Immune system

Science 30

Unit A

Sample Diploma Questions

7. The two blood components that transport oxygen are

A. white blood cells and platelets — White blood fight infection

B. white blood cells and plasma — Oxygen is dissolved in plasma

C. red blood cells and platelets — Platelets stop bleeding

D. red blood cells and plasma — Red blood cells carry oxygen

Sample Diploma Questions

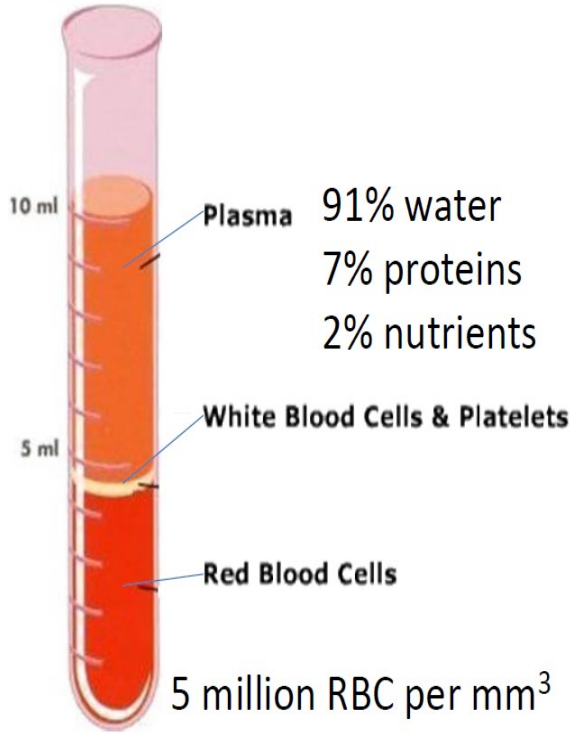
8. When the four major components of human blood are organized from greatest proportion to least proportion, the order is

A. white blood cells, plasma, red blood cells, platelets

B. white blood cells, red blood cells, platelets, plasma

C. plasma, red blood cells, white blood cells, platelets

D. plasma, white blood cells, platelets, red blood cells



Sample Diploma Questions

9. Nutrients absorbed from the intestine are carried throughout the body by

A. plasma — Carry nutrient, blood, CO_2, proteins

B. hemoglobin — Carry oxygen

C. red blood cells — Carry oxygen

D. white blood cells — Fight disease

Sample Diploma Questions

10. When a laboratory technician observes a prepared blood slide under a microscope, the blood component that would have the largest physical size is

A. a red blood cell — small

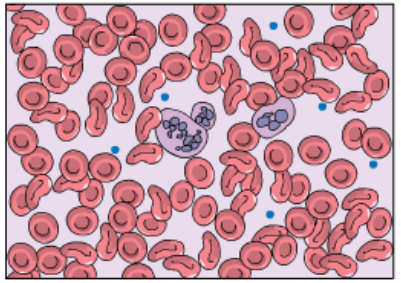
B. a macrophage — White blood cell, larger than RBC

C. an antibody

D. a platelet — 1/5 th size of RBC

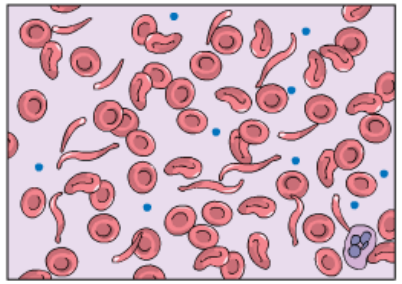
Use the following information to answer question 11.

Blood Slide from a Healthy Person

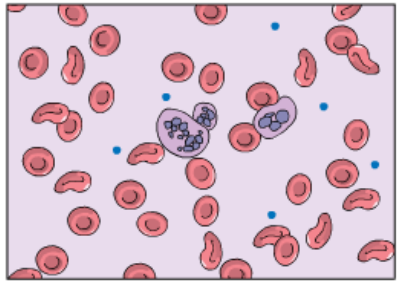


11. Leukemia is a type of cancer that causes uncontrolled division of white blood cells. The blood sample that **most likely** came from a patient with leukemia is labelled

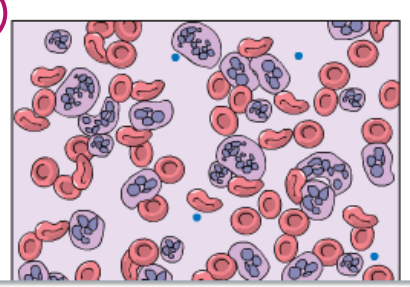
A.



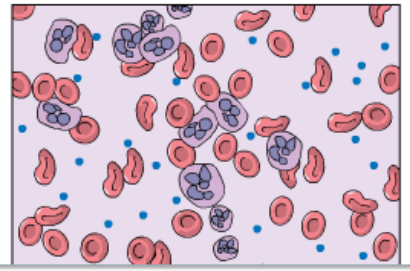
B.



C.



D.



Curriculum

- describe how pathogens in the environment *(e.g., mosquito-borne parasites, bacteria, viruses)* enter the circulatory system and may have an adverse affect on health
- describe, in general terms, the function of various body mechanisms, including the skin and body secretions (i.e., tears and stomach acid), in preventing pathogens from entering body tissues
- describe, in general terms, how immunity to pathogens develops, how the immune system responds to a foreign antigen and the roles of macrophages, B cells, helper T cells, killer T cells, suppressor T cells, memory cells and antibodies
- explain the interrelationship of autoimmune diseases and the human immune system; *e.g., multiple sclerosis, arthritis, lupus*
- analyze how vaccines defend against disease-causing bacteria and viruses.

Your immune system fights foreign invaders (pathogens- viruses or bacteria that try to cause disease)

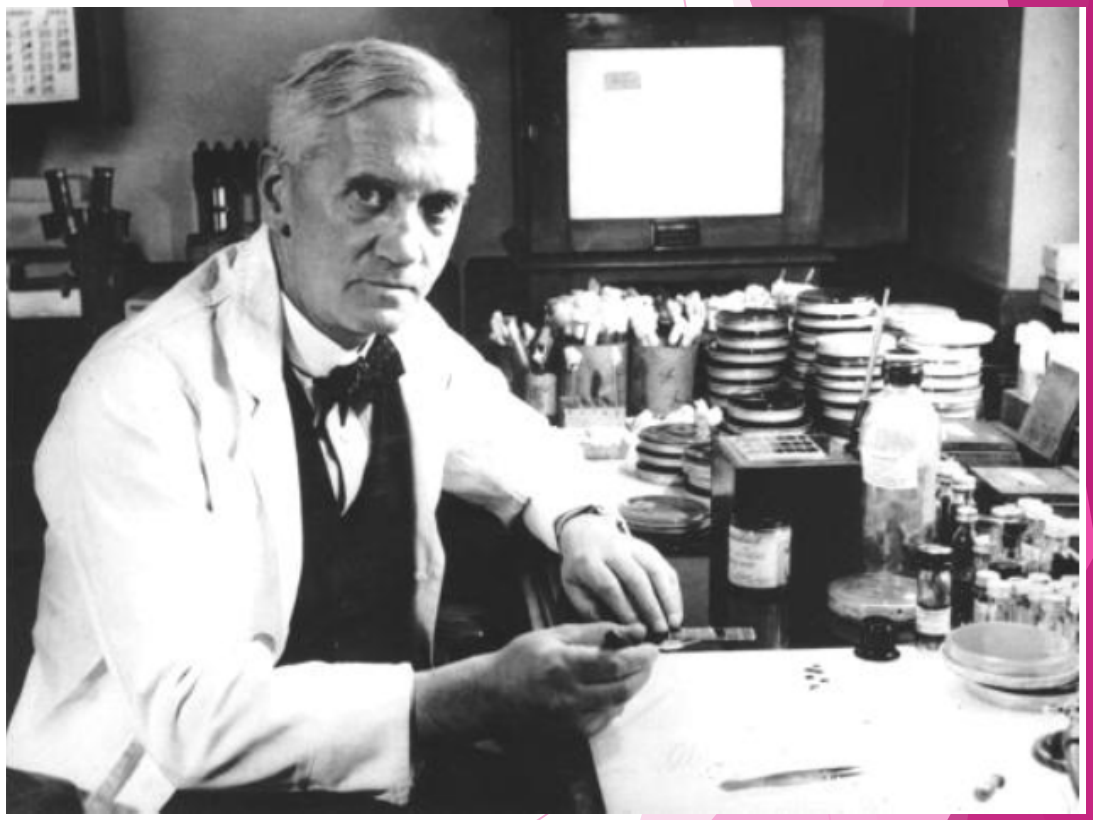
- Bacteria Ex: tetanus
- Viruses (infect host cells and reproduce DNA) EX: HIV, cold virus
- Fungi (mold) example: athletes foot
- Toxins
- Particle matter (dust, pollen ect)

Bacteria

- **Bacteria** are small, single-celled organisms with cell wall and cytoplasm
- Their genetic material is floating in cytoplasm and not contained in nucleus
- As they reproduce rapidly, their life processes damage your cells and produce toxins that make you feel ill
- They can be treated with **antibiotics** such as penicillin

Antibiotics

- In 1929, Alexander Fleming discovered penicillin
- Many other antibiotics have been developed since then
  - Used to fight bacteria

