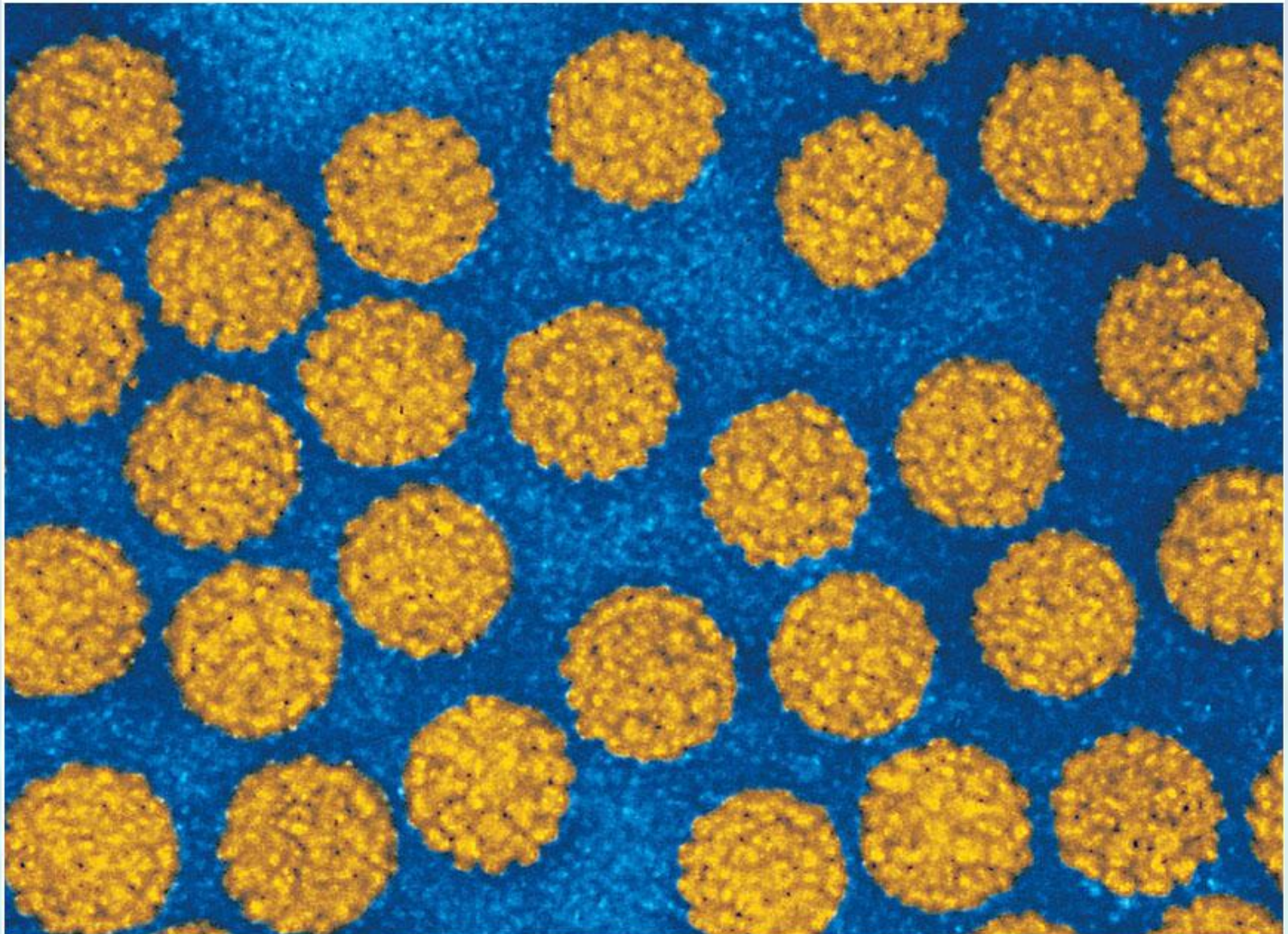


# **Genitourinary Infections**

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# Genitourinary Infections

- Infections of reproductive and urinary system are common
- Urinary infections most common
  - Chief source of fatal nosocomial infections
- United States leads industrialized nations in reported incidence of sexually transmitted diseases (STD)
  - Approximately 1 million unintended pregnancies occur among estimated 12 million college and university students
- Only 15% have never engaged in sex
  - 35% of remaining have had 6 or more partners

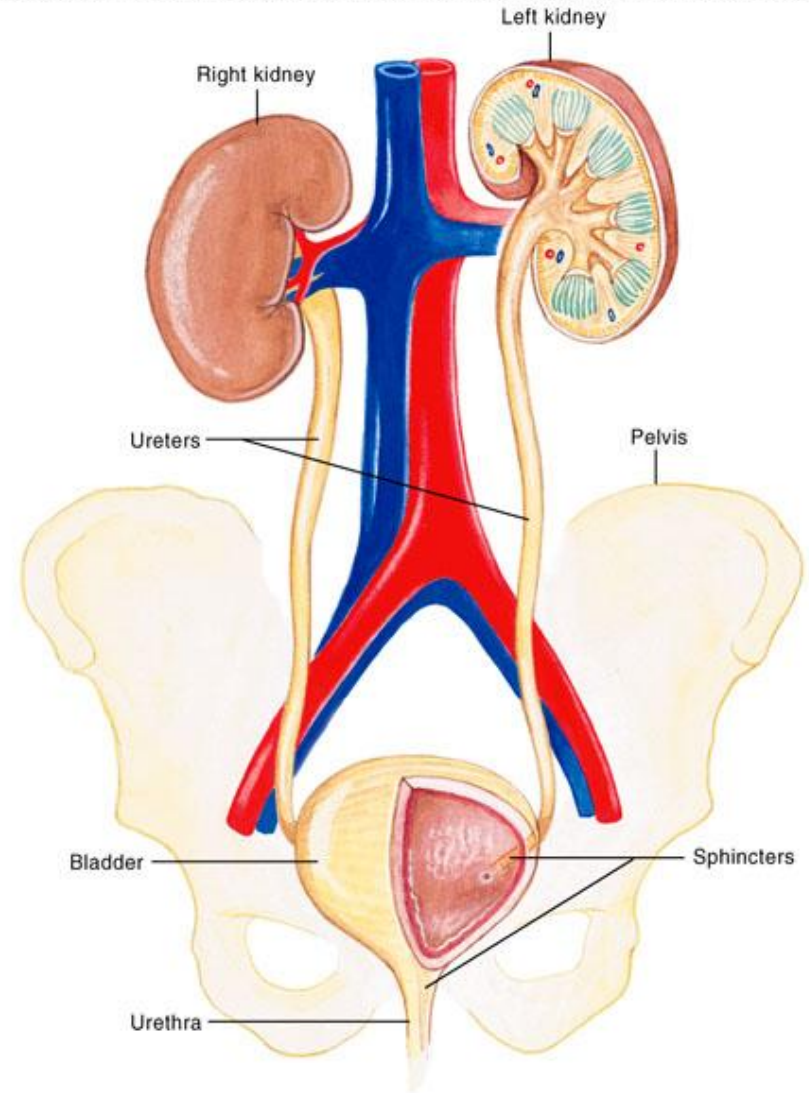
# Normal Microbiota of Genitourinary System

- Normally urine and urinary tract above bladder entrance free of microorganisms
  - Lower urethra contains normal resident flora
    - Species include *Lactobacillus*, *Staphylococcus*, *Corynebacterium* and *Streptococcus*
- Normal flora and resistance to infection varies in female genital tract
  - Depends considerably on hormonal status

# Urinary System Infections

- Urinary tract infections (UTI) account for around 7 million doctor visits annually in United States
  - May include any or all of the organs of the urinary system
  - Any situation interfering with urine flow increases risk of infection

