

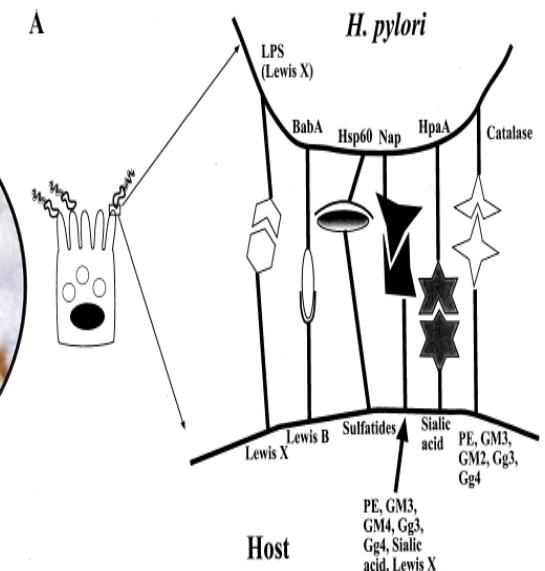
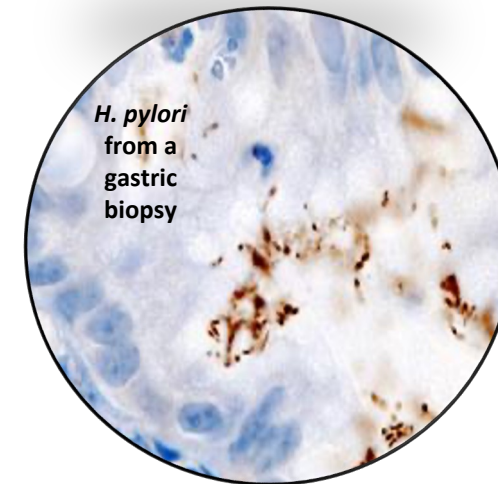
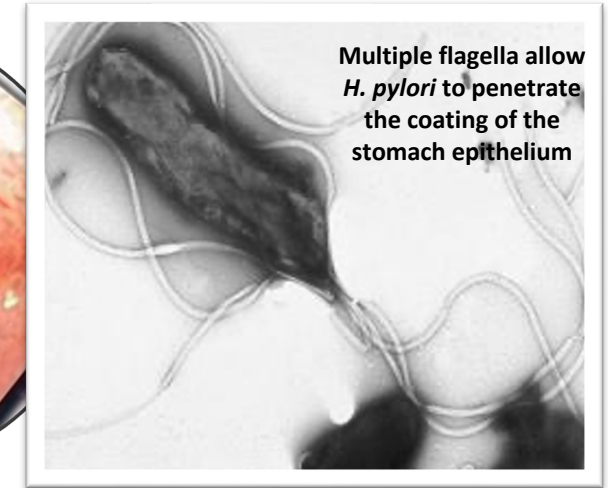
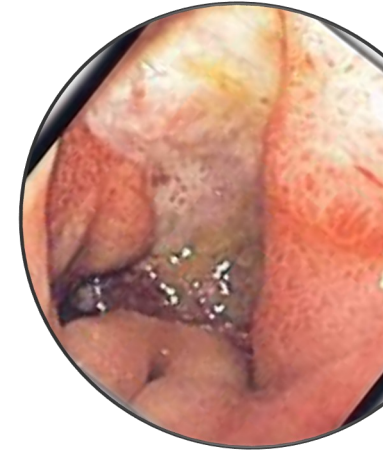
Lesson 20 – Basic immunology: The first line of defense



It ain't easy to be a pathogen

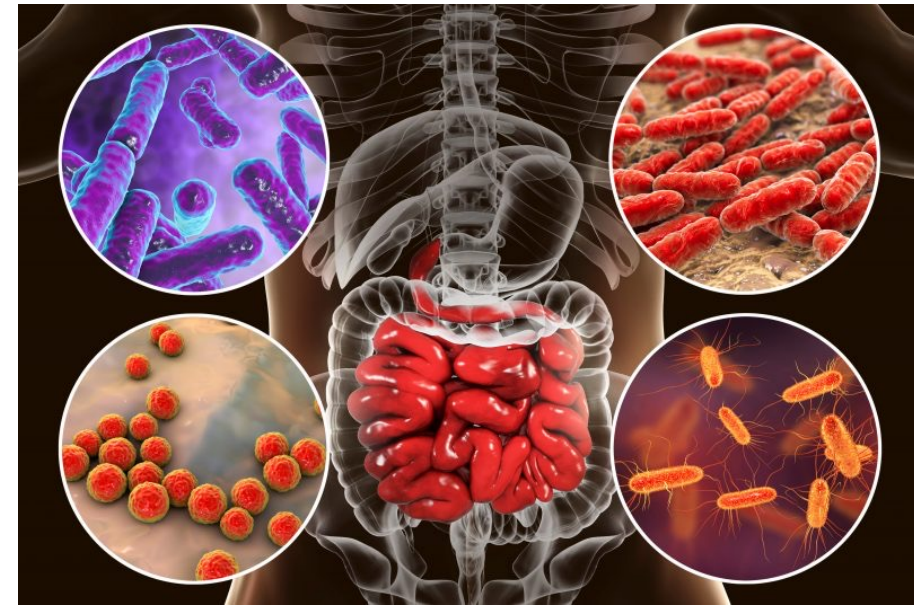
What a pathogen must do in order to cause a disease

