

Microbial Diseases of the Urinary and Reproductive Systems

Microbiology
CCV
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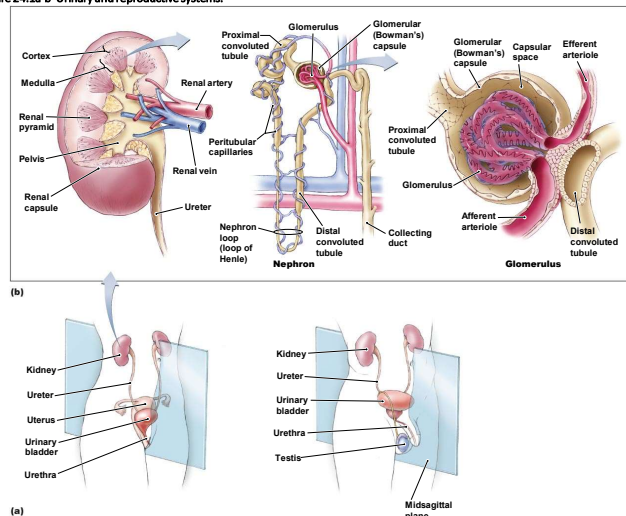
Structures of the Urinary and Reproductive Systems

• Structures of the Urinary System

- Kidneys remove waste from the blood and excrete it in urine
 - Nephrons are the functional unit of the kidneys
 - Filter the blood to form urine
- Ureters carry urine to the urinary bladder
- The urinary bladder stores urine until it can be eliminated
- Urine is excreted via the urethra

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Figure 24.1a-b Urinary and reproductive systems.



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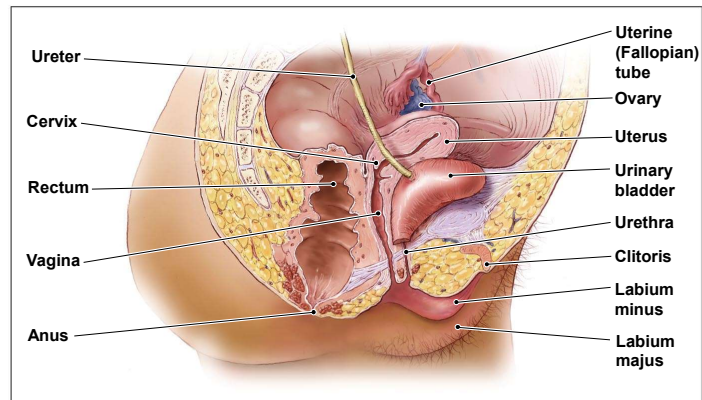
Structures of the Urinary and Reproductive Systems

• Structures of the Reproductive System

- Structures of the female reproductive system
 - Ovaries
 - Uterine tubes
 - Uterus
 - Vagina
 - External genitalia
- Microorganisms enter through the vagina

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Figure 24.1c Urinary and reproductive systems.



(c)

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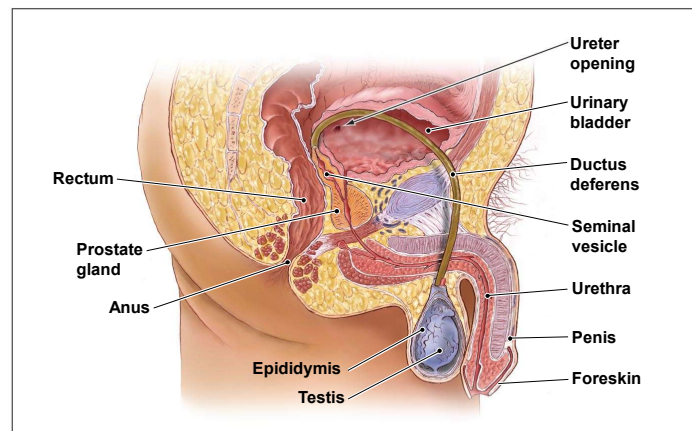
Structures of the Urinary and Reproductive Systems

• Structures of the Reproductive System

- Structures of the male reproductive system
 - Testes
 - Scrotum
 - System of ducts
 - Accessory glands
 - Penis
- Microorganisms enter through the urethra and skin of the penis

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Figure 24.1d Urinary and reproductive systems.



