a follicle and ovulation, the release of an egg.

Ovulation and the menstrual cycle

http://www.youtube.com/watch?v=WGJsrGmWeKE
<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 (FSH)</td>
<td>Pituitary</td>
<td>Stimulates growth of ovarian follicle</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>
Hormones synchronize cyclic changes in the ovary and uterus

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

• If the egg is fertilized
  – the embryo releases hormones that maintain the uterine lining and **menstruation** does not occur

• If the egg is not fertilized
  – the drop in LH shuts down the corpus luteum and its hormones
  – menstruation is triggered
  – the hypothalamus and pituitary stimulate development of a new follicle.
Control by hypothalamus

- Hypothalamus
  - Controls the anterior pituitary
  - Releasing hormone

Inhibited by combination of estrogen and progesterone

Stimulated by high levels of estrogen

Pituitary hormones in blood

- FSH
- LH

FSH stimulates follicle to grow

LH surge triggers ovulation

Ovarian cycle

- Pre-ovulatory phase
  - Growing follicle
  - Mature follicle
  - Ovulation
  - Corpus luteum
- Post-ovulatory phase
  - Degenerating corpus luteum

Estrogen secreted by growing follicle

Progesterone and estrogen secreted by remnant of follicle

Ovarian hormones in blood

- Estrogen
- Progesterone

Peak causes LH surge

Low levels of estrogen trigger menstruation

Progesterone and estrogen promote thickening of endometrium

Menstrual cycle

- Endometrium

Menstruation

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Cleavage starts after Fertilization of mature egg.

Fertilization of mature egg leads to Oviduct and Ovary.

Secondary oocyte is produced by Ovary and moves to Oviduct through Fertilization.

Cleavage starts in Oviduct and continues through Ovary.

Blastocyst forms, which implants in Uterine cavity.

Endometrium and Uterus support Blastocyst (implanted) in uterus.

Figure 27.15A–B

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Fertilization & Conception

- http://www.youtube.com/watch?NR=1&feature=fvwp&v=BFrVmDgh4v4
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
<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. It contains the hormone levonorgestrel — a progestin — which can prevent ovulation, block fertilization or keep a fertilized egg from implanting 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><em>Chlamydia trachomatis</em></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><em>Neisseria gonorrhoeae</em></td>
<td>Genital discharge; painful urination; sometimes no symptoms in women; PID</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Syphilis</td>
<td><em>Treponema pallidum</em></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><em>Herpes simplex virus type 2</em>, 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><em>Papillomaviruses</em></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><em>Trichomonas vaginalis</em></td>
<td>Vaginal irritation, itching, and discharge; usually no symptoms in men</td>
<td>Antiprotozoal drugs</td>
</tr>
<tr>
<td><strong>Fungal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Candidiasis</td>
<td><em>Candida albicans</em></td>
<td>Similar to symptoms of trichomoniasis; frequently acquired nonsexually</td>
<td>Antifungal drugs</td>
</tr>
<tr>
<td>(yeast infections)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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