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# Bacterial Cystitis

- Symptoms
  - Abrupt onset
  - Burning pain on urination
  - Urgent sensation to void
  - Cloudy urine
  - Odor
  - May have pale red color
    - Due to presence of blood
  - Tenderness

# Bacterial Cystitis

- Some cases asymptomatic
  - Especially among children and elderly
  - Complications include pyelonephritis
    - Infection of the kidney
    - Characterized by
      - Sudden elevation of temperature
      - Chills
      - Vomiting
      - Back pain
      - Tenderness overlying kidney

# Bacterial Cystitis

- Causative Agent
  - Infection usually originates from normal intestinal flora
    - *E. coli* most common cause
      - Accounts for 80% to 90% of cases in women
      - 70% of all bladder infection cases
    - Long standing catheterization often accounts for chronic infections
      - Often with multiple species of intestinal flora
- Pathogenesis
  - Organisms reach bladder by ascending from urethra
  - Bacteria attach to receptors on bladder lining
    - Cells die and slough off
      - Bacteria penetrate new cells through endocytosis
  - Pyelonephritis occurs when bacteria ascend ureters and cause damage to kidneys



# Bacterial Cystitis

- Epidemiology
  - Approximately 30% of women develop cystitis during lifetime
  - Factors involved in infection include
    - Relatively short urethra
      - Aids in colonization through fecal contamination
    - Sexual intercourse
      - Introduces bacteria from urethra into urinary bladder
    - Use of diaphragm as contraception
      - Impedes flow of urine

# Bacterial Cystitis

- Epidemiology
  - Infections unusual in men
    - UTI occur generally after age 50
      - Associated with enlargement of prostate
  - Catheterization increases risk
    - Colonization of bacteria on catheter make killing organisms nearly impossible
      - 500,000 hospitalized patients develop bladder infections from catheterization

# Bacterial Cystitis

- Prevention
  - Take in enough fluid to ensure voiding
    - Void at least four or five times per day
  - Void immediately after sexual intercourse
  - Wiping front to back
    - Avoid contamination with fecal matter
- Treatment
  - Antimicrobial therapy with appropriate antibiotic

**TABLE 26.1****Bacterial Cystitis**

<b>Symptoms</b>	Abrupt onset, burning pain on urination, urgency, frequency, foul smell, red-colored urine; with pyelonephritis, fever, chills, back pain, and vomiting
<b>Incubation period</b>	Usually 1 to 3 days
<b>Causative agents</b>	Most due to <i>Escherichia coli</i> ; other enterobacteria, <i>Staphylococcus saprophyticus</i> cause some cases; nosocomial infections with antibiotic-resistant strains of <i>Pseudomonas</i> , <i>Serratia</i> , and <i>Enterococcus</i> genera
<b>Pathogenesis</b>	Usually, bacteria ascend the urethra, enter the bladder, and attach by pili to receptors on urinary tract epithelium. Sloughing of cells and an inflammatory response ensue. Spread to the kidneys can occur via the ureters, causing pyelonephritis and potential kidney failure.
<b>Epidemiology</b>	Bacterial cystitis is common in women, promoted by a relatively short urethra, use of a diaphragm, and sexual intercourse. Middle-aged men are prone to infection because enlargement of the prostate gland partially obstructs their urethra. Placement of a bladder catheter commonly results in infection.
<b>Prevention and treatment</b>	Taking sufficient fluid to void urine at least four to five times daily, wiping from front to back. Single dose of antimicrobial medication with sexual intercourse may help prevent bacterial cystitis in women. Short-term antimicrobial therapy usually sufficient. Longer treatment for pyelonephritis.

# Bacterial Vaginosis

- Causative Agent - *Gardnerella vaginalis*
- Symptoms
  - Thin, grayish-white vaginal discharge
    - Can be slightly bubbly
  - Pungent 'fishy' odor
    - Odor more distressing than vaginal discharge
  - 50% asymptomatic

# Bacterial Vaginosis

- Pathogenesis
  - Key changes include
    - Decrease in vaginal acidity
    - Derangement of normal vaginal flora
      - Increase in less common flora
      - Decrease in more common flora
    - Increased number of slough vaginal cells
      - Called “clue cells”
    - Strong odor due to metabolic products produced by vaginal anaerobes

# Bacterial Vaginosis

- Epidemiology
  - Epidemiology incomplete
    - Due to lack of causative agent
  - Disease most common among sexually active women
    - Has occurred in children that have been sexually abused
    - Sexual promiscuity increases risk
- Prevention and Treatment
  - No proven prevention
  - Treatment of male sexual partners does not prevent recurrences
  - Metronidazole effective treatment

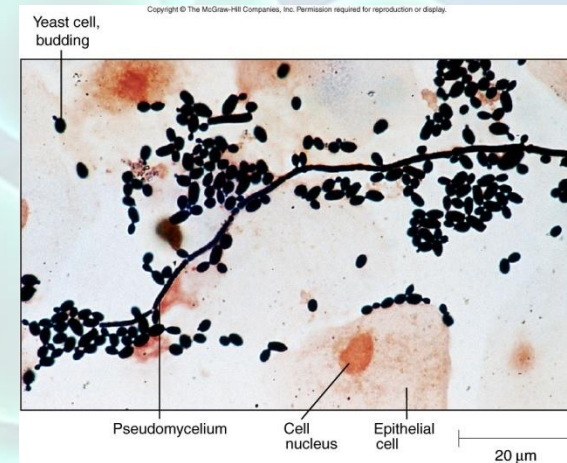
**TABLE 26.3****Bacterial Vaginosis**

<b>Symptoms</b>	Gray-white vaginal discharge and unpleasant fishy odor
<b>Incubation period</b>	Unknown
<b>Causative agent</b>	Unknown
<b>Pathogenesis</b>	Uncertain. Marked distortion of the normal microbiota. Increased sloughing of vaginal epithelium in the absence of inflammation. Odor due to metabolic products of anaerobic bacteria. Association with complications of pregnancy, including premature births.
<b>Epidemiology</b>	Associated with many sexual partners or a new partner, but can occur in the absence of sexual intercourse. Probably not a sexually transmitted disease.
<b>Prevention and treatment</b>	No proven preventive measures. Treatment with metronidazole is effective.



# Vulvovaginal Candidiasis

- Symptoms
  - Most common symptoms include
    - Itching
    - Burning
    - Scant vaginal discharge
      - White in curd-like clumps
    - Involved area usually red and swollen



- Causative Agent
  - *Candida albicans*
    - Part of normal flora in approximately 35% of women

# Vulvovaginal Candidiasis

- Pathogenesis
  - Normally causes no symptoms
    - Due to balance between organism and normal vaginal flora
  - When balance upset fungi multiply without restraint
    - Cause inflammatory response and symptoms
- Epidemiology
  - Disease not spread person to person
    - Generally not sexually transmitted
  - Antibacterial medications increase risk of disease
    - Increase duration of treatment

# Vulvovaginal Candidiasis

- Prevention and Treatment
  - Prevention directed at minimizing use and duration of antibiotic therapy
  - Intravaginal treatment with antifungal medication usually effective
    - Nystatin and clotrimazole most effective
    - Fluconazole given by mouth usually effective
      - 1 out of 7 suffer side effects

**TABLE 26.4****Vulvovaginal Candidiasis**

<b>Symptoms</b>	Itching, burning, thick white vaginal discharge, redness and swelling
<b>Incubation period</b>	Usually unknown. Generally 3 to 10 days when associated with antibacterial medications
<b>Causative agent</b>	<i>Candida albicans</i> , a yeast
<b>Pathogenesis</b>	Inflammatory response to overgrowth of the yeast, which is often present among the normal microbiota. Associated with antibacterial therapy, use of oral contraceptives, pregnancy, and uncontrolled diabetes, but most cases have no identifiable predisposing factor.
<b>Epidemiology</b>	Not contagious. Usually not sexually transmitted.
<b>Prevention and treatment</b>	No proven preventive measures. Intravaginal antifungal medications such as clotrimazole usually effective.