1. Gain access to the body
2. Attach to and/or enter cells of its host
 - Receptors on pathogen must fit, lock-and-key, with receptor sites on host cell
3. Reproduce while avoiding host's **immune system** responses

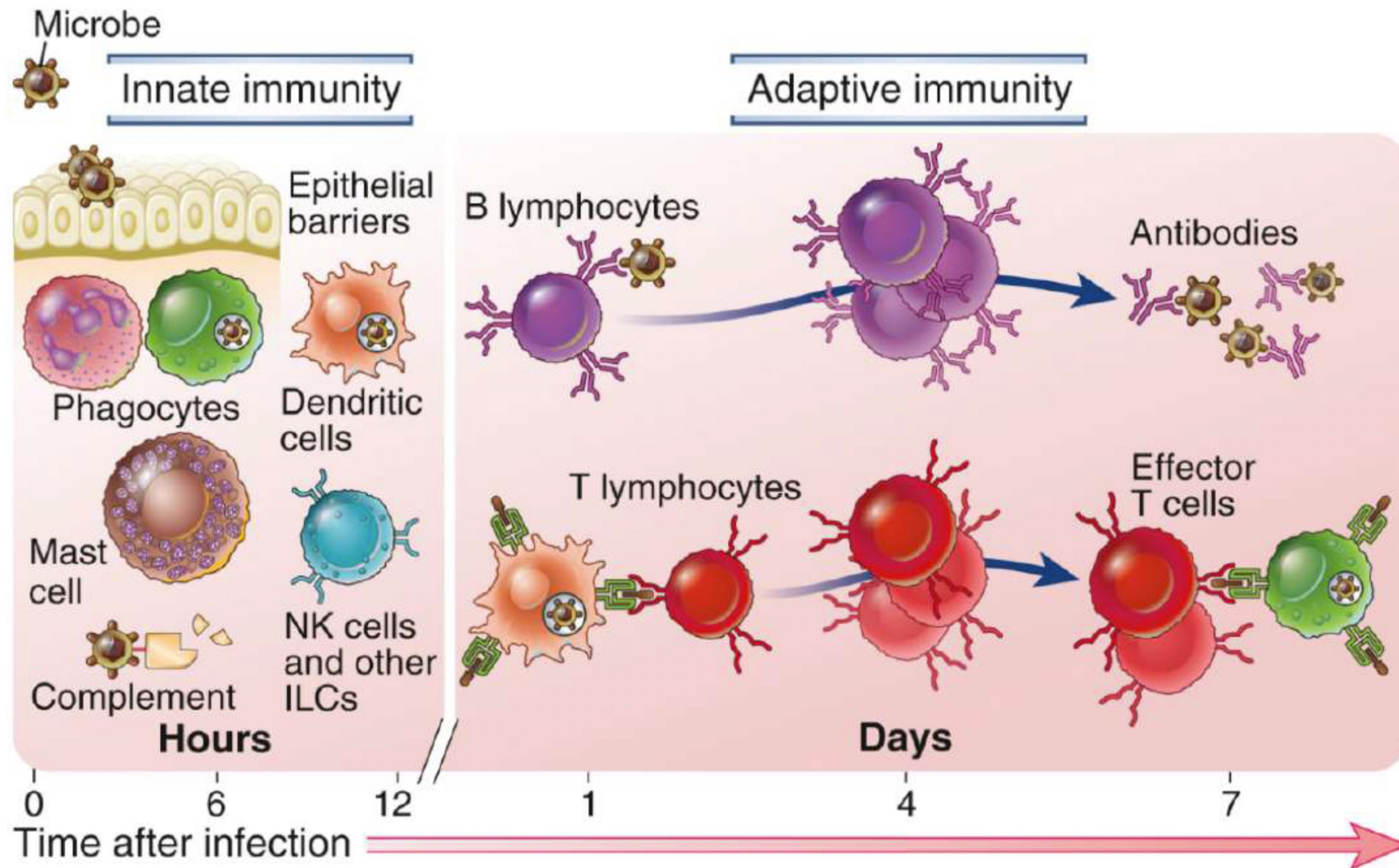


Normal microbiota

- Protect the body by competing with potential pathogens
 - This is called **microbial antagonism**
- **Normal microbiota** protect us by
 - Consuming nutrients that would otherwise be available to pathogens
 - Sometimes changing the pH of the area they inhabit in ways that help them and harm competing microbes
 - Their presence stimulates certain parts of the **second line of immune defense**, helping the body defend itself from invaders
 - Normal gut microbiota improve our overall health by producing several types of vitamins