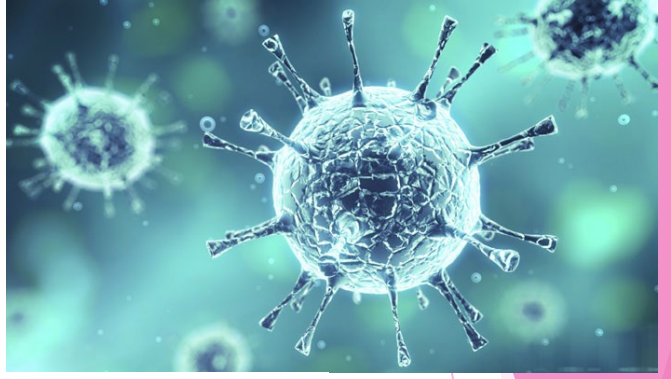


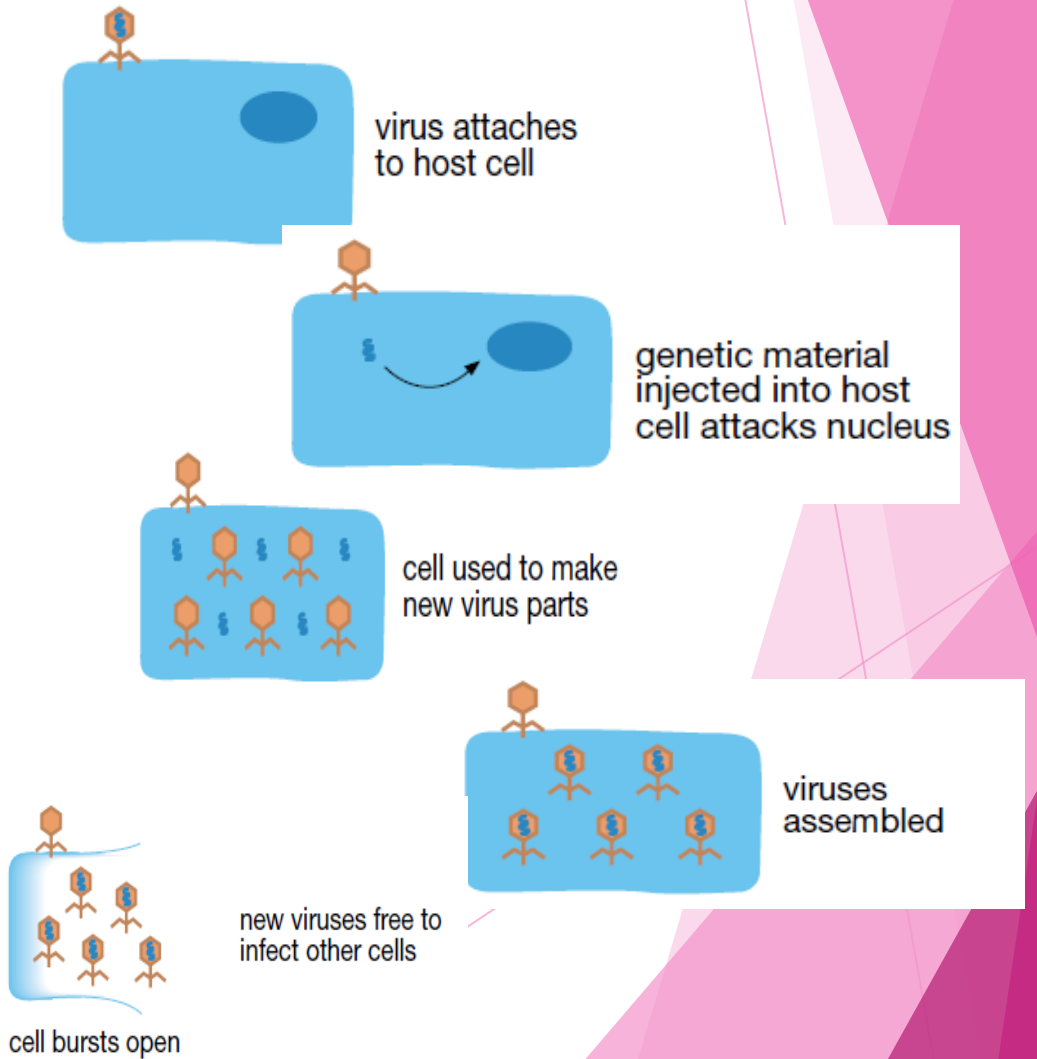
Fungi

- **Fungi** are organisms that absorb food in solution directly through their cell walls and do not conduct photosynthesis; reproduction occurs through spores
- Most fungi live off of the remains of dead organisms

Viruses

- **Viruses** are unable to live without a host so are not considered life
- Viruses infect host cell by injecting their genetic material and turn the host into a virus-making factory
- **Anti-viral drugs** are a type of medication that controls or cures the infection from a virus

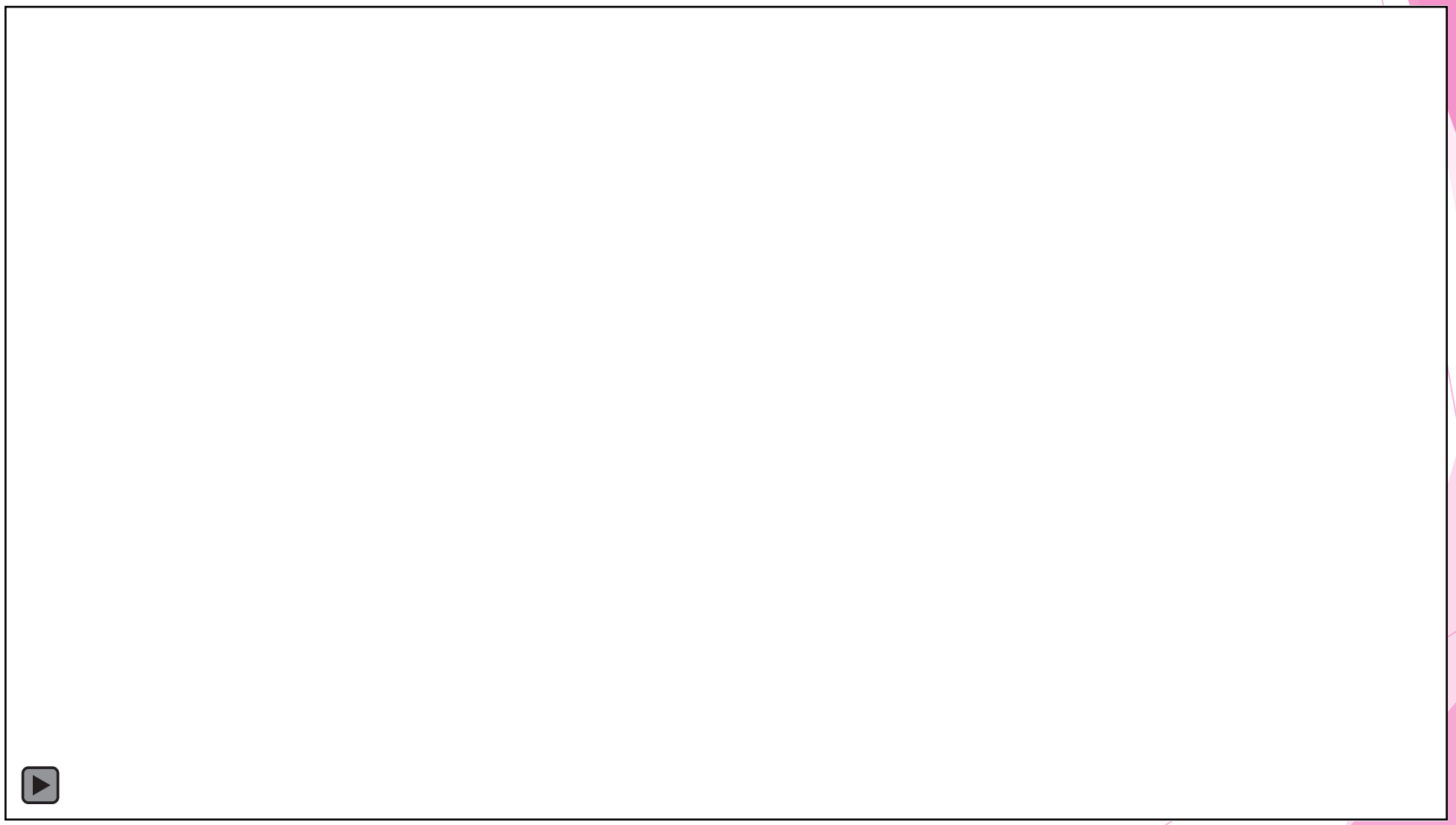




- Antibiotics are **not** effective against *viral* infections

- Some pathogens are becoming immune or resistant to antibiotics

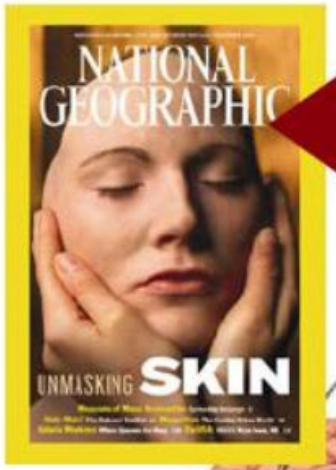
Virus (4 min)



Defending Against Pathogens

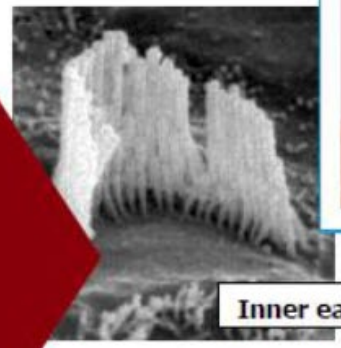
- Your body is like a fortress and has many lines of defense to protect against these pathogens
- **1. Skin -** first line of defense; protects against most disease organisms from getting within body
- **2. Mucous** – block up openings to prevent anything from entering
- **3. Sweat -** the production of sweat and oils in the skin is acidic; kills most bacterial growth
- **4. Hair -** the hairs in your nose for example trap foreign disease-causing organisms and they also have mucous secretions to trap them

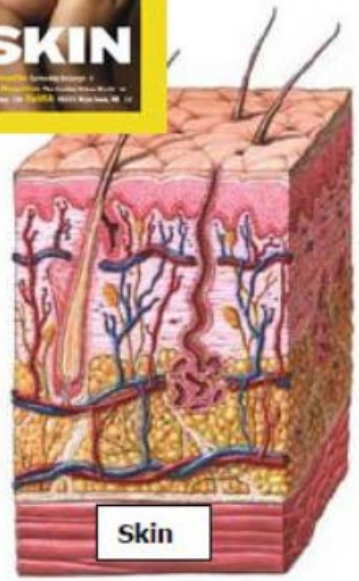
The first lines of defense against foreign invaders:



