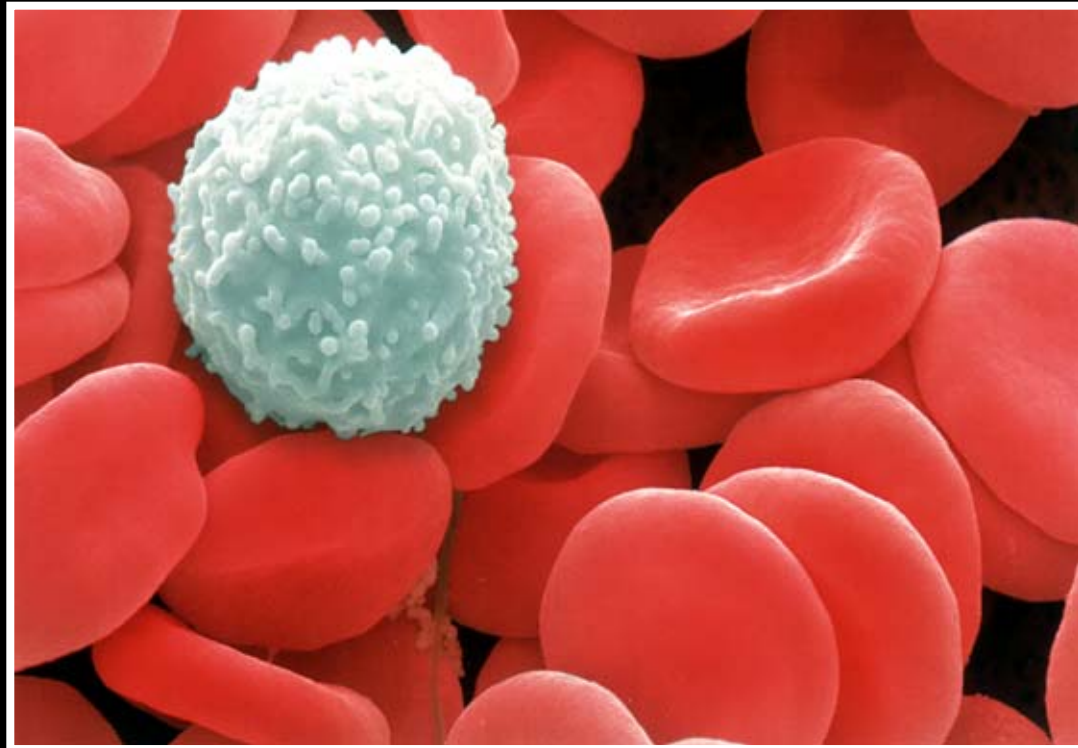


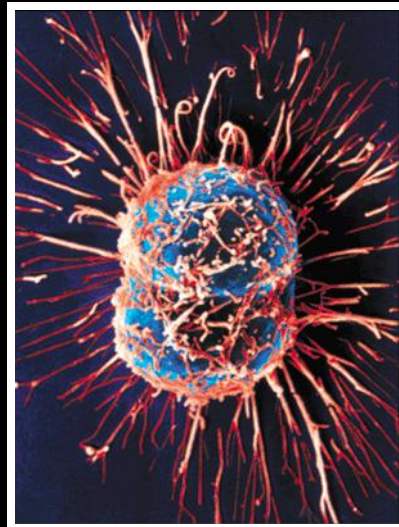
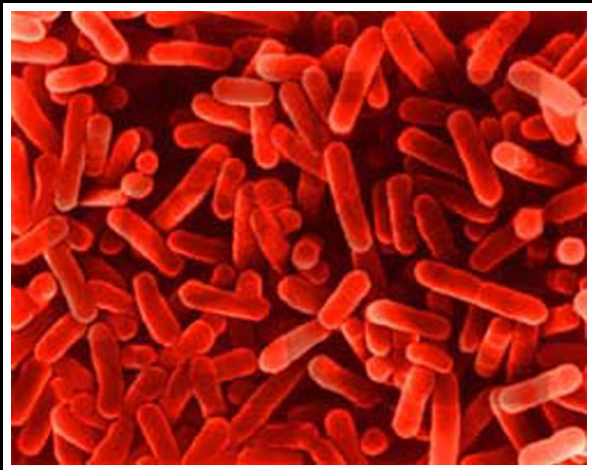
# The Human Immune System



Video

# What is the immune system?

- The body's defense against disease causing organisms, malfunctioning cells, and foreign particles



# The First Line of Defense

## ~Skin~

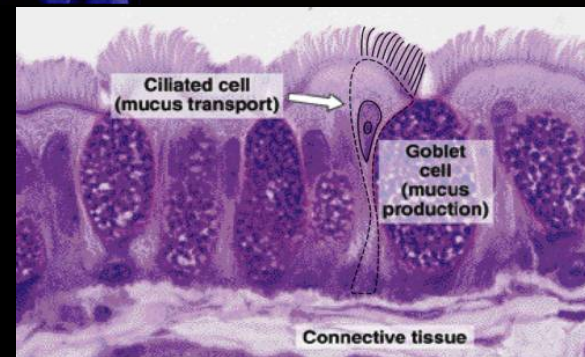
- The dead, outer layer of skin, known as the **epidermis**, forms a shield against invaders and secretes chemicals that kill potential invaders
- You shed between 40 – 50 thousand skin cells every day!



# The First Line of Defense

## ~Mucus and Cilia~

- As you breathe in, foreign particles and bacteria bump into **mucus** throughout your respiratory system and become stuck
- Hair-like structures called **cilia** sweep this mucus into the throat for coughing or swallowing



Don't swallowed bacteria have a good chance of infecting you?



# The First Line of Defense

~Saliva~

What's the first thing you do when you cut your finger?