(d)

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Structures of the Urinary and Reproductive Systems

• Normal Microbiota of the Urinary and Reproductive Systems

- Urinary system
 - Urethra supports colonization by some microorganisms
 - Include *Lactobacillus* and *Staphylococcus*
 - The other urinary organs are sterile
- Male reproductive system
 - Regions above the prostate are sterile
- Female reproductive system
 - The vagina is colonized by various microorganisms, depending on hormone levels

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Structures of the Urinary and Reproductive Systems

• Normal Microbiota of the Urinary and Reproductive Systems

- Microorganisms in the urethra can move up to infect the kidneys
- Opportunistic and sexually transmitted microbes can infect the reproductive system

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Bacterial Diseases of the Urinary Systems

• 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

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Bacterial Diseases of the Urinary Systems

• Bacterial Urinary Tract Infections

- Pathogenesis and epidemiology
 - Often results when fecal bacteria is self-inoculated into urethra
 - More common in females
- Diagnosis, treatment, and prevention
 - Diagnosis is based on urinalysis
 - Many cases resolve without treatment
 - Some treated with antimicrobial drugs
 - Prevented by limiting contamination by fecal microbes

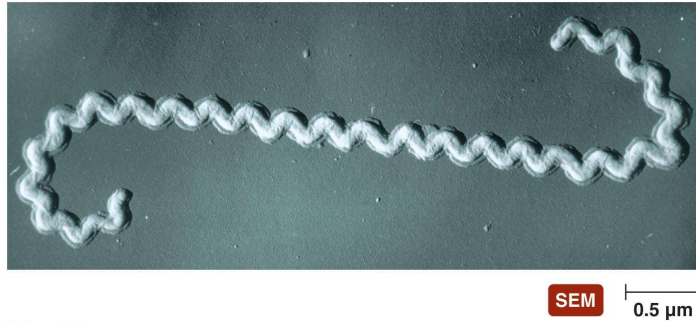
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Bacterial Diseases of the Urinary Systems

• Leptospirosis

- Zoonotic disease seen primarily in animals
- Signs and symptoms
 - Abrupt fever, myalgia, muscle stiffness, and headache
 - Rarely fatal
- Pathogen
 - Caused by *Leptospira interrogans*
 - Normally lives in many wild and domestic animals
 - Virulent strains make adhesins, are motile, and can evade complement activity

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Figure 24.2 *Leptospira interrogans*.

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Bacterial Diseases of the Urinary Systems

• Leptospirosis

- Pathogenesis
 - Transmitted by contact with urine of infected animal or urine-contaminated water
 - Spirochete travels via the bloodstream through the body
- Epidemiology
 - Occurs throughout world but rare in the U.S.
- Diagnosis, treatment, and prevention
 - Diagnosis is based on antibody test
 - Treated with antimicrobial drugs
 - Prevented by avoiding contaminated water

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Bacterial Diseases of the Urinary Systems

• Streptococcal Acute Glomerulonephritis

- Some antibody-antigen complexes against group A streptococci strains are not removed from the body
- Complexes are deposited in the glomeruli of the kidneys
 - Cause inflammation of the glomeruli and nephrons
 - Produce hypertension and low urine output
- Irreversible kidney damage can occur in adults

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Nonvenereal Diseases of the Reproductive Systems

• Staphylococcal Toxic Shock Syndrome

- Signs and symptoms
 - Sudden-onset fever, chills, vomiting, diarrhea, low blood pressure, confusion, and severe red rash
 - Individuals go into shock if untreated
- Pathogen and virulence factors
 - Caused by some strains of *S. aureus*
 - These strains produce toxic shock syndrome toxin
 - Cause excessive cytokine production by T cells

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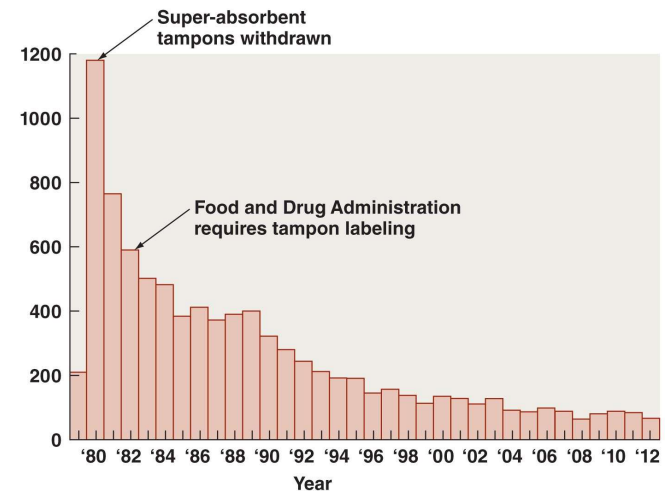
Nonvenereal Diseases of the Reproductive Systems

