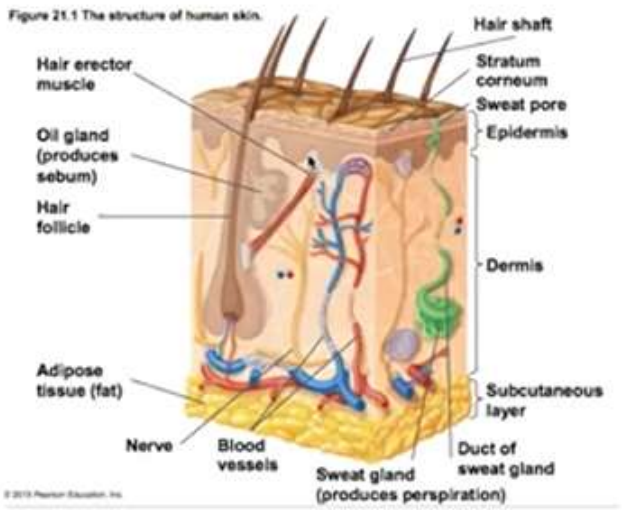
21 slides

Wednesday, December 3, 2025 4:01 PM

Skin

- Hair follicles, sweat gland ducts, oil gland ducts
- Passageways for organisms into deeper tissues
- Perspiration
  - Moisture and nutrients for some microbes
  - However, also contains
    - Salt, lysozyme, antimicrobial peptides (defensins)
- Sebum
  - Secreted by oil glands
  - Mixture of lipids, proteins, salts
  - To inhibit hair from drying out.



Mucous Membranes

- Line body cavities
- Epithelial cells secrete mucus
- Often acidic
- Some cells have cilia.

Normal Microbiota of Skin

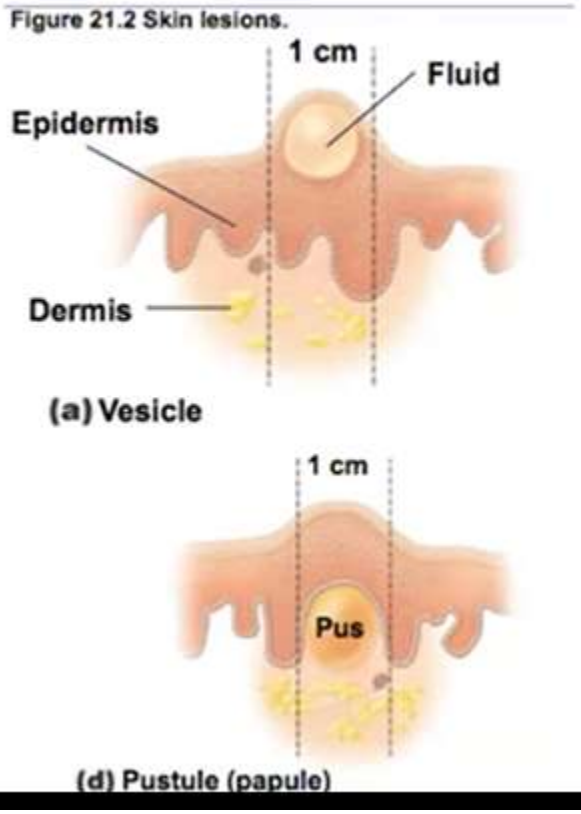
- Skin generally inhospitable to most microbes
- Aerobic bacteria on skin generate fatty acids from sebum
  - Inhibiting many microbes
- Microbes that live on skin:
  - Resistant to drying and high [salt]
  - Gram positive
  - Staphylococci
- Areas of more moisture, more microbes
  - Metabolize secretions from sweat glands
  - Contributing to body odor.

Normal Microbiota of Skin

- Gram positive diphtheroids
  - Aerobic, Gram positive bacilli
  - Skin commensals
- *Propionibacterium acnes*
  - Anaerobic
  - Inhabit hair follicles
  - Growth is supported by sebum
  - Plays a role in acne.

Diseases of the Skin

- Vesicle
  - Small, fluid filled lesion
- Pustule
  - Raised lesion containing pus
- Necrotizing fasciitis
  - Death of muscles, tissue, or skin.



Staphylococcal Skin Infections

- Staphylococci
- Spherical, gram positive
- *Staphylococcus epidermidis*
  - Coagulase negative
  - Common skin bacterium.

Staphylococcal Skin Infections

- *Staphylococcus aureus*
  - Pathogenic
  - Resident nasal bacteria, 20%
  - Golden yellow colonies
  - 300,000 more base pairs in genome than *S. epidermidis*
    - Accounts for virulence factors, evading host defenses
    - Capsule, enterotoxins, penicillinase (MRSA)
  - Coagulase positive.

