



ninth edition

TORTORA | FUNKE | CASE

# MICROBIOLOGY

an introduction

## 21

Part A

## Microbial Diseases of the Skin and Eyes

PowerPoint® Lecture Slide Presentation prepared by Christine L. Case

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# Skin

- Salt inhibits microbes.
- Lysozyme hydrolyzes peptidoglycan.
- Fatty acids inhibit some pathogens.
- Defensins are antimicrobial peptides.

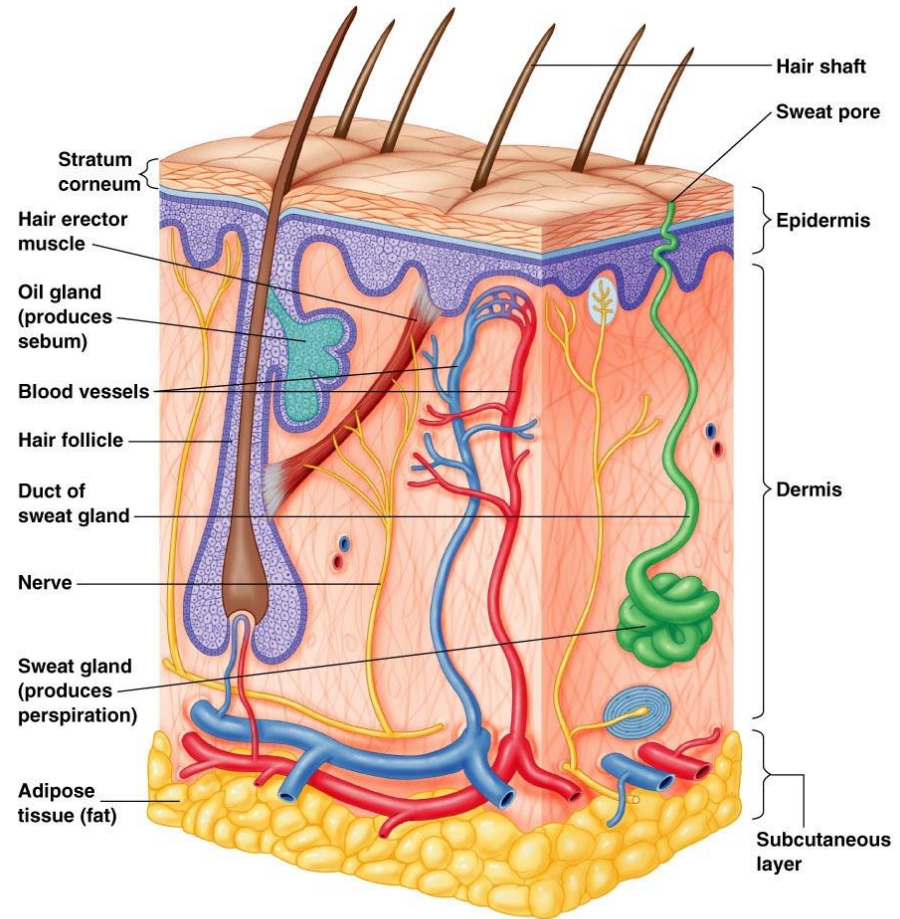


Figure 21.1



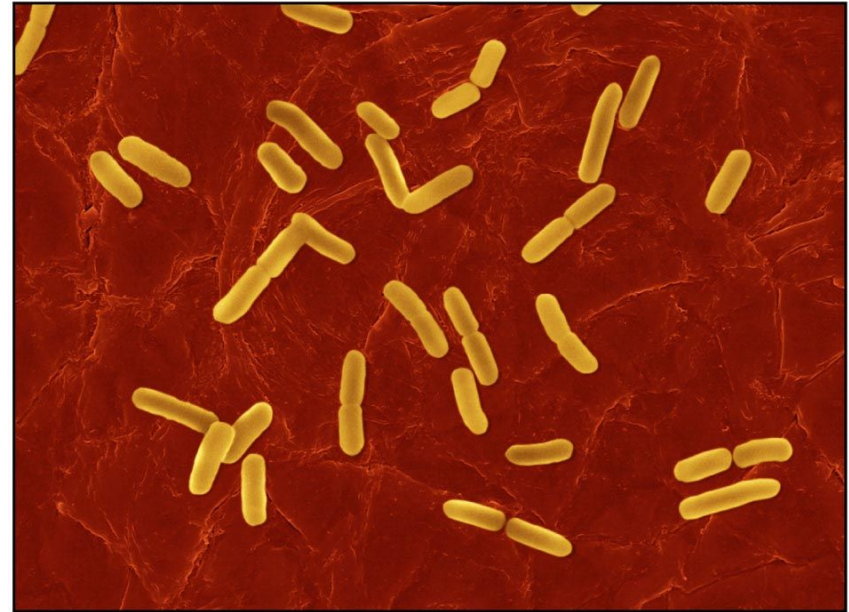
# Mucous Membranes

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- Line body cavities.
- The epithelial cells are attached to an extracellular matrix.
- Cells secrete mucus.
- Some cells have cilia.