• Staphylococcal Toxic Shock Syndrome

- Pathogenesis and epidemiology
 - Absorption of toxin into blood triggers toxic shock syndrome
 - Most cases occur in menstruating females
- Diagnosis, treatment, and prevention
 - Diagnosis is based on signs and symptoms
 - Considered medical emergency
 - Requires removal of foreign material and antimicrobial drugs
 - Avoiding tampons or using less absorbent tampons reduces risk

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Figure 24.3 The incidence of staphylococcal toxic shock syndrome in the United States, 1979–2012.



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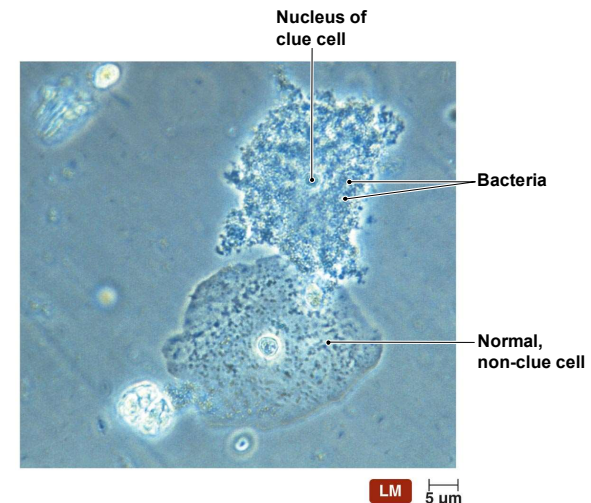
Nonvenereal Diseases of the Reproductive Systems

• Bacterial Vaginosis

- Signs and symptoms
 - White vaginal discharge with a "fishy" odor
- Pathogen and virulence factors
 - Caused by various anaerobic bacteria
- Pathogenesis and epidemiology
 - Associated with multiple sexual partners and vaginal douching
- Diagnosis, treatment, and prevention
 - Diagnosed is based on signs and symptoms
 - Treated with oral or vaginal metronidazole

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Figure 24.4 Clue cell.



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Nonvenereal Diseases of the Reproductive Systems

• Vaginal Candidiasis

- Signs and symptoms
 - Severe vaginal itching and burning
- Pathogen and virulence factors
 - Most commonly caused by *Candida albicans*
 - Normal microbiota of skin and mucous membranes

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Nonvenereal Diseases of the Reproductive Systems

• Vaginal Candidiasis

- Pathogenesis and epidemiology
 - *Candida* overgrows if vaginal pH becomes alkaline or normal microbial populations are reduced
 - Can become systemic in immunocompromised people
- Diagnosis, treatment, and prevention
 - Identification of *Candida* in presence of symptoms is diagnostic
 - Treated with azole or fluconazole
 - Avoiding excessive use of antibacterial drugs can prevent candidiasis

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Sexually Transmitted Infections (STIs) and Diseases (STDs)

- STIs occur from the sexual transmission of potential pathogens
 - Resulting disease is an STD
- STDs are common worldwide
- Young people who experiment with sex are at risk
- Presence of lesions from STDs is a risk factor for transmission of HIV
- Female adolescents are at risk because the cervical lining is prone to bacterial infection
 - Can cause pelvic inflammatory disease

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Sexually Transmitted Infections (STIs) and Diseases (STDs)

- Prevention includes abstinence or mutual monogamy
- Condoms must be used properly and consistently to provide protection

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Bacterial STDs

• Gonorrhea

- Signs and symptoms
 - Men experience painful urination and a purulent discharge
 - Women are often asymptomatic
 - Pelvic inflammatory disease may develop
- Pathogen and virulence factors
 - Caused by *Neisseria gonorrhoeae*
 - Virulence factors include fimbriae, capsule, and endotoxin

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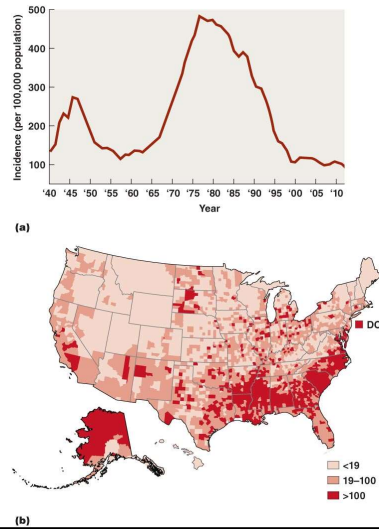
Bacterial STDs