The immune system



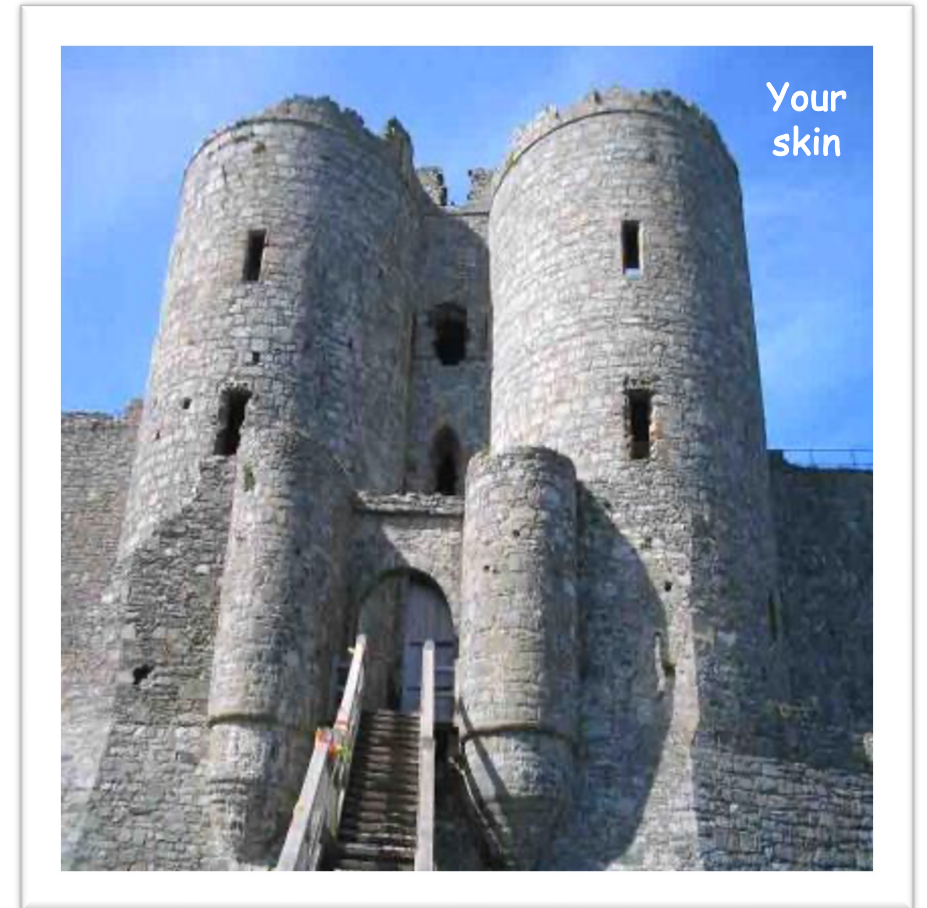
Innate Immunity - the first line of defense (FLD)

- **Innate, or nonspecific, immunity** is the defense system with which you were born
- **It protects you against all antigens** (*non-specific*)
- Innate immunity firstly involves barriers that keep harmful materials from entering your body
 - **These barriers form the first line of defense in the immune response**



Innate Immunity - the first line of defense (FLD)

- The first line of defense comprise all those structures, chemicals, processes that work to *prevent pathogens entering the body*
- Includes the **skin** and **mucous membranes** of the respiratory, digestive, urinary, and reproductive systems