# Normal Microbiota of the Skin

- Gram-positive, salt-tolerant bacteria
  - Staphylococci
  - Micrococci
  - Diphtheroids



SEM | 2  $\mu$ m



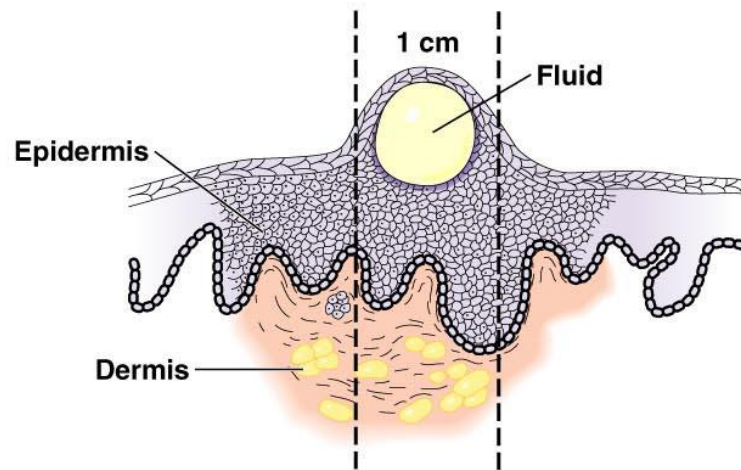
# Microbial Diseases of the Skin

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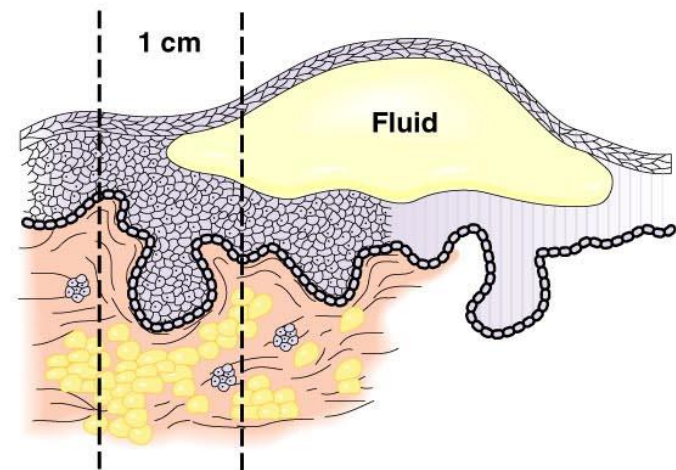
- Exanthem: Skin rash arising from another focus of the infection.
- Enanthem: Mucous membrane rash arising from another focus of the infection.