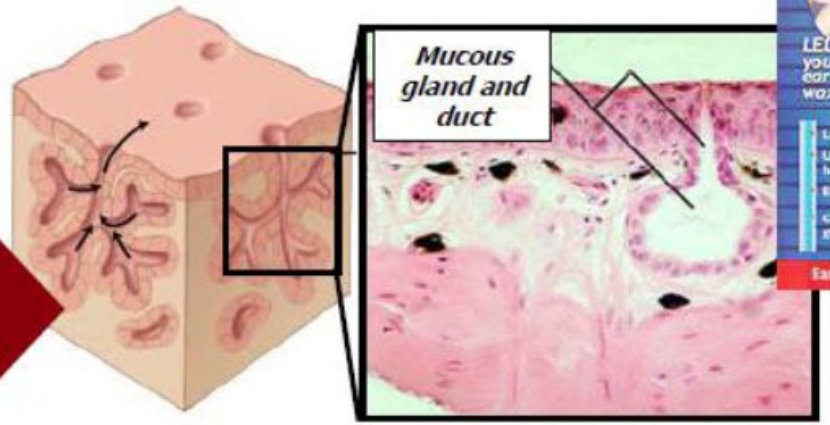
Skin
Acts as a barrier

Hairs and Cillia
Filter out and sweep away dust particles





Stomach Acid



Mucous and Wax
Trap then flush particles

Vectors

- **Vectors** are organisms that carry pathogens from one person to another
- Malaria is one of the most prevalent forms of diseases that has become widespread especially in third world countries
- In mosquitos, a saliva exists that carries the deadly malaria pathogen and acts as a parasite that can cause sickness and even death in its hosts
- Mosquito vector affects red blood cells

Protozoans

- **Protozoans** are single-celled organisms
- Protozoans often live as **parasites** and require a host to reproduce
- This makes them difficult to destroy without harming the host cells
- Malaria is caused by a protozoan where the mosquito vector infects human red blood cells

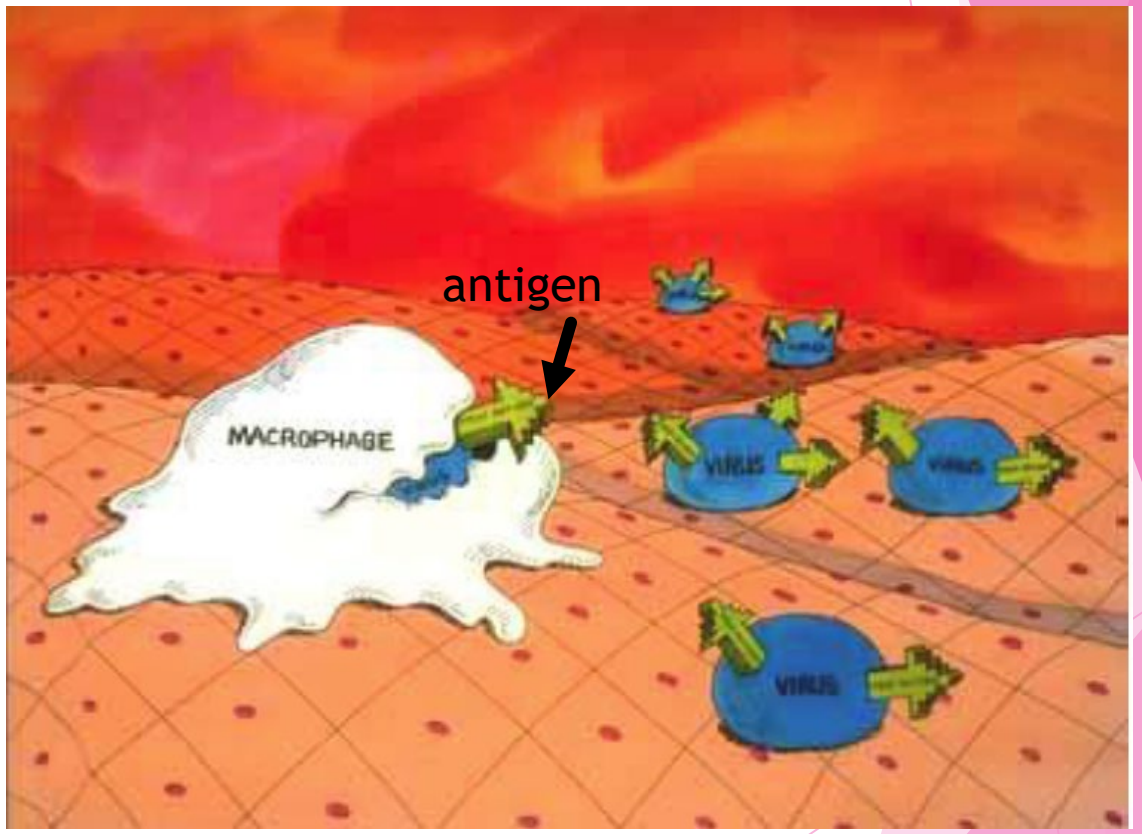
- Once pathogens infiltrate the body, the immune system respond involves several different types of white blood cells

- Macrophages
- Helper T cells
- B lymphocytes
- Killer T cells
- Suppressor T cells
- Memory cells

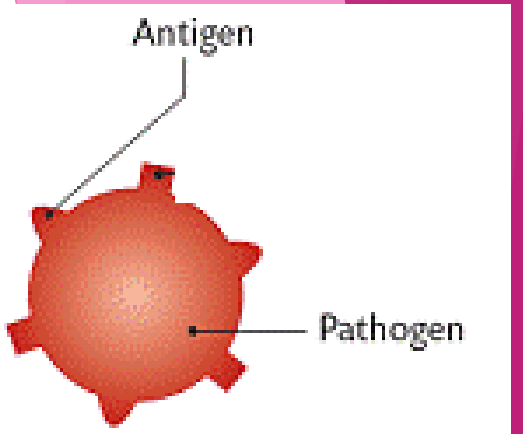
The war on viruses

Step 1: Macrophages

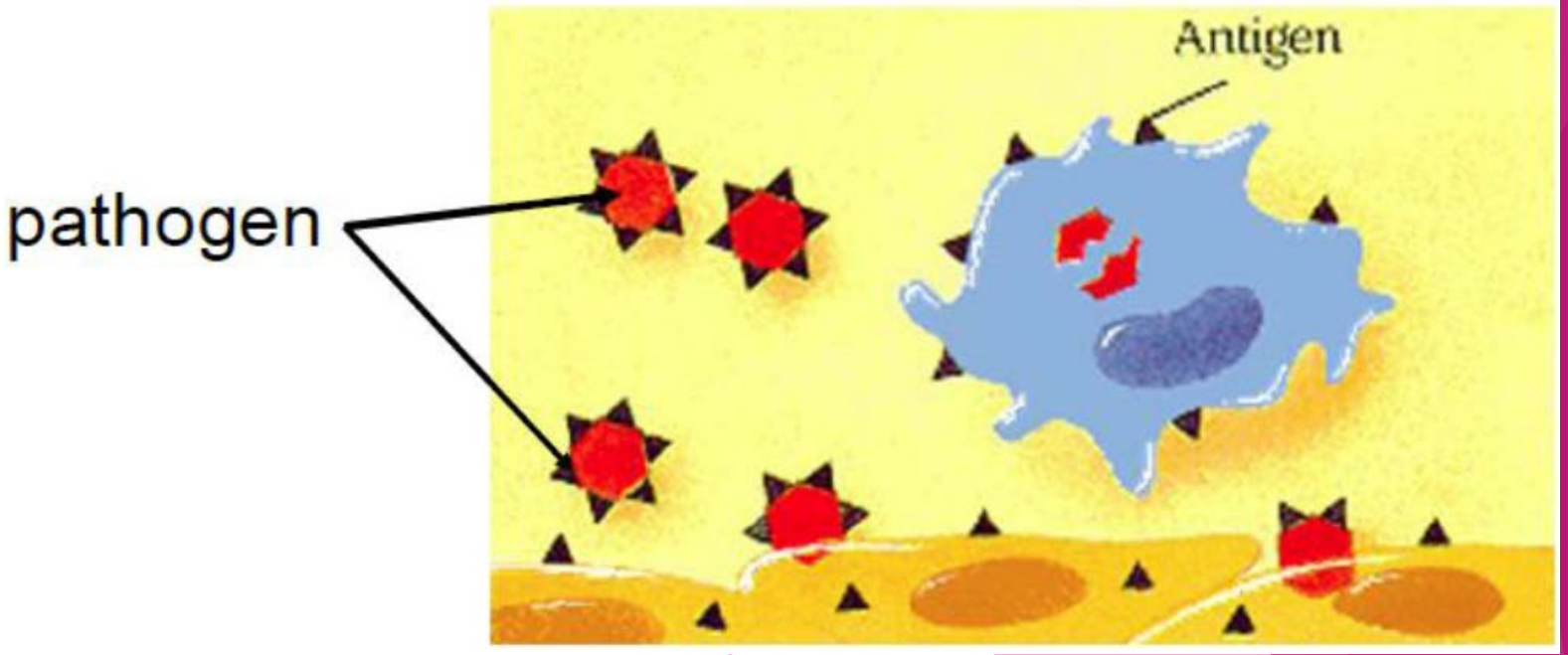
- When an area is infected, a hormone is released which attracts macrophages.
  Greek for “big eater”
  - *Macrophages engulf pathogen, and displays it antigen*



Macrophages engulf the germ and display its surface shape (antigen) for other immune cells to see

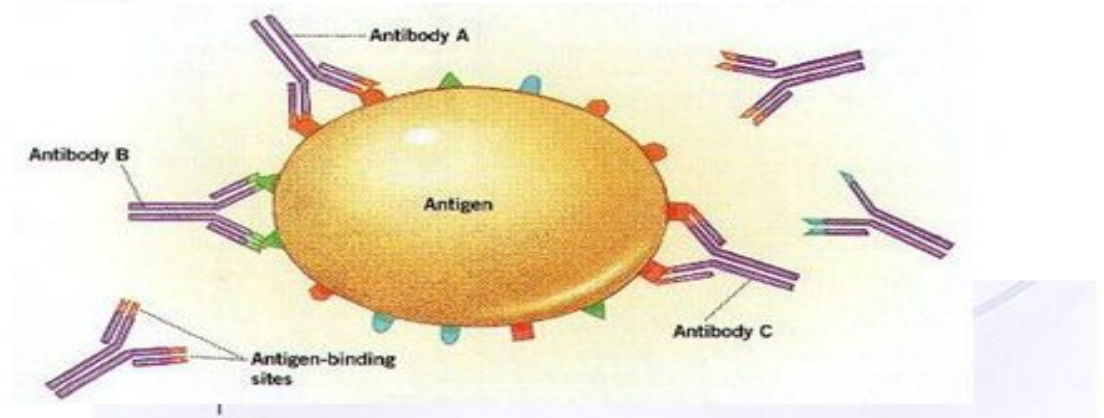


They are able to detect identities through **antigens**, which are *proteins* on the surface of the organism or virus



ANTIGEN

- A protein on a foreign object that stimulates the immune system to produce antibodies.
- A virus, bacteria, toxin, … that trigger the immune response.