Skin – physical components of FLD

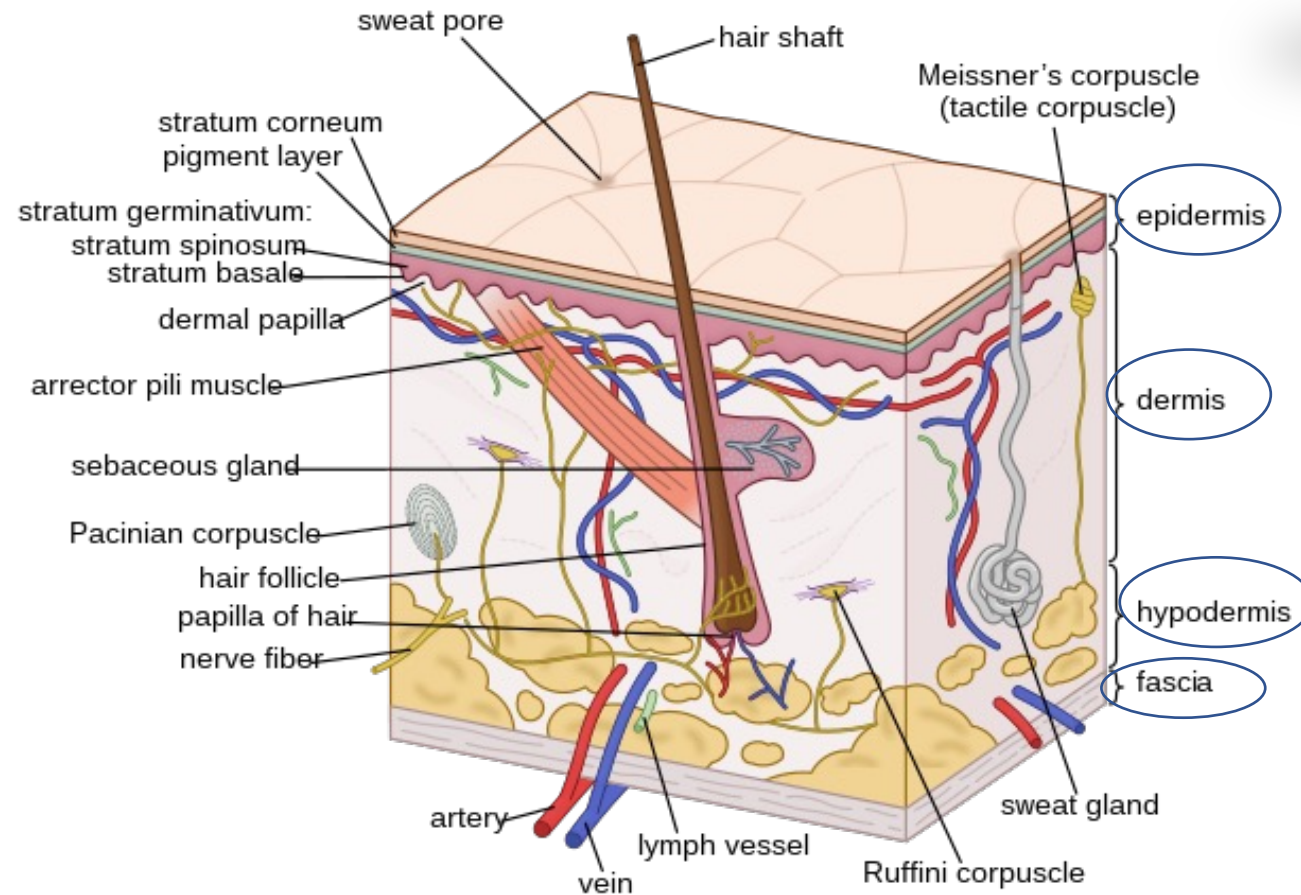


2 major layers

1. Epidermis

2. Dermis

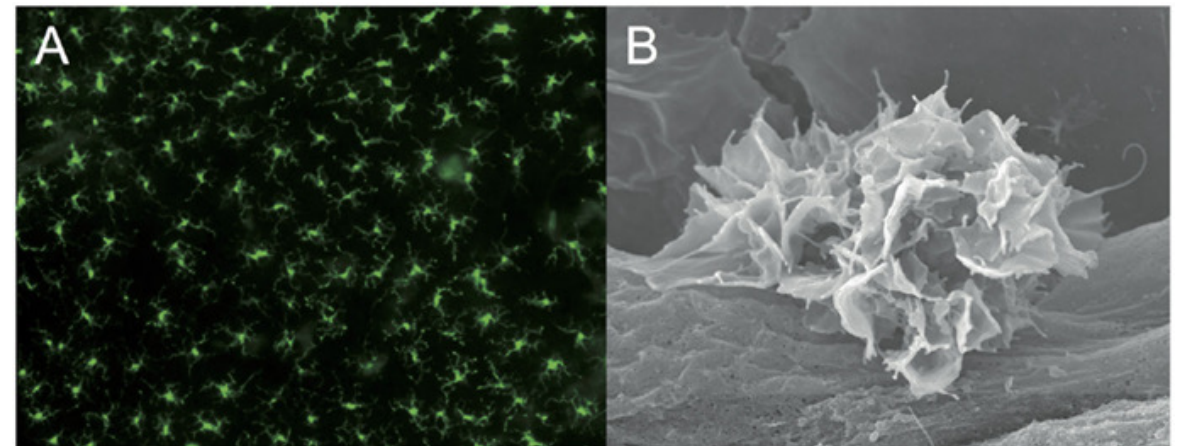
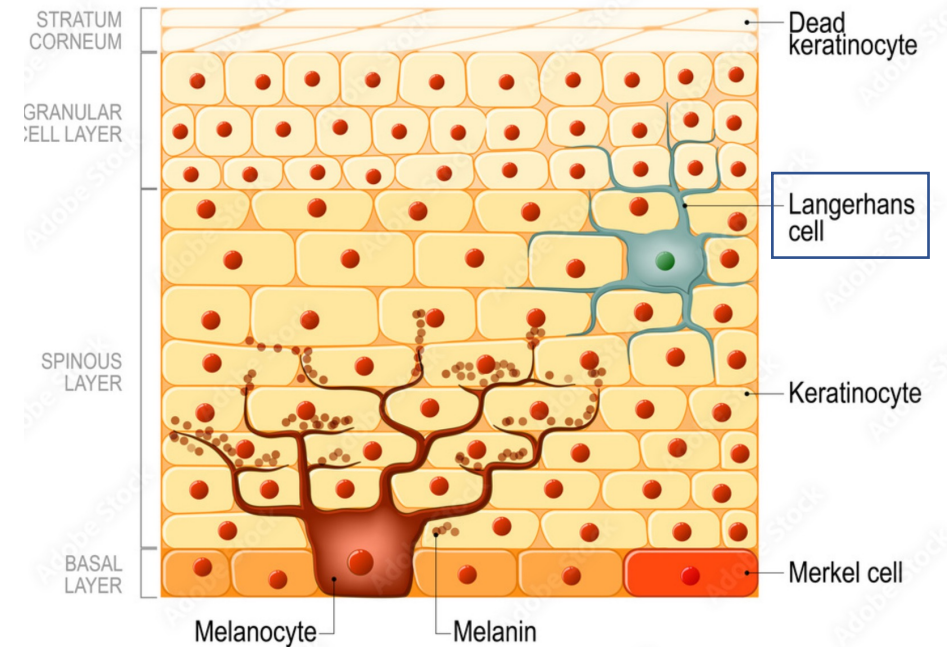
- *Hypodermis*
- *Fascia*