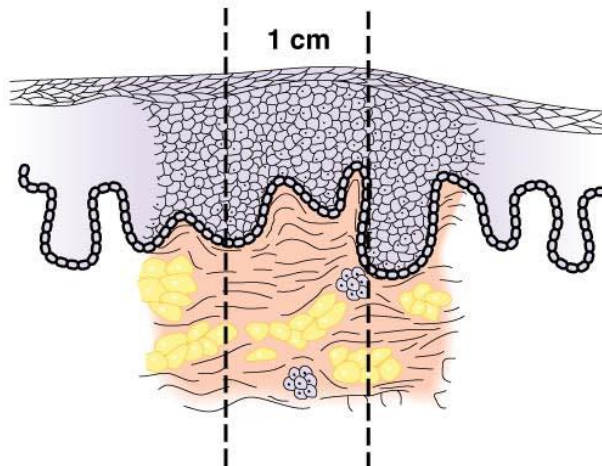
# Microbial Diseases of the Skin



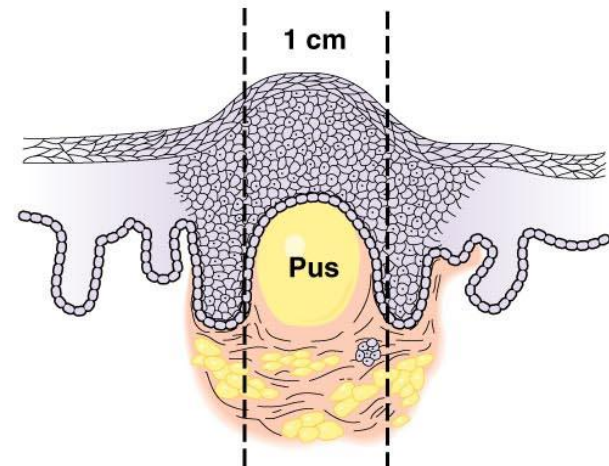
**(a) Vesicle**



**(b) Bulla**



**(c) Macule**



**(d) Pustule (papule)**

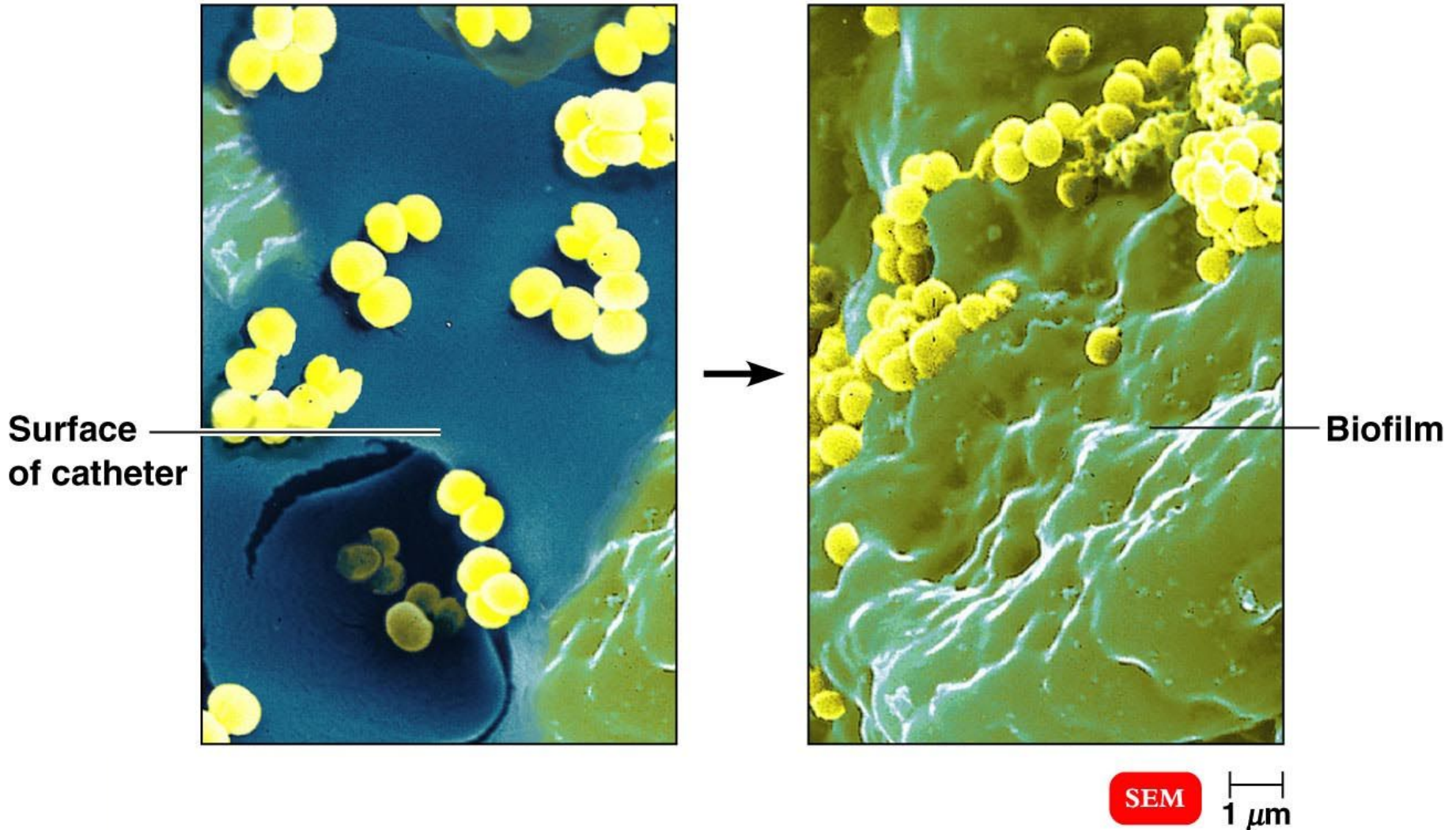


# Staphylococcal Skin Infections

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- *S. epidermidis*
  - Gram-positive cocci and coagulase-negative
- *Staphylococcus aureus*
  - Gram-positive cocci and coagulase-positive
  - Leukocidin
  - Exfoliative toxin

# Staphylococcal Biofilms







# Staphylococcal Skin Infections

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- Folliculitis: Infections of the hair follicles.
- Sty: Folliculitis of an eyelash.
- Furuncle: Abscess; pus surrounded by inflamed tissue.
- Carbuncle: Inflammation of tissue under the skin.

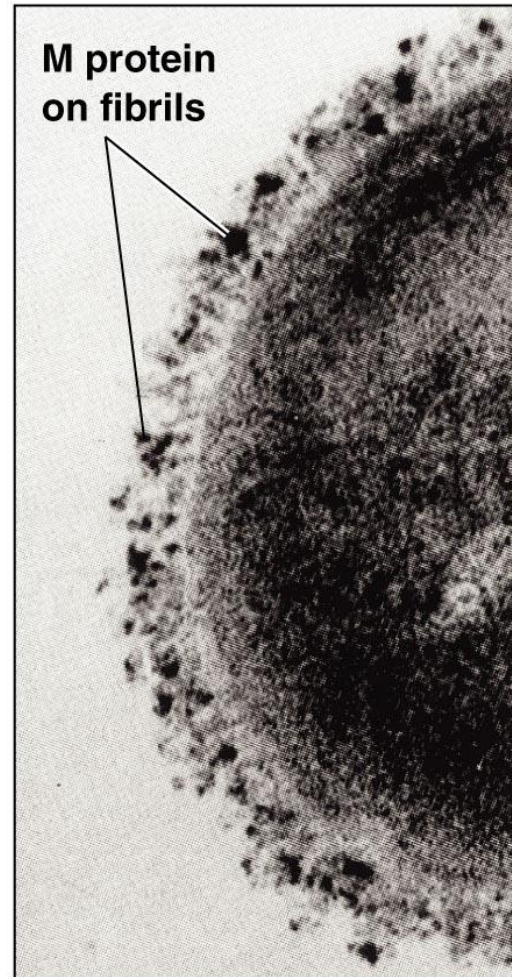
# Staphylococcal Skin Infections

- Impetigo of the newborn
- Toxemia
- Scalded skin syndrome
- Toxic shock syndrome



