Slide 1

Microbial Diseases of the Skin and Eyes

Lecture 23

Slide 2

Learning Outcomes

- Bacterial Infections of the Skin
- Fungal Infections of the Skin
- Viral Infections of the Skin
- Infections of the Eyes

Slide 3

Skin

- Stratum Corneum
- Salt inhibits most microbes
- Lysozyme hydrolyzes peptidoglycan
- Fatty acids inhibit some pathogens
- Dermcidin

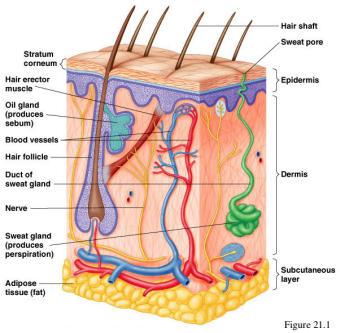


Figure 21.1

Slide 4

Normal Microbiota of the Skin

- Gram-positive, salt-tolerant bacteria
- Cocci
  - *Staphylococcus epidermidis*
  - *Micrococcus luteus*
- *Rods*
  - Diphtheroids
    - *Corynebacterium sp*

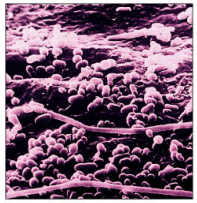


Figure 14.1a

Slide 5

Skin Rashes

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

Slide 6

Skin Lesions

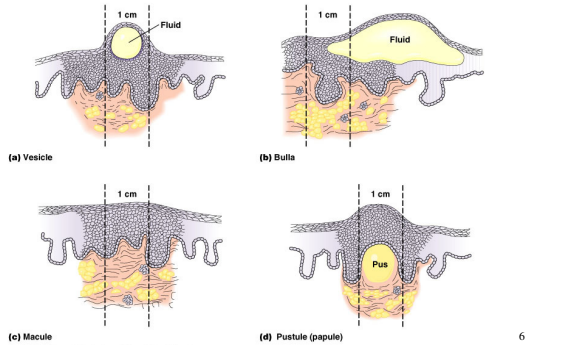
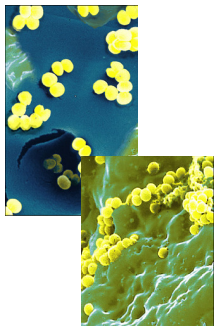


Figure 21.2

Slide 7

Staphylococcal Skin Infections

- Gram-positive cocci
- Form biofilms
- *Staphylococcus epidermidis*
  - catalase positive
  - coagulase-negative
  - Not normally a pathogen
  - Opportunistic in immume compromised patients
- *Staphylococcus aureus*
  - catalase positive
  - coagulase-positive
  - Leukocidin



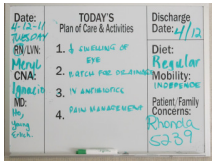
Slide 8

Staphylococcus aureus Skin Infections

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

Methicillin Resistant Staphylococcus aureus

- MRSA
- Resistant to all penicillin and cephalosporin antibiotics
- Susceptible to Vancomycin
- IV
- Nosocomial HA
- Community Acquired MRSA



Staphylococcus aureus Skin Infections

- Impetigo of the newborn
- Highly contagious in hospital nurseries
  - Direct contact
  - superficial
- Toxemia
- Scalded skin syndrome
  - Exfoliative toxin

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Figure 21.4

Streptococcal Skin Infections

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

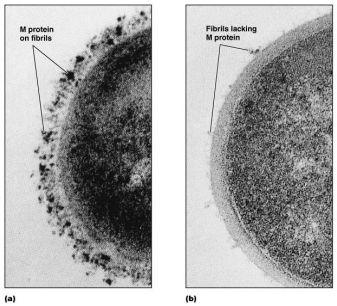


Figure 21.5

Streptococcus pyogenes Skin Infections

- Erysipelas
- Infects dermal layers of skin
- Impetigo in older children usually due to Streptococci
- Isolated pustules that rupture then crust over

Invasive Group A Streptococcal Infections

- Subdermal infections
  - Cellulitis- dermis of skin
  - Myositis - muscle
  - Necrotizing fasciitis – fascia covering muscles
- Tissue destroying enzymes:
  - Streptokinases
  - Hyaluronidase
- Shock
  - Exotoxin A, superantigen

Figure 21.8

Pseudomonas aeruginosa

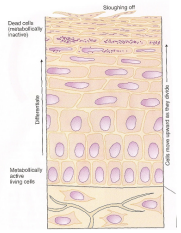
- Gram-negative, aerobic rod
  - Pyocyanin produces a blue-green pus
  - Exotoxin A – inhibits protein synthesis in host cells
- *Pseudomonas* dermatitis
- Post-burn infections
- Otitis externa –
- outer ear infections
  - Swimmers ear

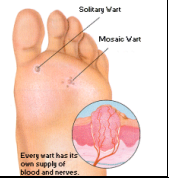
Acne

- Comedonal acne
  - Occurs when sebum channe blocked with shed cells
    - Closed – whiteheads
    - Open - blackheads
- 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*)
  - Nodular cystic acne
  - scarring
    - Treatment: isotretinoin

Warts

- Human Papillomaviruses
  - Viruses enter through lesion
  - Can only infect active cells of basal layer
  - Treatment:
  - Immunotherapy
  - Removal
  - Imiquimod (stimulate interferon production)
    - Interferon





Smallpox

- Droplet transmission, direct, and indirect contact (blankets)
- After 10 days incubation
- Enanthem in mouth
- 48 hours later exanthem maculapapular rash on face
- Smallpox virus (Orthopoxviru Poxviridae)
- Variola major had 30% mortality
- Variola minor had <1% mortality