- **Saliva** contains many chemicals that break down bacteria
- Thousands of different types of bacteria can survive these chemicals



# The First Line of Defense

## ~Stomach Acid~

- Swallowed bacteria are broken down by incredibly strong acids in the stomach that break down your food
- The stomach must produce a coating of special mucus or this acid would eat through the stomach!



Think of the human body as a hollow plastic tube...



The food is digested within the hole in the tube, but it never actually enters into the solid plastic material.

Tube inner surface  
~Digestive System~

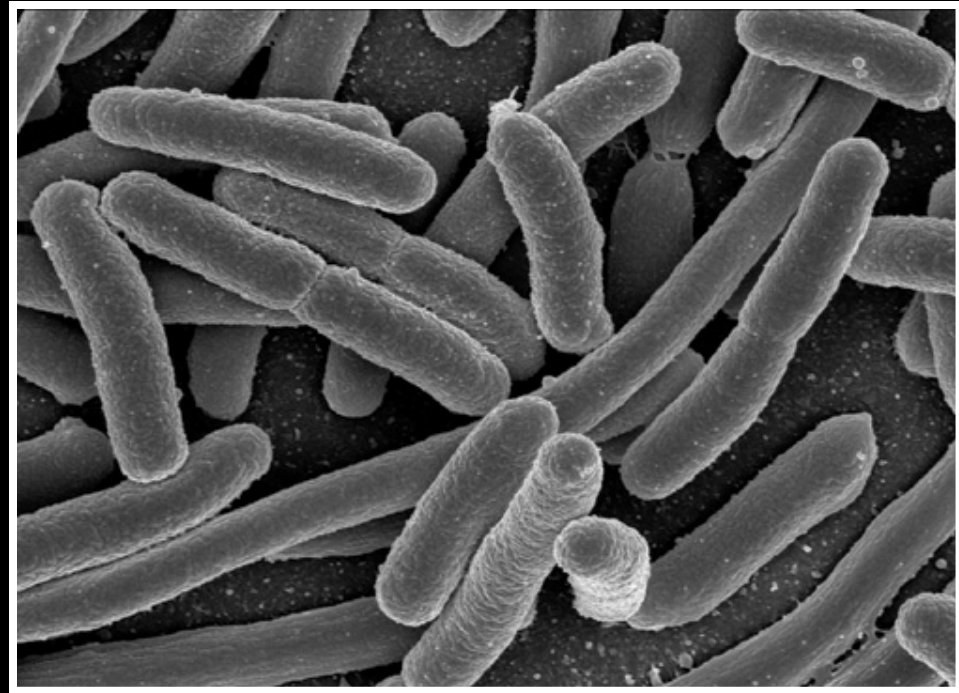
Tube outer surface  
~Skin~

Plastic interior  
~Body~

# Escherichia coli

is common and plentiful in all of our digestive tracts. Why are we all not sick?

- These bacteria are technically **outside** the body and aid in digesting material we cannot
- Only if E.Coli are introduced in an unnatural manner can they break through the first line of defense and harm us

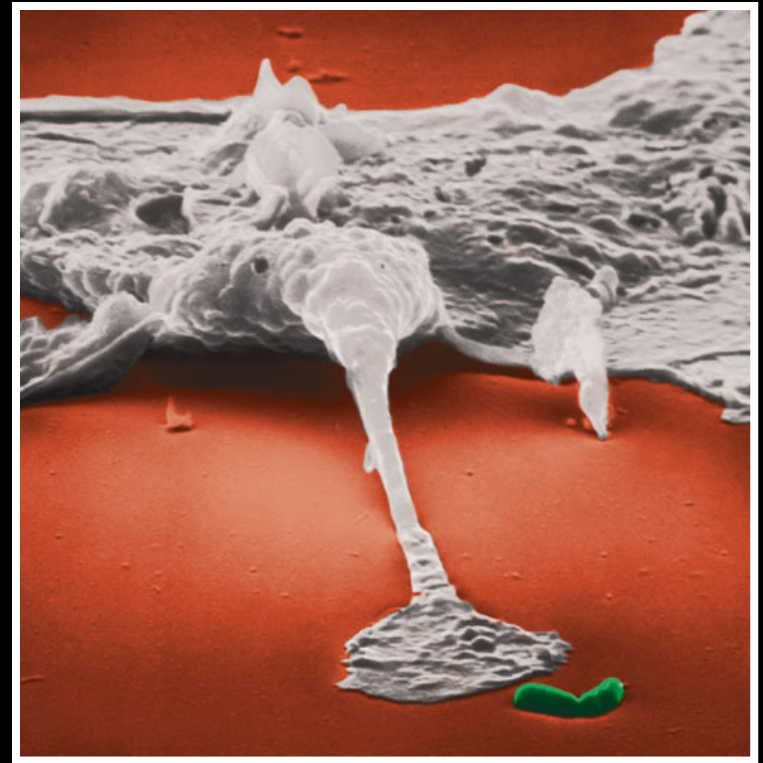




# The Second Line of Defense

~White Blood Cells~

- If invaders actually get **within** the body, then your white blood cells (WBCs) begin their attack
- WBCs normally circulate throughout the blood, but will enter the body's tissues if invaders are detected