# Staphylococcal Toxic Shock

- Symptoms
  - Characterized sudden onset of symptoms including
    - Headache
    - High temperature
    - Muscle aches
    - Blood shot eyes
    - Vomiting
    - Diarrhea
    - Sunburn like rash
    - Confusion
  - Without treatment symptoms also include
    - Dropping blood pressure
    - Kidney failure
    - Death

# Staphylococcal Toxic Shock

- Causative Agent
  - *Staphylococcus aureus*
    - Produces one or more exotoxins
- Pathogenesis
  - Disease results from toxin absorption into bloodstream
    - Vaginal abrasion probably aids in absorption
  - Toxins cause massive release of cytokines
    - Cytokines cause drop in blood pressure and kidney failure

# Staphylococcal Toxic Shock

- Epidemiology
  - Can occur after infection with toxin producing *Staphylococcus aureus*
  - Does not spread person-to-person
  - Can occur after infected surgical wounds
  - Use of tampons increases risk
    - Higher absorbency increase risk
    - Most menstruating associated cases are women under 30

## **TABLE 26.6** Symptoms that Suggest STD

1. Abnormal discharge from the vagina or penis
2. Pain or burning sensation with urination
3. Sore or blister, painful or not, on the genitals or nearby; swellings in the groin
4. Abnormal vaginal bleeding or unusually severe menstrual cramps
5. Itching in the vaginal or rectal area
6. Pain in the lower abdomen in women; pain during sexual intercourse
7. Skin rash or mouth lesions



# Staphylococcal Toxic Shock

- Epidemiology
  - Recovery does not consistently infer immunity
    - 30% will suffer relapse
      - Relapse usually milder
  - There is a slow steady decline in incidence
    - Incidence estimated 2/100,000 menstruating women per year
    - Prevalence of non-menstruating toxic shock increasing

# Staphylococcal Toxic Shock

- Prevention and Treatment
  - Decline in incidence credited to better understanding of tampon use
  - Withdrawing from use of higher absorbency tampons
  - Tampon-associated infection can be minimized by
    - Washing hands
    - Using lowest absorbency practical
    - Change tampon every 6 hours
      - Wear pad to bed
    - Avoid trauma when inserting
    - Know and understand symptoms
    - Don't use tampons if recovered from TSS

# Staphylococcal Toxic Shock

- Prevention and Treatment
  - TSS can be treated with anti-staphylococcal medications, intravenous fluid
  - Prevention measures should be taken to prevent shock and kidney damage
  - Most recover in 2 to 3 weeks
    - Mortality rate is approximately 3%

**TABLE 26.5****Staphylococcal Toxic Shock Syndrome**

<b>Symptoms</b>	Fever, vomiting, diarrhea, muscle aches, low blood pressure, and a rash that peels
<b>Incubation period</b>	3 to 7 days
<b>Causative agent</b>	<i>Staphylococcus aureus</i> , certain toxin-producing strains
<b>Pathogenesis</b>	Toxin (TSST-1 and others) produced by certain strains of <i>S. aureus</i> ; toxins are superantigens, causing cytokine release and drop in blood pressure.
<b>Epidemiology</b>	Associated with certain high-absorbency tampons, leaving tampons in place for long periods of time, and abrasion of the vagina from tampon use. Also as a result of infection by certain toxin-producing <i>S. aureus</i> strains in other parts of the body.
<b>Prevention and treatment</b>	Awareness of symptoms. Prompt treatment of <i>S. aureus</i> infections; frequent change of tampons by menstruating women. Antimicrobial medication effective against the causative <i>S. aureus</i> strain; intravenous fluids.

**TABLE 26.7** Common Sexually Transmitted Diseases

Disease	Cause	Comment
<b>Bacterial</b>		
Gonorrhea (“clap”)	<i>Neisseria gonorrhoeae</i>	Average reported cases per year—340,000. True incidence much higher.
Chlamydial infections	<i>Chlamydia trachomatis</i>	Average reported cases per year—800,000. True incidence much higher.
Syphilis	<i>Treponema pallidum</i>	Average reported cases (primary and secondary) per year—6,600.
Chancroid	<i>Haemophilis ducreyi</i>	Average reported cases per year—50. True incidence much higher.
<b>Viral</b>		
Genital herpes simplex	Herpes simplex virus (HSV)	Not reportable. Estimated 45 million Americans infected; about 85% HSV, type 2.
Papillomavirus infections	Human papillomavirus (HPV)	Not reportable. Estimated 40 million Americans infected.
AIDS	Human immunodeficiency virus (HIV)	Average reported cases per year—40,000.
<b>Protozoal</b>		
Trichomoniasis (“trich”)	<i>Trichomona vaginalis</i>	Not reportable. Estimated 5 million Americans infected per year.

# Gonorrhea

- Symptoms
  - Incubation period 2 to 5 days post exposure
  - Asymptomatic infection can occur on both sexes



# Gonorrhoea

## Symptoms

- In men symptoms characterized as urethritis with
  - Pain on urination
  - Discharge from penis
- In women symptoms are
  - Painful urination
  - Mild discharge
    - May be overlooked
    - Women more likely to be asymptomatic carriers

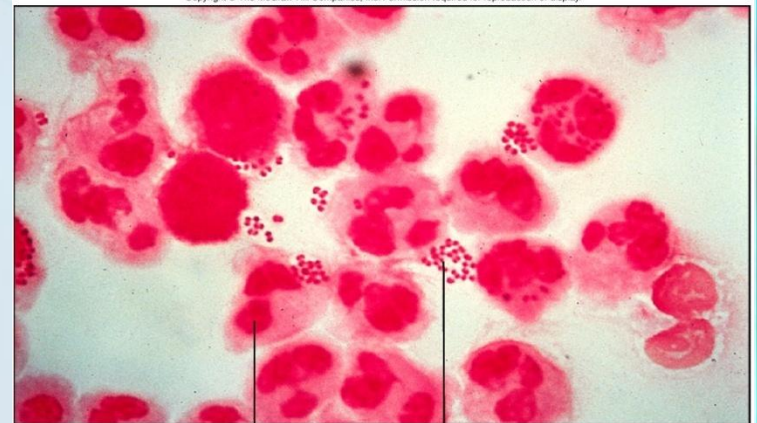
# Gonorrhea

- Causative Agent

- *Neisseria gonorrhoeae*

- Typically found on or in leukocytes in urethral pus
- Infect only humans
- Most strains do not survive well outside host
- Transmitted primarily via intimate sexual contact
- Increasing number of strains resistant to antibiotics

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White blood cell

*Neisseria gonorrhoeae*

15 μm



# Gonorrhea

- Pathogenesis
  - Attach to non-ciliated epithelial cells via pili
    - Particularly of the urethra, uterine cervix pharynx and conjunctiva
    - Bacterial proteins bind CD4 lymphocytes
      - Prevents activation of immune response
  - Antigenic variation allows escape from antibody
    - Variation interferes with ability to make effective vaccine
  - Untreated disease in men can lead to complications including
    - Urinary tract infections
    - Orchitis
    - Sterility

# Gonorrhea

- Pathogenesis
  - In women disease follows different course
    - Organism thrives in cervix and fallopian tubes
    - 15% to 30% of untreated women develop pelvic inflammatory disease (PID)
    - Scar tissue formation in fallopian tubes lead to increased risk of ectopic pregnancy and sterility
  - Ophthalmia neonatorum
    - Gonococcal conjunctivitis of the newborn
    - Acquired from infected birth canal
    - Prevented with silver nitrate or erythromycin within 1 hour of birth

