



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



**19GET277 / Biology For Engineers
IV YEAR / VII SEMESTER**

UNIT-III: GENETICS AND IMMUNE SYSTEM

**ANTIGENS AND ANTIBODIES-
IMMUNE RESPONSE**



Immune System

Infectious Disease



Infectious Disease

- Disrupts normal body function (homeostasis)
- Caused by a pathogen.
 - Pathogen: anything that invades your body & causes a disease
 - Ex: bacteria, protozoan, fungi, viruses, parasites, worms
- It can be **contagious = infectious**



Disease Transmission

- People may carry a disease without even knowing it.
 - Can be spread during the **incubation period** (before symptoms occur)
- Transmission by:
 - 1. **Direct contact**
 - Kissing
 - 2. **Indirect contact**-through the air
 - coughing & sneezing
 - 3. **Contact with object**
 - sharing drinks, door knobs, desks

- **4. Infected animals**
 - Vector transmits disease
 - Ex: mosquito



- **5. Contaminated food or water**
 - food poisoning



Agents of Disease

- Bacteria

- Viruses

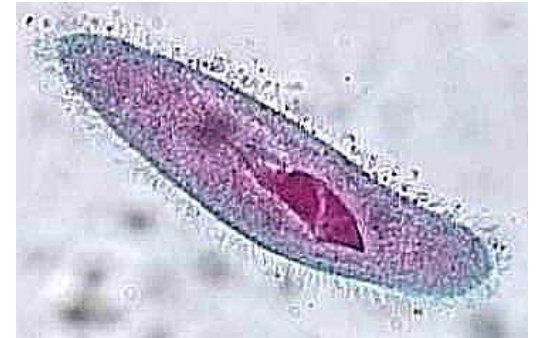
} See Next
Sections

- Protists

- feed on nutrients in host's blood
 - ex: malaria, dysentery

- Worms

- parasitic flatworms & round worms
 - ex: tapeworms & hook worms



YOU ARE TICKLES TAPEWORM

Tickles is a
funny friend.
He is always
making jokes
to tell. He lives
in my tummy and
loves good food.

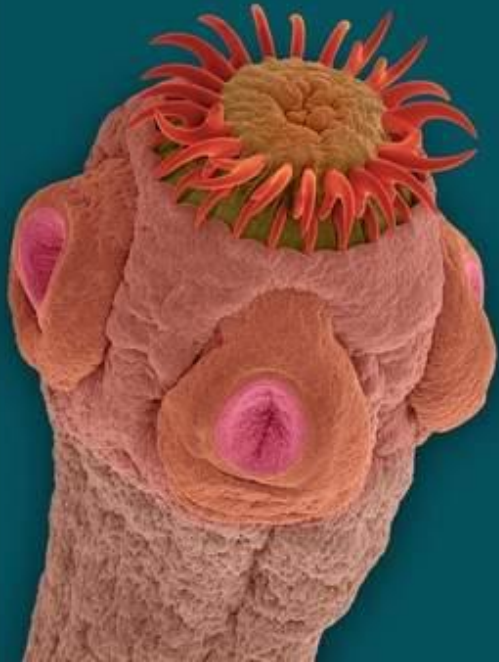
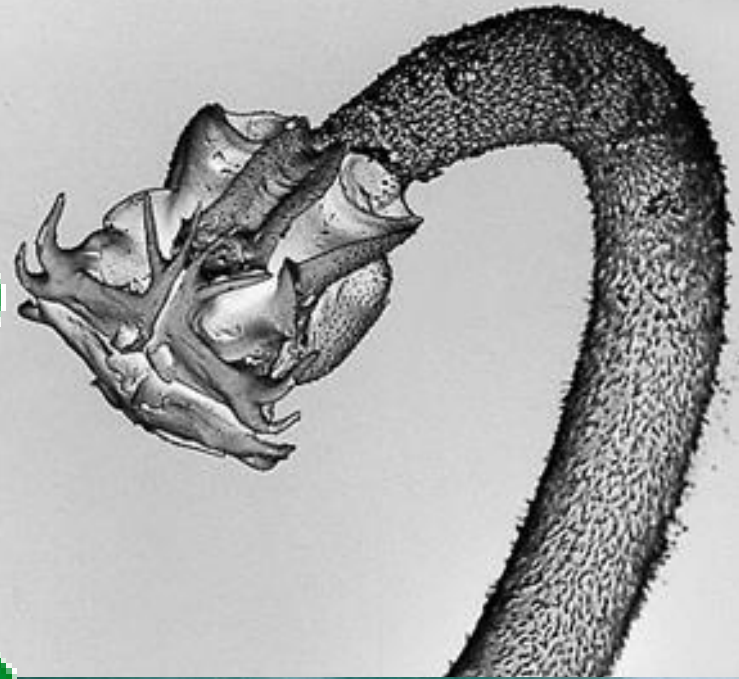
Size: Spaghetti noodle.

Favorites: Hamburger, making jokes, growing longer.

Pet Peeves: Fingernails, tattletales.

Style: Casual but not sloppy.

Toast with Honey or Toast with Jam?: Toast with Jam.





- **Fungi**

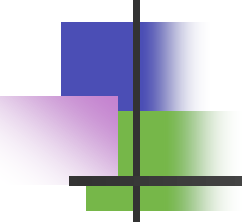
- most are harmless
- attack moist areas, like the skin, scalp, mouth & throat
- ex: ringworms & athlete' s foot

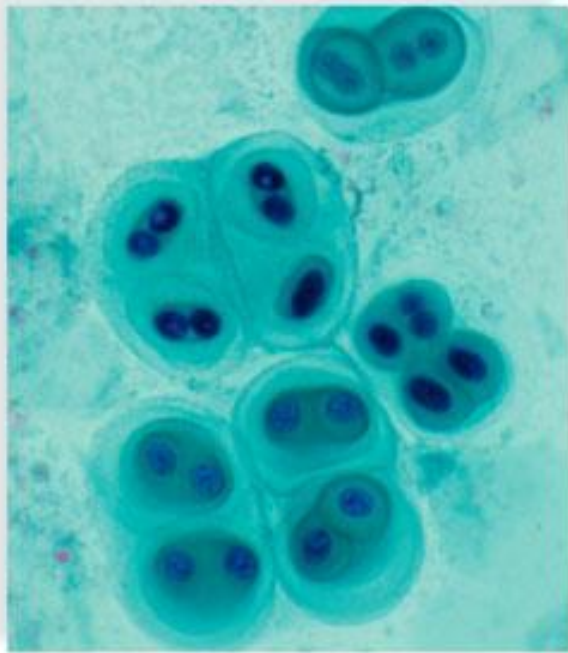




Bacteria

- **Bacteria: prokaryote cells** (no nucleus, no membrane-bound organelles)
 - **Most bacteria are helpful or harmless**
 - **A few are pathogens; they release toxins in our bodies**
 - streptococcus (strep throat), staphylococcus (staph infection)
 - **Most bacterial pathogens are fought by the immune system or can be treated with ANTIBIOTICS**