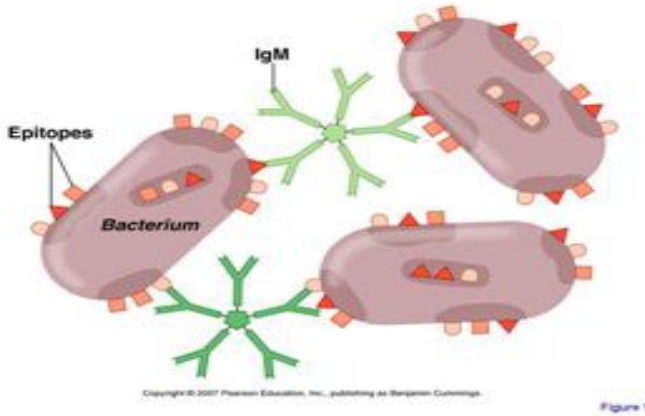
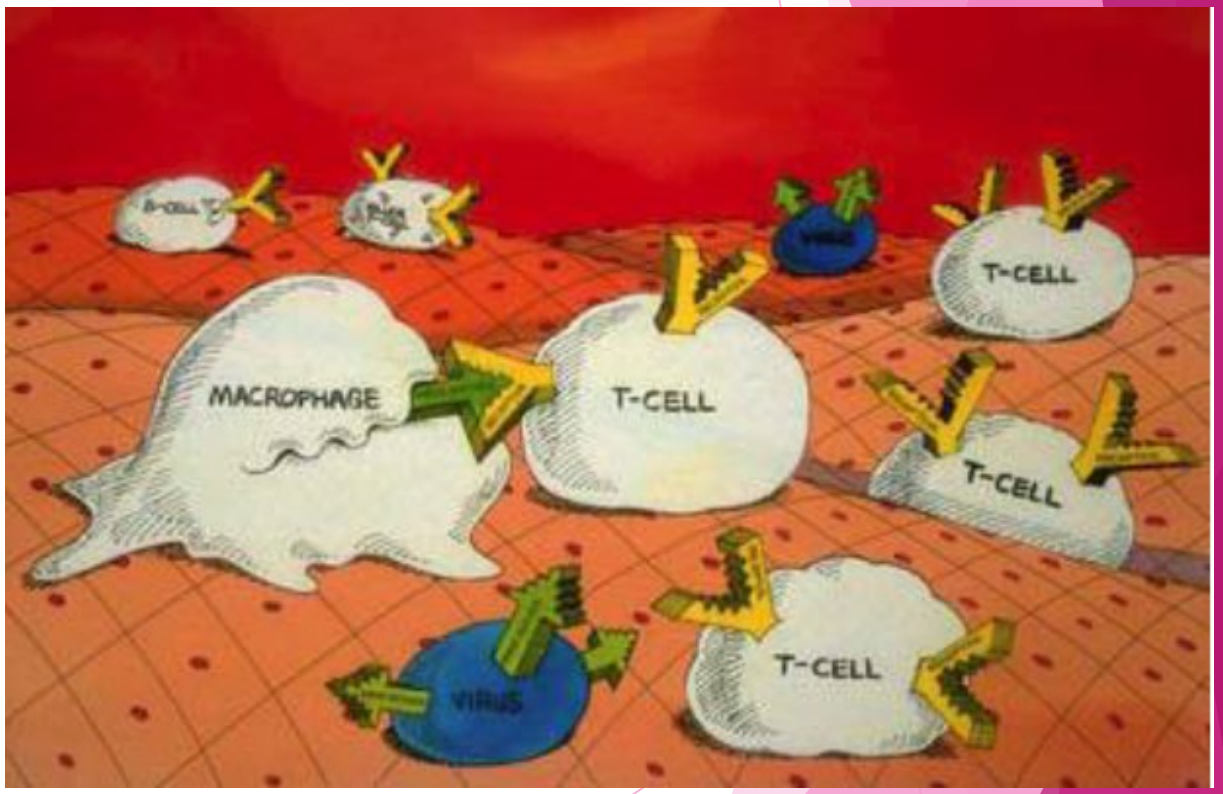


Figure 9.7

Step 2: Helper T cells

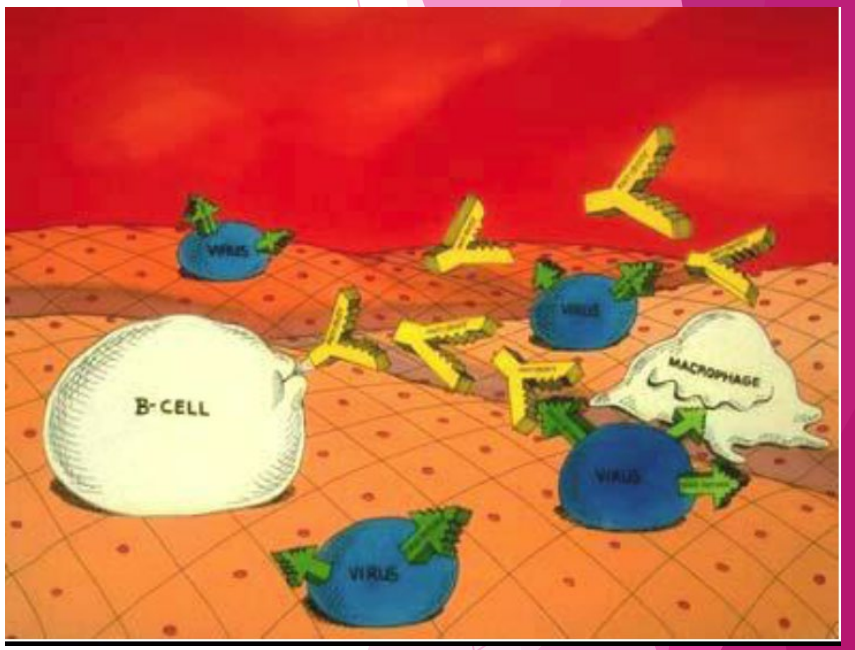
- Identifies the foreign antigens on the macrophages and begins to multiple

- Alerts B cells and directs the body's defense



Step 3: B cells

- Make antibodies that lock onto foreign antigens making it easier for other immune cells to destroy them



- They also releasee hormone, which causes the B cells to divide rapidly, producing large amounts of the antibody

- Antibodies are large Y shape proteins which function to identify and help remove foreign antigens or targets such as viruses and bacteria

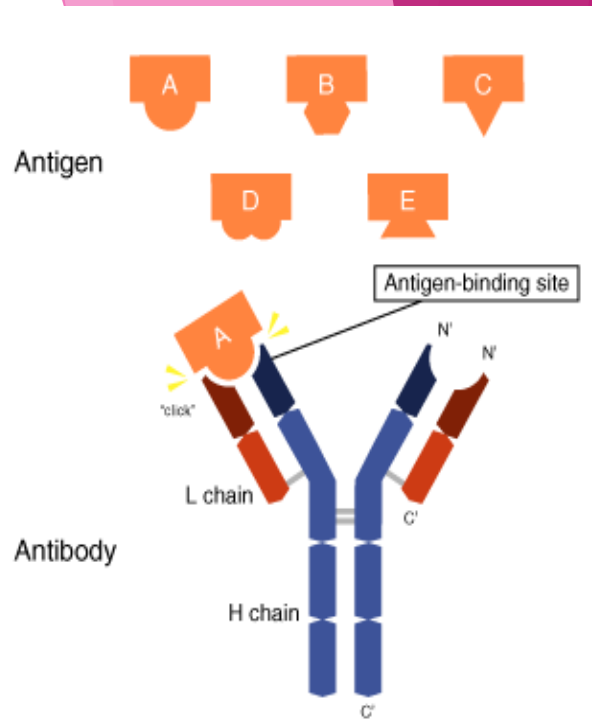
Antibodies

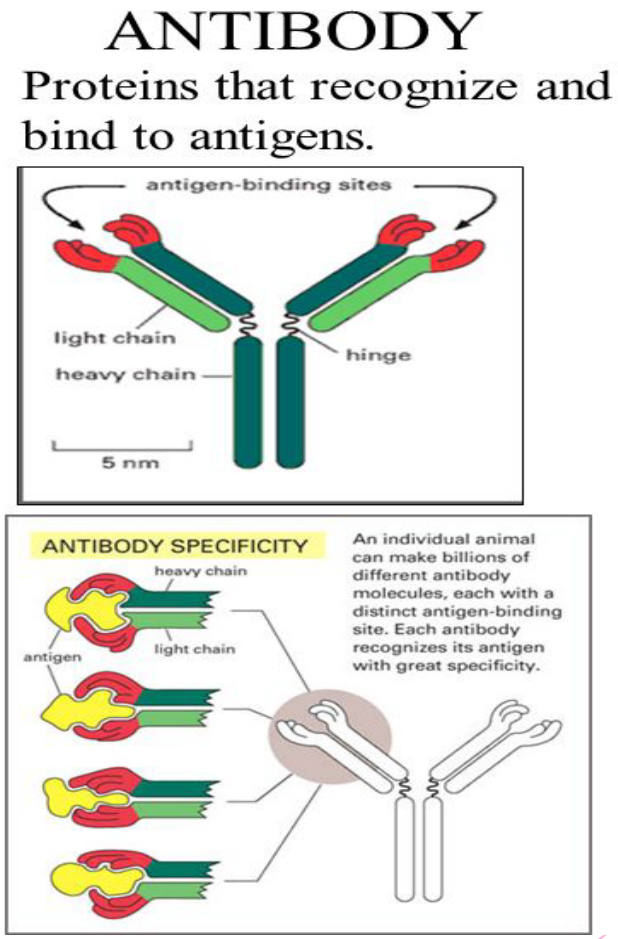
- Antibodies are effective only against 1 antigen
- Antibodies attach