Skin – physical components of FLD

Epidermis

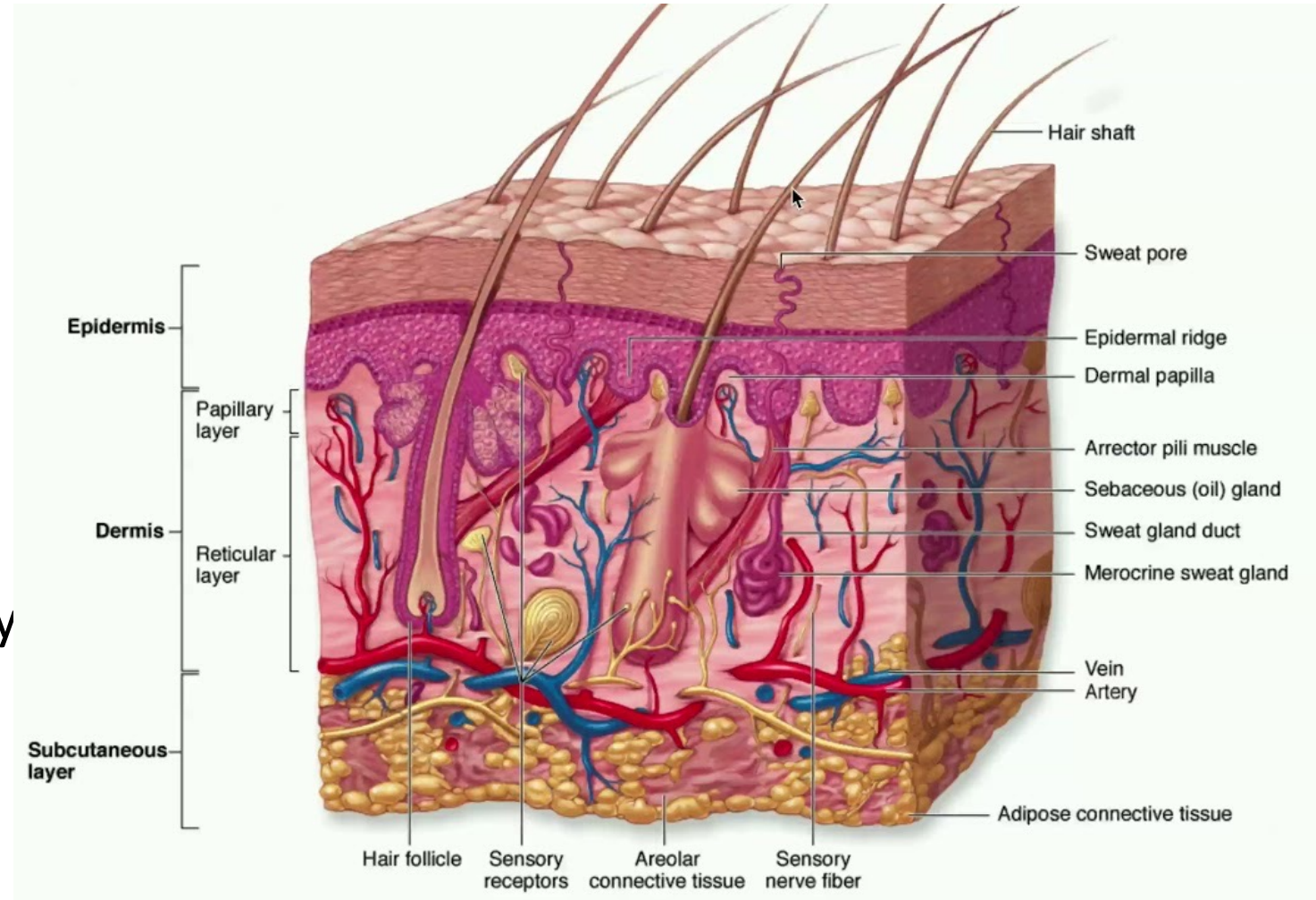
- Outer layer composed of multiple layers of tightly packed cells
 - Few pathogens can penetrate these layers
 - Shedding of dead skin cells removes attached microorganisms
- Epidermal dendritic cells (*Langerhans cells*) phagocytize pathogens
 - These cells extend out among other cells of the epidermis, forming a network to intercept invaders