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- **Antibiotic Resistance**
 - **Currently, many bacteria are becoming resistant to antibiotics**
 - **This is because of antibiotics being over prescribed**
 - **(often for viral infections, which they have no effect on)**



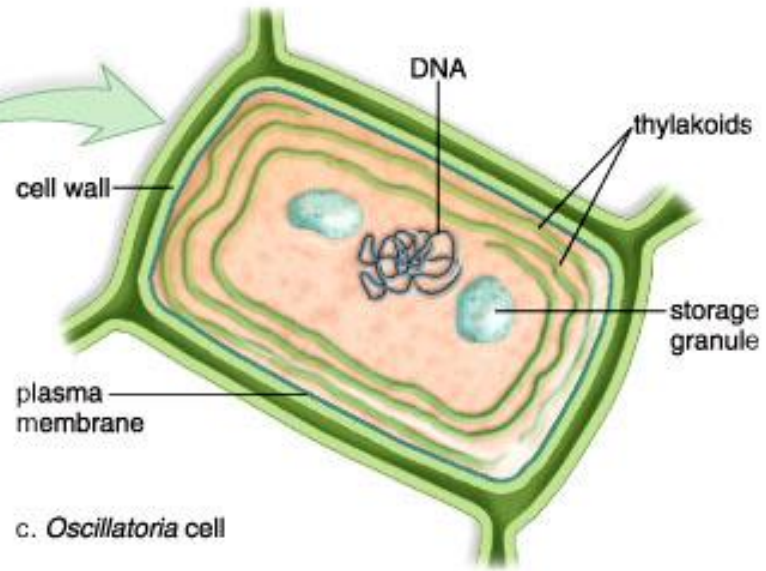
a. *Gloeocapsa*

LM 250×



b. *Oscillatoria*

LM 100×

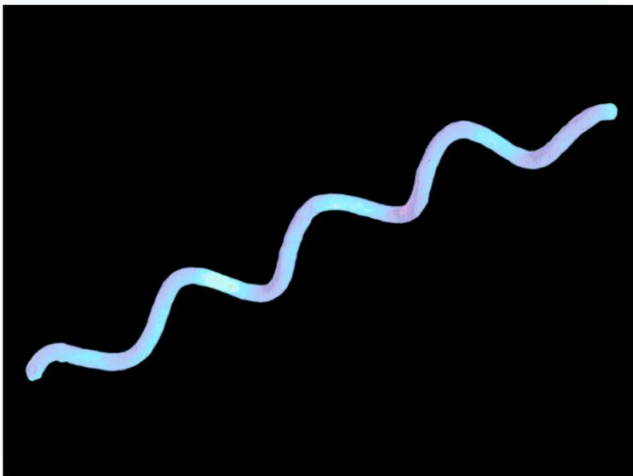


c. *Oscillatoria* cell

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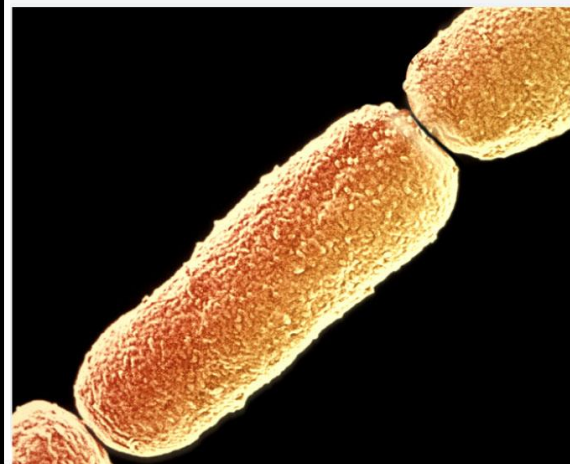
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a. Spirillum:
Spirillum volutans

SEM 3,520×



b. Bacilli:
Bacillus anthracis

SEM 35,0



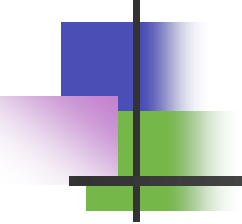
c. Cocci:
Streptococcus thermophilus

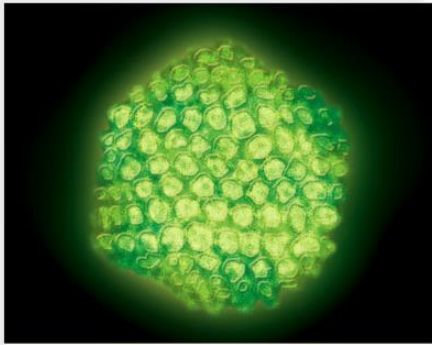
SEM 6,250×



Viruses

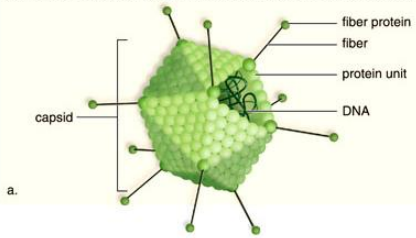
- **Virus: a NONLIVING protein coat surrounding either DNA or RNA**
 - **Viruses are NON-LIVING:**
 - Do not grow or develop
 - Do not obtain or use energy
 - Do not respond to environment

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- **However, viruses have some properties of living things:**
 - **Have genetic material DNA or RNA**
 - **Can replicate--but only by using the host cell**
 - **Can evolve**

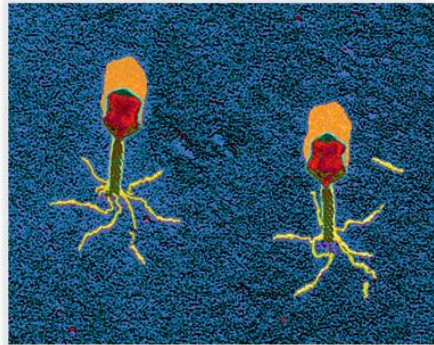


TEM 80,000×

Adenovirus: DNA virus with a polyhedral capsid and a fiber at each corner.

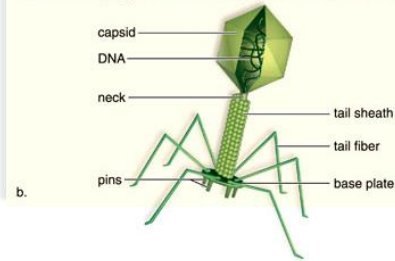


a.

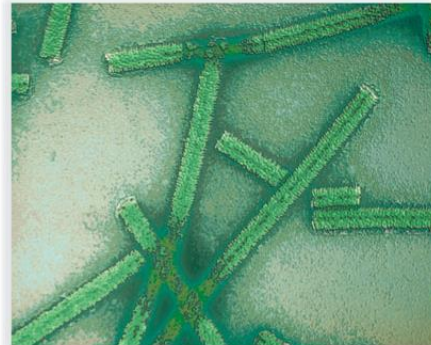


TEM 90,000×

T-even bacteriophage: DNA virus with a polyhedral head and a helical tail.

