

ninth edition

TORTORA | FUNKE | CASE

MICROBIOLOGY

an introduction

21

Part A

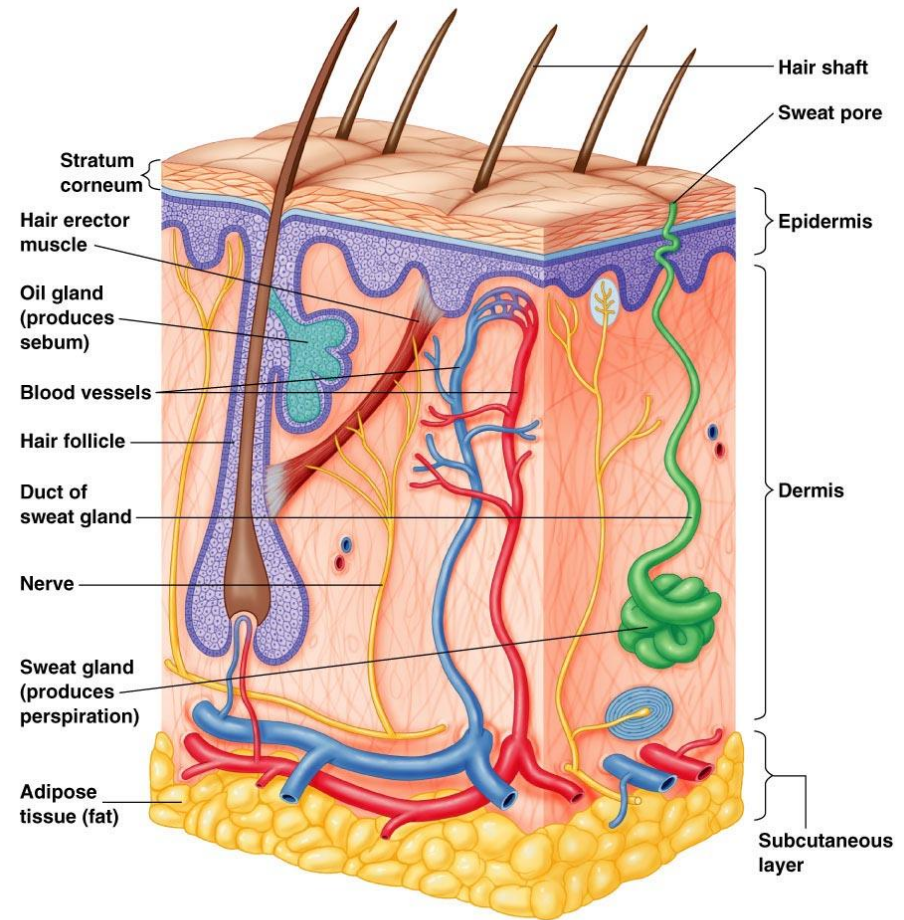
Microbial Diseases of the Skin and Eyes

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.