# Streptococcal Skin Infections

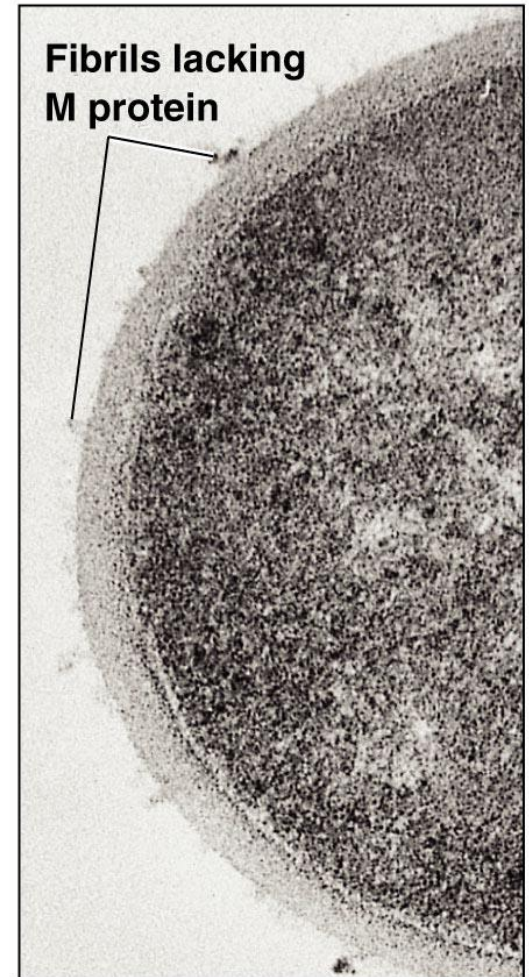
- *Streptococcus pyogenes*
- Group A  
beta-hemolytic  
streptococci
- M proteins



(a)

TEM

0.1  $\mu\text{m}$



(b)

TEM

0.1  $\mu\text{m}$



# Streptococcal Skin Infections

- Erysipelas



- Impetigo





# Invasive Group A Streptococcal Infections

- Streptokinases
- Hyaluronidase
- Exotoxin A, superantigen
- Cellulitis
- Necrotizing fasciitis





# Infections by Pseudomonads

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- *Pseudomonas aeruginosa*
  - Gram-negative, aerobic rod
  - Pyocyanin produces a blue-green pus
- *Pseudomonas dermatitis*
- Otitis externa
- Post-burn infections



# Acne

- Comedonal acne occurs when sebum channels are blocked with shed cells.
- Inflammatory acne
  - *Propionibacterium acnes*
    - Gram-positive, anaerobic rod
    - Treatment
      - Preventing sebum formation (isotretinoin)
      - Antibiotics
      - Benzoyl peroxide to loosen clogged follicles
      - Visible (blue) light (kills *P. acnes*)



# Acne

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- Inflammatory acne (continued)
  - Nodular cystic acne
    - Treatment: isotretinoin





# Warts

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- Papillomaviruses
  - Treatment
    - Removal
      - Imiquimod (stimulates interferon production)
      - Interferon

# Poxviruses

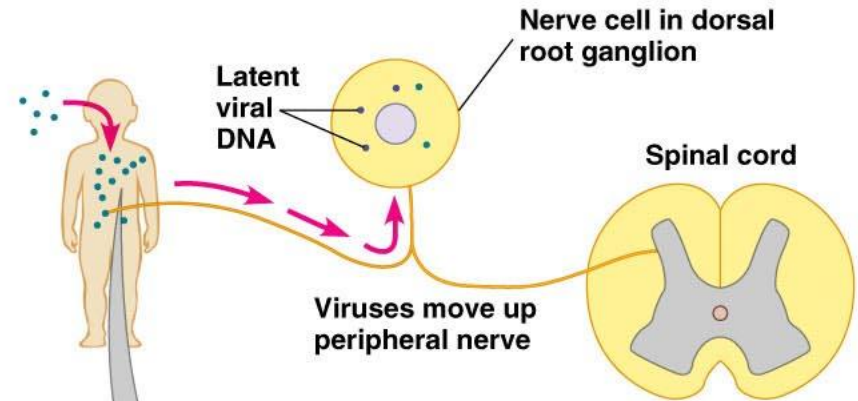
- Smallpox (variola)
  - Smallpox virus (orthopox virus)
  - Variola major has 20% mortality
  - Variola minor has <1% mortality
- Monkeypox
  - Prevention by smallpox vaccination



Figure 21.9

# Herpesviruses

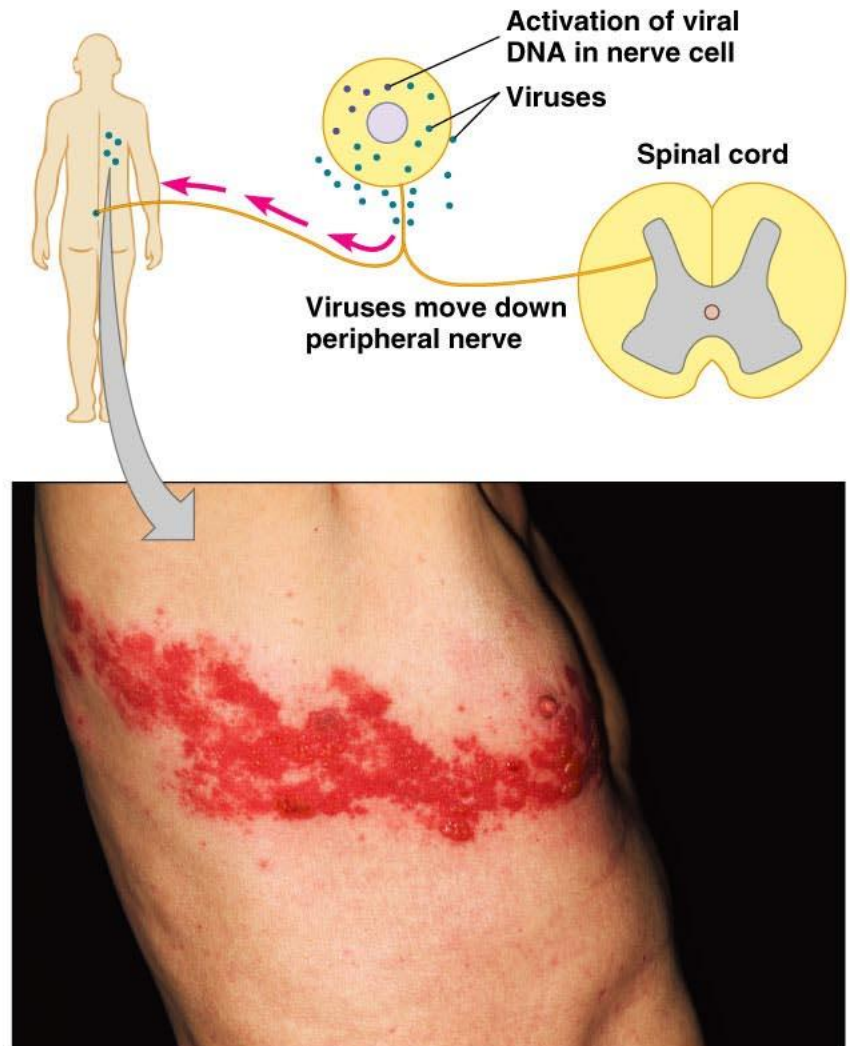
- Varicella-zoster virus (human herpes virus 3)
- Transmitted by the respiratory route
- Causes pus-filled vesicles
- Virus may remain latent in dorsal root ganglia