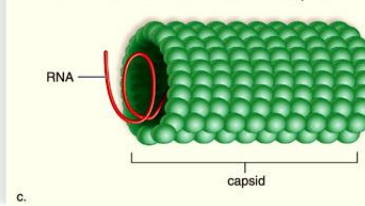


b.

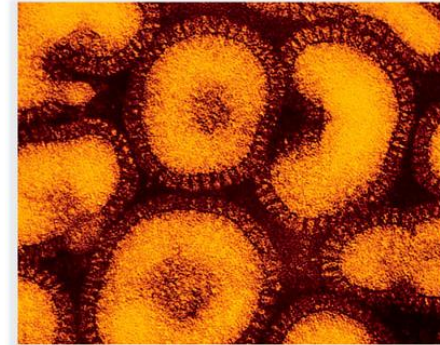


TEM 500,000×

Tobacco mosaic virus: RNA virus with a helical capsid.

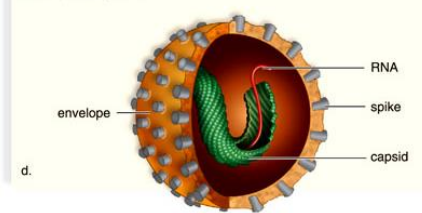


c.

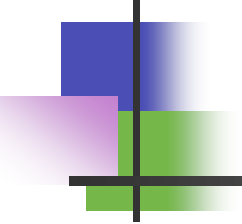


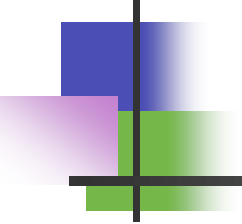
20 nm

Influenza virus: RNA virus with a helical capsid surrounded by an envelope with spikes



d.

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- Vaccines PREVENT viral infection
 - Person is injected with a weakened virus.
 - The immune system can later recognize the normal virus and fight it off
 - Ex: measles, mumps, rubella (MMR), smallpox, polio, flu strains (swine flu)

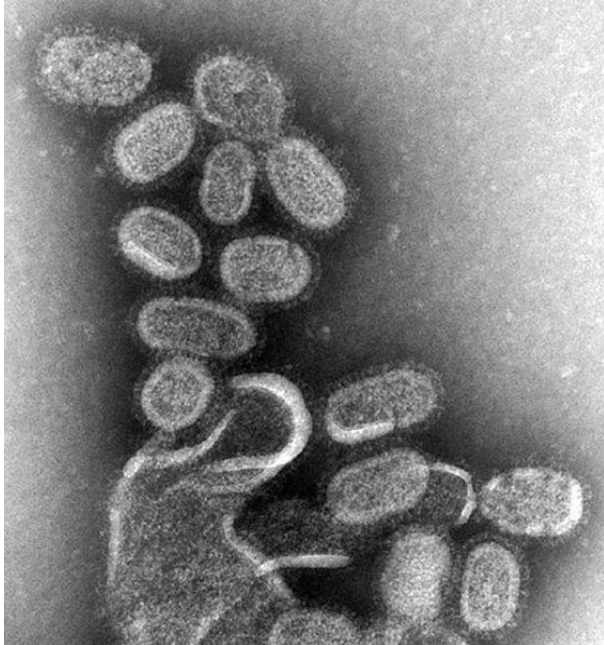
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- **Viral infections are fought by the immune system or with anti-viral drugs.**
 - **Some viruses are too strong and too fast for the immune system to fight.**
 - **These viruses lead to:**
 - **Epidemics** (over large areas)
 - **Pandemics** (over whole countries)
 - **To treat mass outbreaks: contain the area and quarantine the infected.**



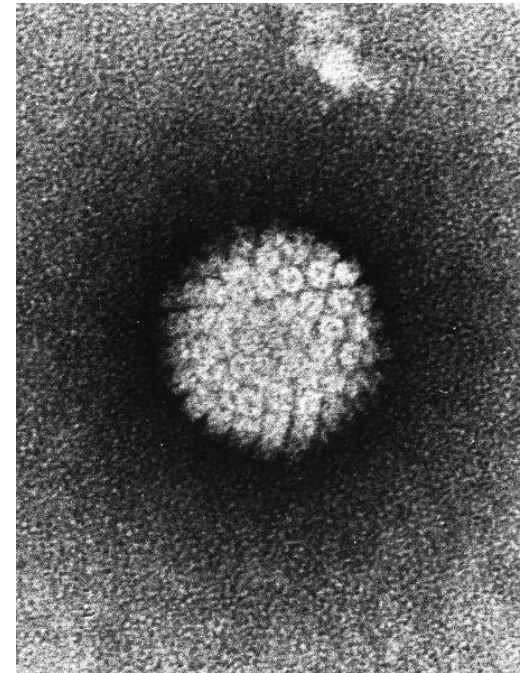
■ Common Viruses

Influenza (Flu Virus)

- Kills 30,000 Americans every year



Human Papilloma Virus (HPV)