Mucous Membranes

- 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



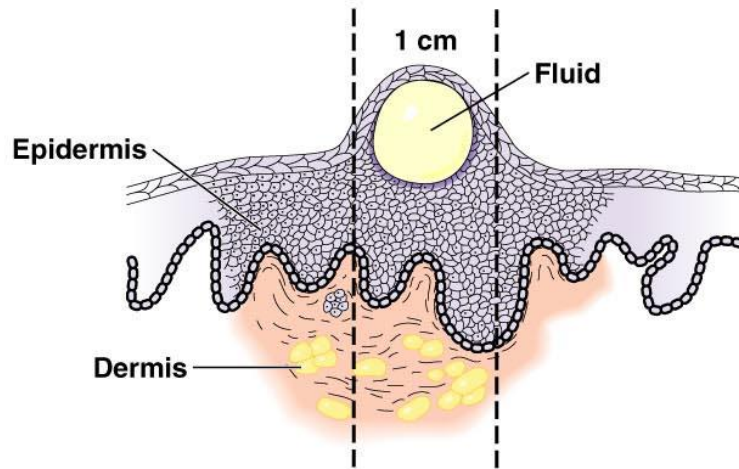
SEM | 2 μm



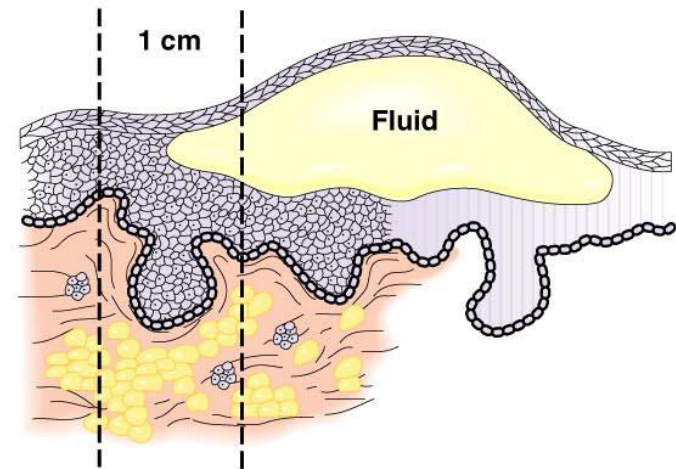
Microbial Diseases of the Skin

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

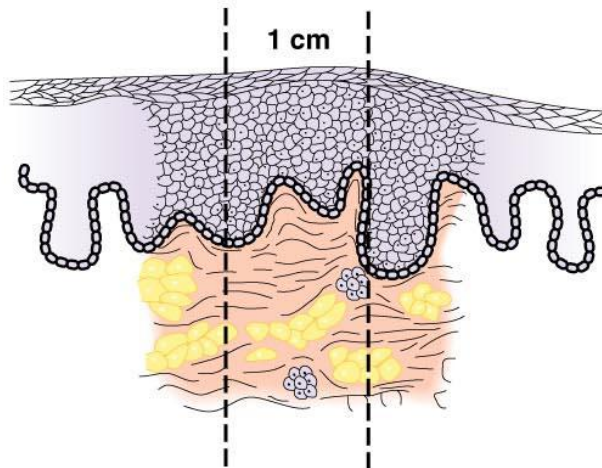
Microbial Diseases of the Skin



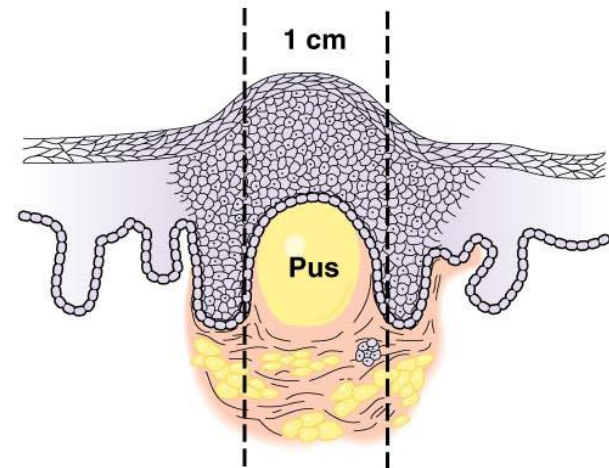
(a) Vesicle



(b) Bulla



(c) Macule

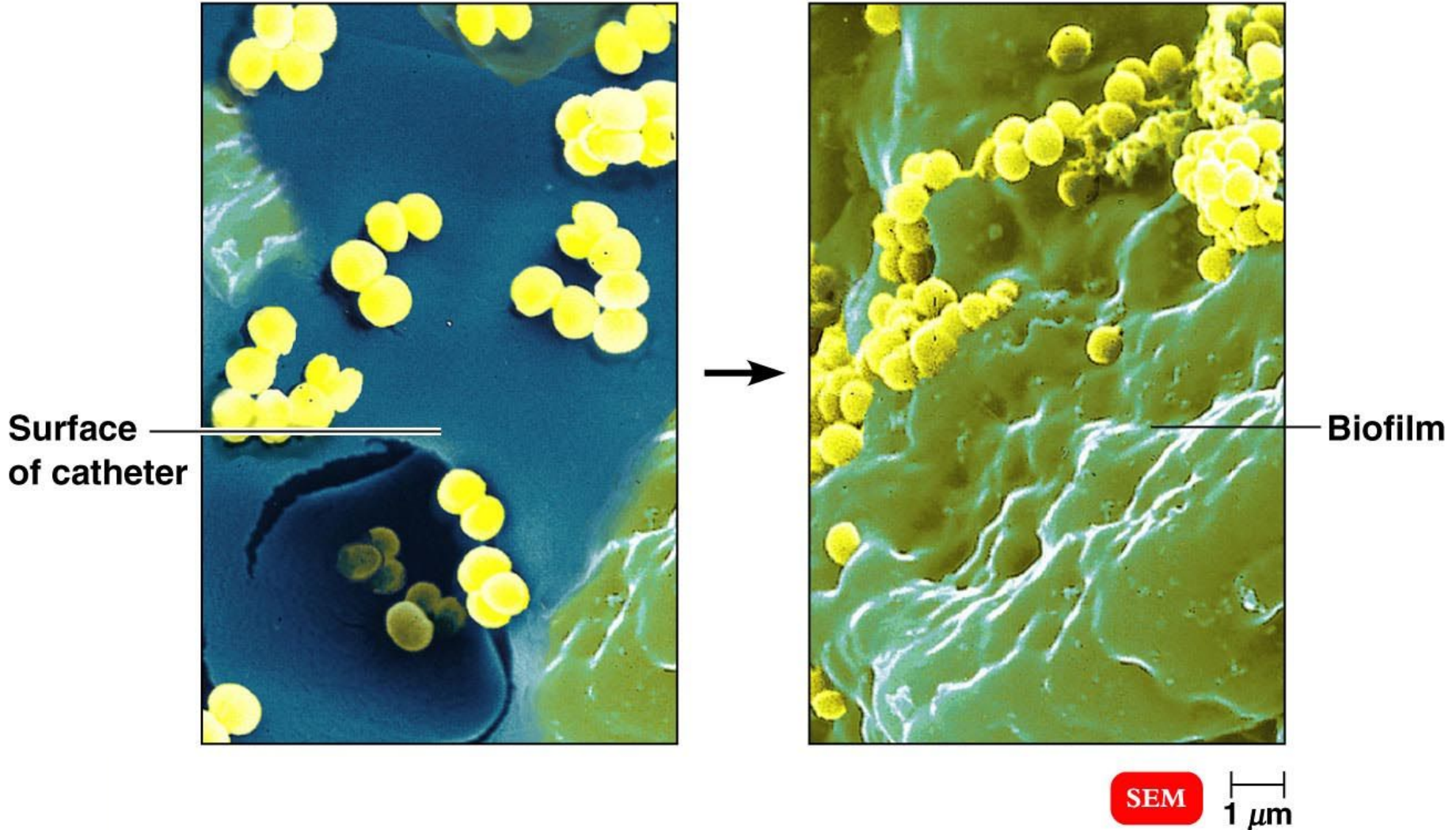


(d) Pustule (papule)

Staphylococcal Skin Infections

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

Staphylococcal Biofilms





Staphylococcal Skin Infections

- 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 μm



(b) TEM 0.1 μm

Streptococcal Skin Infections