to the antigens

to deactivate

them

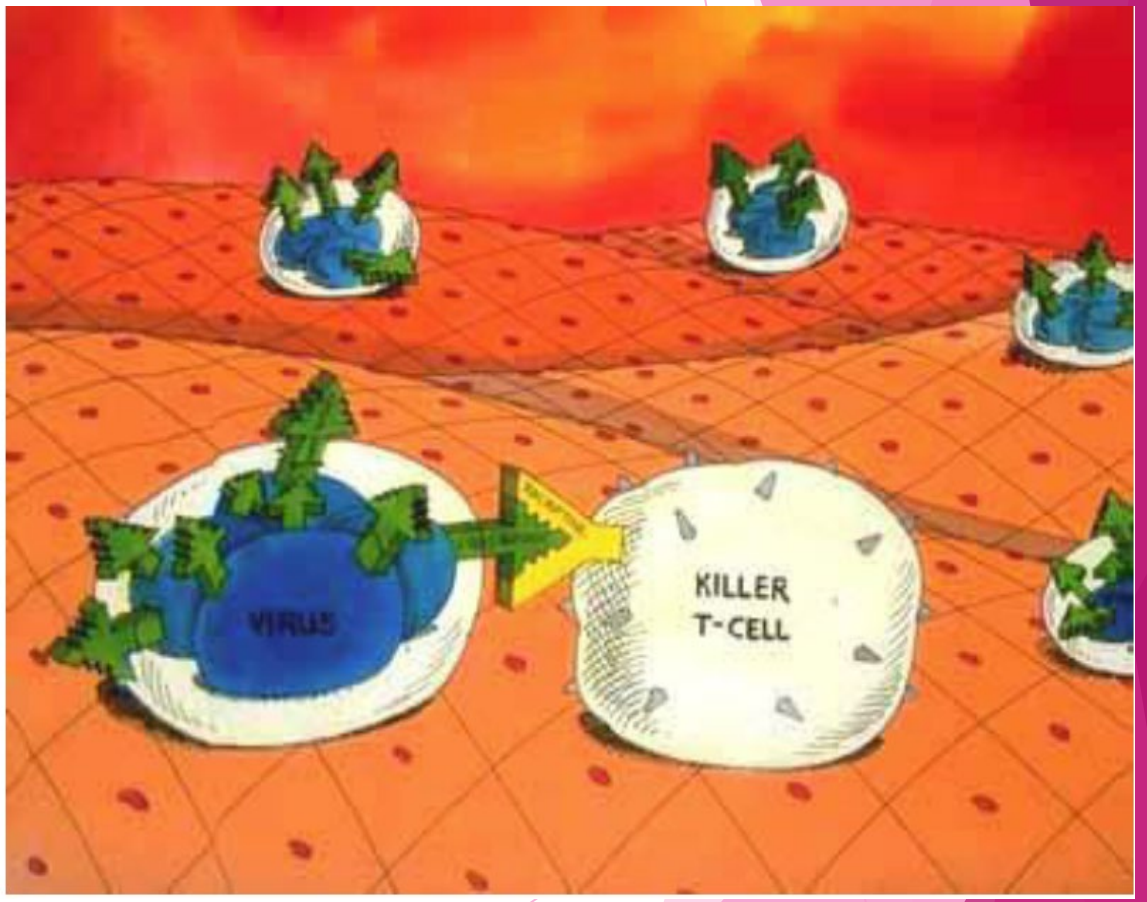




Step: 3b Cyotoxic “Killer” T cells

- The surface of infected cells changes, and this change is recognized by T cells

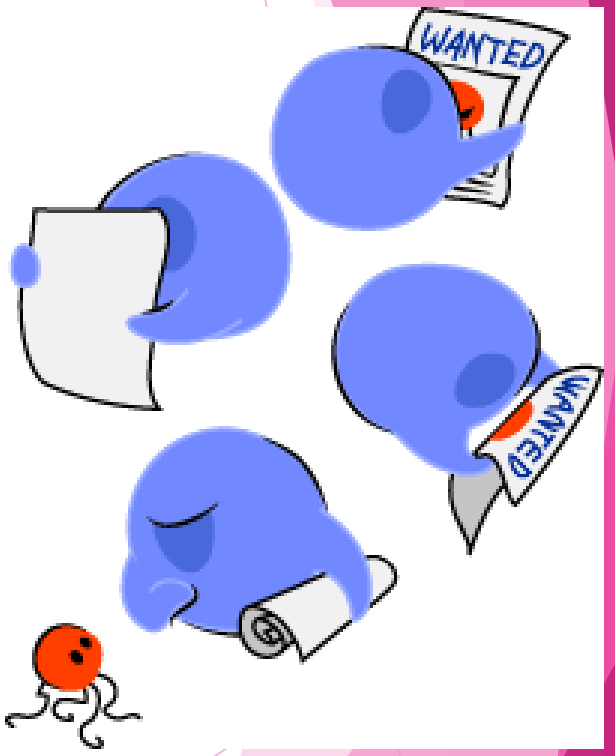
- Killer T cells kill infected cells, preventing these cells from producing more pathogens



Step 4: memory B cells

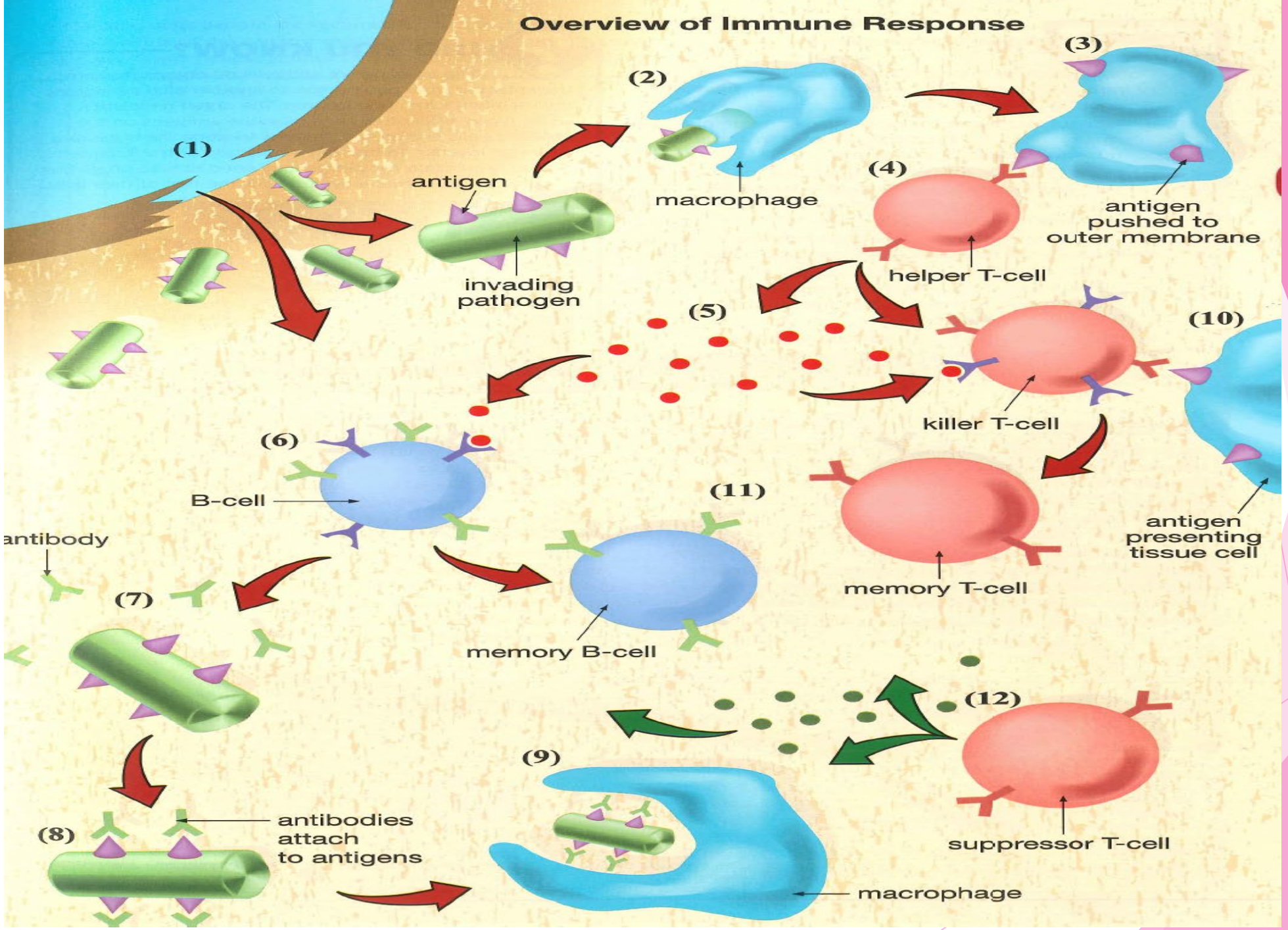
- Some B cells retain memory of the foreign invader and rest until another infection of the same pathogens occurs

- If the same pathogens infect the person, the memory cells produce the antibodies