■ Deadly Viruses

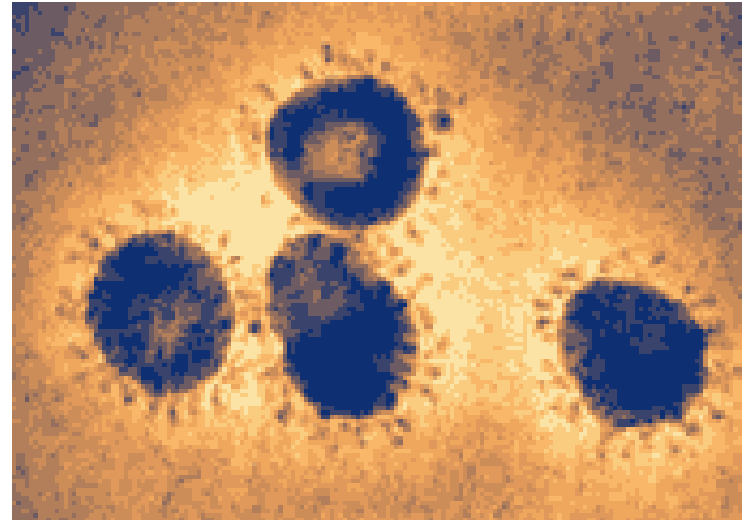
Ebola virus

- Africa
- ~90% mortality rate



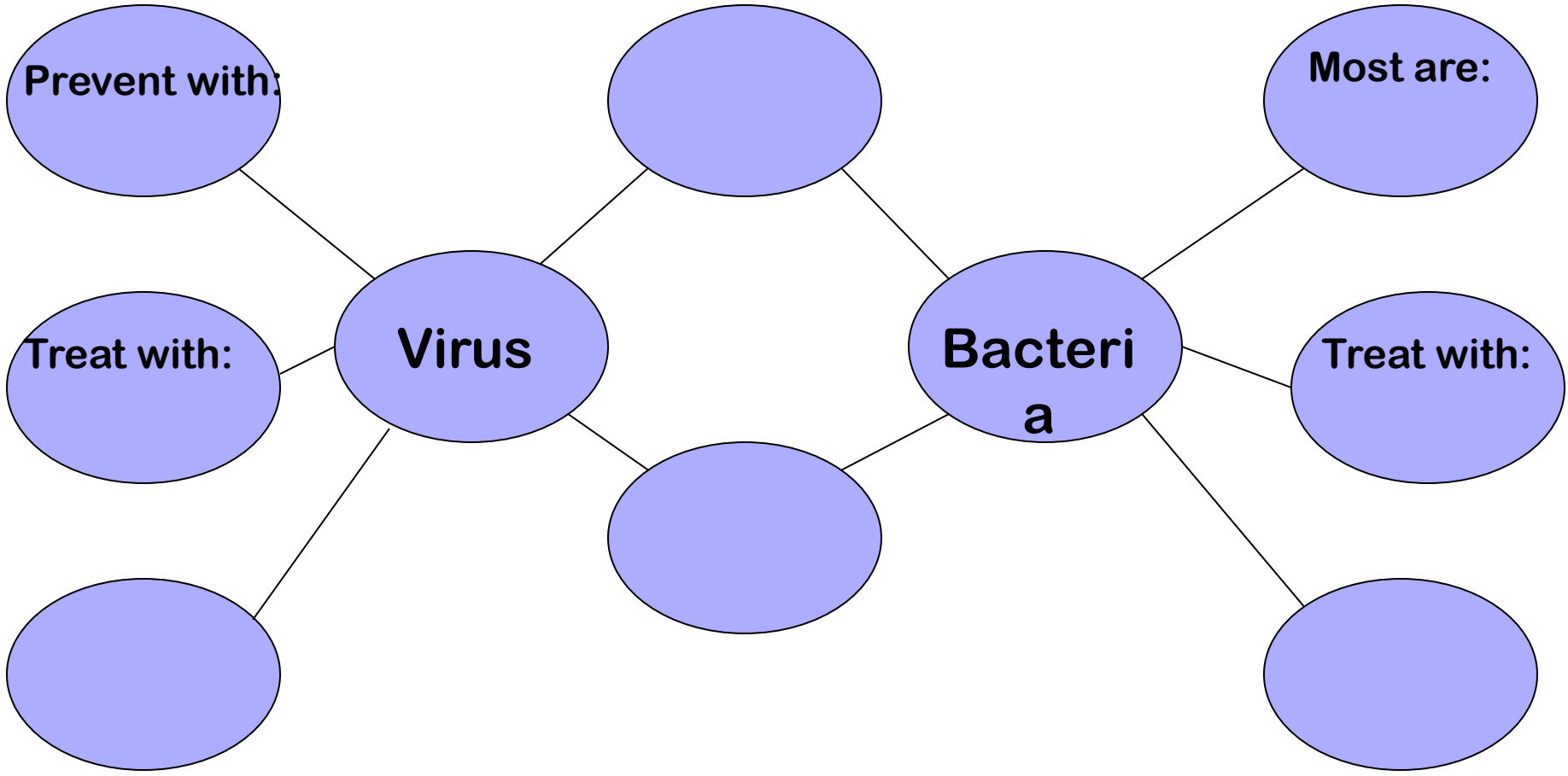
SARS (Severe acute respiratory syndrome)

- China 2002-3
- 5328 cases, 349 deaths



Double Bubble: Viruses vs. Bacteria

pg. 60

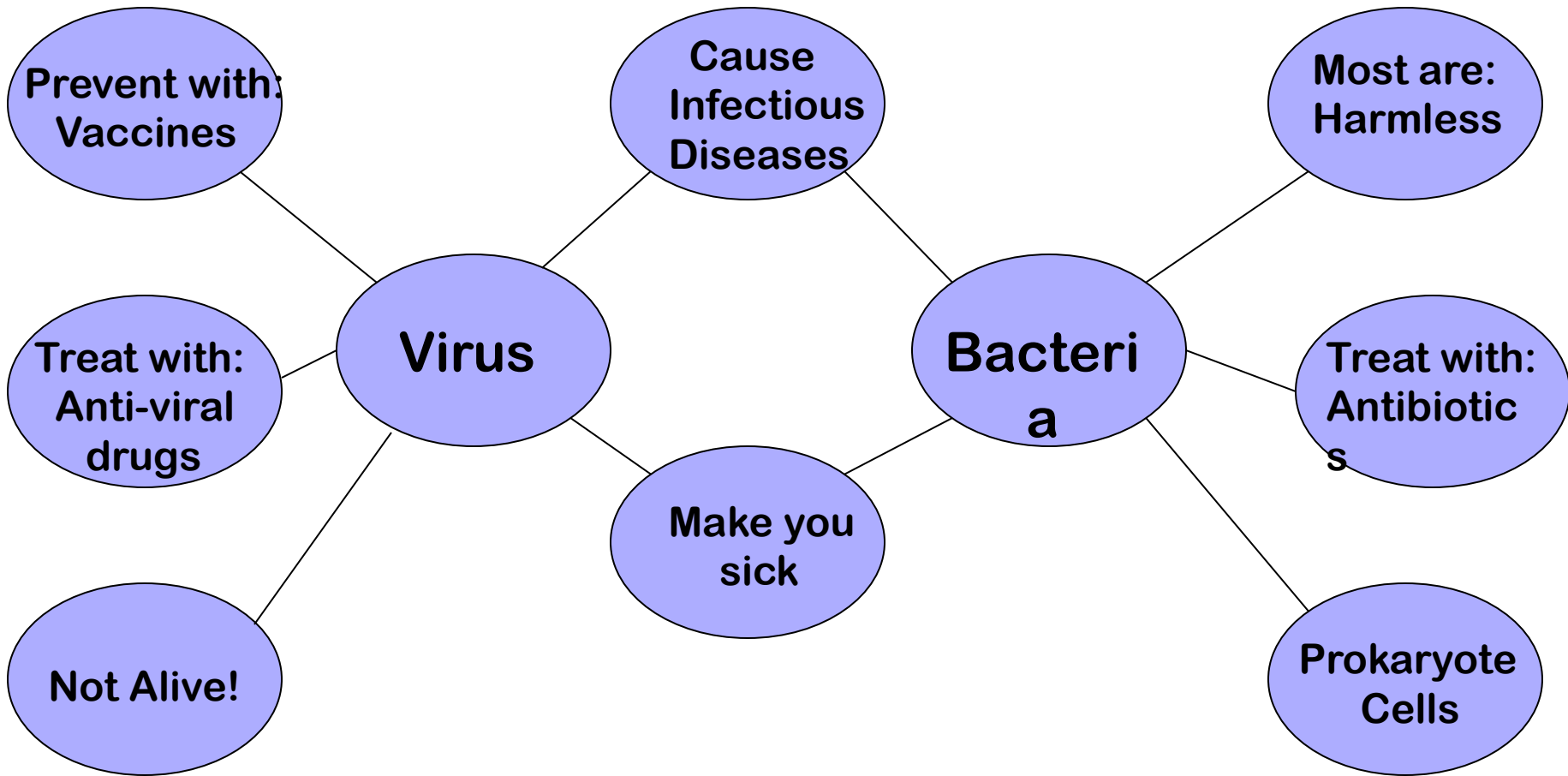


Contrast

Compare

Contrast

Double Bubble: Viruses vs. Bacteria



Contrast

Compare

Contrast

The Immune System Part 2

Human Body Systems
Chapter 40-2



Immune System

- **Immune System:** bodies defense system against disease
- **White Blood Cells (WBCs)** fight infection through inactivating foreign substances or cells
 - soldiers of your defense system