# Gonorrhea

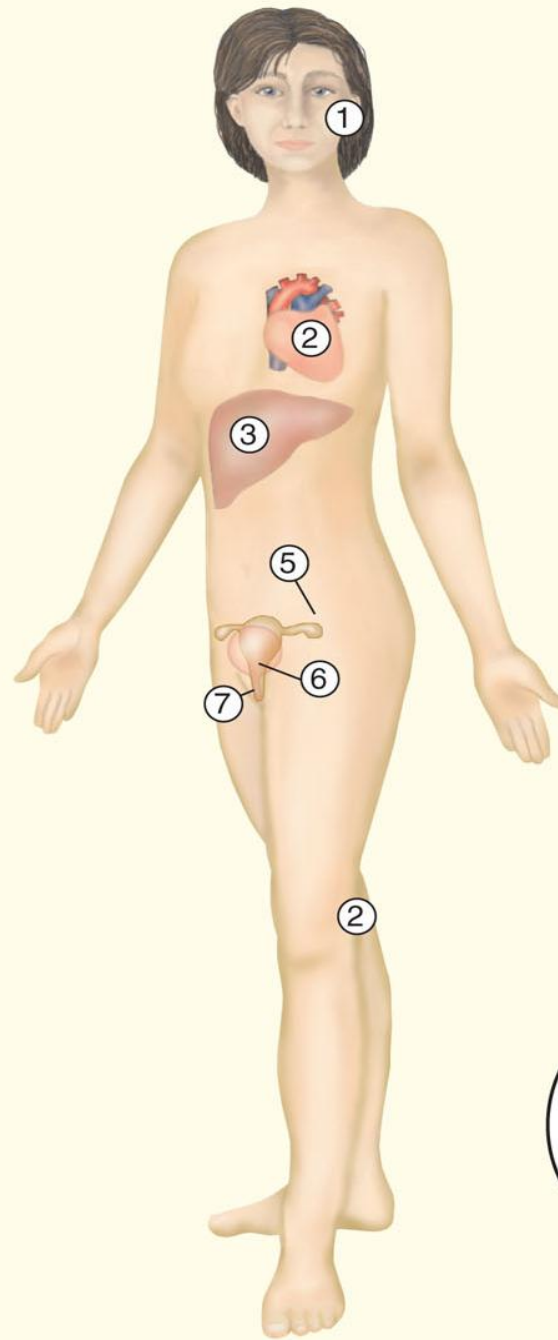
- Epidemiology
  - Most prevalent STD
    - Incidence is highest of any reportable disease in United States
      - Only after *Chlamydia*
  - Factors that influence infection include
    - Birth control pills
      - May increase susceptibility to infection
      - More often engage in sex without condom
    - Carriers
      - Those with symptomatic infection
    - Lack of immunity
      - No immunity following recovery

# Gonorrhoea

- Prevention and Treatment
  - Prevention directed at
    - Abstinence
    - Monogamous relationship
    - Constant use of condom
  - No vaccine available
  - Fluoroquinolones and cephalosporins effective against 95% of strains

## TABLE 26.8 Gonorrhoea

- ① Eyes of adults and children are susceptible to the gonococcus; serious infections leading to loss of vision are likely in newborns.
- ② Organisms carried by the bloodstream infect the heart valves and joints.
- ③ The outer covering of the liver is infected when gonococci enter the abdominal cavity from infected fallopian tubes.
- ④ Prostatic gonococcal abscesses may be difficult to eliminate.
- ⑤ Infection of the fallopian tubes results in scarring, which can lead to sterility or ectopic pregnancy.
- ⑥ The cervix is the usual site of primary infection in women.
- ⑦ Urethral scarring from gonococcal infection can predispose to urinary infections by other organisms.
- ⑧ Scarring of testicular tubules can cause sterility.



### Symptoms

Men: no symptoms, pain on urination, discharge; with complication impaired urinary flow, sterility, or arthritis. Women: no symptoms or pain on urination, discharge, fever, pelvic pain, sterility, ectopic pregnancy, arthritis can occur

### Incubation period

2 to 5 days

### Causative agent

*Neisseria gonorrhoeae*, a Gram-negative diplococcus

### Pathogenesis

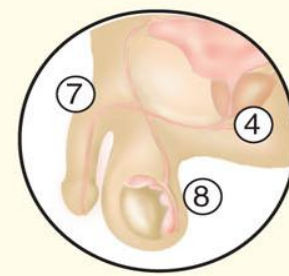
Organisms attach to certain non-ciliated epithelial cells by pili; phase and antigenic variation in surface proteins allows attachment to different host cells and escape from immune mechanisms. Inflammation, scarring; can spread by bloodstream.

### Epidemiology

Transmitted by sexual contact. Asymptomatic carriers. No immunity.

### Prevention and treatment

Abstinence, monogamous relationships, condoms, early treatment of sexual contacts. Treatment: intramuscular ceftriaxone.



male

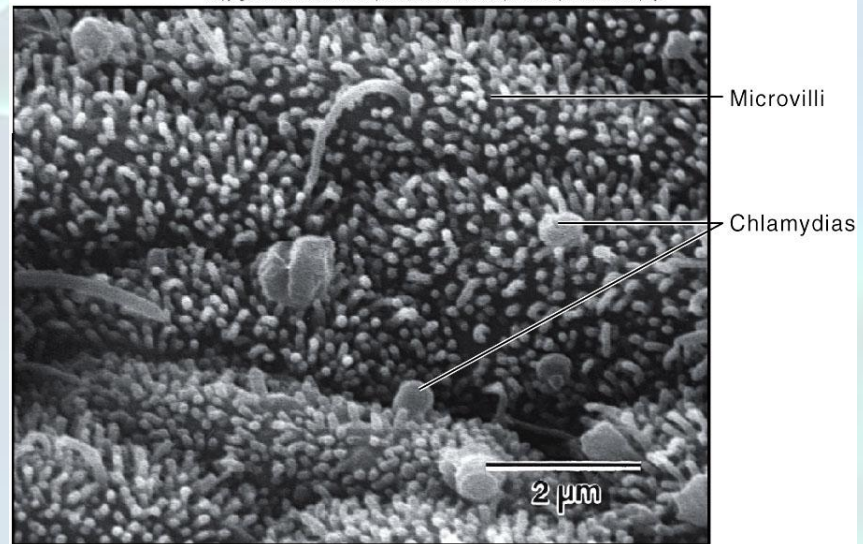
# Chlamydial Genital System Infections

- Symptoms
  - Generally appear in 7 to 14 days
  - In men
    - Thin grayish-white discharge from penis
    - Sometimes painful testes
  - In women
    - Increased vaginal discharge
    - Often painful urination
    - Abdominal bleeding
    - Upper and lower abdominal pain
    - Women often asymptomatic

# Chlamydial Genital System Infections

- Causative Agent
  - *Chlamydia trachomatis*
    - Approximately eight types responsible for STD

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# Chlamydial Genital System Infections

- Pathogenesis
  - Infectious form attaches to host epithelial cells
    - This form called elementary body
    - Cells take up organism through endocytosis
  - Bacterial enlarges in vacuole
    - Becomes non-infectious
      - Form called reticular body
  - Reticular body divides repeatedly
    - Produces numerous elementary bodies
      - These infect nearby cells
  - Much tissue damage results from cellular immune response
  - In men
    - Infection spreads from urethra to tubules
      - Results in acute swelling
  - In women
    - Infection commonly involves cervix, uterus and fallopian tubes
      - Resulting in PID, ectopic pregnancy or sterility