• Gonorrhea

- Pathogenesis
 - Bacteria attach to epithelial cells of the mucous membranes
 - Infections outside the reproductive tract also occur
 - Babies delivered vaginally by infected mothers can become infected
- Epidemiology
 - Gonorrhea occurs only in humans
 - Cases in the U.S. have been declining
 - Risk increases with frequency of sexual encounters

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Figure 24.5 The incidence of civilian gonorrhea in the United States.



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Bacterial STDs

• Gonorrhea

- Diagnosis, treatment, and prevention
 - Genetic probes are used to diagnose asymptomatic infection
 - Treated with broad-spectrum cephalosporin
 - Spread of gonococcal strains resistant to many antimicrobials has complicated treatment
 - Prevented with safe sex practices

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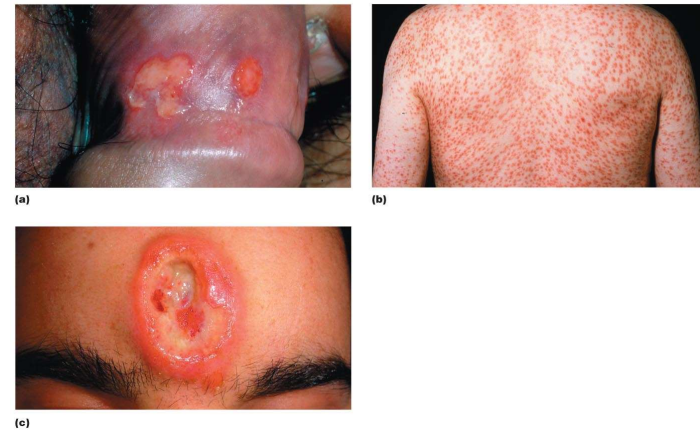
Bacterial STDs

• Syphilis

- Signs and symptoms
 - Four phases of syphilis
 - Primary syphilis
 - Secondary syphilis
 - Latent syphilis
 - Tertiary syphilis

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Figure 24.6 The lesions of syphilis.



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Bacterial STDs

• Syphilis

- Pathogen and virulence factors
 - *Treponema pallidum* causes syphilis
 - Lives only in humans
 - Virulence factors have been difficult to identify
- Pathogenesis
 - Transmitted mostly via sexual contact
 - Sometimes transmitted from mother to child
 - Most individuals do not develop tertiary syphilis

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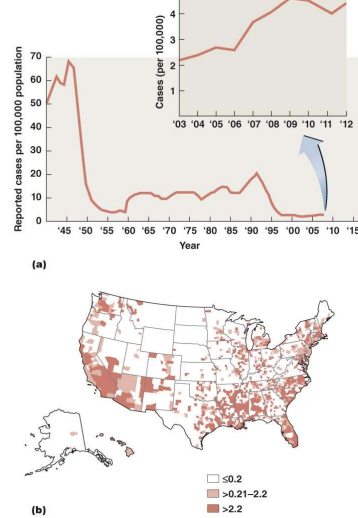
Bacterial STDs

• Syphilis

- Epidemiology
 - Syphilis occurs worldwide
 - Endemic among sex workers, men who have sex with men, and users of illegal drugs
- Diagnosis, treatment, and prevention
 - Antibody test is used to diagnose primary, secondary, and congenital syphilis
 - Tertiary syphilis is difficult to diagnose
 - Penicillin G is used to treat all but tertiary syphilis
 - Prevented with safe sex practices

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Figure 24.7 The Incidence of syphilis in the United States.



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Bacterial STDs

• Chlamydial Infections

- Signs and symptoms
 - Women are usually asymptomatic
 - Men have painful urination and pus discharge from penis
- Causes numerous diseases
 - Epididymitis: inflammation of the epididymis
 - Orchitis: inflammation of the testes
 - Trachoma: disease of the eye
 - Lymphogranuloma venereum: formation of a genital lesion and bubo in the groin

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Figure 24.8 An advanced case of lymphogranuloma venereum in a man.