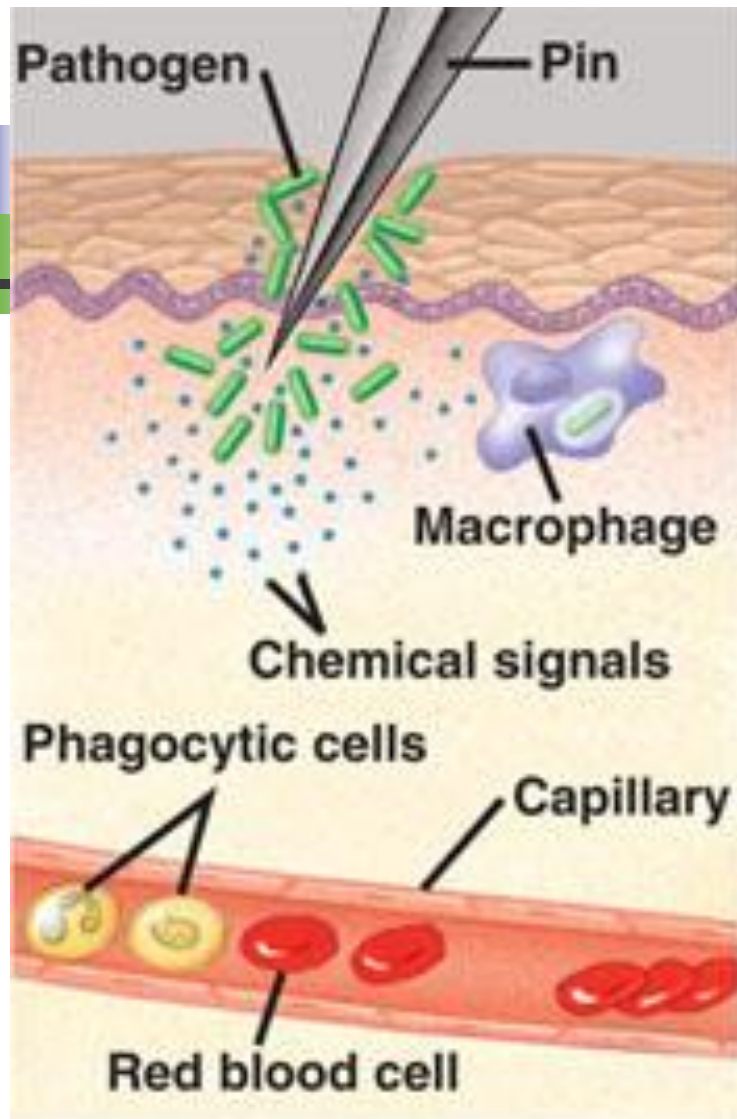
Immune Divisions Overview

- **Nonspecific Defenses**
- **Specific Defenses**

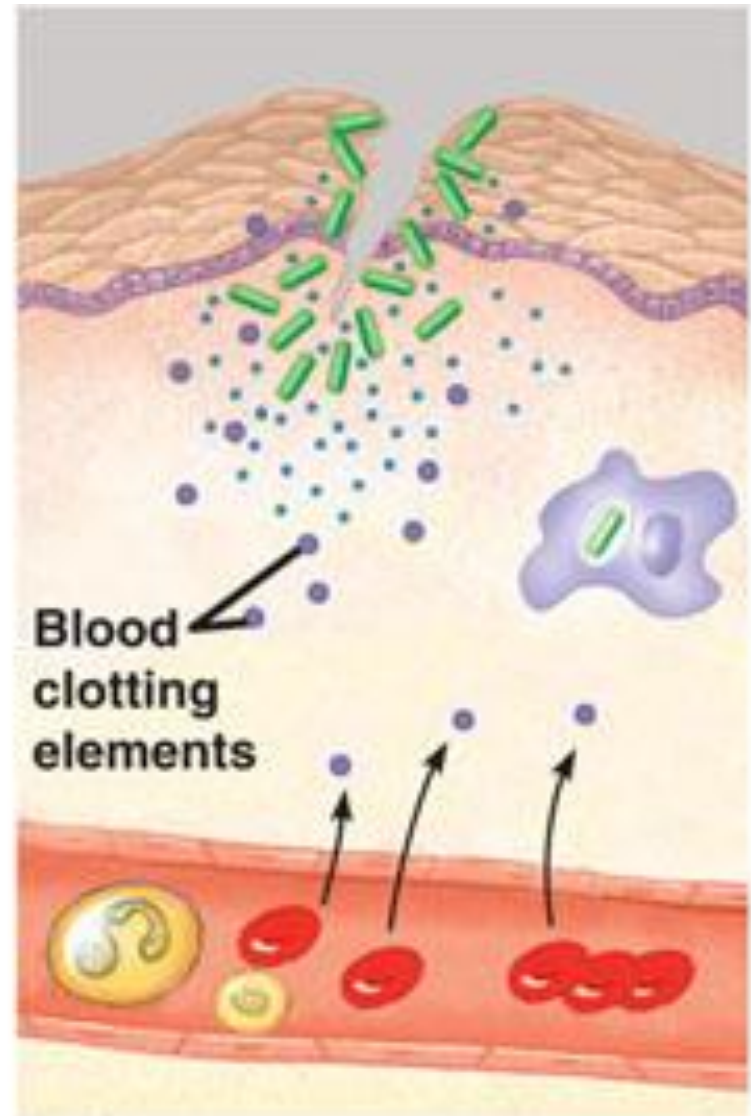
Nonspecific Defenses

- Body protects itself the **SAME** way regardless of what is invading it
- **Fast-acting Response**
- **Lines of Defense**
 - 1. **Skin-** protective barrier
 - 2. **Fever-** raises body temp. to kill infection
 - 3. **Inflammation-** swelling & redness