**(a) Initial infection: chickenpox (varicella)**

# Shingles

- Reactivation of latent HHV-3 releases viruses that move along peripheral nerves to skin.



**(b) Recurrence of infection: shingles (herpes zoster)**





# Herpes Simplex 1 and Herpes Simplex 2

- Human herpes virus 1 and HHV-2
- Cold sores or fever blisters (vesicles on lips)
- Herpes gladiatorum (vesicles on skin)
- Herpes whitlow (vesicles on fingers)
- Herpes encephalitis (HHV-2 has up to a 70% fatality rate)
- HHV-1 can remain latent in trigeminal nerve ganglia.
- HHV-2 can remain latent in sacral nerve ganglia.
- Acyclovir may lessen symptoms.

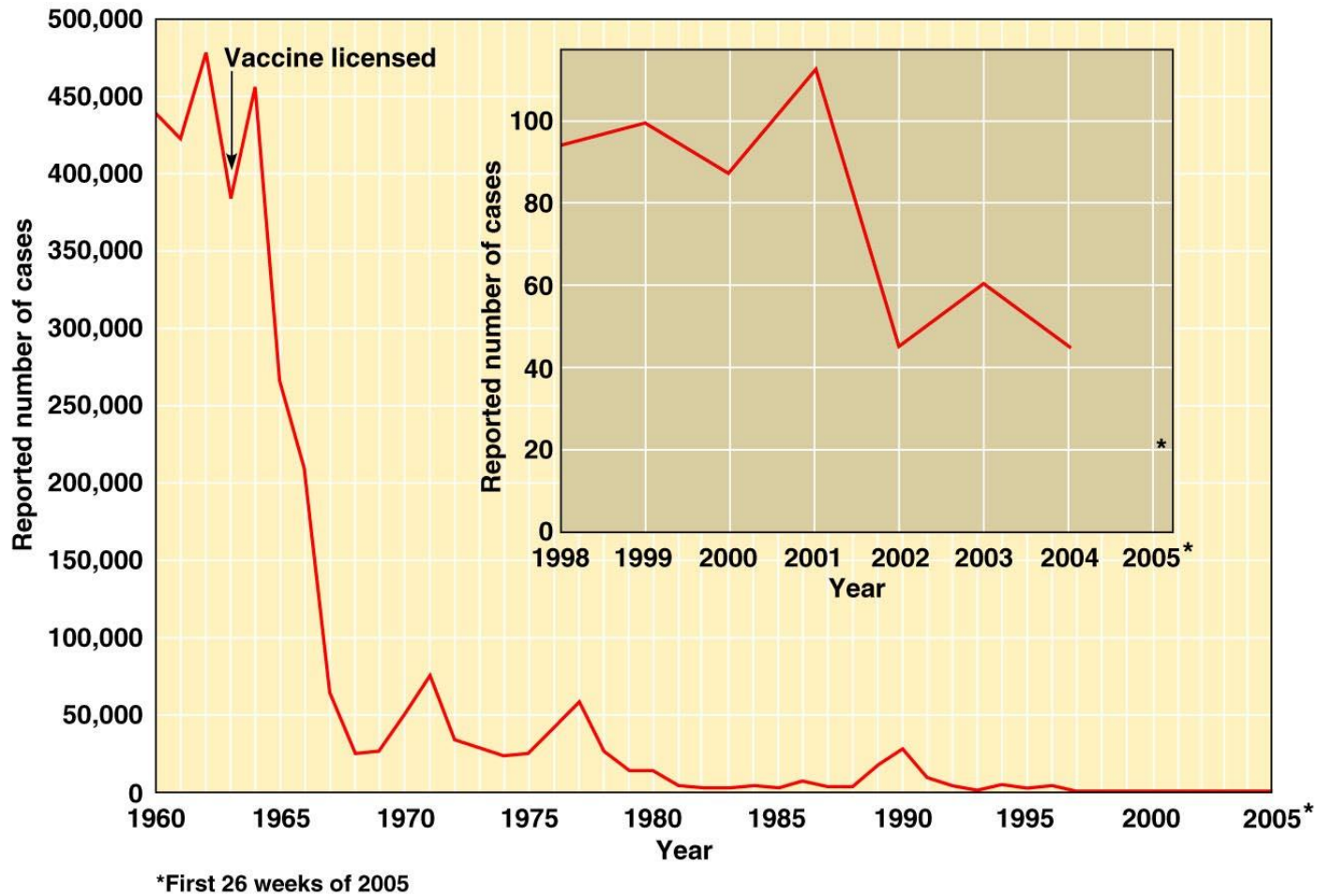
# Measles (Rubeola)

- Measles virus
- Transmitted by respiratory route.
- Macular rash and Koplik's spots.
- Prevented by vaccination.
- Encephalitis in 1 in 1,000 cases.
- Subacute sclerosing panencephalitis in 1 in 1,000,000 cases.