# Chlamydial Genital System Infections

- Epidemiology
  - Reportable infectious disease
    - Number of reported cases tends to rise each year
      - Estimated 4 million reported in United States
  - According to study 14% of sexually active high school and college women are asymptomatic carriers
  - Non-sexual transmission also occurs
    - Major source is non-chlorinated swimming pools
  - Newborns contact conjunctivitis much like with gonorrhea

# Chlamydial Genital System Infections

- Prevention and Treatment
  - Abstinence
  - Monogamous relationship
  - Use of condom
  - All sexually active women should get tested annually
    - Semi annually if multiple partners
  - Azithromycin effective single dose treatment
  - Tetracycline erythromycin less expensive alternatives

**TABLE 26.9****Chlamydial Genital System Infections**

<b>Symptoms</b>	Men: thin, gray-white penile discharge, painful testes. Women: vaginal discharge, vaginal bleeding, lower or upper abdominal pain
<b>Incubation period</b>	Usually 7 to 14 days
<b>Causative agent</b>	<i>Chlamydia trachomatis</i> , an obligate intracellular bacterium, certain serotypes
<b>Pathogenesis</b>	Elementary body attaches to specific receptors on the epithelial cell, causing endocytosis; transforms to reticulate body in the endocytic vacuole; repeated replication by binary fission and differentiation into elementary bodies; rupture of the vacuole and release of elementary bodies to infect adjacent cells; release of cytokines results in inflammatory response; cellular immune response against infection causes extensive damage; scar tissue formation responsible for ectopic pregnancy and sterility.
<b>Epidemiology</b>	The leading reportable bacterial infection in the United States. Large numbers of asymptomatic men and women carriers. Non-sexual transmission can occur in non-chlorinated swimming pools.
<b>Prevention and treatment</b>	Abstinence, monogamous relationship, condom use. Test sexually active men and women at least once yearly to rule out asymptomatic infection. Treatment: azithromycin, single dose; other antibacterial medications.

# Syphilis

- Symptoms
  - Occurs in numerous forms
    - Easily confused with other diseases
  - Manifestation occurs in three stages
    - Primary stage
    - Secondary stage
    - Tertiary stage

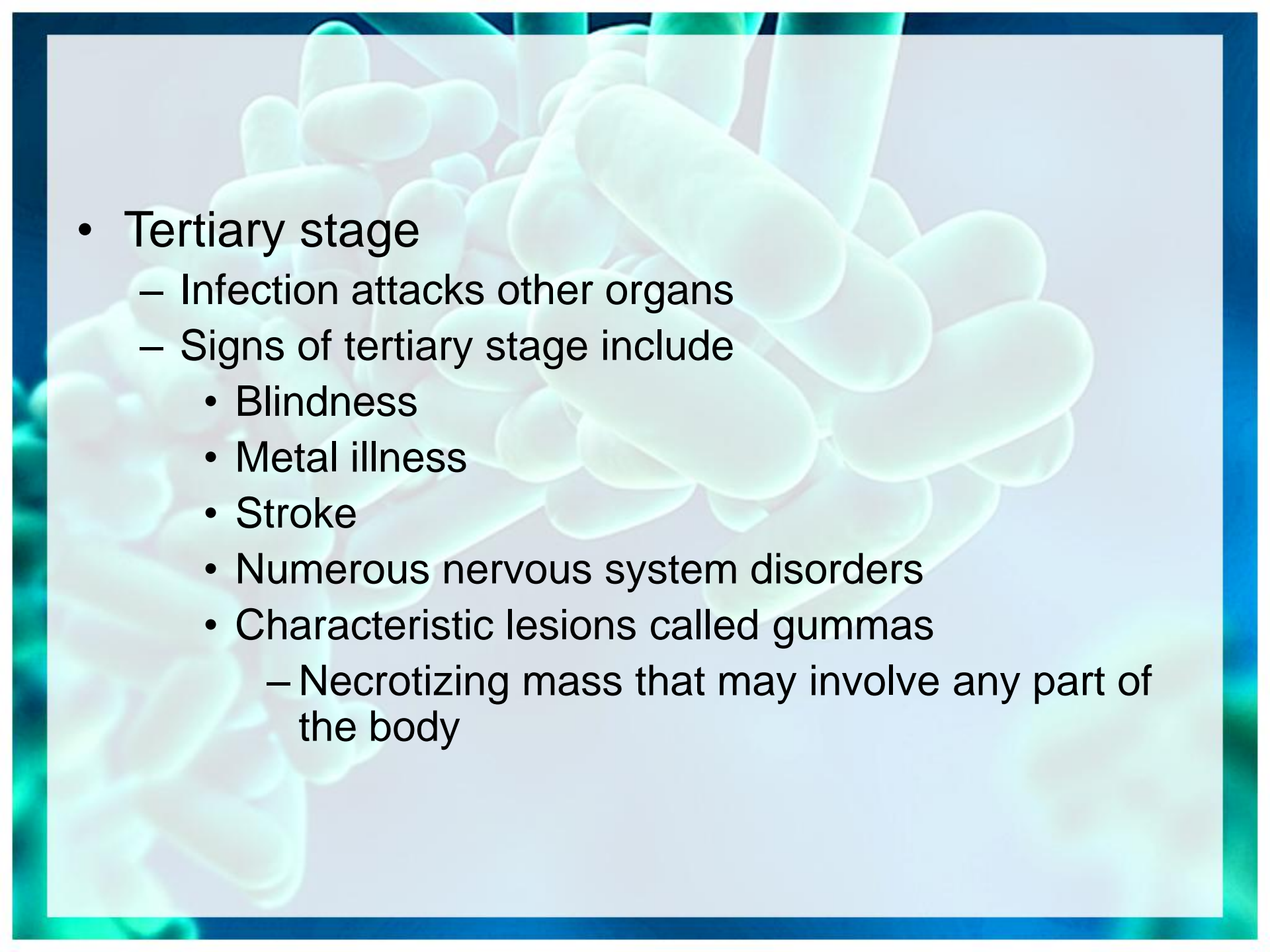
- Primary stage
  - Occurs about 3 weeks post infection
  - Characterized by a painless red ulcer
    - Ulcer called a hard chancre
    - Chancre appears at the site of infection
      - Usually on the genitalia
    - Local lymph nodes become enlarged
    - Spontaneous healing of chancre
- Primary syphilis often goes unnoticed in women and homosexual men

# Syphilis

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- Secondary stage
  - Begins 2 to 10 weeks after primary stage heals
  - Secondary symptoms include
    - Runny nose and watery eyes
    - Generalized aches and pains
    - Sore throat
    - Rash
      - Usually appears on the palms and soles of feet
    - Spontaneous healing
      - Latent period may last years

- 
- A microscopic view of numerous rod-shaped bacteria, likely bacilli, arranged in various orientations and clusters. The bacteria are light blue or cyan in color, with some showing distinct cell walls and internal structures. The background is a soft, out-of-focus light blue.
- Tertiary stage
    - Infection attacks other organs
    - Signs of tertiary stage include
      - Blindness
      - Mental illness
      - Stroke
      - Numerous nervous system disorders
      - Characteristic lesions called gummas
        - Necrotizing mass that may involve any part of the body



# Syphilis

- Causative Agent
  - *Treponema pallidum*
    - Motile spirochete
    - Cannot be cultivated in laboratory
      - Darkfield microscopy used for identification

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# Syphilis

- Pathogenesis
  - Organism penetrates mucous membranes and abraded skin
  - Very low infecting dose
    - Less than 100 organisms
  - Organism multiplies in localized area
    - Spreads to lymph nodes and bloodstream
  - Three stages of disease
    - Primary stage
    - Secondary stage
    - Tertiary stage