1



2

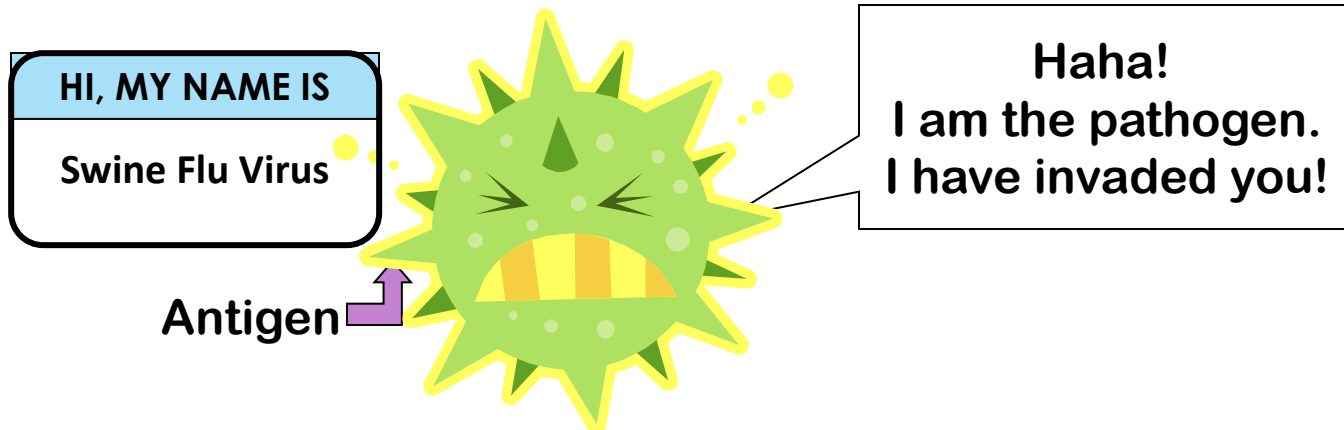


Specific Defenses

- Immune system attacks *specific* pathogen
- **Pathogen** can be recognized by its **antigen**

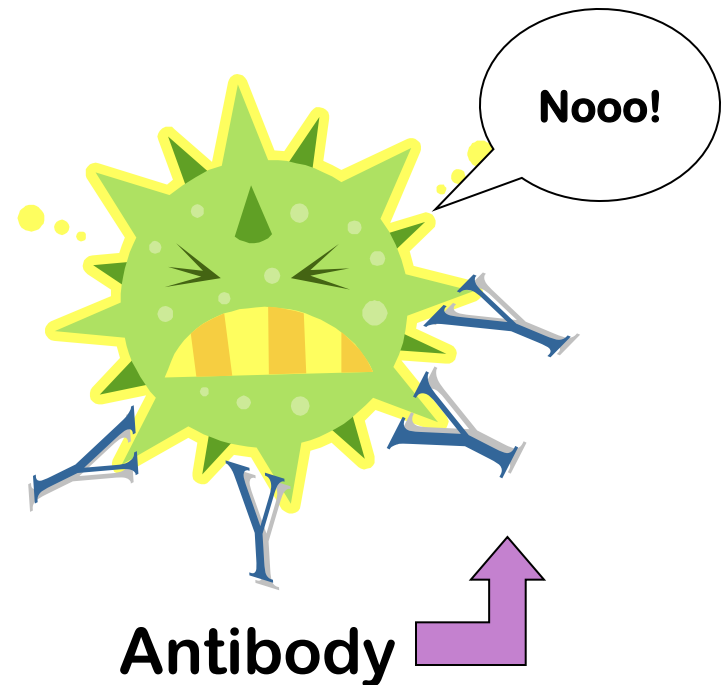
Pathogens & Antigens

- Pathogens (things that infect you) contain antigens
- Antigens are like chemical markers (name tag) that tell what the pathogen is

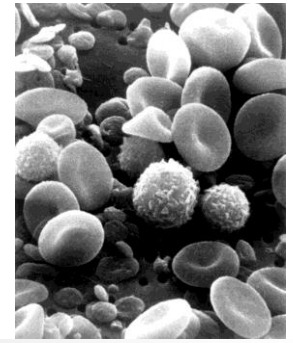


WBCs & Antibodies

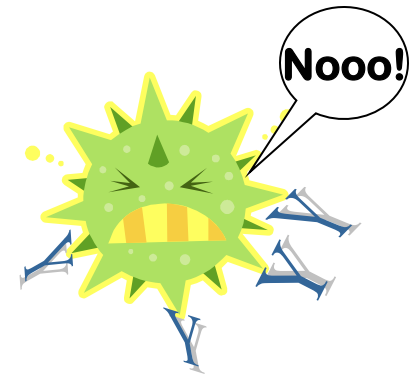
- WBCs can recognize the antigens because they have antibodies.
- Antibodies are proteins that recognize and bind to the antigen because they fit together
 - Antibodies mark the pathogen for destruction