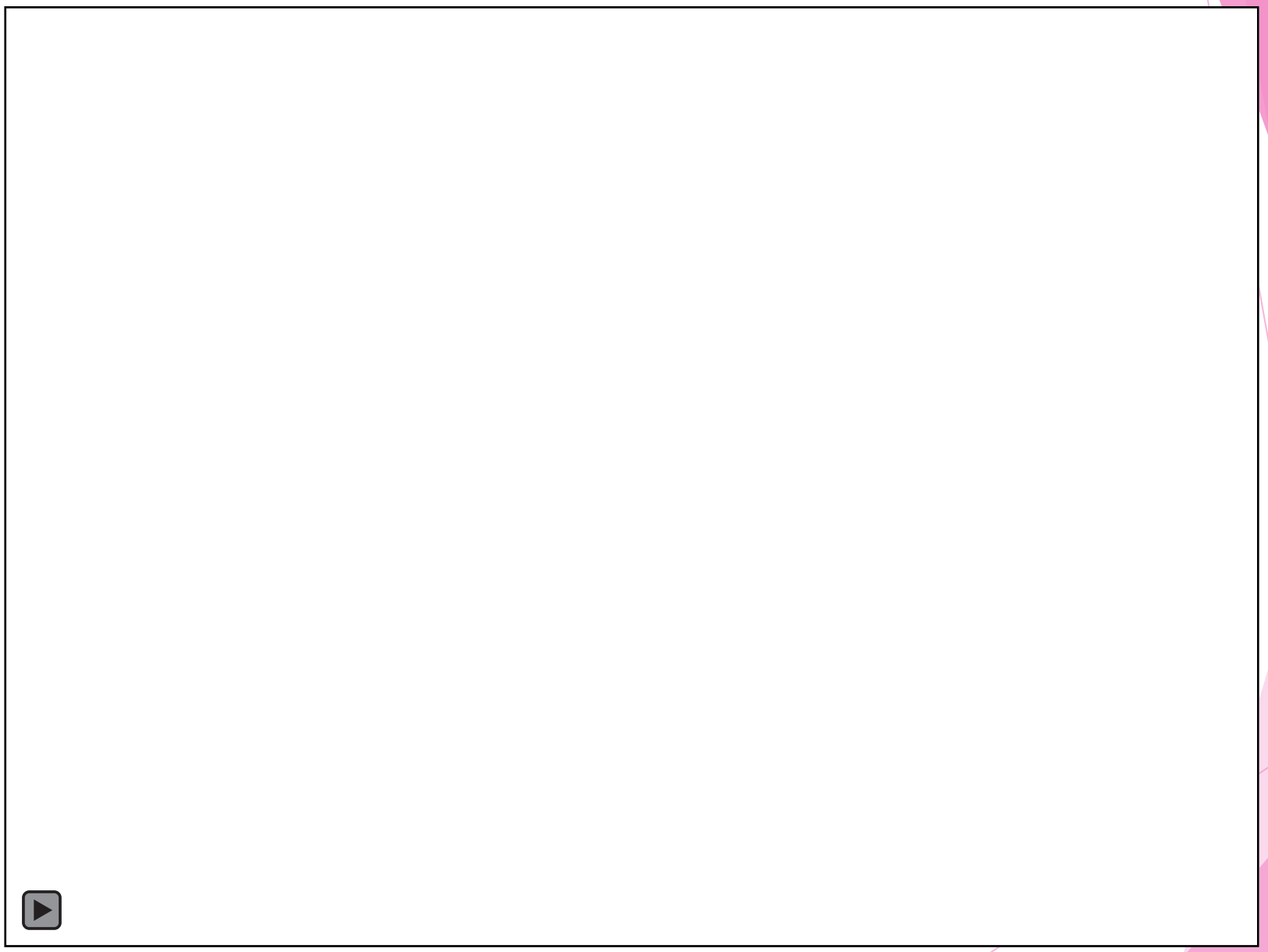


Step 5: Suppressor T cells

- Regulates the immune system response
- Responsible for *turning off* the immune response after an infection has been cleared


Overview of Immune Response
(1)
antigen
invading pathogen
(2)
macrophage
(3)
antigen pushed to outer membrane
(4)
helper T-cell
(5)
killer T-cell
(10)
antigen presenting tissue cell
(6)
B-cell
antibody
(7)
(11)
memory B-cell
memory T-cell
(8)
antibodies attach to antigens
(9)
macrophage
(12)
suppressor T-cell

Video (9 min)



vaccinations

- Involves the injection of dead or weakened pathogens into the body

- Immune system then produces antibodies

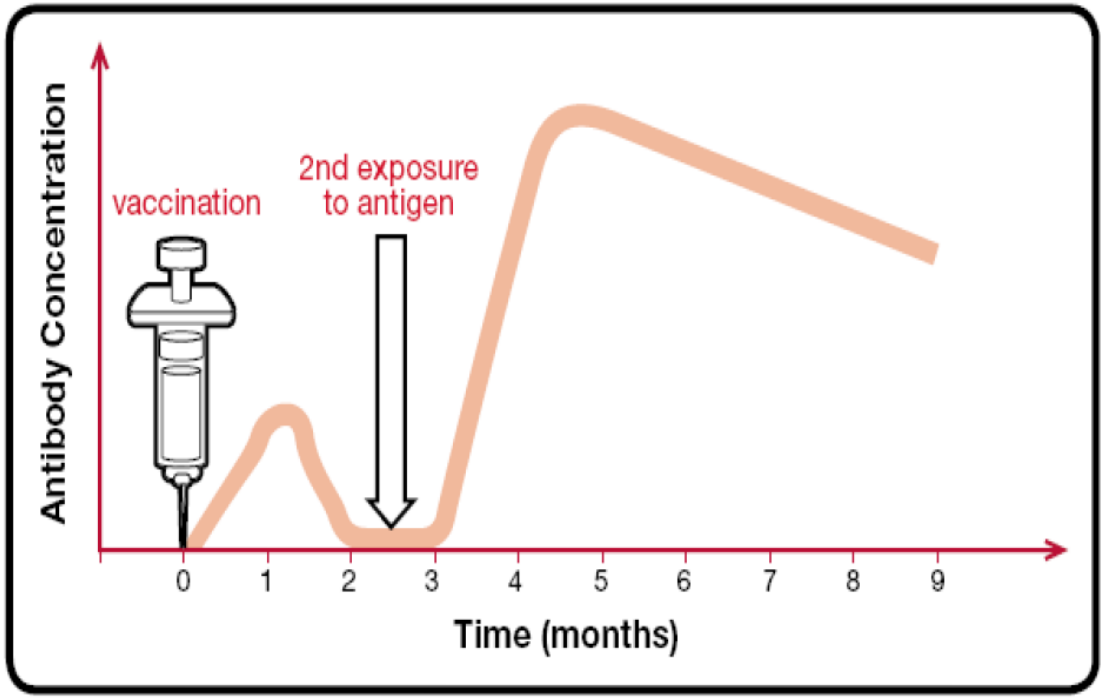
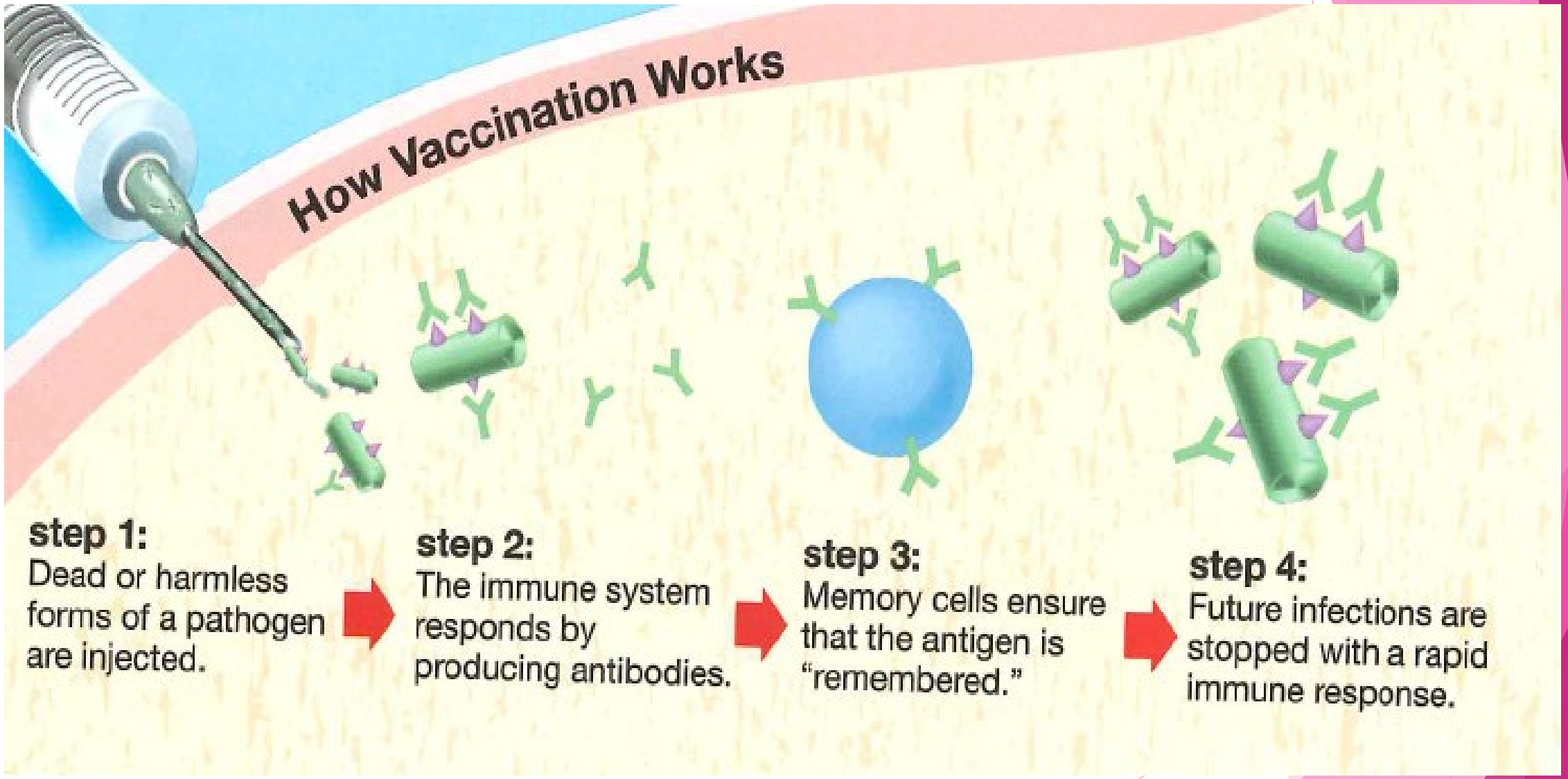
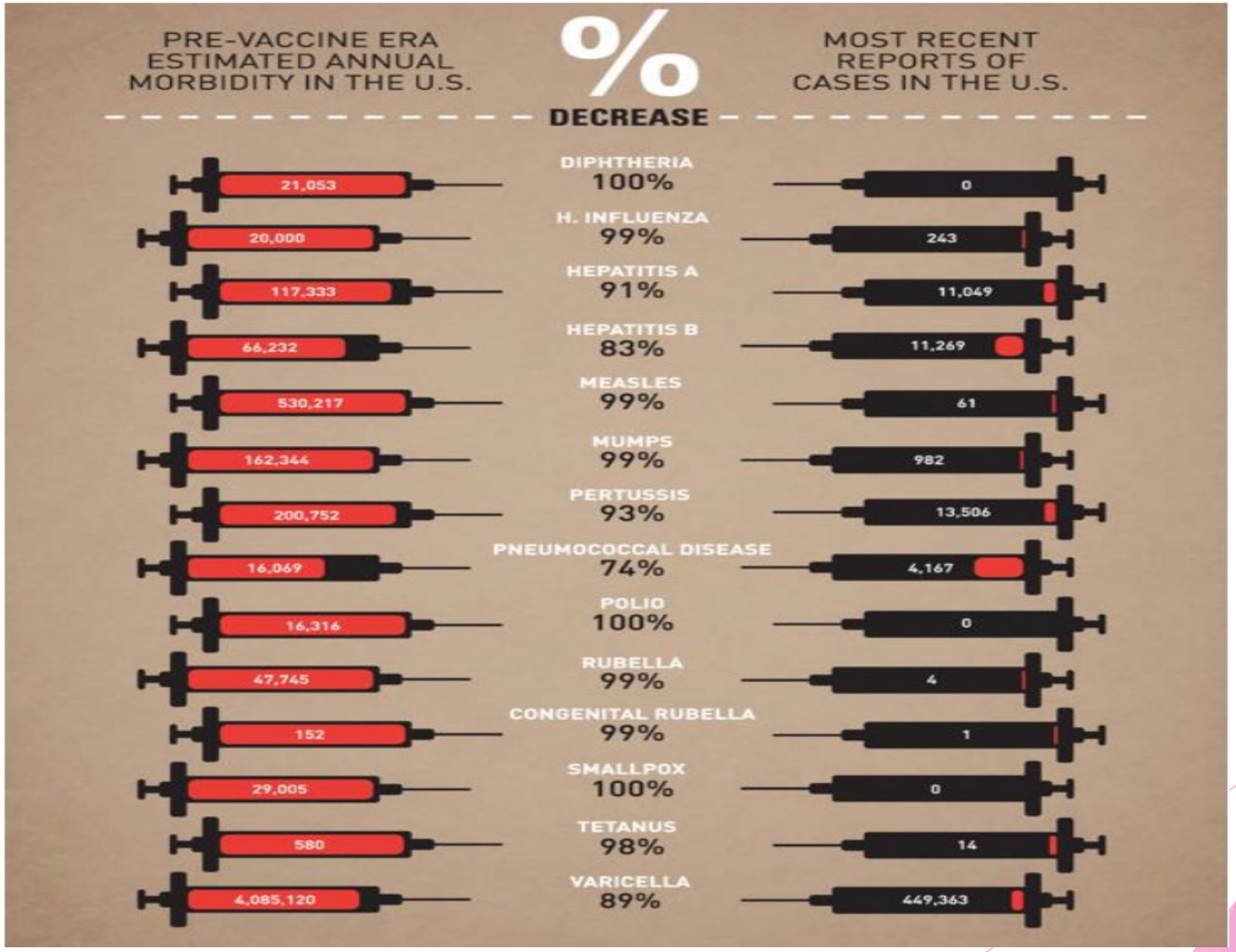


