Structures of the Urinary and Reproductive Systems

- **Females**
  - Urinary and reproductive systems are distinct
- **Males**
  - Urinary and reproductive systems share some components
Structures of the Urinary Systems

- **Kidneys**
  - Remove waste from the blood and excrete it in urine
  - Nephrons are the functional unit of the kidneys
    - Responsible for filtering the blood to form urine
- **Ureters** – urine travels via these to the urinary bladder
- **Urinary bladder** – stores urine until it can be eliminated
- **Urethra** – site of urine excretion

Structures of the Female Reproductive System

- **Ovaries** – site of egg production
- **Uterine tubes** – eggs travel toward the uterus through the uterine tubes
- **Uterus** – develops a blood-rich wall in preparation for pregnancy
- **Vagina** – unfertilized eggs pass through the vagina during menstruation
- **External genitalia** – includes the clitoris and labia

- Microorganisms can enter the reproductive tract through the vagina
Structures of the Male Reproductive System

- **Testes** – site of sperm production
- **Scrotum** – external structure that contains the testes
- **System of ducts** – pass sperm to the prostate gland
- **Accessory glands** – such as the prostate gland, add fluid to sperm to form semen
- **Penis** – semen passes from the penis out of the body

• Microorganisms can enter the reproductive tract through the urethra, skin of the penis
Normal Flora of the Urinary and Reproductive Systems
– Urethra
  • Supports colonization by some microorganisms
  • Primary species include *Lactobacillus* and *Staphylococcus*
– Remainder of the urinary organs are sterile
– Male reproductive system
  • The regions above the prostate are sterile
– Female reproductive system
  • The vagina is colonized by various microorganisms depending on hormone levels

Normal Flora of the Urinary and Reproductive Systems (cont.)
– Microorganisms infecting the urethra can move up to infect the kidneys
– Opportunistic and sexually transmitted microbes can infect the reproductive system

Bacterial Urinary Tract Infections
– Signs and symptoms
  • Frequent, urgent, painful urination; urine may be cloudy with foul odor
– Pathogens and virulence factors
  • Enteric bacteria are the most common cause
  • *Escherichia coli* causes most cases
  • Virulence factors include flagella and attachment fimbriae
Bacterial Urinary Tract Infections (cont.)

- **Bacterial Urinary Tract Infections**
  - Pathogenesis and epidemiology
    - Infection often occurs by self-inoculation of the urethra with fecal bacteria
    - More common in females because their shorter urethras are closer to the anus
  - Diagnosis, treatment, and prevention
    - Diagnosis based on urinalysis
    - Many cases resolve without treatment
    - Some cases require treatment with antimicrobial drugs
    - Prevent by limiting contamination by fecal microbes
**Streptococcal Acute Glomerulonephritis**

- Antigens of some group A *Streptococcus* strains are not removed from the body when they are bound to antibody.
- These antibody-antigen complexes are deposited in the glomeruli of the kidneys
  - Produce inflammation of the glomeruli and nephrons (glomerulonephritis)
  - Produce hypertension and low urine output
- Young patients usually recover but irreversible kidney damage can occur in adults.

**Example Toxic Shock Signs**

![Image of a skin rash, possibly indicating toxic shock syndrome.]

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

**Incidence of Staphylococcal Toxic Shock (tampon-related) in US**

![Graph showing the incidence of staphylococcal toxic shock in the US.](chart)

- *Food and Drug Administration* requires tampon labelling.
- *Super-absorbent tampons withdrawn.*

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.
**Bacterial Vaginosis**

- **Signs and symptoms**
  - White vaginal discharge with a “fishy” odor

- **Pathogen and virulence factors**
  - Caused by bacteria such as *Gardnerella vaginalis* and *Mycoplasma hominis*

- **Pathogenesis and epidemiology**
  - Associated with having multiple sexual partners and vaginal douching

- **Diagnosis, treatment, and prevention**
  - Diagnosed based on signs and symptoms
  - Treated with oral or vaginal metronidazole
Sexually Transmitted Diseases

