

# Lymphatic System



# What is it?

- We talked about how the circulatory system **exchanges substances** with the cells
  - Well this exchange is not direct, it actually happens in the fluid around the cells called **extracellular** or **interstitial fluid**
    - It is this fluid that is the basis of the **lymphatic system**

# What is it?

- The lymphatic system works with **the circulatory system**
  - The two systems are **intricately joined**
- The lymphatic system is composed of **lymphatic vessels** that carry a clear fluid called **lymph** around **the body**

# What is lymph?

- Lymph is just **extracellular fluid** that is now being carried in the vessels of the lymphatic system

- This fluid contains:

- **Blood plasma**
- **White blood cells**
- **Dissolved substances**

When the fluid is just outside the cells

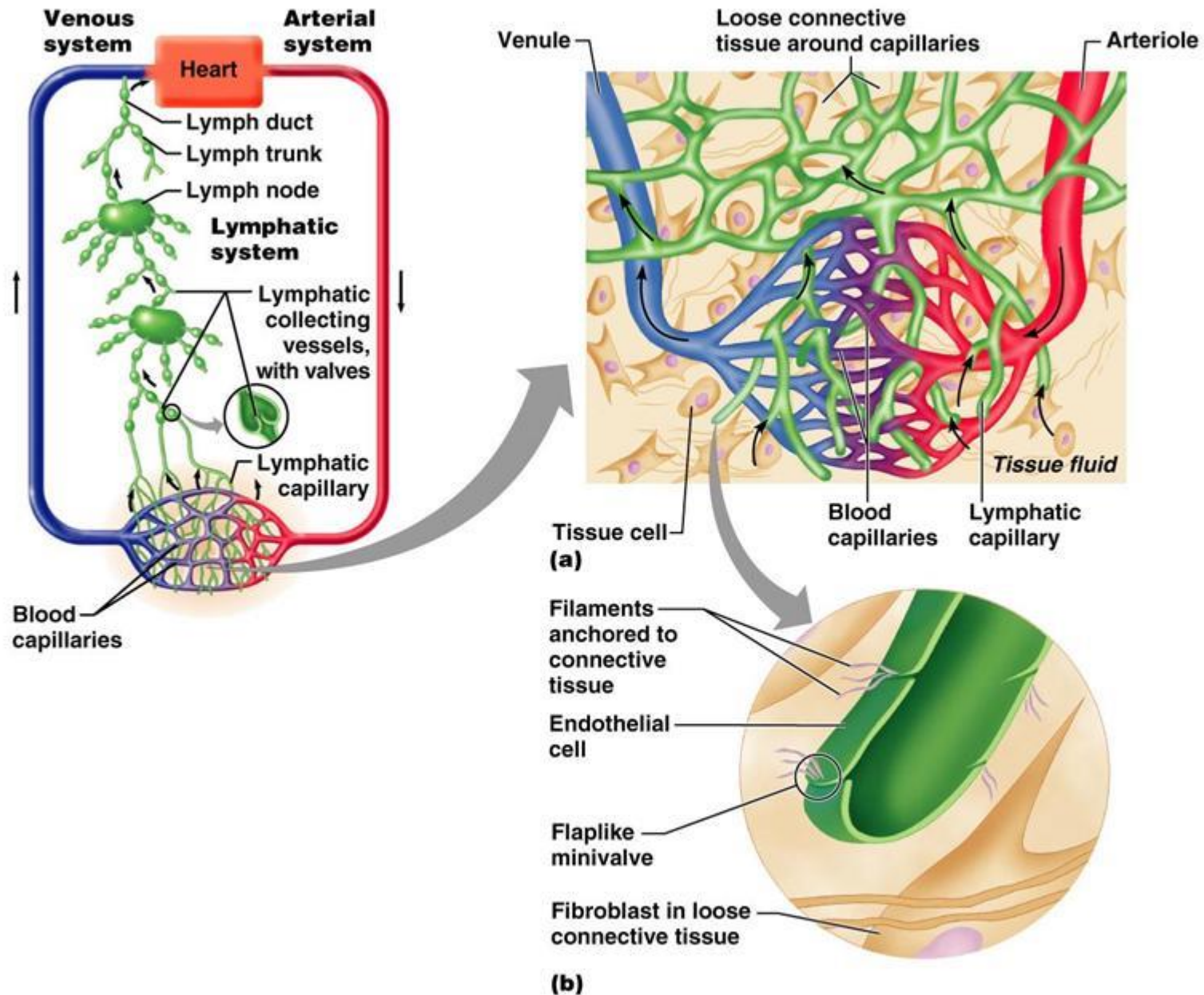
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**extracellular fluid**