Figure 21.14

# Measles (Rubeola)





# Rubella (German Measles)

- Rubella virus
- Macular rash and fever
- Congenital rubella syndrome causes severe fetal damage.
- Prevented by vaccination







- A 1905 list of skin rashes included (1)measles, (2)scarlet fever, (3)rubella, (4)Filatow-Dukes (mild scarlet fever), and
  - (5)Fifth Disease: Erythema infectiosum
    - Human parvovirus B19 produces milk flu-like symptoms and facial rash.
- Roseola
  - Human herpesvirus 6 causes a high fever and rash, lasting for 1-2 days.



# Cutaneous Mycoses

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- Dermatomycoses: Tineas or ringworm
- Metabolize keratin
- *Trichophyton*: Infects hair, skin, and nails
- *Epidermophyton*: Infects skin and nails
- *Microsporum*: Infects hair and skin
- Treatment
  - Oral griseofulvin
  - Topical miconazole

# Cutaneous Mycoses



**(a) Ringworm**



**(b) Athlete's foot**



# Subcutaneous Mycoses

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- Sporotrichosis
  - *Sporothrix schenckii* enters puncture wound
  - Treated with KI

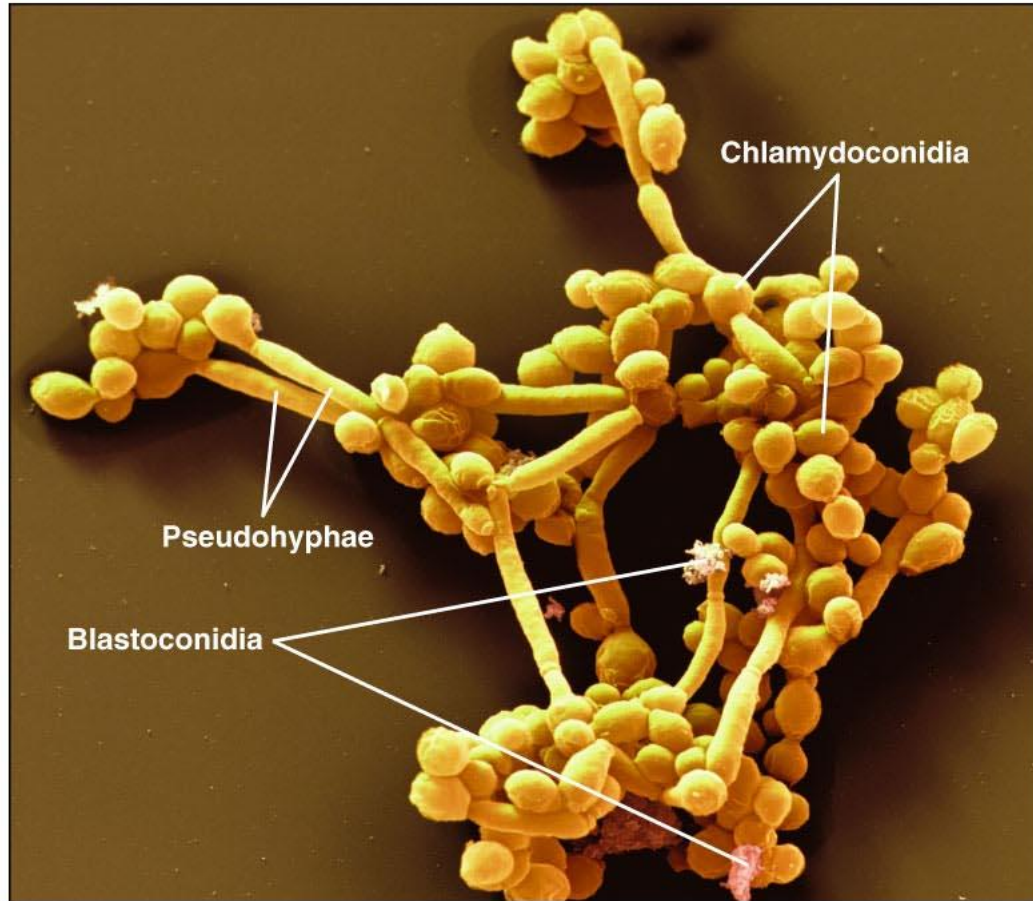




# Candidiasis

- *Candida albicans* (yeast)
- Candidiasis may result from suppression of competing bacteria by antibiotics.
- Occurs in skin; mucous membranes of genitourinary tract and mouth.
- Thrush is an infection of mucous membranes of mouth.
- Topical treatment with miconazole or nystatin.