Skin – physical components of FLD

Dermis

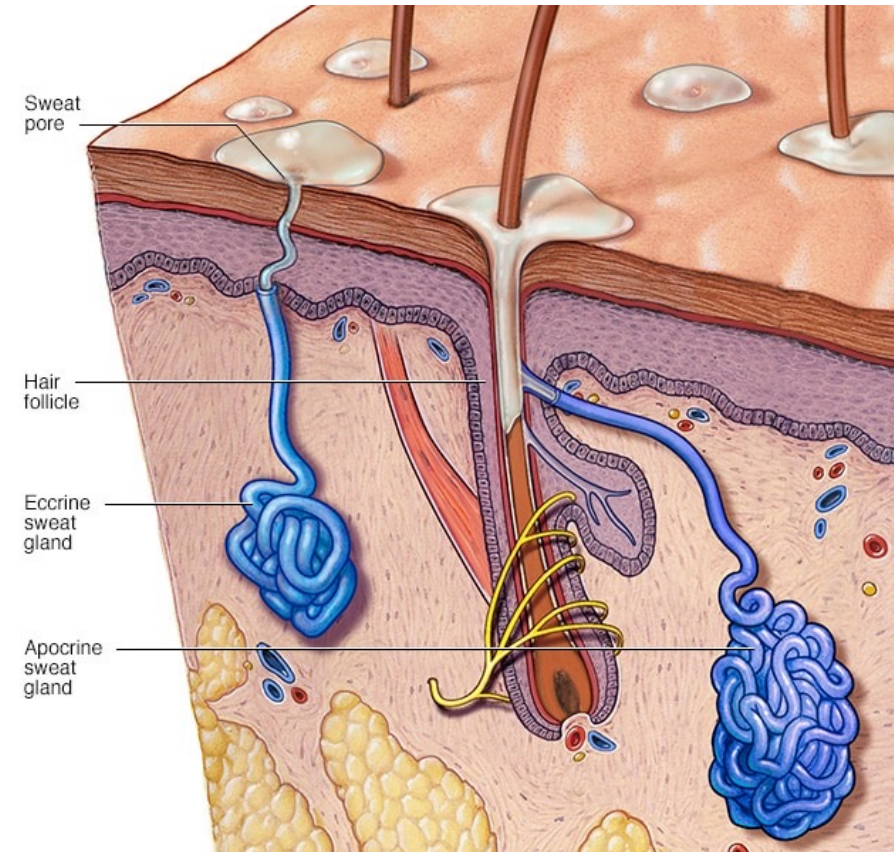
- Subdivided in two layers
 - Papillary layer
 - Reticular layer
- Contains protein fibers called collagen
 - Give skin strength and pliability to resist abrasions that could introduce microorganisms



Skin – chemical components of FLD

Perspiration

- secreted by sweat glands
- function:
 - **salts** inhibit growth of pathogens by drawing water from their cells
 - **antimicrobial peptides**
 - **lysozyme**, a protein that destroys bacteria cell walls