- STDs are a common worldwide occurrence
- Young people who experiment with sex are at risk
- Presence of lesions from STDs is a risk factor for the transmission of HIV
- Female adolescents are at risk because the cervical lining is prone to bacterial infection
- Prevention includes abstinence or mutual monogamy
- Condoms must be used properly and consistently to provide protection

Bacterial STDs

Neisseria gonorrhoeae

Incidence of Bacterial STDs
Bacterial STD - Syphilis (Treponema pallidum)

Syphilis
- Signs and symptoms
  - Primary syphilis
    - Presence of chancre (painless, hard lesion)
  - Secondary syphilis
    - Widespread rash, sore throat, headache, mild fever, malaise, myalgia
  - Latent syphilis
    - No clinical signs
  - Tertiary syphilis
    - Gummas, dementia, blindness, paralysis, heart failure

Syphilitic Lesions
Chlamydial Infections

– Signs and symptoms
  • Females – most are asymptomatic
  • Males – painful urination, pus discharge from the penis
  • Lymphogranuloma venereum – severe form of disease characterized by a transient genital lesion and a bubo in the groin

– Pathogens and virulence factors
  • *Chlamydia trachomatis*
    – Developmental cycle
      » Elementary bodies – infective form
      » Reticulate bodies – reproductive form
Chlamydial Infection (cont.)
- Pathogenesis
  - Enter body through abrasions or lacerations and infect cells of the conjunctiva or cells lining various mucous membranes
  - Chlamydial infection in adolescence is associated with increased risk of cervical cancer
- Epidemiology
  - Most common reportable STD in the U.S.
- Diagnosis, treatment, and prevention
  - Diagnosed by demonstration of chlamydial DNA following PCR amplification
  - Treatment is with antimicrobial drugs
  - Prevented by abstinence or mutual monogamy

Chancroid
- Signs and symptoms
  - Soft chancres (ulcers), pain upon urination in women
- Pathogens and virulence factors
  - Caused by Haemophilus ducreyi
  - Produces a toxin that kills epithelial cells
- Pathogenesis and epidemiology
  - Rare in Europe and the Americas
- Diagnosis, treatment, and prevention
  - Treated with antimicrobial drugs
  - Prevented by abstinence or mutual monogamy

Chancroid Lesion
(\textit{Haemophilus ducreyi} soft chancre)
Viral STDs

• Genital Herpes
  – Signs and symptoms
    • Small blisters on or around the genitals or rectum
  – Pathogen and virulence factors
    • Herpes simplex viruses type 2 (main cause) and type 1
    • Virus can become latent in nerve cells
  – Pathogenesis
    • Herpesvirus kills epithelial cells at infection site
    • Blisters may form at sites far removed from initial infection site

Viral STD- Genital Herpes
(usually HHV-2)

Sites for Genital Herpes
Infections & Latency

Trigeminal (V) nerve ganglion
(sites of viral latency)

Ophthalmic branch

Ocular herpes

Maxillary branch

Fever blisters

Buccal ganglia
(sites of viral latency)

Genital herpes

Sacral ganglia
(sites of viral latency)
Viral STDs

- **Genital Herpes**
  - Epidemiology
    - Genital herpes quadruples the risk of HIV infection
  - Diagnosis, treatment, and prevention
    - Diagnosis made based on characteristic lesions
    - Treatment requires administration of acyclovir or other antiviral agents to lessen symptoms
    - Prevention can be achieved through abstinence or mutual monogamy
    - Condoms often provide little protection
Protozoan STDs

- Trichomoniasis
  - Signs and symptoms
    - Females – foul-smelling, yellow-green vaginal discharge and vaginal irritation
    - Males – typically asymptomatic
  - Pathogen and virulence factors
    - Trichomonas vaginalis
  - Pathogenesis and epidemiology
    - Transmission primarily via sexual intercourse
    - Most common curable STD in women
    - Individuals with multiple sex partners or infected with other venereal diseases are at higher risk for the disease
Protozoan STDs

• Trichomoniasis
  – Diagnosis, treatment, and prevention
  • Diagnosis made based on presence of *Trichomonas* in secretions of the vagina, urethra, or prostate
  • Treated with a single dose of oral metronidazole
  • Prevention requires refraining from sexual intercourse with infected persons