# Candidiasis



**(a)** *Candida albicans*

SEM 20 mm

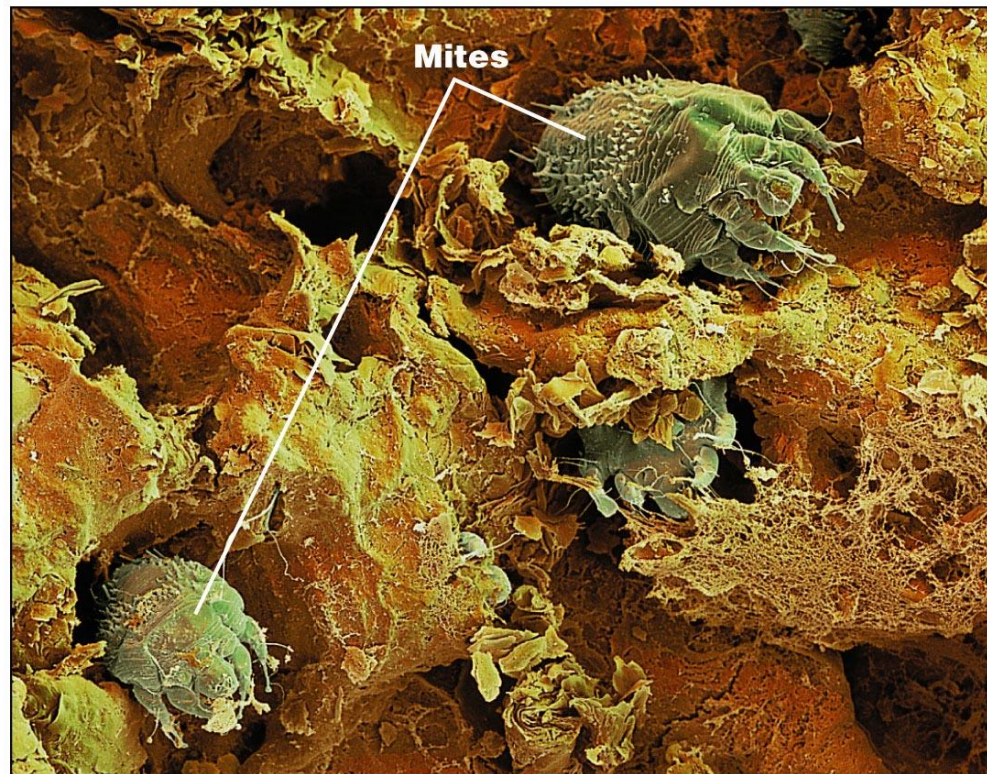


**(b)** Oral candidiasis, or thrush



# Scabies

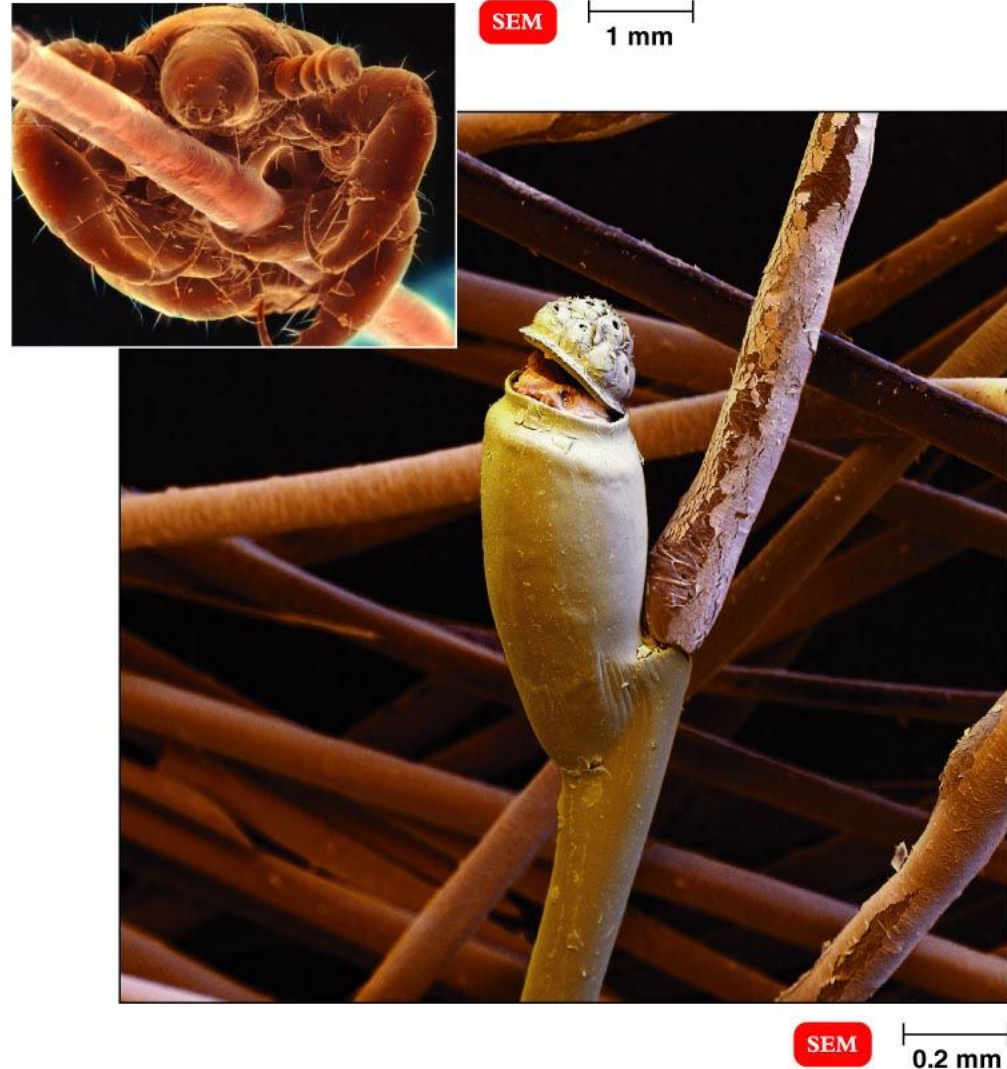
- *Sarcoptes scabiei* burrows in the skin to lay eggs
- Treatment with topical insecticides



SEM 1 mm

# Pediculosis

- *Pediculus humanus capitis* (head louse)
- *P. h. corporis* (body louse)
  - Feed on blood.
  - Lay eggs (nits) on hair.
  - Treatment with topical insecticides.