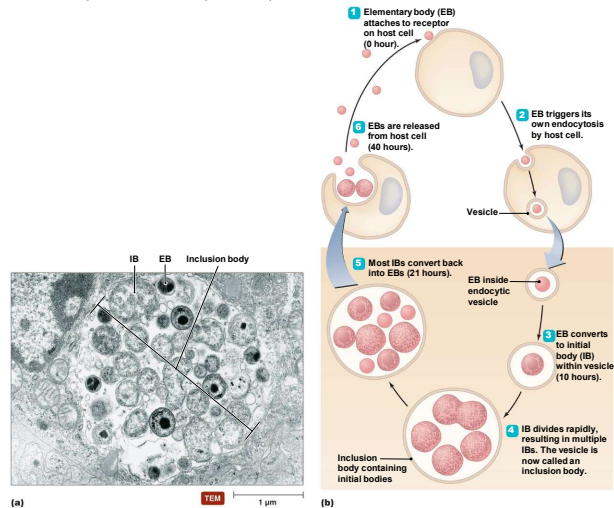
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Bacterial STDs

• Chlamydial Infections

- Pathogens and virulence factors
 - Caused by *Chlamydia trachomatis*
 - All strains but one are pathogens of humans
 - Grow only within vesicles inside host cells
- Developmental cycle
 - Elementary bodies are the infective form
 - Reticulate bodies are the reproductive form

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Figure 24.9 The developmental forms and life cycle of *Chlamydia*.

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Bacterial STDs

• Chlamydial Infections

- Pathogenesis
 - Microbes enter body through scrapes or cuts
 - Infect conjunctiva or cells lining mucous membranes
 - Spread to the lymphatic system causes proctitis
 - Adolescent infection increases cervical cancer risk
- Epidemiology
 - Most common reportable STD in the U.S.
 - Eye infections endemic in poor, crowded areas
- Diagnosis, treatment, and prevention
 - Detection of chlamydial DNA by PCR is diagnostic
 - Treated with antimicrobial drugs
 - Prevented by abstinence or mutual monogamy

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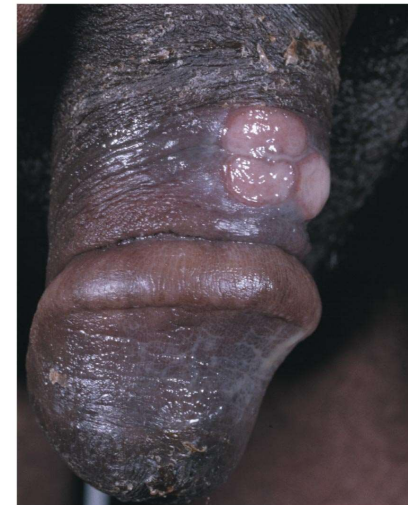
Bacterial STDs

• Chancroid

- Signs and symptoms
 - Soft chancres; in women, pain upon urination
- Pathogen and virulence factors
 - Caused by *Haemophilus ducreyi*
 - Produces a toxin that kills epithelial cells
- Pathogenesis and epidemiology
 - Most cases in the U.S. are due to foreign travel
- Diagnosis, treatment, and prevention
 - Diagnosis based on presence of lesion and buboes
 - Treated with antimicrobial drugs
 - Prevented by abstinence or mutual monogamy

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Figure 24.10 Soft chancres of chancroid.



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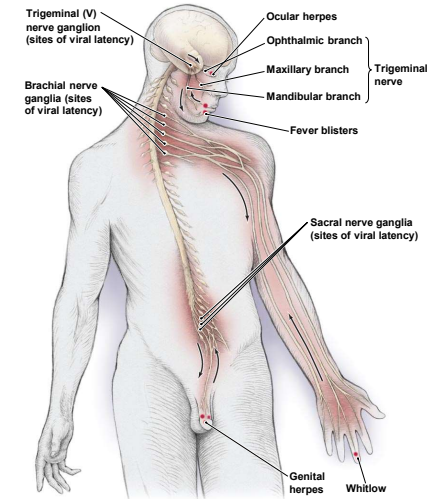
Viral STDs

• Genital Herpes

- Signs and symptoms
 - Small blisters on or around the genitals or rectum
- Pathogen and virulence factors
 - *Human herpesvirus 2* causes most cases
 - *Human herpesvirus 1* causes remainder of cases
 - Virus can become latent in nerve cells
- Pathogenesis
 - Herpesvirus kills epithelial cells at infection site
 - Blisters may form at sites far from initial infection
 - Babies can become infected during birth

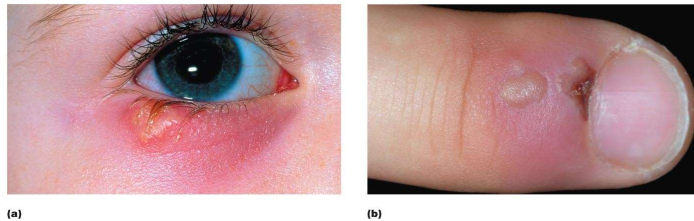
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Figure 24.11 Sites of events in genital herpesvirus infections.