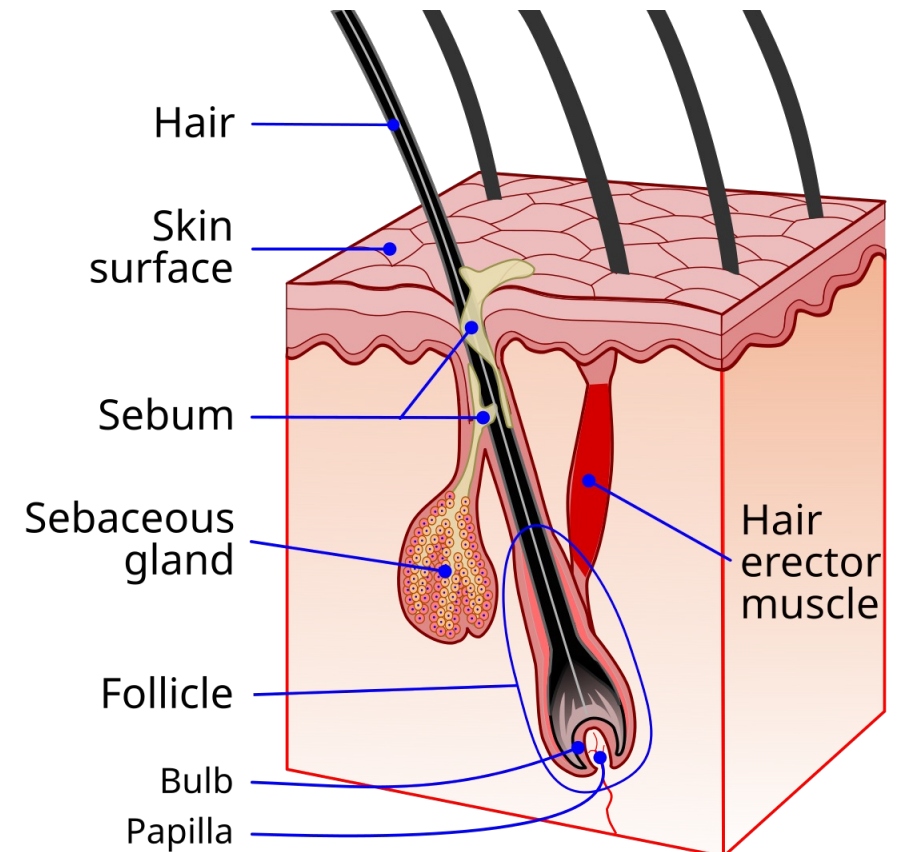
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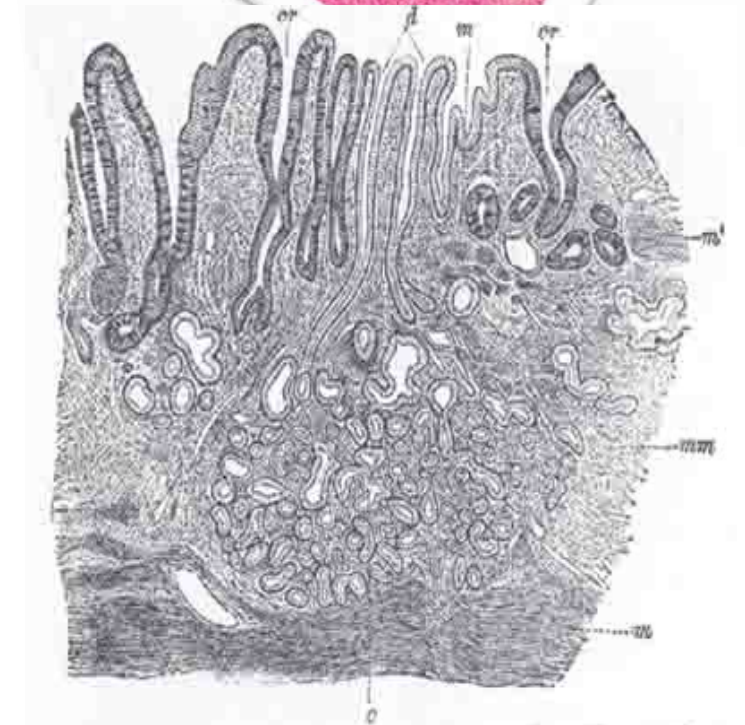
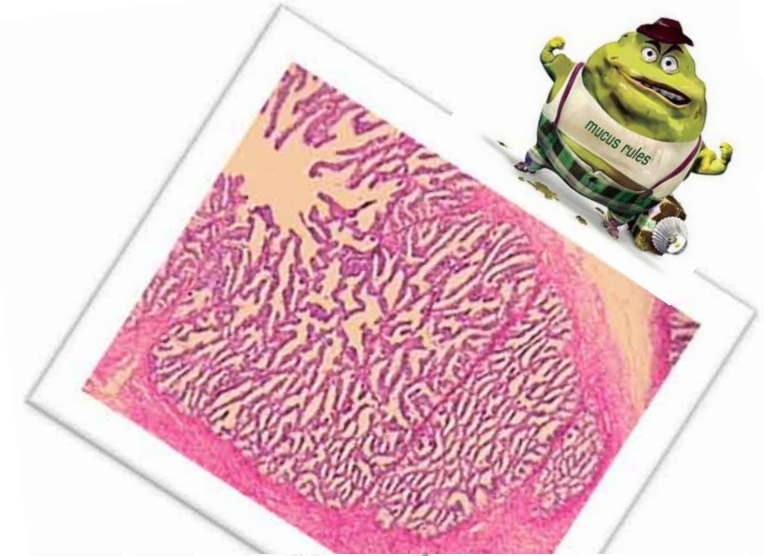
Sebum

- secreted by sebaceous (oil) glands
- function:
 - helps keep skin pliable and less likely to break or tear
 - lowers pH of skin to a level inhibitory to many bacteria



Mucous membranes – hybrid FLD

- A **mucous membrane** or **mucosa** lines all body cavities open to the outside environment
 - eyes, eyelids, ears, inside the nose, inside the mouth, lips, and the genital areas
- It consists of a few layers of **alive** epithelial cells overlying a layer of loose connective tissue
- Epithelial cells packed tightly to prevent entry of pathogens
 - often they reduce to one cell layer thick, so pathogens sometimes breach the barrier