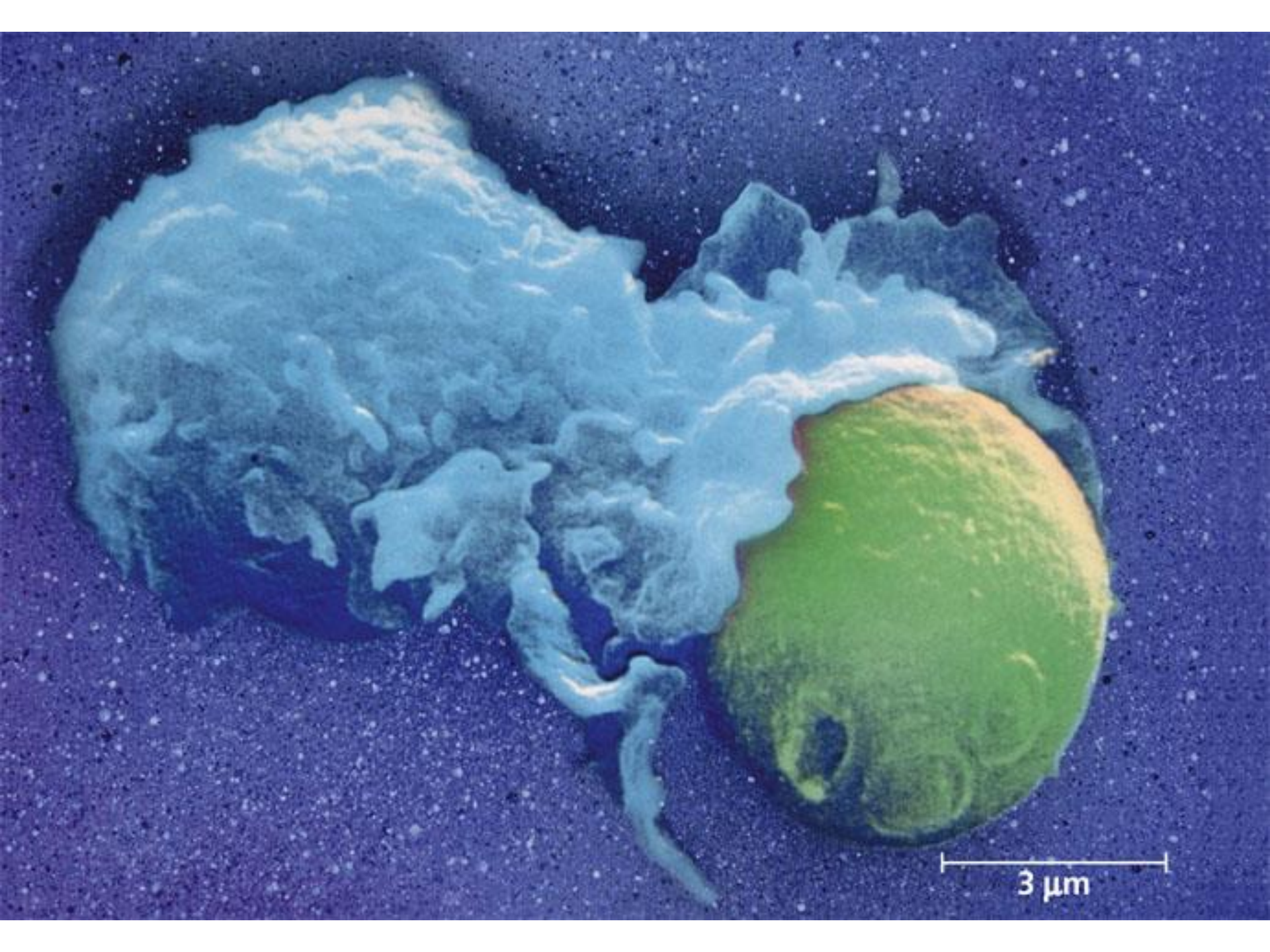


Types of WBCs

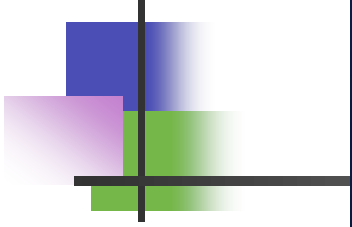
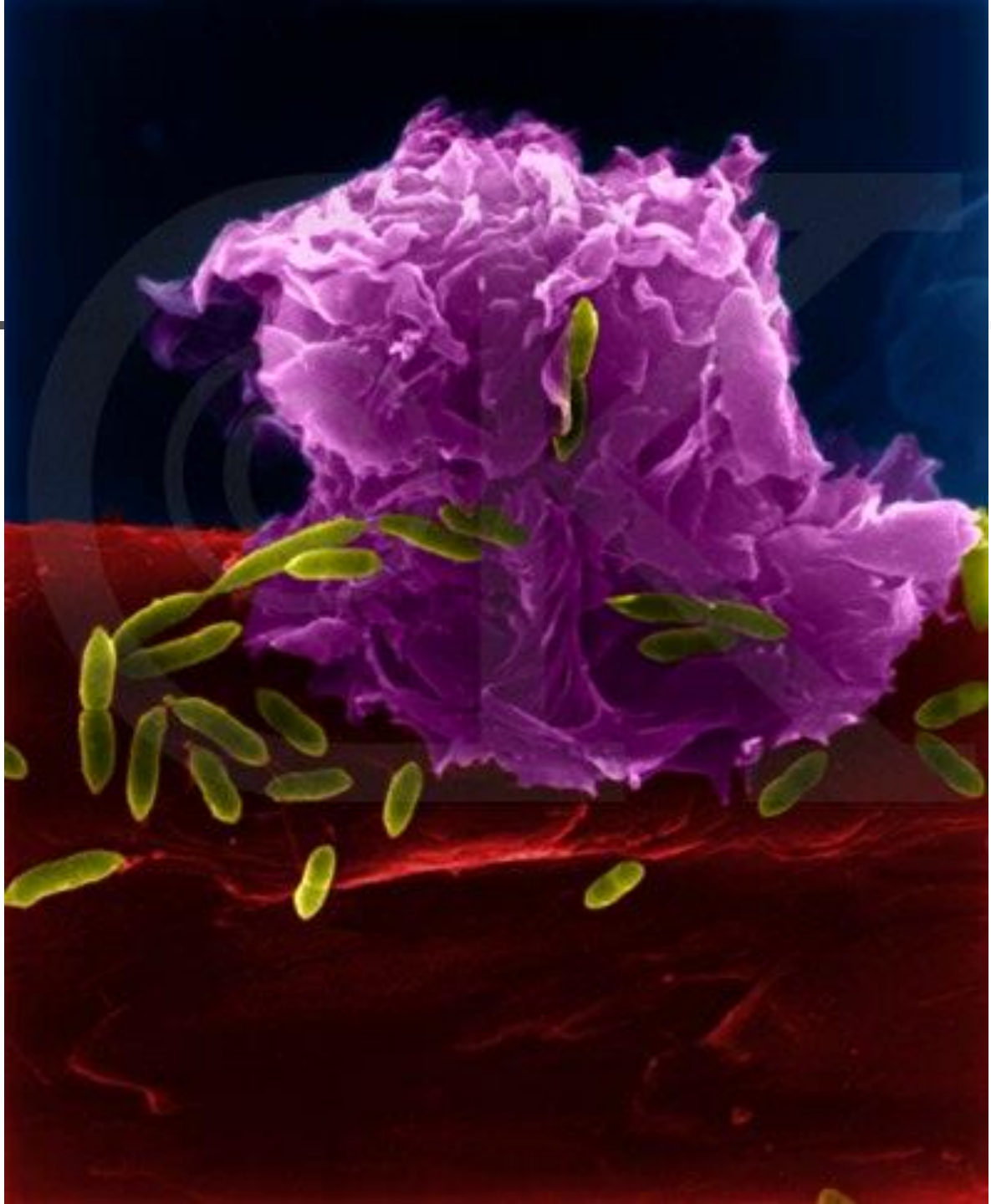


- White blood cells are produced by bone marrow & lymphatic glands
 - Macrophages: “eat” & destroy pathogens
 - Some pathogens are marked for destruction by antibodies
 - Lymphocytes (B-cells & T-cells)
 - B-cells- make antibodies
 - T-cells- recognize & kill pathogen





3 μm



1. Fighting Pathogens in Body

- B-cells- make antibodies

- Primary Response: 3-6 days

- B-cell activated: antibody binds to antigen to mark it for destruction
- B-memory cells “remember” antigen in case of second infection