Figure A1.18: This graph shows how the concentration of antibodies is influenced by vaccination and a second exposure.

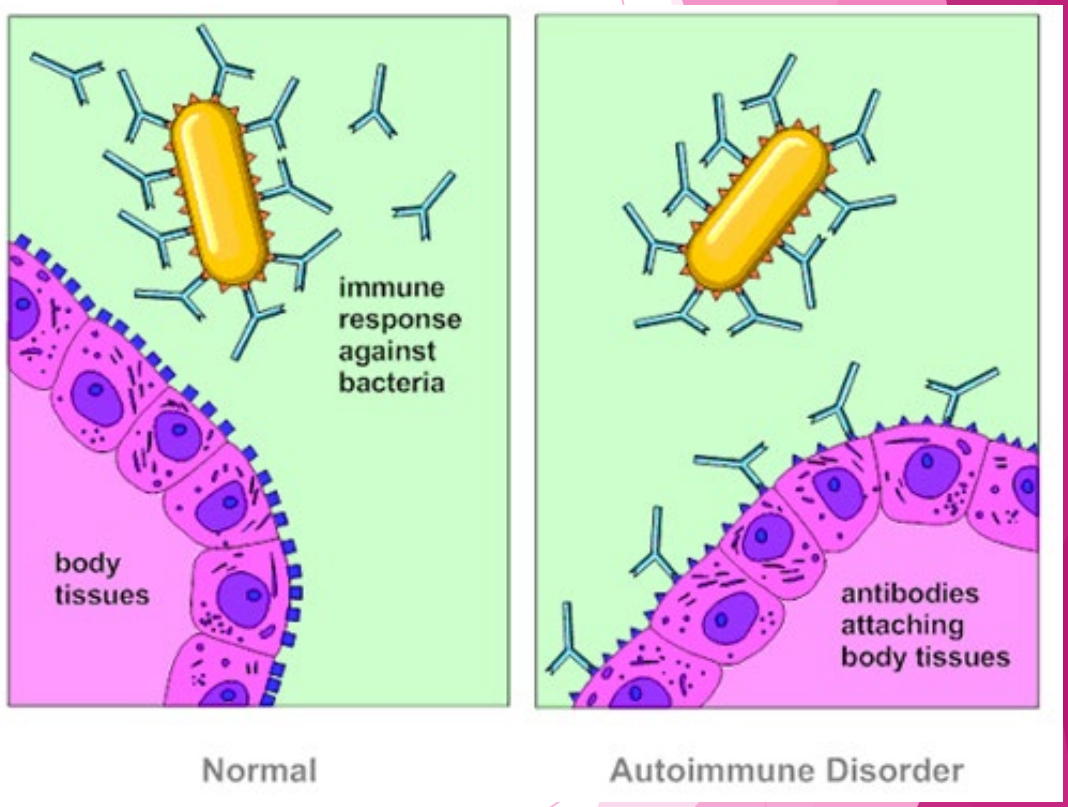
How vaccinations work




PRE-VACCINE ERA ESTIMATED ANNUAL MORBIDITY IN THE U.S.
%
DECREASE
MOST RECENT REPORTS OF CASES IN THE U.S.
21,053
DIPHTHERIA 100%
0
20,000
H. INFLUENZA 99%
243
117,333
HEPATITIS A 91%
11,049
66,232
HEPATITIS B 83%
11,269
530,217
MEASLES 99%
61
162,344
MUMPS 99%
982
200,752
PERTUSSIS 93%
13,506
16,069
PNEUMOCOCCAL DISEASE 74%
4,167
16,316
POLIO 100%
0
47,745
RUBELLA 99%
4
152
CONGENITAL RUBELLA 99%
1
29,005
SMALLPOX 100%
0
580
TETANUS 98%
14
4,085,120
VARICELLA 89%
449,363

Autoimmune disorders

- The immune system forms *antibodies* against their own tissues, treating them like the antigens of invading pathogens.
- Failure of suppressor T cells to control mutated Killer T cells and B Cells
- Example: Rheumatoid Arthritis, multiple sclerosis, Type 1 diabetes, inflammatory diseases, Psoriasis, HIV, Lupus



Allergies

- **Allergies** are when the body is hypersensitive to something that will cause it no harm
- When something like a peanut comes into contact with the body, your body starts producing antibodies to fight it thinking that it is harmful
- It releases a chemical call **histamine** which are inflammatory
- This can cause swelling and rashes

3. Blood components that are capable of engulfing and destroying bacteria are called

A. antibodies — Neutralized pathogens

B. macrophages — Engulf invading bacteria

C. helper T cells — Identifies foreign antigens

D. suppressor T cells — Regulates immune system

Sample Diploma Question

Use the following information to answer question 12.

A high-security facility is completely enclosed by a fence with several electronic gates that open only to allow authorized people to enter and leave the facility.

12. When compared with body mechanisms that prevent pathogens from entering the body, the fence around the facility has the same function as

A. skin — First line of defense
B. B cells — Make antibodies
C. T cells — Identifies foreign particles
D. stomach acid

Sample Diploma Question

13. Proteins found on the surface of bacteria that are recognized as foreign by the immune system are called

A.	antigens	Triggers production of antibodies
B.	plasmids	Contains DNA
C.	antibodies	Attach to antigens to deactivate
D.	pathogens	Bacteria, virus ect

Sample Diploma Question

Use the following information to answer numerical-response question 3.