- Erysipelas



- Impetigo



Invasive Group A Streptococcal Infections

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





Infections by Pseudomonads

- *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

A microscopic view of skin cells, showing various cellular structures and colors like green, blue, and orange, likely representing different layers or components of the skin.

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



Warts

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

Poxviruses

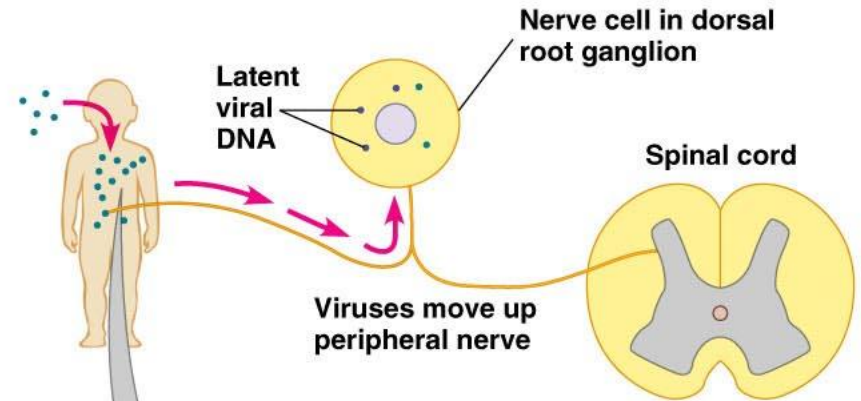
- Smallpox (variola)
 - Smallpox virus (orthopox virus)
 - Variola major has 20% mortality
 - Variola minor has <1% mortality
- Monkeypox
 - Prevention by smallpox vaccination