# Syphilis

- Pathogenesis
  - Primary syphilis
    - Characterized by hard chancre from inflammatory response
    - Chancre disappears in 2 to 6 weeks with or without treatment
  - Secondary syphilis
    - Characterized by mucous patches on skin and mucous membranes
      - Disease can be transmitted by kissing at this stage
    - Stage may last weeks to months
      - Followed by extended latent period



- Pathogenesis
  - Tertiary syphilis
    - Not all individuals develop tertiary syphilis
    - Stage characterized by gumma
      - Necrotizing mass of tissue
    - Patient no longer infectious
    - If organisms persist in walls vital organs can cause life-threatening condition
  - Congenital syphilis
    - Organism readily crosses placenta
      - Most dangerous during fourth month
    - Nearly 40% of babies lost to miscarriage or stillbirth
    - Children often develop deformities of face, teeth and other body parts later in childhood

# Syphilis

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# Syphilis

- Epidemiology
  - No animal reservoir
  - Usually transmitted via sexual contact
  - Elimination within reach in U.S.
    - Depends on identification and treatments of cases
  - Blood test can be used as potential screening method

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**TABLE 26.10** Stages of Syphilis

Stage of Disease	Main Characteristics	Infectious?
Primary	Firm, painless ulcer (hard chancre) at site of infection; lymph node enlargement	Yes
Secondary	Rash, aches, and pains; mucous membrane lesions	Yes
Tertiary	Gummas; damage to large blood vessels, eyes, nervous system; insanity	No

# Syphilis

- Prevention

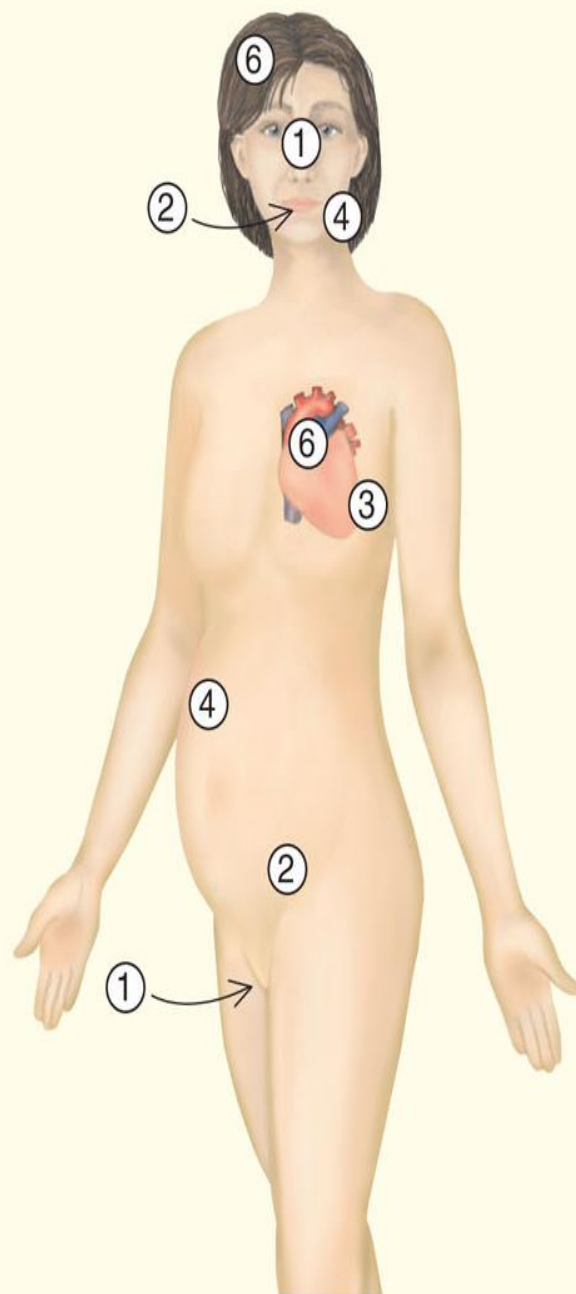
- No vaccine
- Safe sex practices decrease risk
- Prompt identification and treatment of infected individuals and contacts

- Treatment

- Primary and secondary stages effectively treated with antibiotics
- Antibiotics somewhat effective in tertiary but must be treated longer

**TABLE 26.11** Syphilis

- ① *Treponema pallidum* enters the body through a microscopic abrasion or mucous membrane, usually genitalia, mouth, or rectum.
- ② A chancre develops at site of entry.
- ③ Organisms multiply locally and spread throughout the body by the bloodstream.
- ④ Infectious mucous patches and skin rashes of secondary syphilis appear. A fetus will become infected, resulting in miscarriage or a live-born infant with congenital syphilis.
- ⑤ An asymptomatic latent period occurs. *T. pallidum* disappears from blood, skin, and mucous membranes.
- ⑥ After months or years, symptoms of tertiary syphilis appear:
  - heart and great vessel defects
  - gummas
  - strokes
  - eye abnormalities
  - general paresis
  - insanity.

**Symptoms**

Chancre, fever, rash, stroke, nervous system deterioration; can imitate many other diseases

**Incubation period**

10 to 90 days

**Causative agent**

*Treponema pallidum*, a non-culturable spirochete

**Pathogenesis**

Primary lesion, or chancre, appears at site of inoculation, heals after 2 to 6 weeks; *T. pallidum* invades the blood vessel system and is carried throughout the body, causing fever, rash, mucous membrane lesions; damage to brain, arteries, and peripheral nerves appears years later.

**Epidemiology**

Sexual contact with infected partner; kissing; transplacental passage.

**Prevention and treatment**

Monogamous relationships, use of condoms, treatment of sexual contacts, reporting cases. Treatment: penicillin.



# Chancroid

- Symptoms
  - Characterized by single or multiple painful genital sores
  - Sores are soft chancres
    - Unlike hard chancres of syphilis
  - Groin lymph nodes tender and swollen
    - Often pus filled
- Causative Agent
  - *Haemophilus ducreyi*

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(a)



(b)

# Chancroid

- Pathogenesis
  - Pimple appears at site of entry
    - Pimple ulcerates and enlarges within a few days
  - Organisms reach lymph nodes and initiate intense immune response
- Epidemiology
  - Epidemics generally associated with prostitution
  - Lesions promote AIDS transmission

# Chancroid

- Prevention and Treatment
  - Safe sex practices decrease risk
  - Chancroids respond well to antibiotic treatment
    - Erythromycin and ceftriaxine
    - Some strains resistant

**TABLE 26.12****Chancroid**

<b>Symptoms</b>	One or more painful, gradually enlarging, soft chancres on or near the genitalia; large, tender regional lymph nodes
<b>Incubation period</b>	3 to 10 days
<b>Causative agent</b>	<i>Haemophilus ducreyi</i> , a small, pleomorphic, Gram-negative rod requiring X-factor for growth
<b>Pathogenesis</b>	A small pimple appears first, which ulcerates and gradually enlarges; multiple lesions may coalesce; lymph nodes enlarge, liquefy, and may discharge to the skin surface.
<b>Epidemiology</b>	Sexual transmission. Common in prostitutes; fosters the spread of AIDS.
<b>Prevention and treatment</b>	Abstinence from sex, monogamous relationships; avoidance of sexually promiscuous partners; proper use of condoms. Treatment: several antibacterial medications effective. Resistance can be a problem.