Figure 21.9

Varicella-zoster virus

- Human herpes virus 3
- Chicken Pox = Varicella
- Transmitted by the respiratory route
  - viremia
- Causes pus-filled vesicles
- Virus may remain latent in dorsal root ganglia

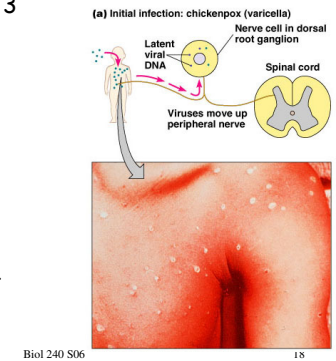


Figure 21.10a

Zoster

- Shingles
- Reactivation of latent HHV-3 releases viruses that move along peripheral nerves to skin.
- 500,000 cases USA per year
- 1995 Varicella vaccine introduced
- Postherpetic neuralgia
  - pain lasting 3 months after Zoster

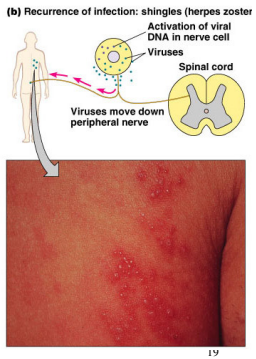
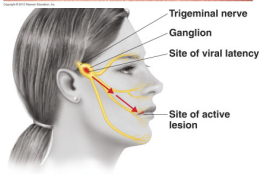


Figure 21.10b

Herpes Simplex

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



Slide 21

Measles (Rubeola)

- Morbillivirus (Paramyxoviridae)
- Transmitted by respiratory route
- Koplik's spots (enanthem)
- Macular rash (exanthem)
- Measles complications 0.3% mortality
  - pneumonia
  - Encephalitis in 1 in 1000 cases
  - Subacute sclerosing panencephalitis in 1 in 1,000,000 cases

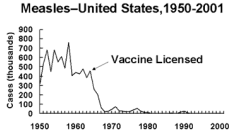


Figure 21.14

Slide 22

Measles Vaccination

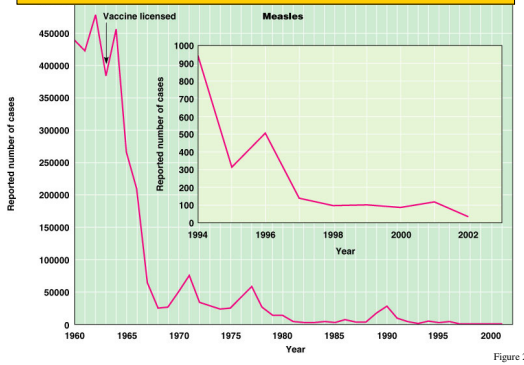
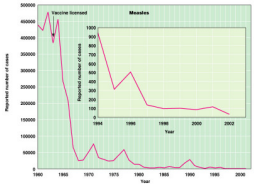


Figure 21.13

Measles Vaccination

- Prevented by MMR vaccination 1971
- No longer an endemic disease
- < 200 cases per year (US) since 1997
- 1998 Andrew Wakefield fraudulently claimed link between MMR and autism
- 2011 Wakefield research discredited as being dishonest
- Struck off 2010
- NO link found between MMR and autism in any medical study
- Decline in vaccination rates responsible for increase in incidence and fatalities



Rubella (German Measles)

- Rubella virus (little red)
- Rubivirus (Togaviridae)
- Macular rash and fever
- May even be asymptomatic
- Infection during pregnancy
  - 20% cases → abortion
  - Congenital rubella syndrome causes severe fetal damage
- Prevented by MMR vaccination

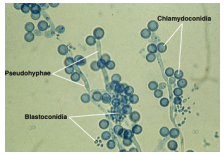
Figure 21.15

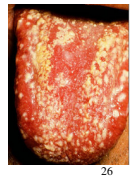
Cutaneous Mycoses

- Dermatomycoses: tineas or ringworm
- Fungi grow in epidermis
- metabolize keratin
- *Trichophyton*
  - infects hair, skin, nails
    - Jock itch *T. rubrum*
- *Epidermophyton*
  - infects skin and nails
- *Microsporum*
  - infects hair and skin
- Treatment
  - Oral griseofulvin
  - Topical miconazole

Candidiasis

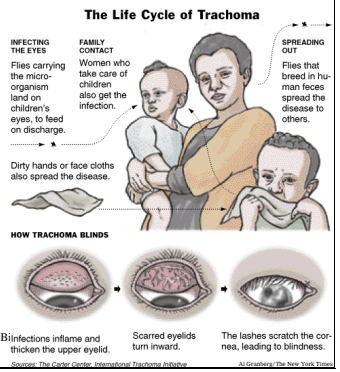
- *Candida albicans* (yeast)
  - suppression of competing bacteria by antibiotics
- Affects:
  - Skin folds
  - Mouth (Thrush)
  - mucous membranes of genitourinary tract
- Topical treatment with miconazole or nystatin
- Malassezia furfur-
  - Dandruff superficial mycosis





Microbial Diseases of the Eyes

- Conjunctivitis (pinkeye)
  - *Haemophilus influenzae*
  - Various microbes
  - adenoviruses
  - Direct and indirect contact
  - unsanitary contact lenses
- Neonatal gonorrheal ophthalmia
  - *Neisseria gonorrhoeae*
  - Transmitted to newborn's eyes during passage through the birth canal
  - All newborn's eyes treated with preventative antibiotics

Chlamydia trachomatis

- Inclusion conjunctivitis
  - Transmitted to newborn's eyes during passage through the birth canal
  - Treated with tetracycline
- Trachoma
  - Greatest cause of blindness worldwide
  - Infection causes permanent scarring; scars abrade the cornea leading to blindness