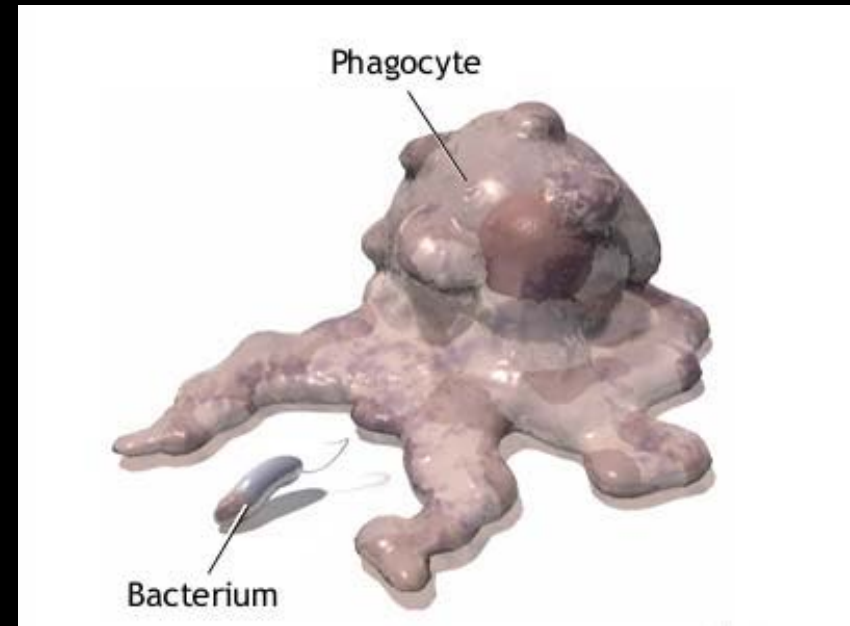


[Video](#)

# White Blood Cells

## ~Phagocytes~

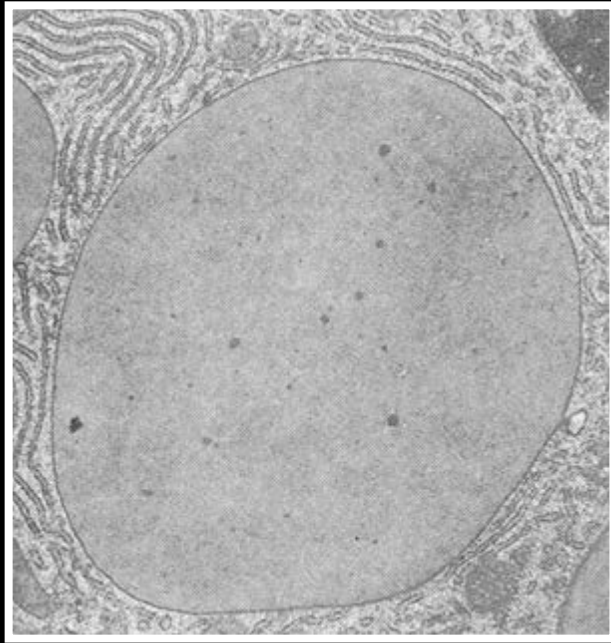
- These white blood cells are responsible for eating foreign particles by engulfing them
- Once engulfed, the phagocyte breaks the foreign particles apart in organelles called Lysosomes



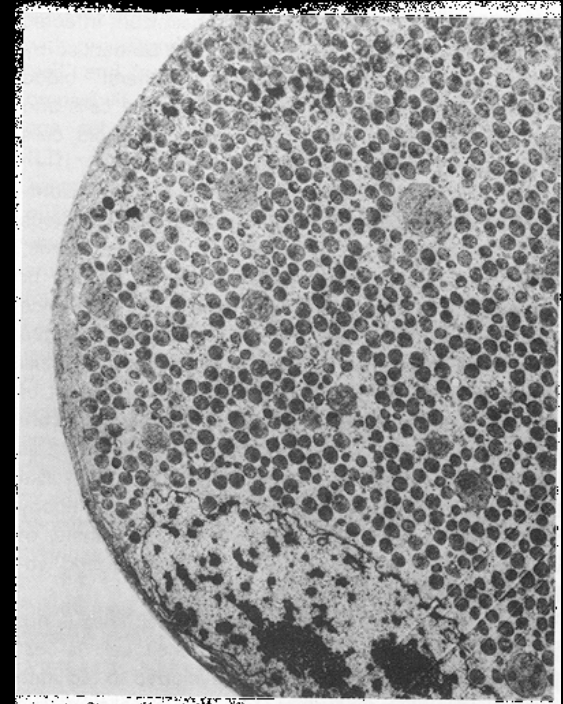
Where could invaders  
hide from phagocytes?

# Viruses

**Viruses** enter body cells, hijack their organelles, and turn the cell into a virus making-factory. The cell will eventually burst, releasing thousands of viruses to infect new cells.



Cell before infection...

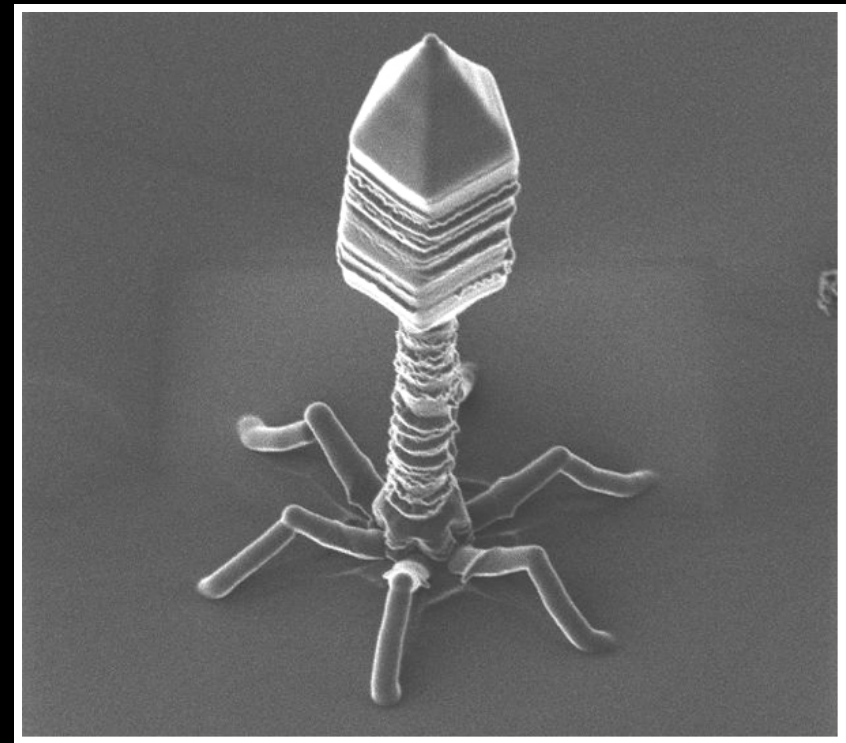


...and after.