# Genital Herpes

- Symptoms
  - Begin 2 to 20 days post infection
  - Genital itching and burning
  - Pain
    - Primarily in women
  - Blisters develop on genitals
  - Blisters heal spontaneously
    - Most patients will have recurrence
- Causative Agent
  - Usually herpes-simplex virus type 2
  - Disease recurrence due to latent virus



# Genital Herpes

- Pathogenesis
  - Blisters created by infected epithelial cells
    - Blisters contain large numbers of bacteria
  - Blisters rupture to produce painful ulcerations
  - Latency follows ulceration
  - Recurrence is due to replication of complete virions from latent DNA
    - Viruses re-infect area supplied by nerve
  - Congenital herpes can pose serious risk for newborn
    - 1 in 3 newborns contract herpes if mother has primary infection at time of birth
    - Can be debilitating and potentially lethal

# Genital Herpes

- Epidemiology
  - No animal reservoir
  - Virus can survive short time on fomites or in bathwater
    - Non-sexual transmission rarely occurs
  - Sexual transmission most likely occurs during first days of symptomatic disease
    - Transmission can happen in absence of symptoms
  - Once infected there is lifelong risk of transmission

# Genital Herpes

- Prevention and Treatment
  - Avoidance of sexual intercourse during active symptoms
    - Use of condom and spermicide reduce but do not eliminate transmission
  - There is no cure for genital herpes
    - Medications such as acyclovir and famciclovir can decrease severity



**TABLE 26.13****Genital Herpes Simplex****Symptoms**

Itching, burning pain at the site of infection, painful urination, tiny blisters with underlying redness. The blisters break, leaving a painful superficial ulcer, which heals without scarring. Recurrences are common.

**Incubation period**

Usually 1 week (range, 2 to 20 days)

**Causative agent**

Usually herpes simplex virus, type 2. The cold sore virus, herpes simplex type 1, can also be responsible. Herpesviruses are enveloped and contain double-stranded DNA.

**Pathogenesis**

Lysis of infected epithelial cells results in fluid-filled blisters containing infectious virions. Rupture of these vesicles causes a painful ulceration. The acute infection is controlled by body defenses; genome persists within nerve cells in a non-infectious form beyond the reach of body defenses. Replication of infectious virions can occur and cause recurrent symptoms in the area supplied by the nerve. Newborn infants can contract fatal generalized herpetic infection if their mother has a primary infection at the time of delivery.

**Epidemiology**

No animal reservoirs. Transmission by sexual intercourse, oral-genital contact. Transmission risk greatest first few days of active disease. Transmission can occur in the absence of symptoms. Herpes simplex increases the risk of contracting HIV.

**Prevention and treatment**

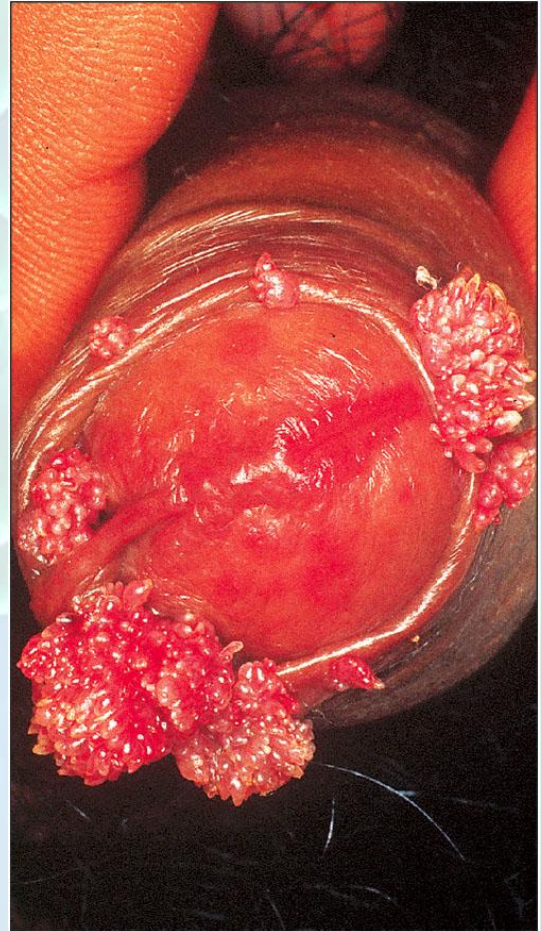
Abstinence, monogamy, and condoms help prevent transmission. Medications help prevent recurrences, shorten duration of symptoms. No cure.

# Papillomavirus

## Genital Warts and Cervical Cancer

- Symptoms
  - Individual may be asymptomatic
    - Especially women
  - Genital warts most easily recognized symptom
    - Often appear on the head or shaft of penis, at the vaginal opening or around anus
  - Warts can become inflamed or bleed
  - Precancerous lesion on cervix often asymptomatic
    - Can be detected with vaginal exam

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# Papillomavirus

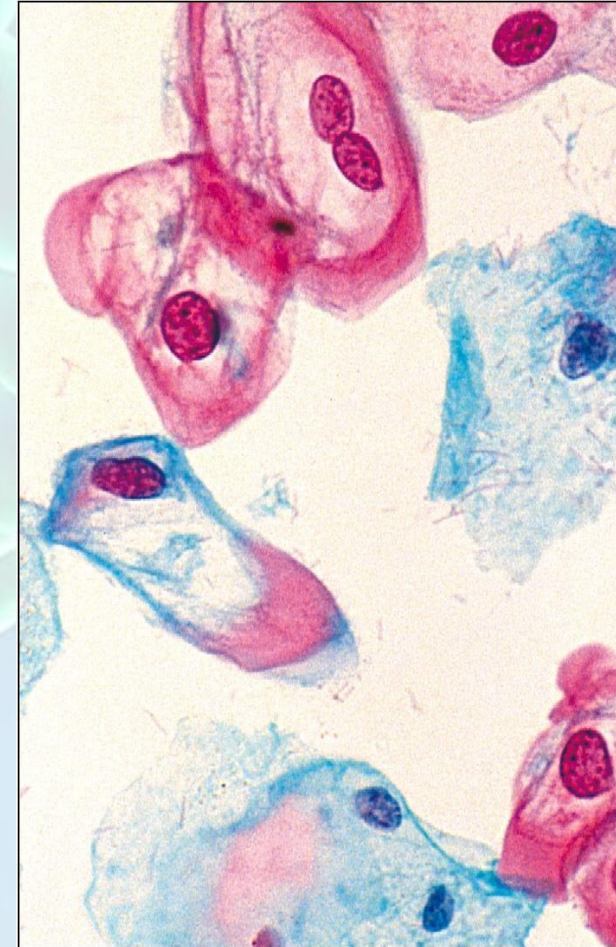
## Genital Warts and Cervical Cancer

- Causative agent
  - Human papillomavirus (HPV)
  - Non-enveloped, double-stranded DNA virus
    - Nearly 100 types of HPV
      - 30 are transmitted sexually
      - 15 types strongly associated with cancer
- Pathogenesis
  - HPV enters and infects deeper layers of tissue through abrasions
    - May lead to latent infection
  - Mechanism of wart formation is unknown
    - Warts usually appear about 3 months after infection
    - Removal of warts does not eliminate virus
  - HPV can be transmitted to fetus through birth canal
  - Most cervical cancers associated with HPV

# Papillomavirus

## Genital Warts and Cervical Cancer

- Epidemiology
  - HPV readily spread through sexual contact
    - Asymptomatic carriers can infect others with HPV
  - HPV most common reason for abnormal Pap smear
  - History of multiple sex partners is most important risk factor for acquiring HPV
  - Warts can develop in the mouth via oral sex



# Papillomavirus

## Genital Warts and Cervical Cancer

- Prevention and Treatment
  - Condom use can help decrease chance of transmission
  - Women should have Pap smear annually
    - Can identify precancerous lesions
    - Abnormal growth can be removed preventing development of cancer
  - Warts can be removed via laser treatment or freezing with liquid nitrogen

**TABLE 26.14****Papillomavirus STDs**

<b>Symptoms</b>	Many have no symptoms. Warts of the external and internal genitalia the most common symptom.
<b>Incubation period</b>	Usually 3 months (range, 3 weeks to 8 months)
<b>Causative agents</b>	Human papillomaviruses, many types, small, non-enveloped, double-stranded DNA viruses of the papovavirus family. Different types infect different tissues and produce different lesions.
<b>Pathogenesis</b>	Virus enters epithelium through abrasions, infects deep layer of epithelium; establishes latency; cycles of replication occur when host cell begins maturation; cancer-associated viral types can integrate into the host cell chromosome and can cause precancerous lesions.
<b>Epidemiology</b>	Asymptomatic individuals can transmit the disease; 60% transmission with a single sexual contact; multiple sex partners the greatest risk factor; warts can be transmitted to the mouth with oral sex, and to newborn babies.
<b>Prevention and treatment</b>	Latex condoms advised to minimize transmission and avoidance of sexual contact with those having multiple sex partners. Pap tests at least yearly for sexually active women. Wart removal by multiple techniques, does not cure the infection. Imiquimod useful in treating multiple warts about anus and external genitalia.