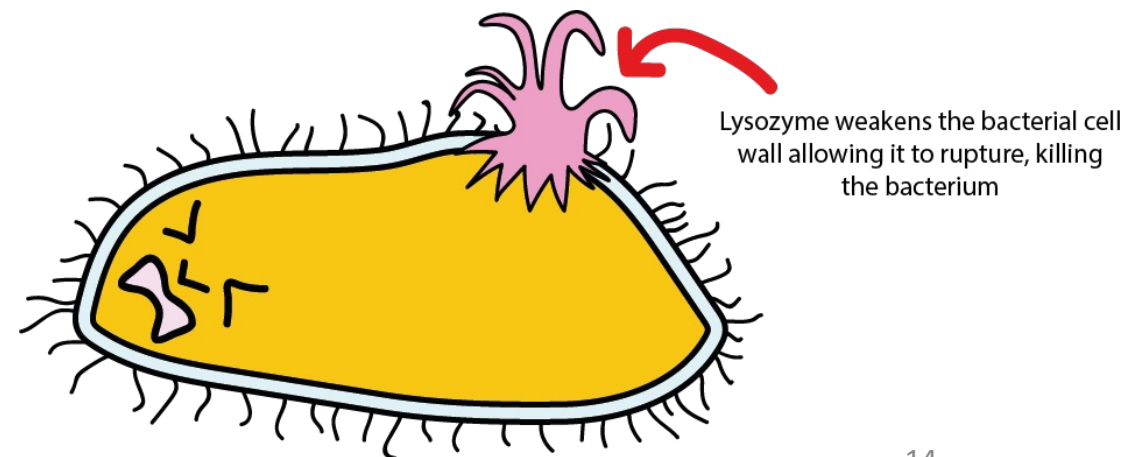
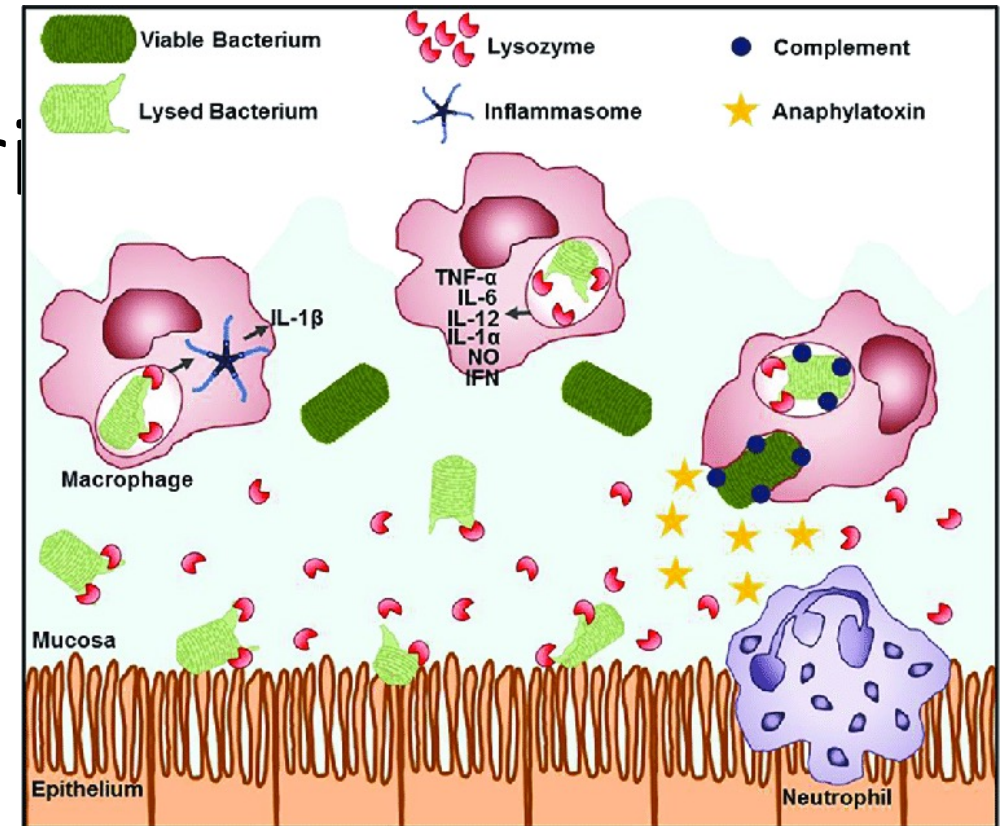
Mucous membranes - hybrid FLD

- Some mucous membranes secrete **mucus**, a thick protective fluid that helps in
 - entrapping pathogens and dirt and avert their body penetration
 - think about your nose when you have a flu
 - preventing bodily tissues from becoming dehydrated



Mucous membranes – hybrid

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- Besides producing mucus, mucosa also produces
 - lysozyme (cell wall lysis)



Mucous membranes

- Some mucous membranes secrete mucus, a thick protective fluid that helps in
 - entrapping pathogens and dirt and avert their body penetration
 - think about your nose when you have a flu
 - preventing bodily tissues from becoming dehydrated
- Besides producing mucus, mucosa also produces
 - lysozyme (cell wall lysis)
 - other antimicrobial peptides
- Every day you swallow and digest about 1 liter of mucus (OMG U R Nasty!)