# The Second Line of Defense

~Interferon~

- Virus-infected body cells release **interferon** when an invasion occurs
  - Interferon – chemical that **interferes** with the ability to viruses to attack other body cells

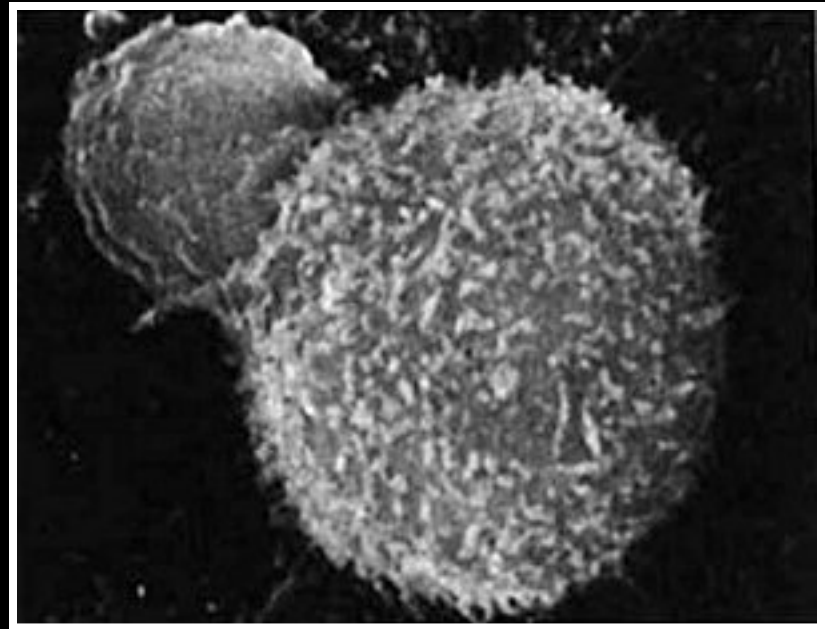


What happens to already infected cells?

# White Blood Cells

## ~T-Cells~

- T-Cells, often called “natural killer” cells, recognize infected human cells and cancer cells
- T-cells will attack these infected cells, quickly kill them, and then continue to search for more cells to kill





# The Second Line of Defense

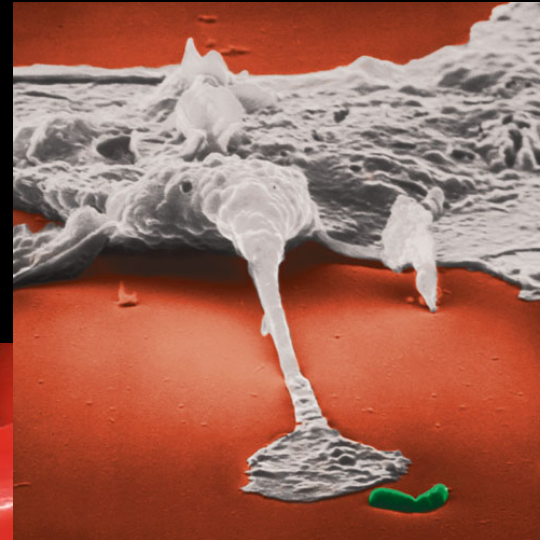
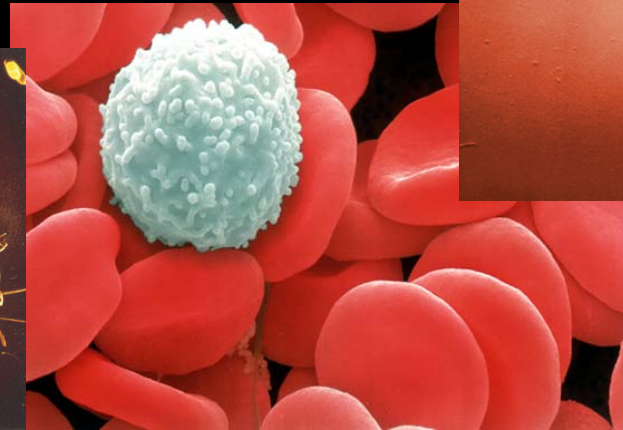
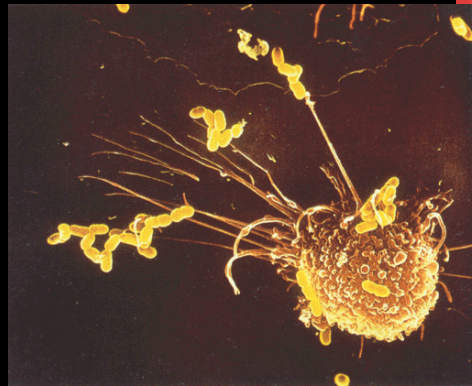
~The Inflammatory Response~

- Injured body cells release chemicals called **histamines**, which begin **inflammatory response**
  - Capillaries dilate
  - Pyrogens released, reach hypothalamus, and temperature rises
  - Pain receptors activate
  - WBCs flock to infected area like sharks to blood



# Two Divisions of the Immune System

- The efforts of the WBCs known as phagocytes and T-cells is called the **cell-mediated immune system**.
  - Protective factor = living cells
    - Phagocytes – eat invaders
    - T-cells – kill invaders