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Figure 24.12 Herpes lesions of the eyes and skin.



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Viral STDs

• Genital Herpes

- Epidemiology
 - Genital herpes quadruples the risk of HIV infection
- Diagnosis, treatment, and prevention
 - Diagnosis is based on characteristic lesions
 - Acyclovir or other antiviral agents can lessen symptoms
 - Circumcised males are at lower risk of infection
 - Condoms often provide little protection
 - Infected pregnant women should deliver by C-section

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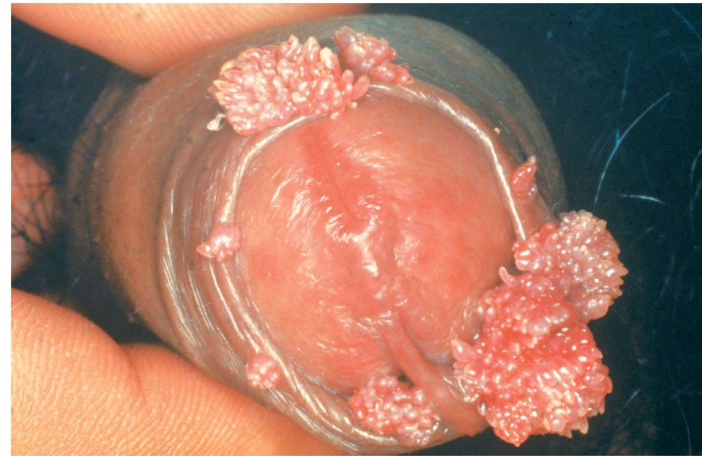
Viral STDs

• Genital Warts

- Signs and symptoms
 - Warts on the genitalia and surrounding areas
 - Large growths called condylomata acuminata may form
- Pathogens
 - Caused by human papillomaviruses (HPV)
 - Viral proteins can trigger cancer

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Figure 24.13 Genital warts.



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Viral STDs

• Genital Warts

- Pathogenesis and epidemiology
 - HPVs invade skin or mucous membranes during sex
 - Most common STD in the U.S.
- Diagnosis, treatment, and prevention
 - Diagnosis is made by presence of warts
 - Variety of methods available to remove warts
 - Vaccine is available against HPV strain associated with cervical cancer

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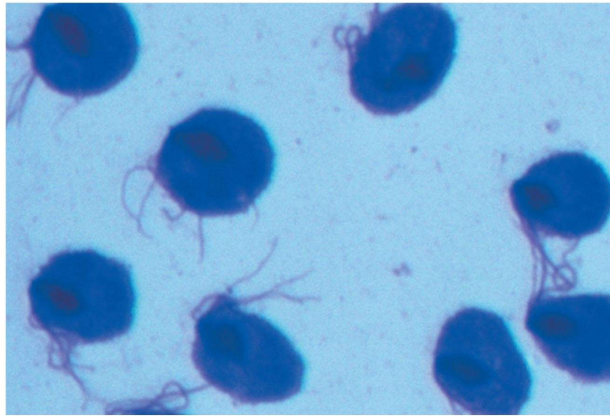
Protozoan STDs

• Trichomoniasis

- Signs and symptoms
 - Females have vaginal discharge and irritation
 - Males are typically asymptomatic
- Pathogen and virulence factors
 - Caused by *Trichomonas vaginalis*
- Pathogenesis and epidemiology
 - Transmitted primarily via sexual intercourse
 - Most common curable STD in women
 - Trichomoniasis increases risk of infection by HIV
 - Various virulence factors contribute to disease

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Disease at a Glance 24.8



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Protozoan STDs

- **Trichomoniasis**

- Diagnosis, treatment, and prevention
 - Diagnosed by presence of *Trichomonas* in clinical samples
 - Treated with a single dose of oral metronidazole
 - Prevented by avoiding sexual intercourse with infected persons

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