Figure 21.9

Herpesviruses

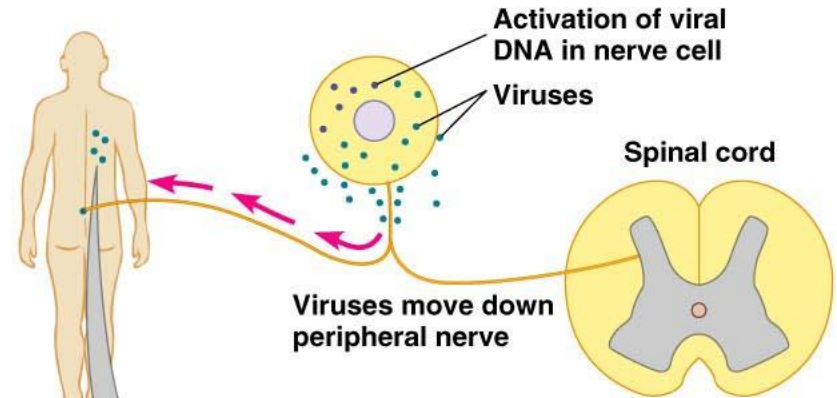
- Varicella-zoster virus (human herpes virus 3)
- Transmitted by the respiratory route
- Causes pus-filled vesicles
- Virus may remain latent in dorsal root ganglia



(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

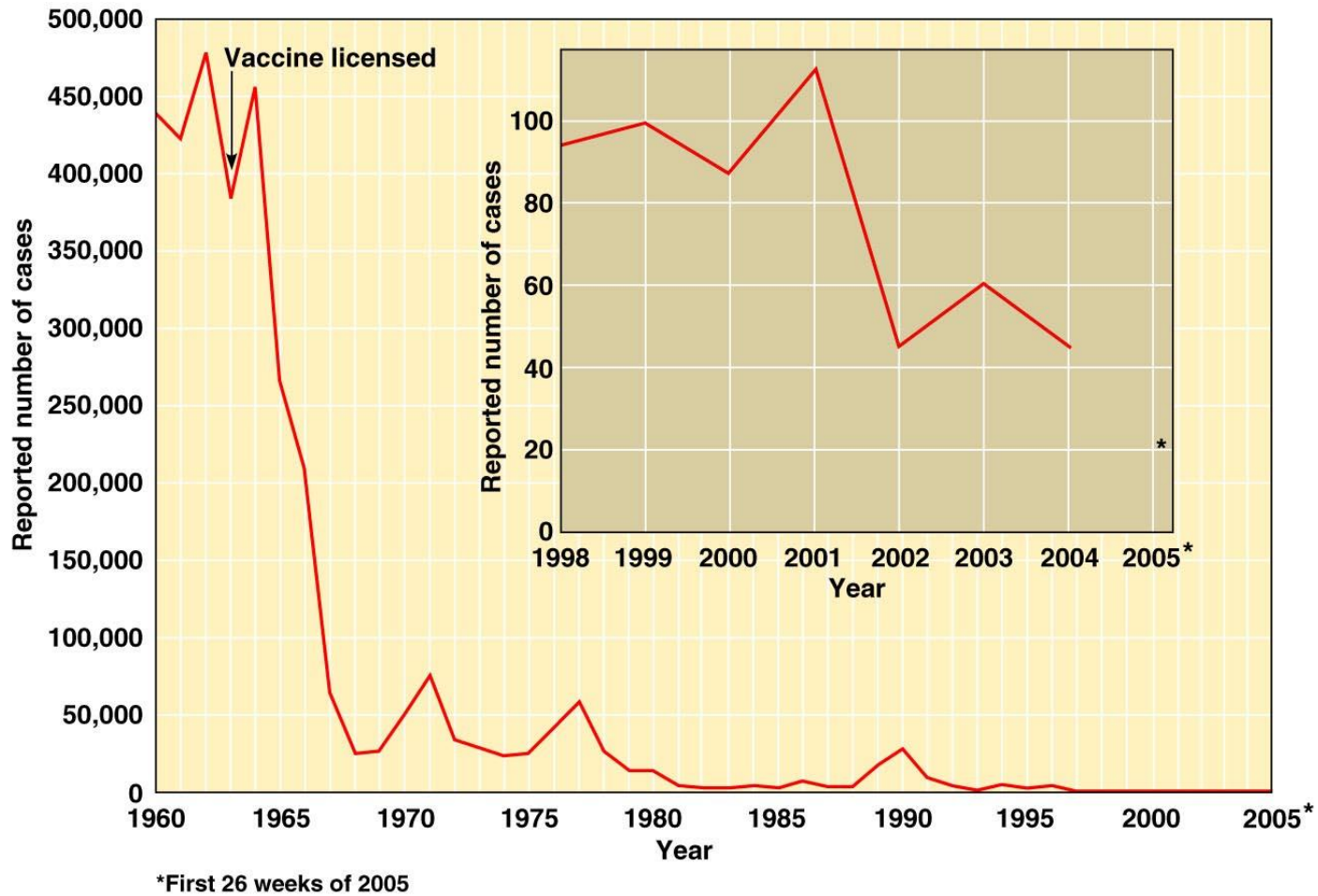
- Human herpes virus 1 and HHV-2
- Cold sores or fever blisters (vesicles on lips)
- Herpes gladiatorum (vesicles on skin)
- Herpes whitlow (vesicles on fingers)
- Herpes encephalitis (HHV-2 has up to a 70% fatality rate)
- HHV-1 can remain latent in trigeminal nerve ganglia.
- HHV-2 can remain latent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