# Macular Rashes

- A 9-year-old girl with a history of cough, conjunctivitis, and fever ( $38^{\circ}\text{C}$ ) has a macular rash that starts on her face and neck and is spreading to the rest of her body.

Can you identify the cause of her symptoms

- Measles
- Rubella
- Fifth disease
- Roseola
- Candidiasis



# Bacterial Diseases of the Eye

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- Conjunctivitis (pinkeye)
  - *Haemophilus influenzae*
  - Various microbes
  - Associated with unsanitary contact lenses
- Neonatal gonorrheal ophthalmia
  - *Neisseria gonorrhoeae*
  - Transmitted to a newborn's eyes during passage through the birth canal.
  - Prevented by treatment of a newborn's eyes with antibiotics

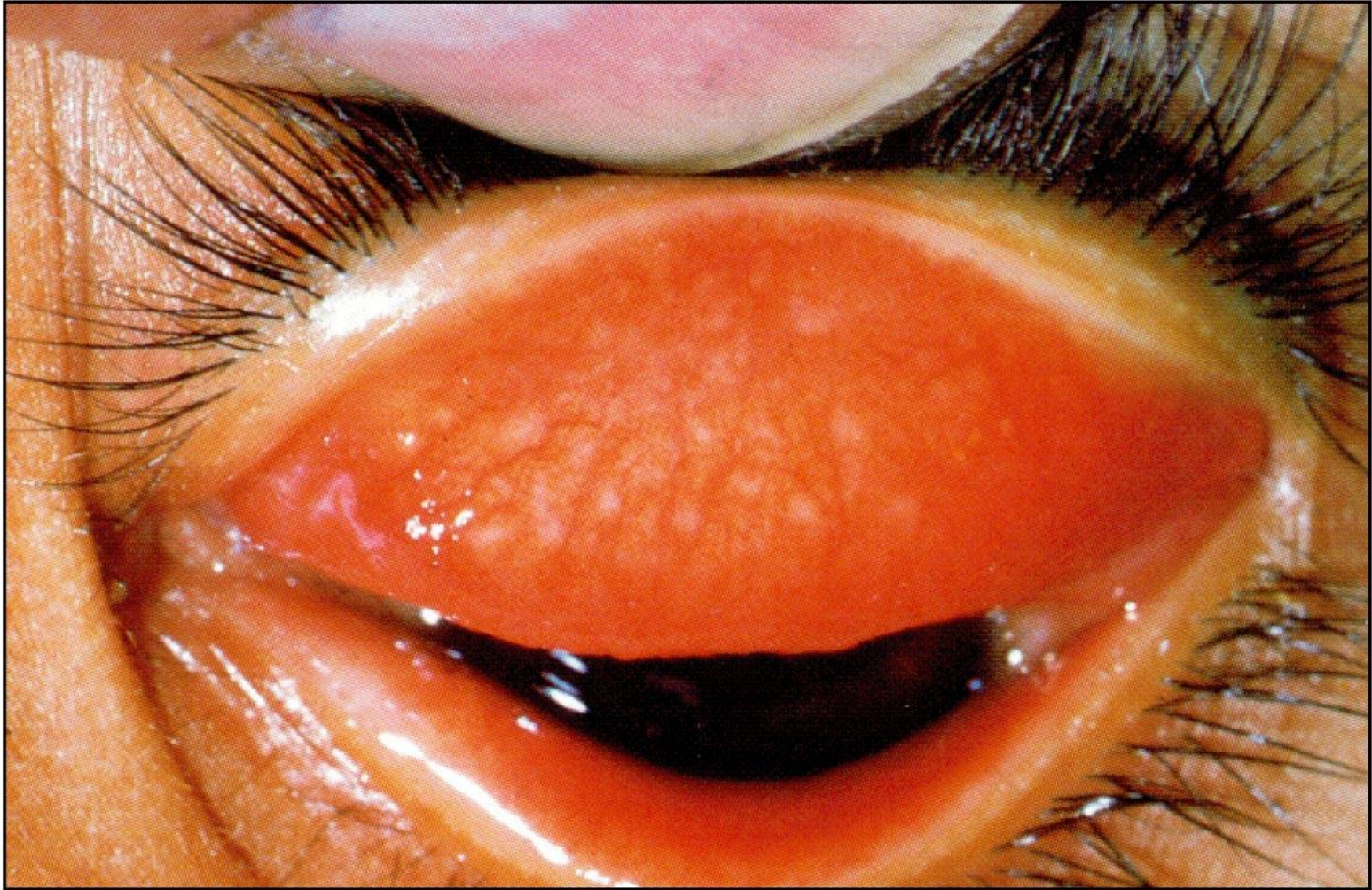


# Bacterial Diseases of the Eye

- *Chlamydia trachomatis*
  - Inclusion conjunctivitis
    - Transmitted to a newborn's eyes during passage through the birth canal
    - Spread through swimming pool water
    - Treated with tetracycline
  - Trachoma
    - Leading cause of blindness worldwide
    - Infection causes permanent scarring; scars abrade the cornea leading to blindness



# Trachoma



**(a) Chronic inflammation of the eyelid**





# Viral Diseases of the Eye

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- Conjunctivitis
  - Adenoviruses
- Herpetic keratitis
  - Herpes simplex virus 1 (HHV-1).
  - Infects cornea and may cause blindness
  - Treated with trifluridine



# Protozoan Disease of the Eye

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- *Acanthamoeba* keratitis
  - Transmitted from water
  - Associated with unsanitary contact lenses