# AIDS

- Symptoms
  - Symptoms of HIV disease include
    - Fever
    - Head and muscle aches
    - Enlarged lymph nodes
    - Rash
    - Symptoms usually arise 6 days to 6 weeks post infection
- Causative agent
  - Human immunodeficiency virus (HIV)
    - Most US cases caused by HSVI
    - Most African cases caused by HSVII
  - Virus is enveloped, single-stranded RNA virus of retrovirus family

# AIDS

- Pathogenesis
  - HIV attacks variety of cell types
  - After entry, DNA copies of RNA genome produced using reverse transcriptase viral enzyme
  - In activated cells virus leaves cell genome and kills cell
    - Releases additional viruses to infect other cells
  - Macrophages have CD4 receptors
    - Virally infected macrophages are not generally killed but function is impaired
  - Eventually immune system becomes too impaired to respond



# AIDS

- Epidemiology

- HIV is spread mainly through sexual contact, needles or from mother to newborn
- Virus not highly contagious outside of risk factors
- Transmission can be halted by changes in human behavior

- Prevention and Treatment
  - Interruption of mother to child transmission via chemotherapy
  - Needle exchange programs
  - Educational programs targeting at risk populations
  - Treatment of other STD to lessen risk on contracting HIV
  - Treatment is designed to block replication of HIV
    - Generally with cocktail of medication

**TABLE 26.15****HIV Disease and AIDS****Symptoms**

No symptoms, or “flu”-like symptoms early in the illness; an asymptomatic period typically lasting years; symptoms of lung, intestine, skin, eyes, brain, and other infections, and certain cancers

**Incubation period**

About 6 days to 6 weeks for “flu”-like symptoms; many months or years for cancers and unusual infections

**Causative agents**

Generally human immunodeficiency virus, type 1 (HIV-1)

**Pathogenesis**

The virus infects CD4<sup>+</sup> lymphocytes and macrophages, thereby slowly destroying the ability of the immune system to fight infections and cancers.

**Epidemiology**

HIV present in blood, semen, and vaginal secretions in symptomatic and asymptomatic infections; spread usually by sexual intercourse, sharing of needles by injected-drug abusers, and from mother to infant at childbirth. Other STDs foster transmission.

**Prevention and treatment**

Abstinence from sexual intercourse and drug abuse; monogamy; consistent use of latex condoms; avoidance of sexual contact with injected-drug abusers, those with multiple partners or history of STDs. Anti-HIV medication for expectant mothers and their newborn infants. Treatment: reverse transcriptase and protease inhibitors in combination.

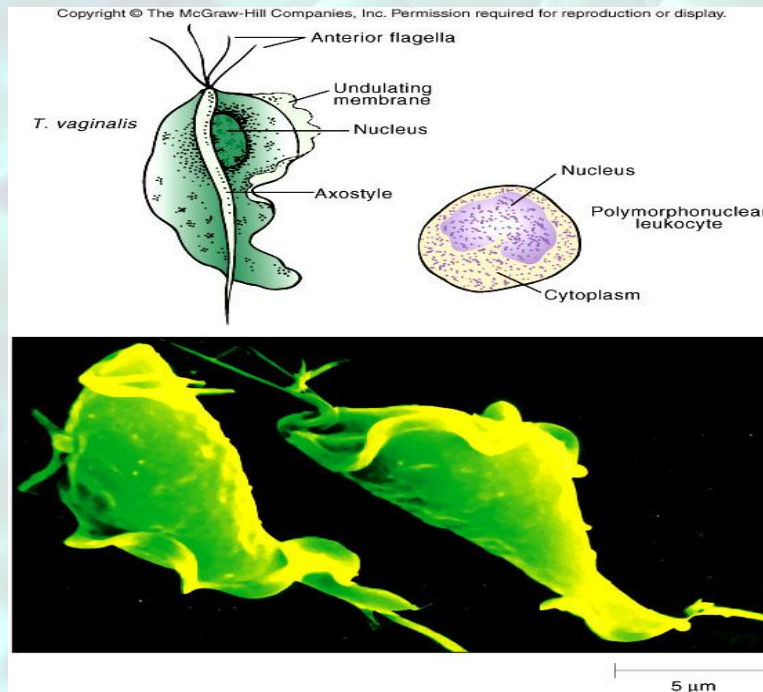
# Trichomoniasis

- Symptoms
  - Women most symptomatic
  - Characterized by
    - itching of vulva and inner thighs
    - Itching and burning of the vagina
    - Frothy, malodorous yellowish-green vaginal discharge
  - Most infected men are asymptomatic
    - Some may have penile discharge, pain on urination, painful testes or tender prostate

# Trichomoniasis

- Causative agent
  - *Trichomonas vaginalis*
  - Flagellated protozoan

- Pathogenesis
  - Not fully understood
  - Red swollen nature of vagina attributed to trauma of moving protozoan
  - Frothy discharge is most likely due to gas production by organism



# Trichomoniasis

- Epidemiology
  - Distributed worldwide as human parasite
    - Has no other reservoir than humans
  - Easily killed by drying
    - Due to lack of cyst form of organism
  - Transmission usually via sexual contact
  - Organism can survive for a time on moist objects such as towels and bathtubs
    - Can be transmitted non-sexually - Very rare
  - Newborns can contract disease from infected mother
  - Infection rates highest in men and women with multiple sex partners

# Trichomoniasis

- Prevention and Treatment
  - Abstinence, monogamy and use of condoms decreases risk of transmission
  - Treatment with metronidazole usually successful in treatment of disease

**TABLE 26.16****Trichomoniasis****Symptoms**

Women: itching, burning, swelling, vaginal redness, frothy, sometimes malodorous, yellow-green discharge, and burning on urination. Men: discharge from penis, burning on urination, painful testes, tender prostate. Many women, most men asymptomatic

**Incubation period**

4 to 20 days

**Causative agent**

*Trichomonas vaginalis*, a protozoan with four anterior flagella, and a posterior flagellum attached to an undulating membrane; a rigid rodlike structure called an axostyle protrudes posteriorly; unmistakable jerky motility; no mitochondria; hydrogenosomes are present

**Pathogenesis**

Unexplained. Inflammatory changes and pinpoint hemorrhages suggest mechanical trauma from the motile organisms.

**Epidemiology**

Worldwide distribution; asymptomatic carriers foster spread; easily killed by drying due to lack of cyst form, transmission by intimate contact; high rate of infection with multiple sex partners. Newborn infants of infected mothers can acquire the infection at birth.

**Prevention and treatment**

Abstinence, monogamy, and consistent use of condoms prevent the disease. Treatment: metronidazole.