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



- 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



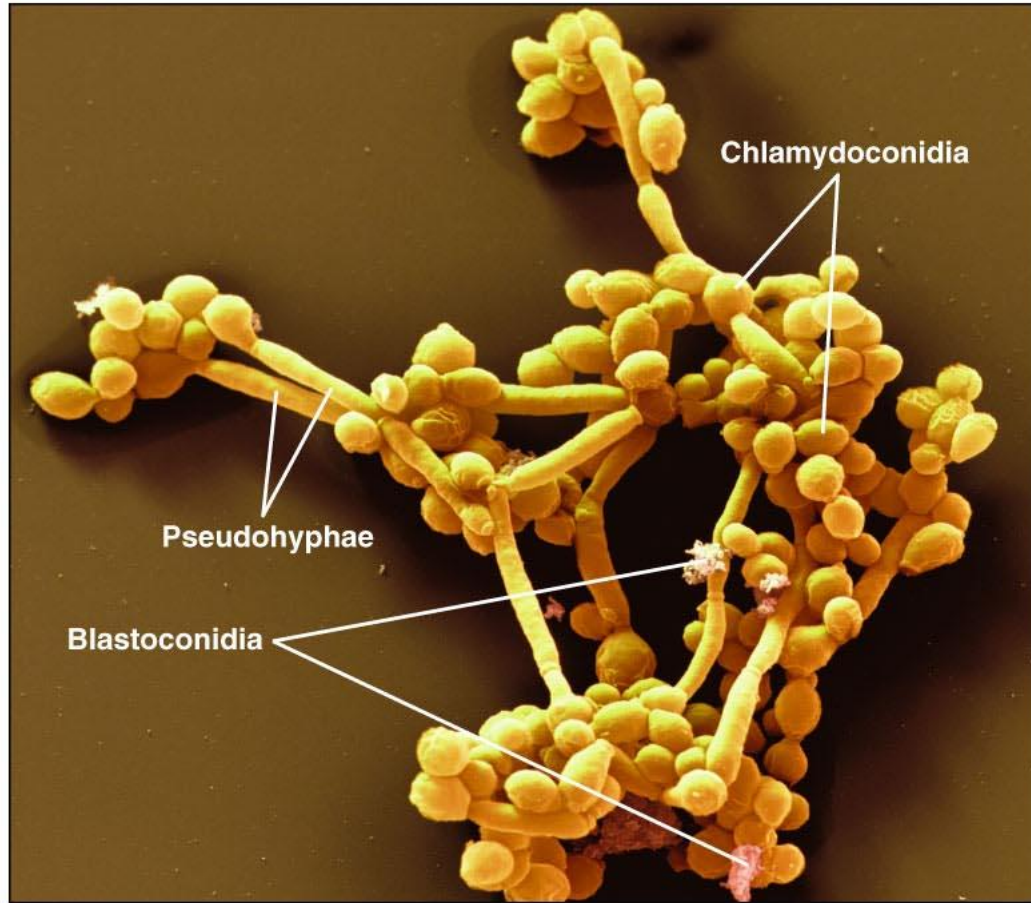
- Sporotrichosis
 - *Sporothrix schenckii* enters puncture wound
 - Treated with KI