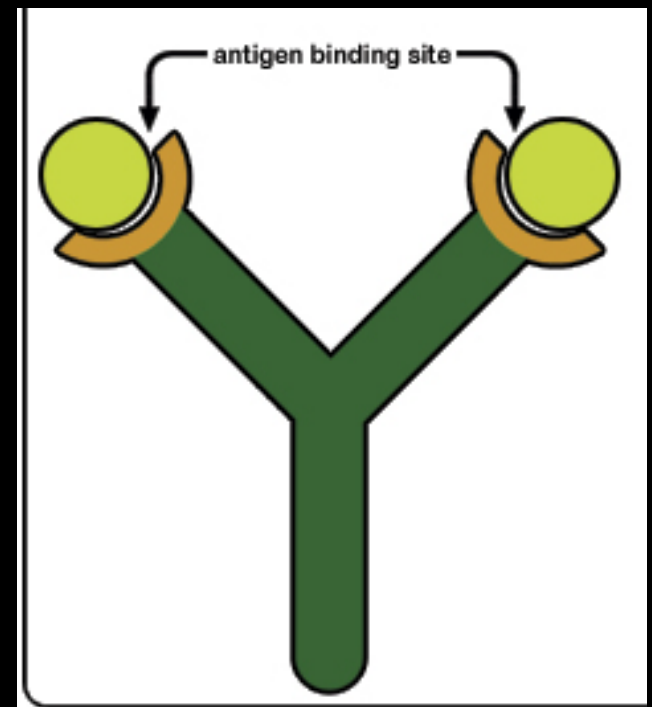
# Two Divisions of the Immune System

- The other half of the immune system is called antibody-mediated immunity, meaning that is controlled by antibodies
- This represents the third line of defense in the immune system

# The Third Line of Defense

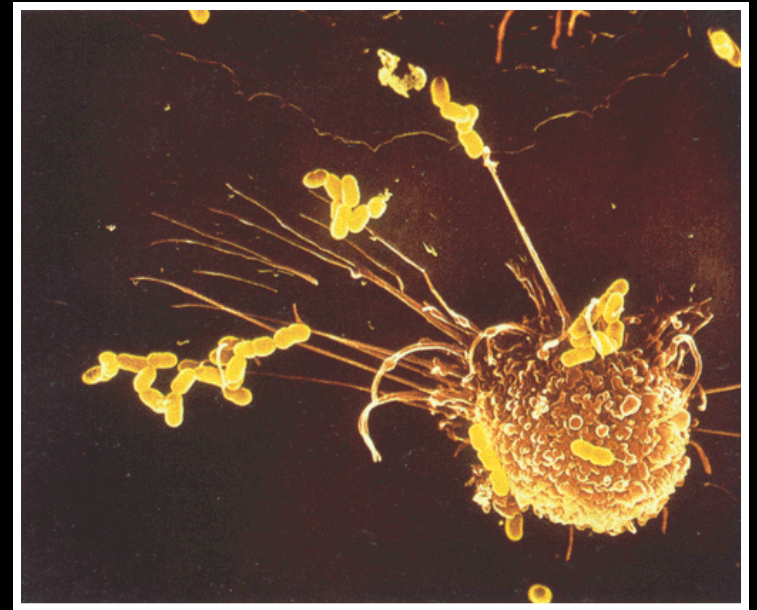
~Antibodies~

- Most infections never make it past the first and second levels of defense
- Those that do trigger the production and release of **antibodies**
  - Proteins that latch onto, damage, clump, and slow foreign particles
  - Each antibody binds only to one specific binding site, known as an **antigen**



# Antibody Production

- WBCs gobble up invading particles and break them up
- They show the particle pieces to T-cells, who identify the pieces and find specific B-cells to help
- B-cells produce antibodies that are equipped to find that specific piece on a new particle and attach