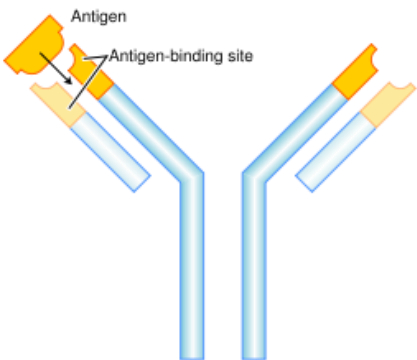


Antigens

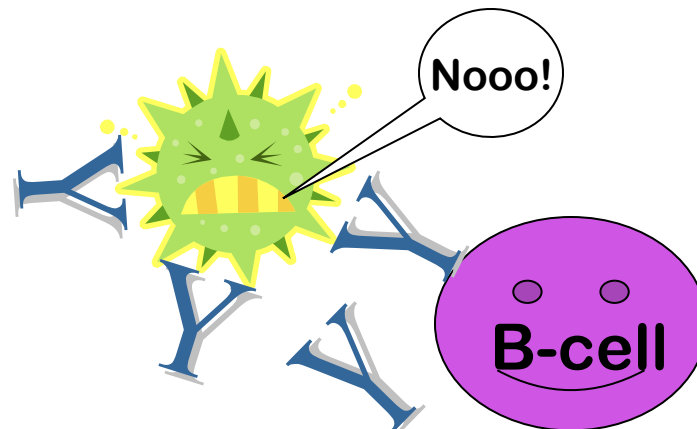


Antigen

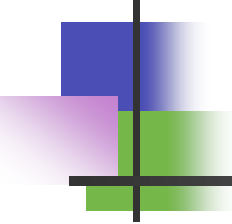
Antigen-binding site

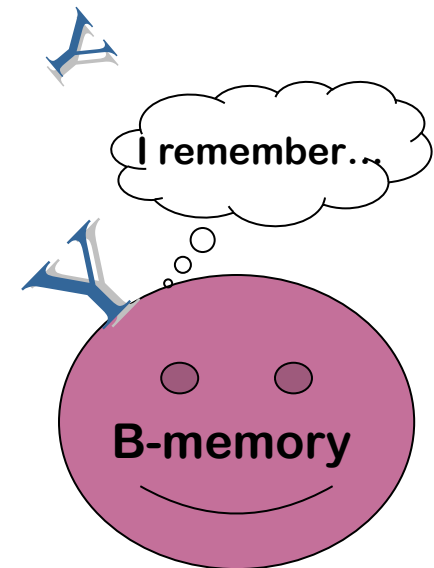


Antibody



Antibody ↗

- 
-
- **Secondary Response: 2-3 days**
 - Exposure to same antigen later
 - **B-memory cells respond faster** to make antibodies
 - Do not get sick
 - Memory Cells =
IMMUNITY



2. Fighting Pathogens inside Cells

- T-cells: recognize and kill infected self cell
 - Helper T-cells recognize antigen and:
 - tell B-cells to make antibodies
 - attract Killer T-cells: kill infected self-cell by injecting enzymes (trained assassins)



Hello,
I am a deadly
Killer T-cell



HIV

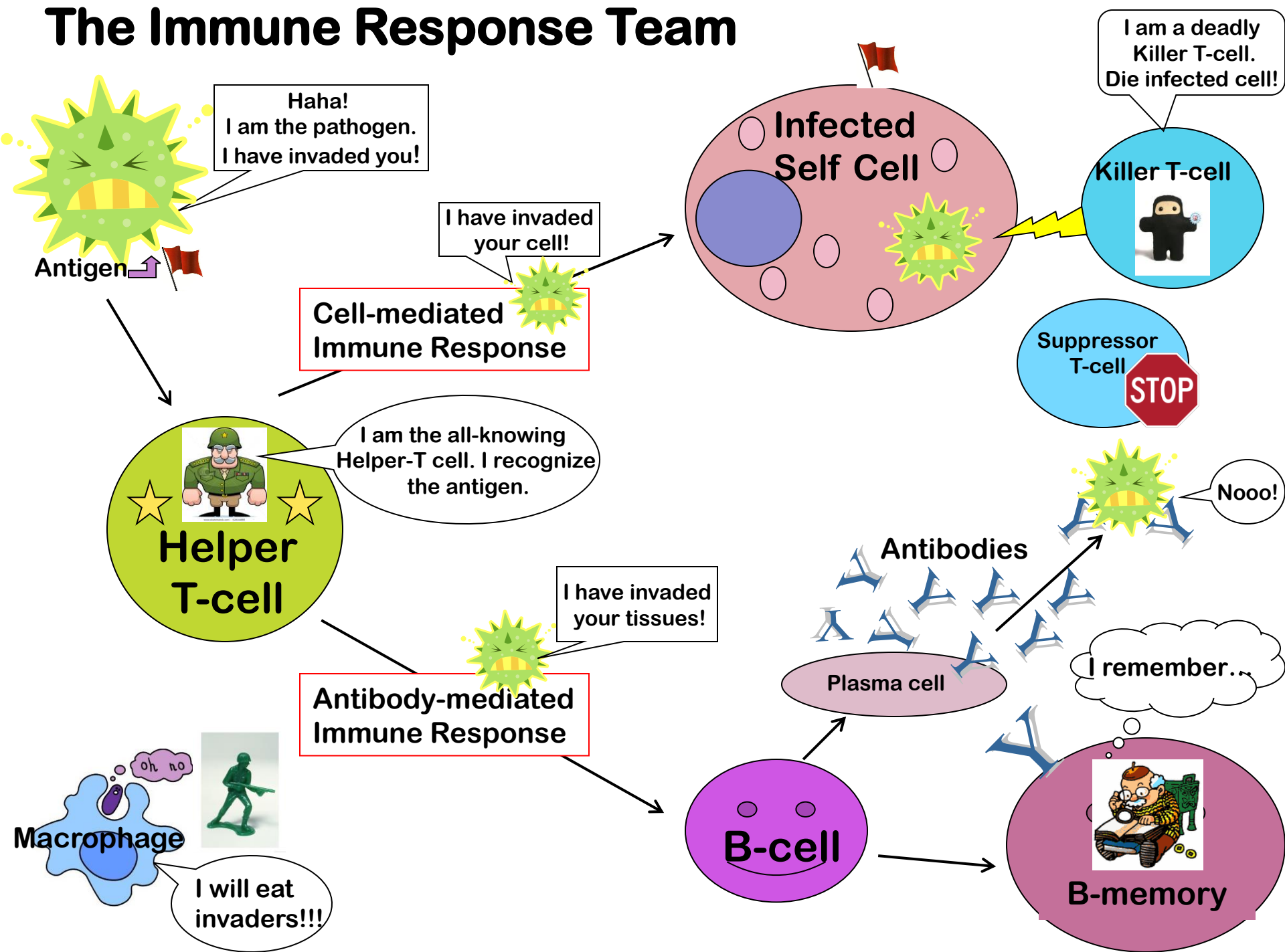
- **A retrovirus (has RNA) that targets and kills Helper T-cells**
 - **Leaves immune system defenseless against disease**
 - **Develops into the disease AIDS**



Acquired Immunity

- Immunity is acquired after exposure to antigen
- 2 Kinds
 - **Active Immunity:** you make antibodies in response to antigen
 - Vaccine
 - Natural exposure to pathogen
 - **Passive Immunity:** you obtain antibodies from another source
 - Mother's milk gives baby antibodies

The Immune Response Team





Word Bank (Homework)

- Pathogen
- Immune system
- White blood cells
- Non specific defenses
- Specific defenses
- Antigen
- Antibodies
- Macrophages
- Lymphocytes (B cells & T cells)