- *Staphylococcus aureus*
- Most pathogenic of staphylococci
- 20,000 deaths in US each year
- Large number of nosocomial infections
- Very resistant, non-spore forming pathogen
- Can withstand:
  - High [salt] (7-10%)
  - Extremes in pH
  - High temps
  - Remains viable for months.

S. aureus: Localized Cutaneous Infection

- Invades skin through wounds, follicles, glands
- Most common: inflammation of hair follicles (folliculitus, pimple)
- More serious – furuncle (boil).

Streptococcal Skin Infections

- Gram positive
- Can cause: meningitis, pneumonia, sore throat
- Secrete toxins
  - Hyaluronidase
  - Hemolysin
    - α-hemolytic, β-hemolytic, γ-hemolytic
- Divided into groups based on antigenic carbohydrates on cell wall.

Streptococcal Skin Infections…

- Flesh eating bacteria
- Caused by *Streptococcus pyogenes*
- ~1200 cases in US annually
- Infection precipitated by minor breaks in skin
- Once established, necrotizing fasciitis rapidly destroys tissue
- Causes shock
- Exotoxin A
  - Acts as superantigen
  - Causes immune system to contribute to damage.

Infections by *Pseudomonads*

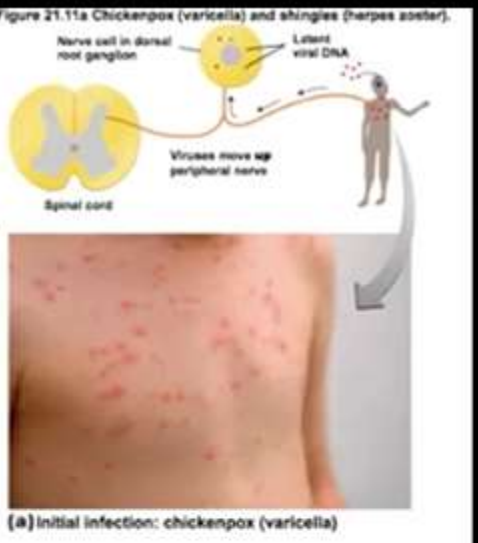
- Aerobic, Gram negative bacilli
- Soil and water bacterium
- Resistant to soaps, antibiotics, some disinfectants
- *Pseudomonas aeruginosa*
- Hot tub rash
  - More people in spa, alkalinity rises
  - Chlorine less effective
  - Hot water opens hair follicles
  - Facilitates entry of bacteria
- Common opportunistic infection in burn patients
- Can cause otitis externa (swimmer's ear).

Chickenpox

- Caused by varicella-zoster virus (VZV)
- Harbored in respiratory system
- Transmitted via respiration and fluid of skin lesions
- Dried scabs not infectious
- Virus unstable in environment.

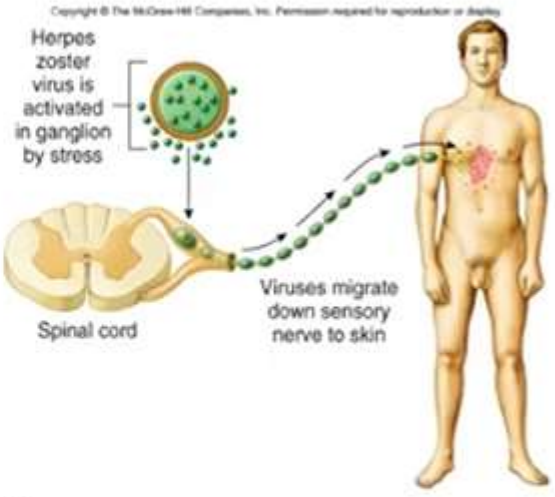
Chickenpox

- After entering respiratory system
- Localizes in skin cells after 2 weeks
- Symptoms
  - Fever
  - Abundant rash (face, scalp, trunk)
    - Most contagious 1-2 days before rash
    - And until all blisters forms scabs
- Vaccine is available (12 months, 4-6 years).