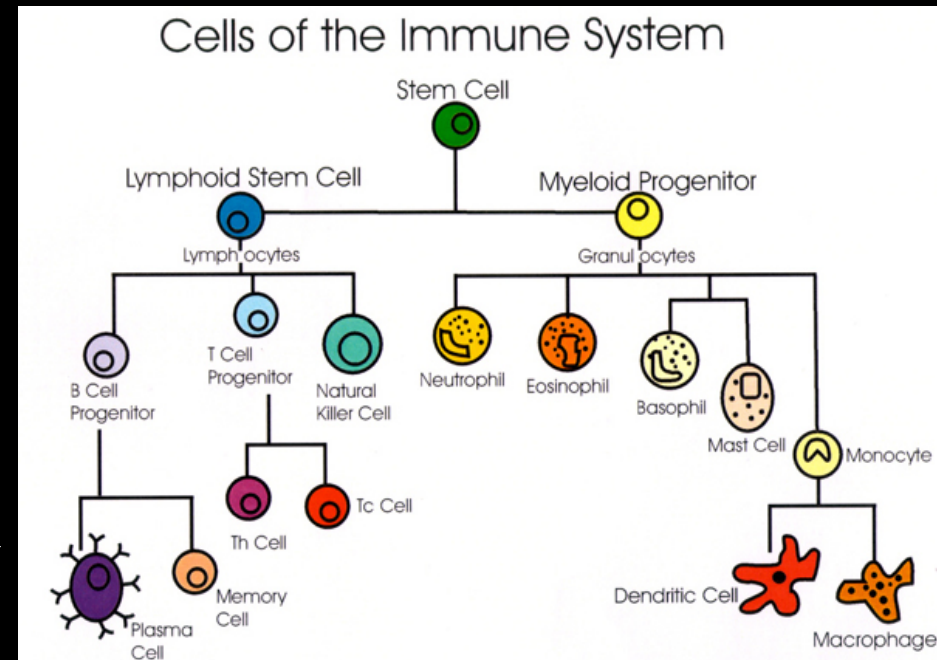


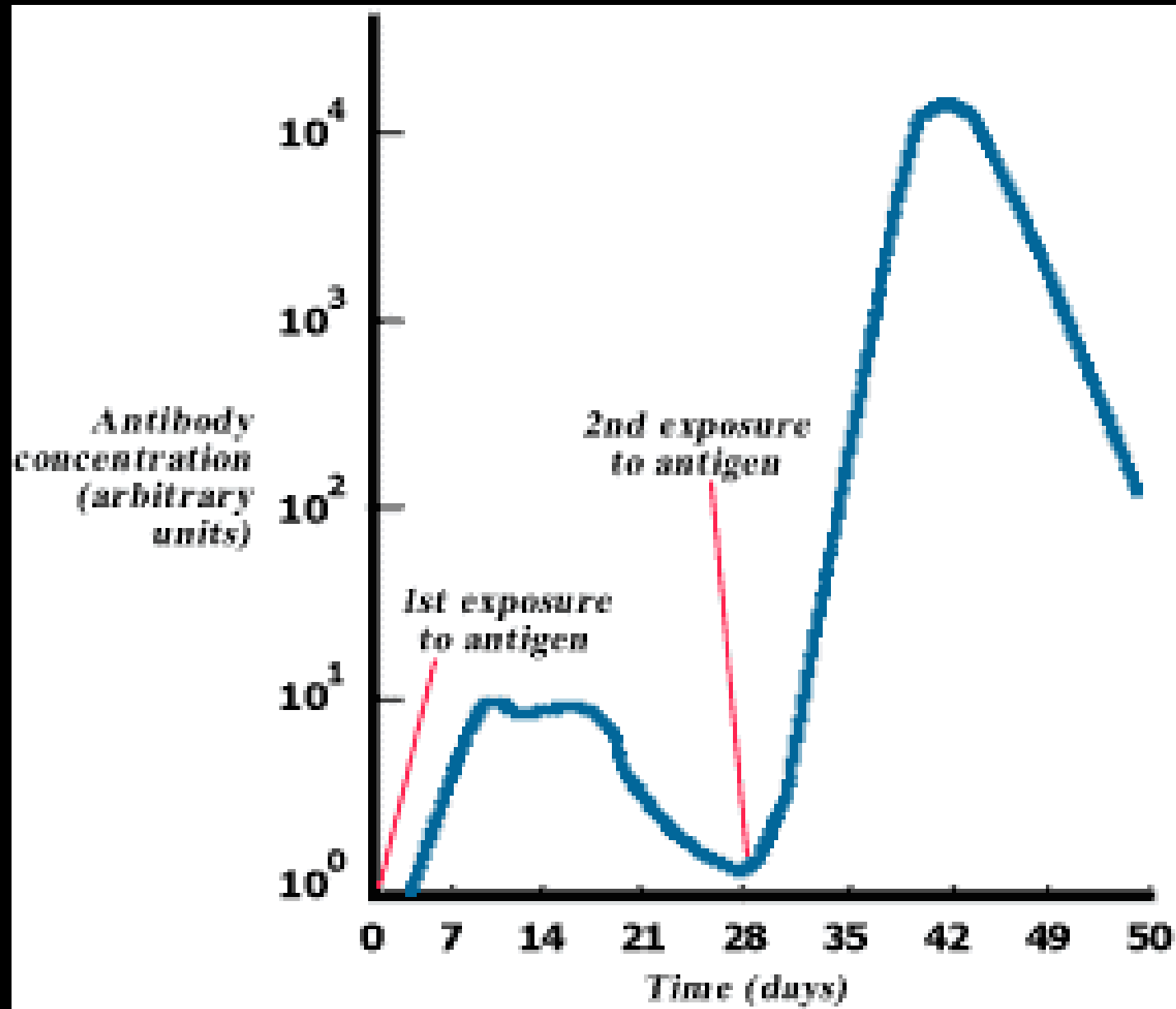
[Video - 1:58](#)



# Immunity

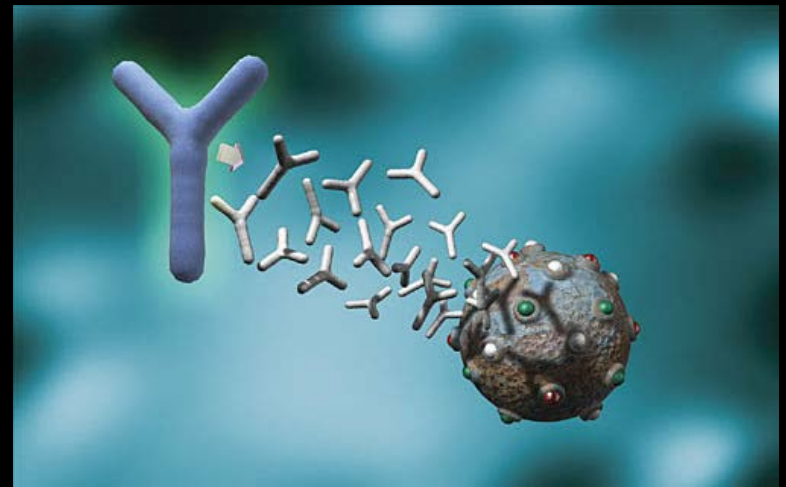
- New particles take longer to identify, and a person remains ill until a new antibody can be crafted
- Old particles are quickly recognized, and a person may never become ill from that invader again. This person is now immune.





# What is immunity?

- Resistance to a disease causing organism or harmful substance
- Two types
  - Active Immunity
  - Passive Immunity



# Active Immunity

- You produce the antibodies
  - Your body has been exposed to the antigen in the past either through:
    - Exposure to the actual disease causing antigen – You fought it, you won, you remember it
    - Planned exposure to a form of the antigen that has been killed or weakened – You detected it, eliminated it, and remember it

What is this second type of exposure called?