Some Steps in an Immune Response

1 B cells form antibodies
2 Macrophages engulf the bacteria
3 Helper T cells identify the antigen marker
4 Regulator (Suppressor) T cells shut down the production of B cells

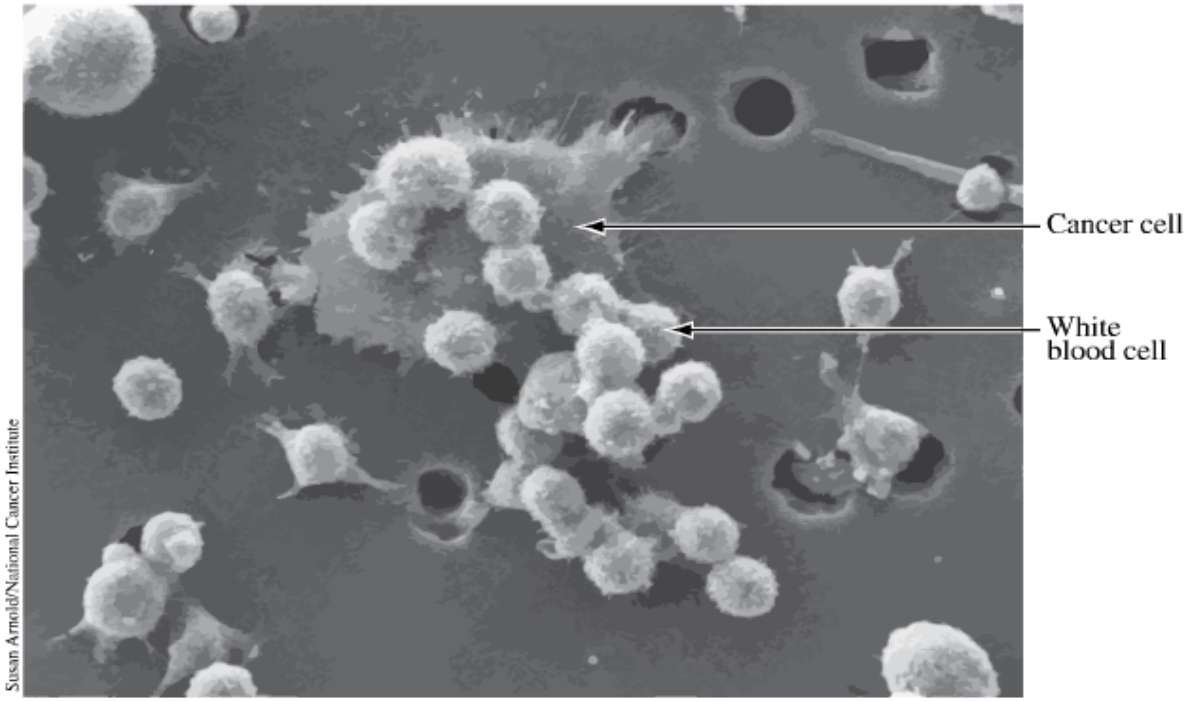
Numerical Response

3. When a person is exposed to a pathogen that he or she has not previously been exposed to, the sequence in which the steps in the immune response numbered above would occur is __2__, __3__, __1__, and __4__.

(Record all **four digits** of your answer **in correct order** in the response boxes at the bottom of the screen.)

Use the following information to answer question 14.

In the scanning electron microscope (SEM) image shown below, a particular type of white blood cell is attacking a body cell that has become cancerous.



14. The white blood cells shown in the image above are **most likely**

A. B cells — Produces antibodies

B. killer T cells — Kills infected cells

C. helper T cells — Identifies foreign antigens

D. suppressor T cells — Responsible for turning off response after infection has been cleared

Use the following information to answer question 15.

The Spanish flu killed at least 20 million people worldwide during the global epidemic of 1918–1919.

In 2005, researchers collected blood samples from Spanish flu survivors, who were between the ages of 91 and 101 years old at the time of collection. They found that certain immune cells in the survivors' blood still reacted to the Spanish flu virus even though the first exposure to the virus was between 80 and 90 years earlier.

15. In the survivors' blood samples, the blood cells that responded to **re-exposure** of the Spanish flu were the

A. regulator (suppressor) T cells — Turns off attack

B. red blood cells — Carry oxygen

C. memory cells — Retains memory of invaders

D. killer T cells — Kills infected cells

Use the following information to answer question 16.

Human immunodeficiency virus (HIV) attacks the components of the immune system that promote the activation of B cells.

16. Given the information above, the components of the immune system that are attacked by HIV are

A. antibodies — Made by B cells, binds to antigens

B. macrophages — Attack pathogens

C. helper T cells — Identify antigens

D. memory T cells — Retains memory of pathogen

17. Which of the following rows describes the action of B cells in response to a pathogen and the action of B cells in an autoimmune disease?

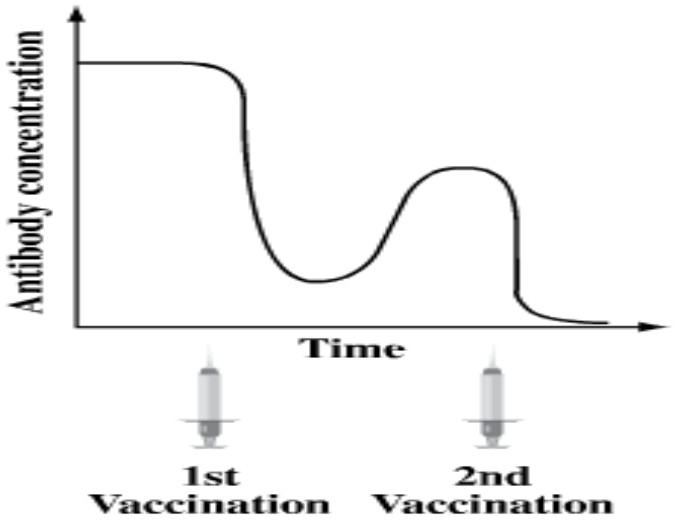
Makes antibodies

Row	Action of B Cells in Response to a Pathogen	Action of B cells in an Autoimmune Disease
A.	Produce antibodies against pathogen antigens	Produce antibodies against the body's own antigens
B.	Produce antibodies against pathogen antigens	Fail to produce antibodies
C.	Produce antigens against pathogen antibodies	Produce antigens against the body's own antibodies
D.	Produce antigens against pathogen antibodies	Fail to produce antigens

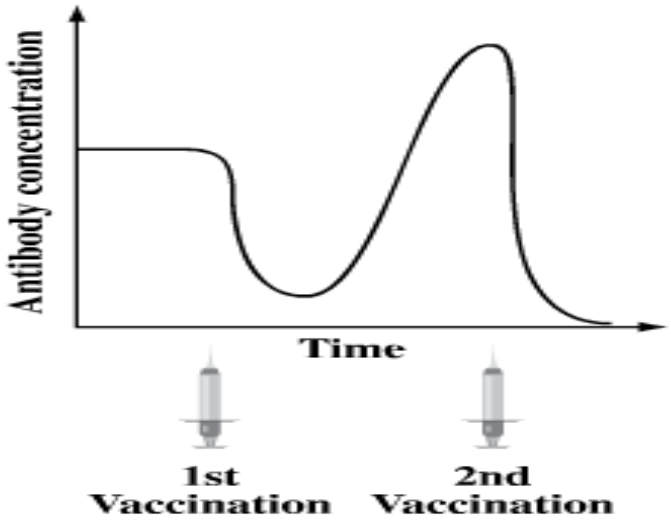
Attacks bodies cells, does not stop. (suppressing , suppressor T cells)

18. Which of the following diagrams **best** represents the antibody concentration after a person receives a vaccination against a particular virus and then receives a second vaccination (booster) against the same virus?

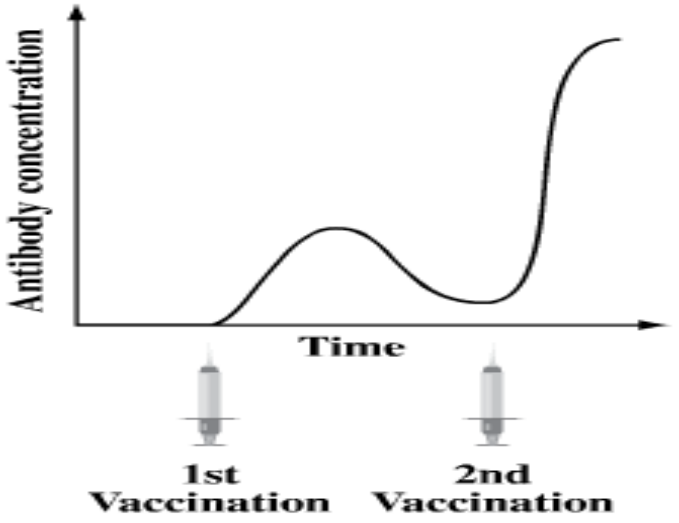
A.



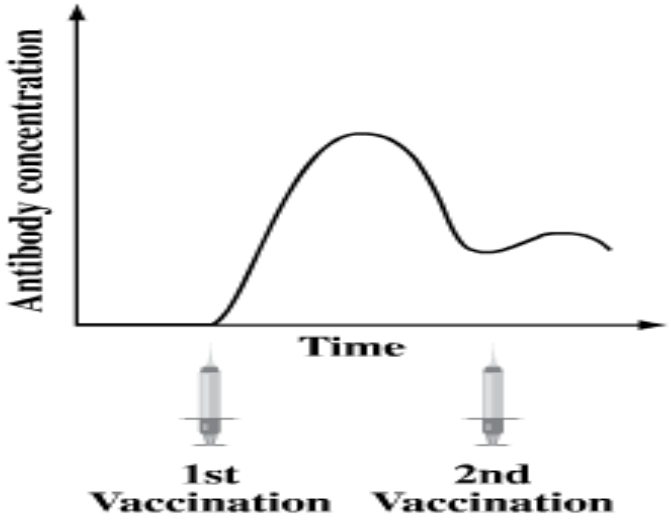
B.



C.



D.



Assignment:

1. Name some of the first lines of defense your body has to prevent against infection
2. What are the four common types of infections that can enter your body and give a description of each using your own words
3. When an infection does enter your body write the order of things that happen
   - B cells produce antibodies
   - Helper T cells copy antigen
   - Killer T cells destroy cells responsible for making new viruses
   - Macrophage
   - Memory cells
   - Suppressor Cells
4. What's the difference between an antibody and an antigen?
5. How do vaccines work?
6. What is an autoimmune disease?

End of chapter 1