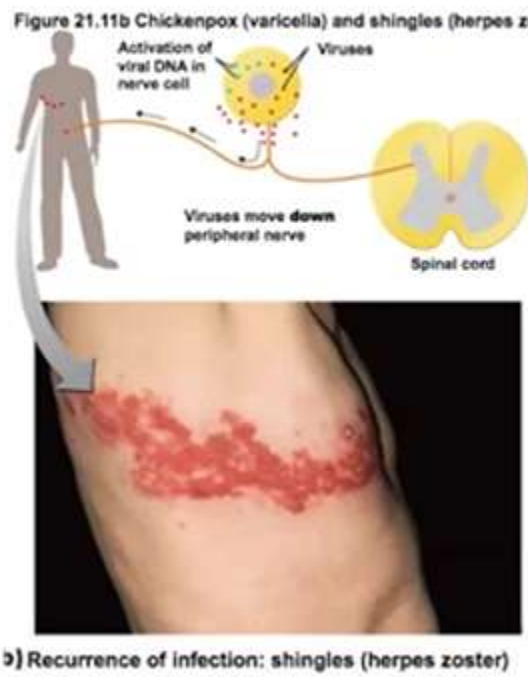
Chickenpox → Shingles

- VZV can remain latent in body
- After primary infection, VZV enters neurons
  - Where it persists as viral DNA
- Abs can't penetrate neuron
- No viral antigens presented on surface
- So no cytotoxic T cells activated
- VZV located in dorsal root ganglion near spine
- Reactivated decades later
- Virions produced move along peripheral nerves
  - To cutaneous sensory nerves on skin
- Shingles.



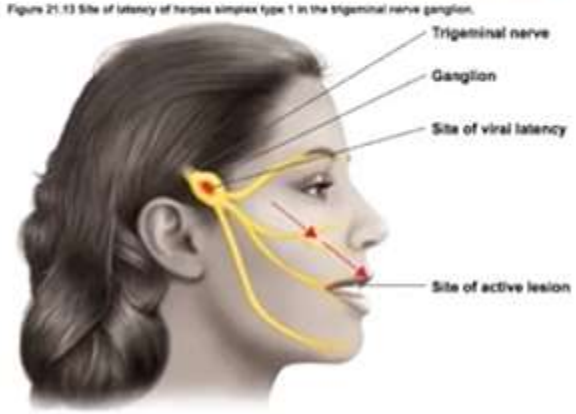
Shingles

- Distributed along waist
- (Shingles = cingulum = belt)
- Symptoms
  - Severe burning or stinging pain
  - Risk increases with age (depressed immunity)
  - 1 of 3 people will contract
- Transmission: direct contact with fluid from rash blisters
  - Can be spread to person who never had chickenpox
- Zoster vaccine (Shingrix) given after 50 yrs



Herpes Simplex Virus (HSV)

- HSV-1
- Transmitted by oral or respiratory routes
- 90% US population has it
- Cold sores are most common, recurrent infection
- Painful, short lived vesicles near lips
- Remains latent in trigeminal nerve ganglia
- Recurrences triggered by stress, UV, hormonal changes.



Herpes Simplex Virus (HSV)

- HSV-2
- Different antigenic make up than HSV-1
- Transmitted sexually
  - Causes genital herpes
- Latent in nerve ganglia at base of spine
- Lesions on genitalia
- Sensitive (painful) vesicles
- 16% of 14-49 yr olds nationwide.

Herpes

- Treatment
  - There is no cure!
  - Agents like Valtrex suppress outbreaks or reduce viral shedding.

Measles

- Highly contagious viral disease (measles virus)
- Spread by respiratory route
- Can be infectious before symptoms appear
- Koplik's spots, small red spots with blue/white specks, appear in mouth
- Rash
  - First on face, then spreads to trunk
- 104° F fever
- MMR vaccine
  - In US, led to 99% reduction
- 37-200 cases per year in 2000-2013
- Worldwide, 19 cases/ 1M get measles and 122k deaths
  - Pneumonia most common cause of death from measles.

Fungal Diseases of Skin and Nails

- Mycosis
  - Fungal infection of body
- Fungi can resist low moisture and high salt of skin
- Dermatophytes
  - Fungi that colonize hair, nails, outer layer of epidermis; on the keratin
  - Known as ringworm or tinea.

Fungal Diseases of Skin and Nails

- Ringworm of the scalp
- *Tinea capitis*
- Common in school children
- Results in bald patches
- Infection spreads in circular motion
- Usually transmitted by fomites, cats, and dogs.

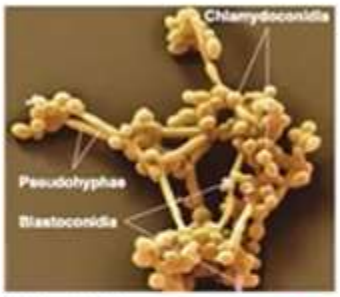
Tinea capitis
(Ringworm of the scalp)

Fungal Diseases of Skin and Nails

- *Tinea cruris*
  - Jock itch
- *Tinea pedis*
  - Athlete's foot
- Growth is favored by moisture
- So dry your….

Candidiasis

- Normal microbiota suppresses fungus *Candida albicans*
  - which lives inside body
- Can proliferate if antibiotics are used
- Candidiasis
- Yeastlike and can form pseudohyphae
- Resistant to phagocytosis
- Whitish overgrowth in mouth
  - Thrush
- Can also cause (candidal) vaginitis.



(a) Candida albicans

(b) Oral candidiasis, or thrush