# Vaccine

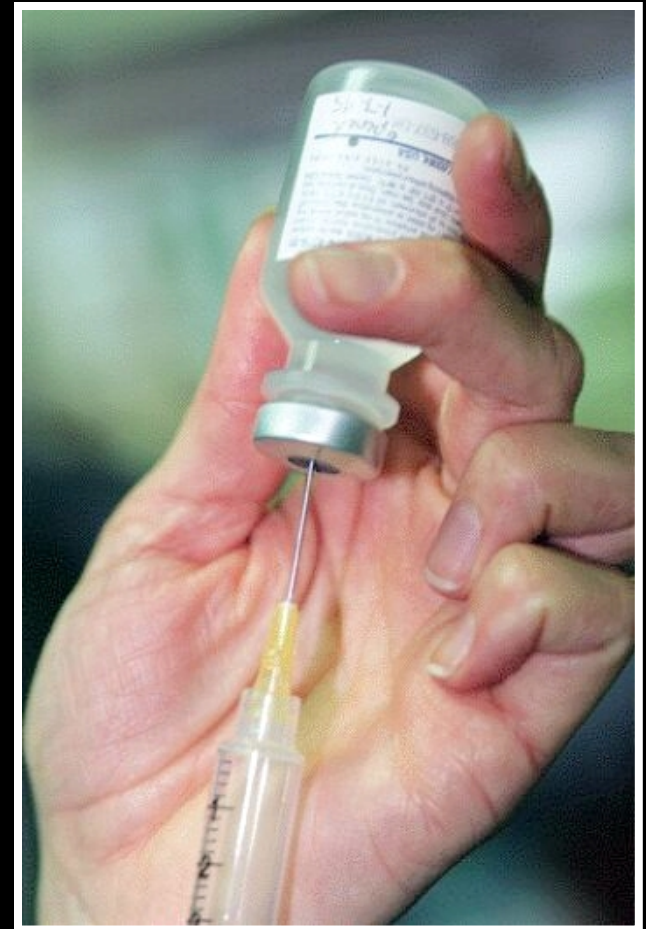
- Antigens are deliberately introduced into the immune system to produce immunity
- Because the bacteria has been killed or weakened, minimal symptoms occur
- Have eradicated or severely limited several diseases from the face of the Earth, such as polio and smallpox





# How long does active immunity last?

- It depends on the antigen
- Some disease-causing bacteria multiply into new forms that our body doesn't recognize, requiring annual vaccinations, like the flu shot
- Booster shot - reminds the immune system of the antigen
- Others last for a lifetime, such as chicken pox



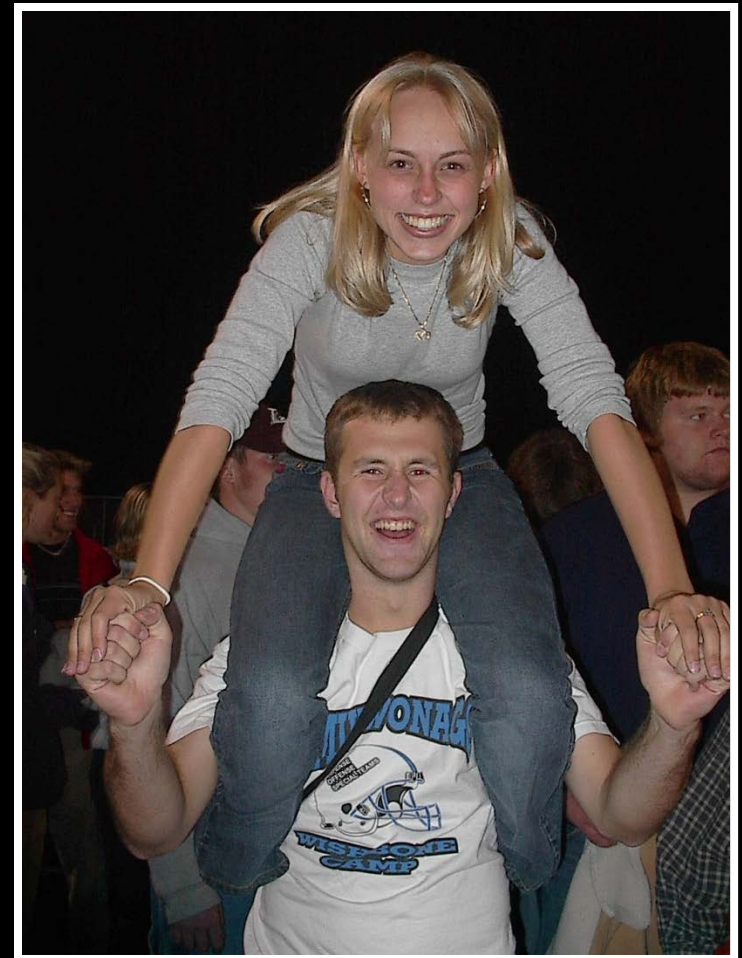
# Think the flu is no big deal?

- Think again...
- In 1918, a particularly deadly strain of flu, called the Spanish Influenza, spread across the globe
- It infected 20% of the human population and killed 5%, which came out to be about 100 million people



# Do we get all the possible vaccines we can?

- Although the Center for Disease Control (CDC) recommends certain vaccines, many individuals go without them
- Those especially susceptible include travelers and students
- Consider the vaccine for meningitis, which is recommended for all college students and infects 3,000 people in the U.S., killing 300 annually



[Link](#)

# Passive Immunity

- You don't produce the antibodies
  - A mother will pass immunities on to her baby during pregnancy - through what organ? Placenta
  - These antibodies will protect the baby for a short period of time following birth while its immune system develops. What endocrine gland is responsible for this? Thymus
  - Lasts until antibodies die



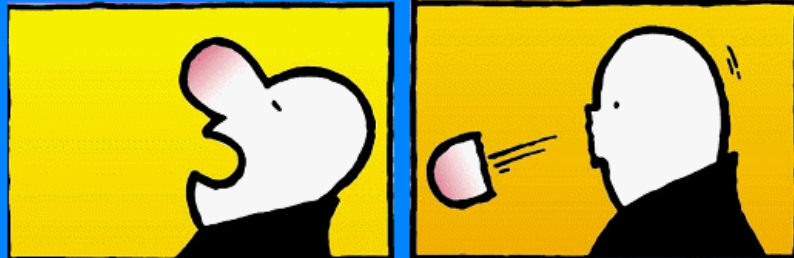
Why doesn't the mother just pass on the WBCs that "remember" the antigens?