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



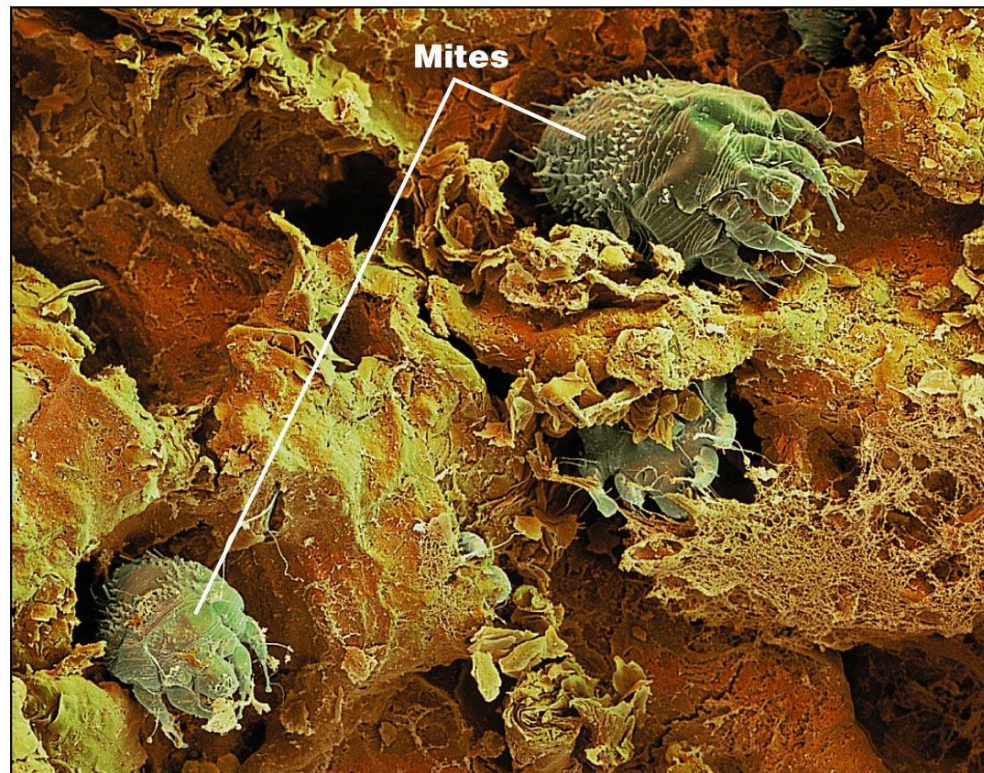
(a) *Candida albicans*



(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.