# Immune Disorders

## ~Allergies~

- Immune system mistakenly recognizes harmless foreign particles as serious threats
- Launches immune response, which causes sneezing, runny nose, and watery eyes
- Anti-histamines block effect of histamines and bring relief to allergy sufferers

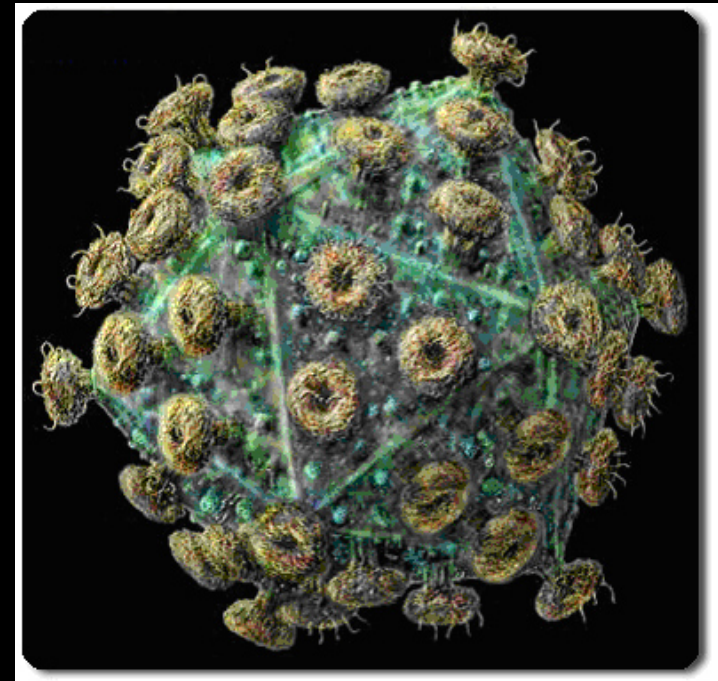
### Allergies



Nothing To SNEEZE AT !

# Acquired Immune Deficiency Syndrome

- Caused by the Human Immunodeficiency Virus
- Discovered in 1983
- Specifically targets and kills T-cells
- Because normal body cells are unaffected, immune response is not launched





# AIDS

~The Modern Plague~

- The HIV virus doesn't kill you – it cripples your immune system
- With your immune system shut down, common diseases that your immune system normally could defeat become life-threatening
- Can show no effects for several months all the way up to 10 years



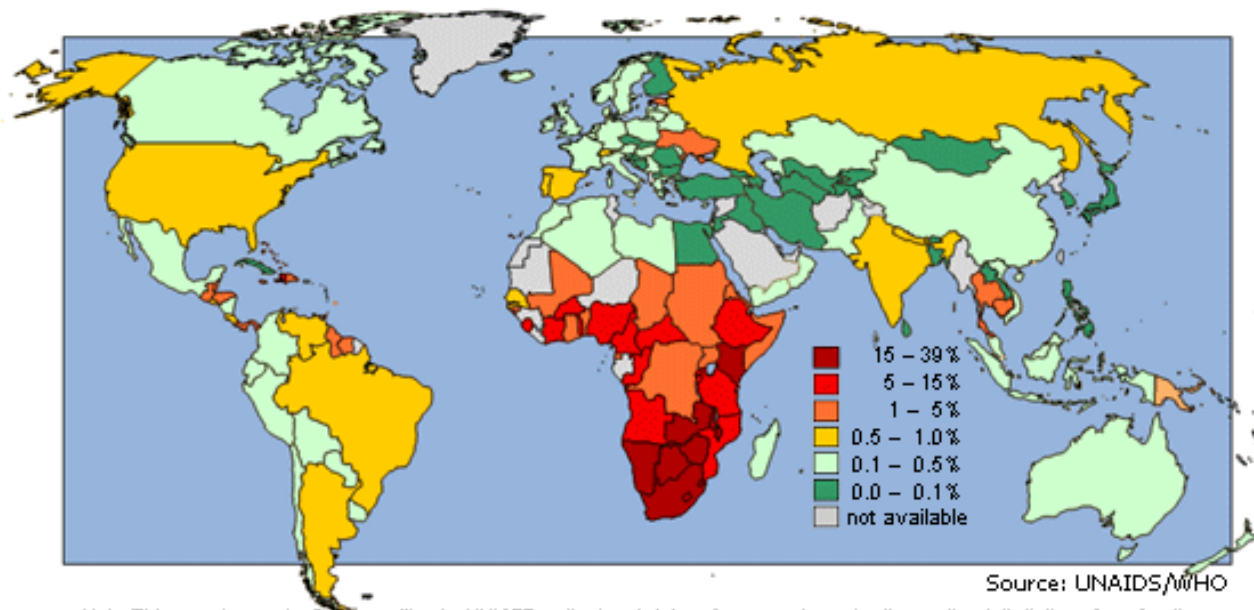


# AIDS

~The Silent Spread~

- Transmitted by sexual contact, blood transfusions, contaminated needles
- As of 2007, it affects an estimated 33.2 million people

HIV prevalence in adults, end 2001



Note: This map does not reflect a position by UNICEF on the legal status of any country or territory or the delimitation of any frontiers.