SEM | 1 mm



SEM | 0.2 mm



Macular Rashes

- A 9-year-old girl with a history of cough, conjunctivitis, and fever (38°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



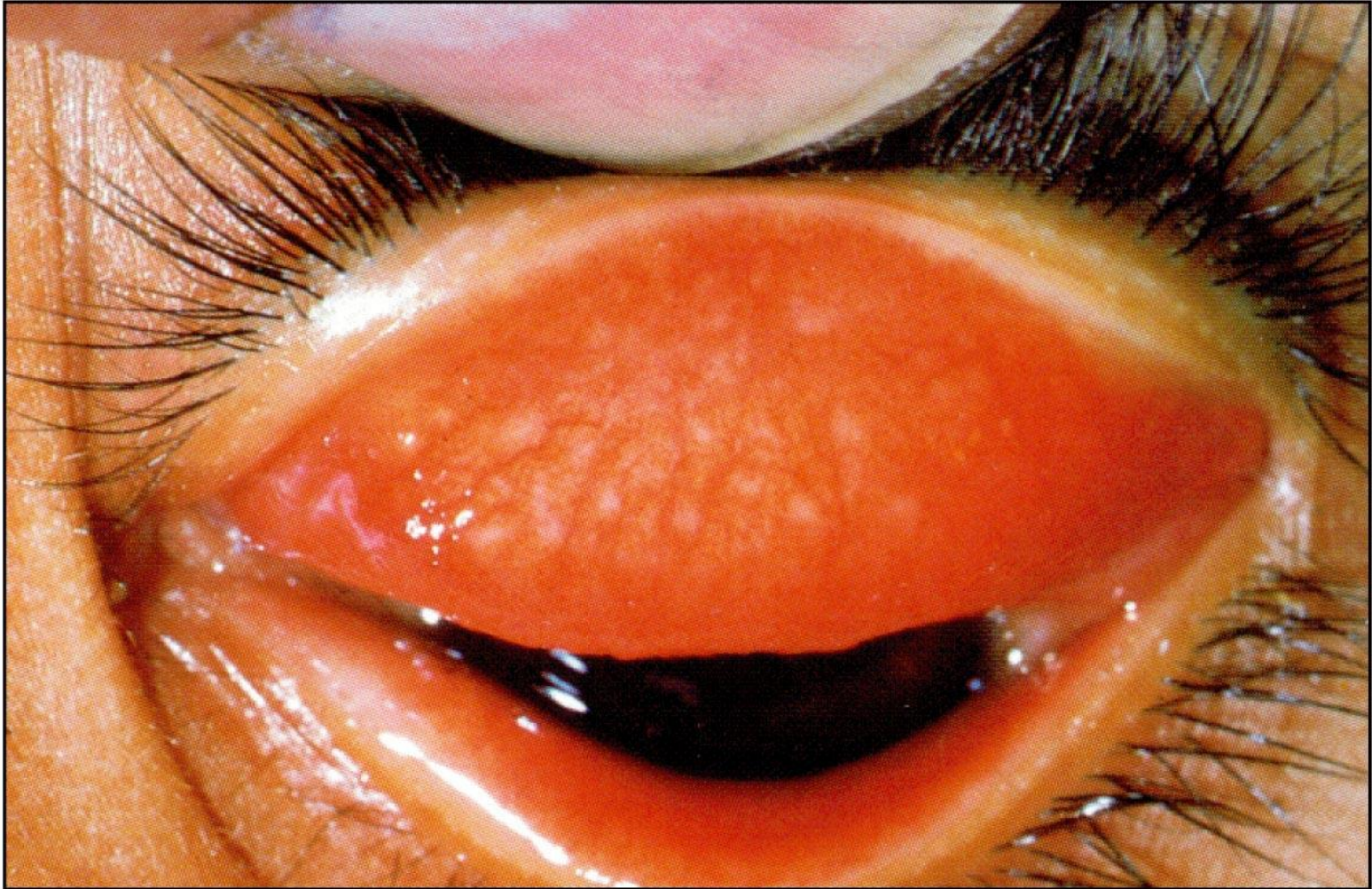
- Conjunctivitis (pinkeye)
 - *Haemophilus influenzae*
 - Various microbes
 - Associated with unsanitary contact lenses
- Neonatal gonorrhoeal ophthalmia
 - *Neisseria gonorrhoeae*
 - Transmitted to a newborn's eyes during passage through the birth canal.
 - Prevented by treatment of a newborn's eyes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

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



Protozoan Disease of the Eye

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