When the fluid is inside the vessels

=

**lymph**

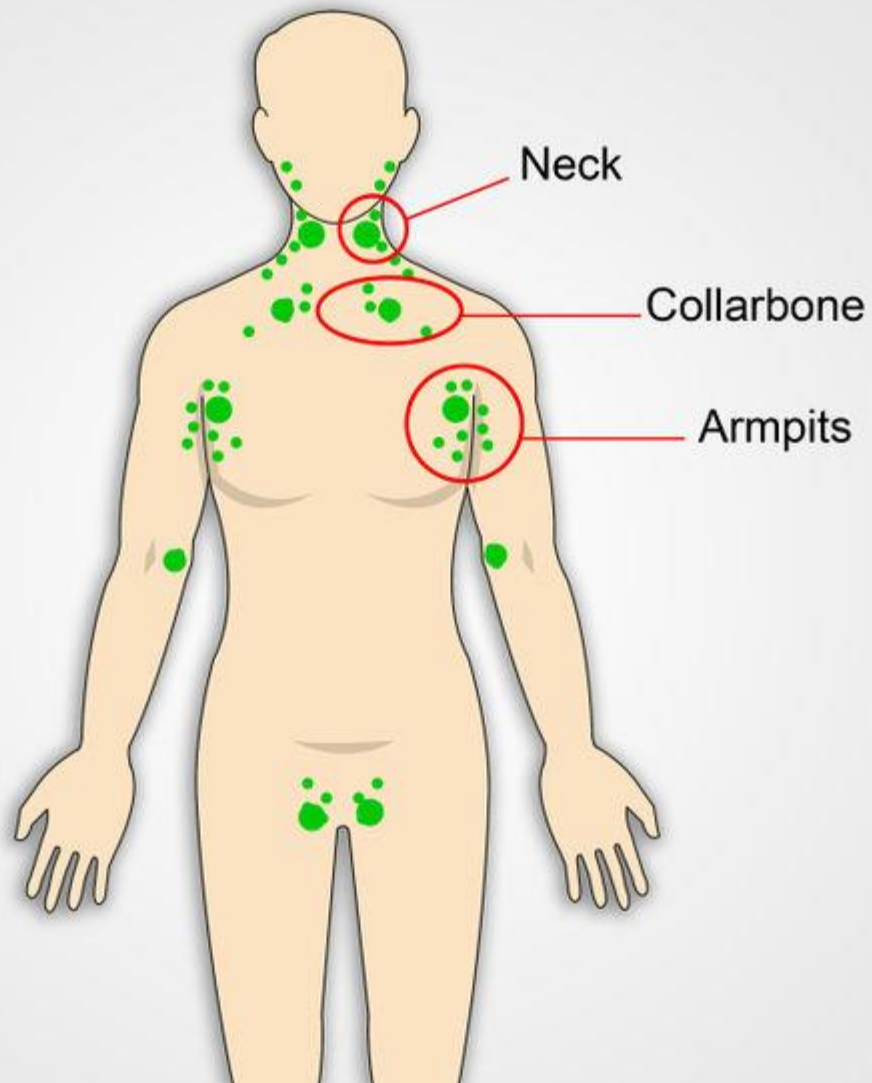


# Immune defense

- Lymph is very similar to blood plasma
- Contains:
  - Lymphocytes (type of white blood cell)
  - Waste
  - Cell debris
  - Bacteria
  - Proteins

# Lymph nodes

- **What do they do?**
  - **Filtration sites** along the lymphatic system
    - **Monitor** and **cleanse** the lymph
  - **Produce white blood cells** to fight viruses and other infections (immune defense)
- **Located in:**
  - groin, neck, armpit, tonsils, thymus, spleen, and wall of the intestine





Why do they check your lymph nodes when you're sick?



# Lymph nodes

- Normally you **can't see or feel** your lymph nodes but when you're **sick** they can get **swollen**
- This is because they are working overtime to **produce white blood** cells to fight the infection

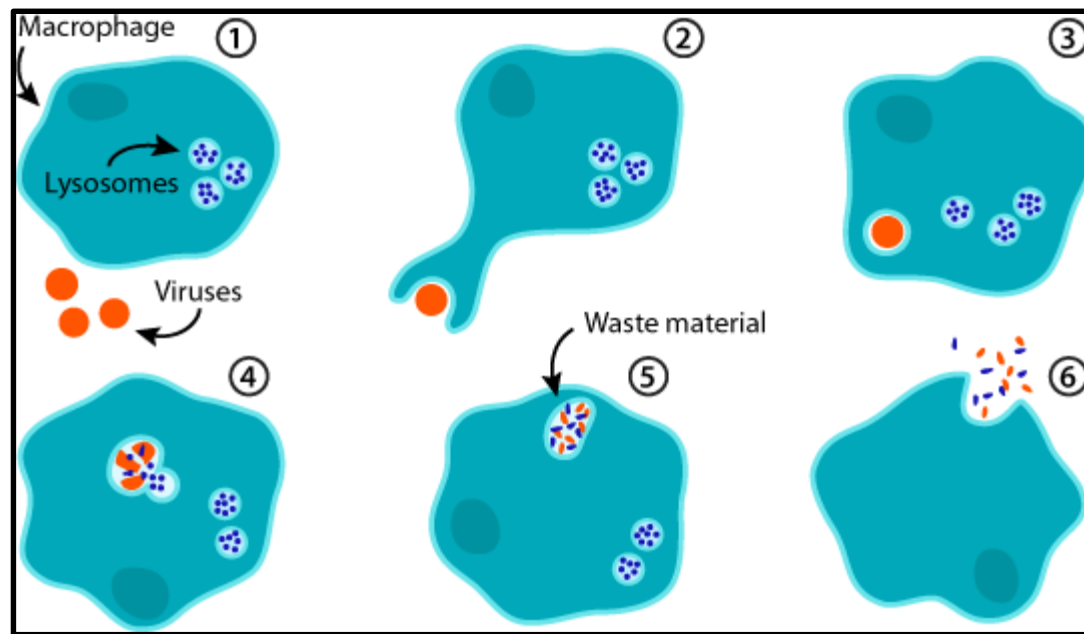
So if a person is sick (or was recently) they are going to have **more white blood** cells than normal

Basically....

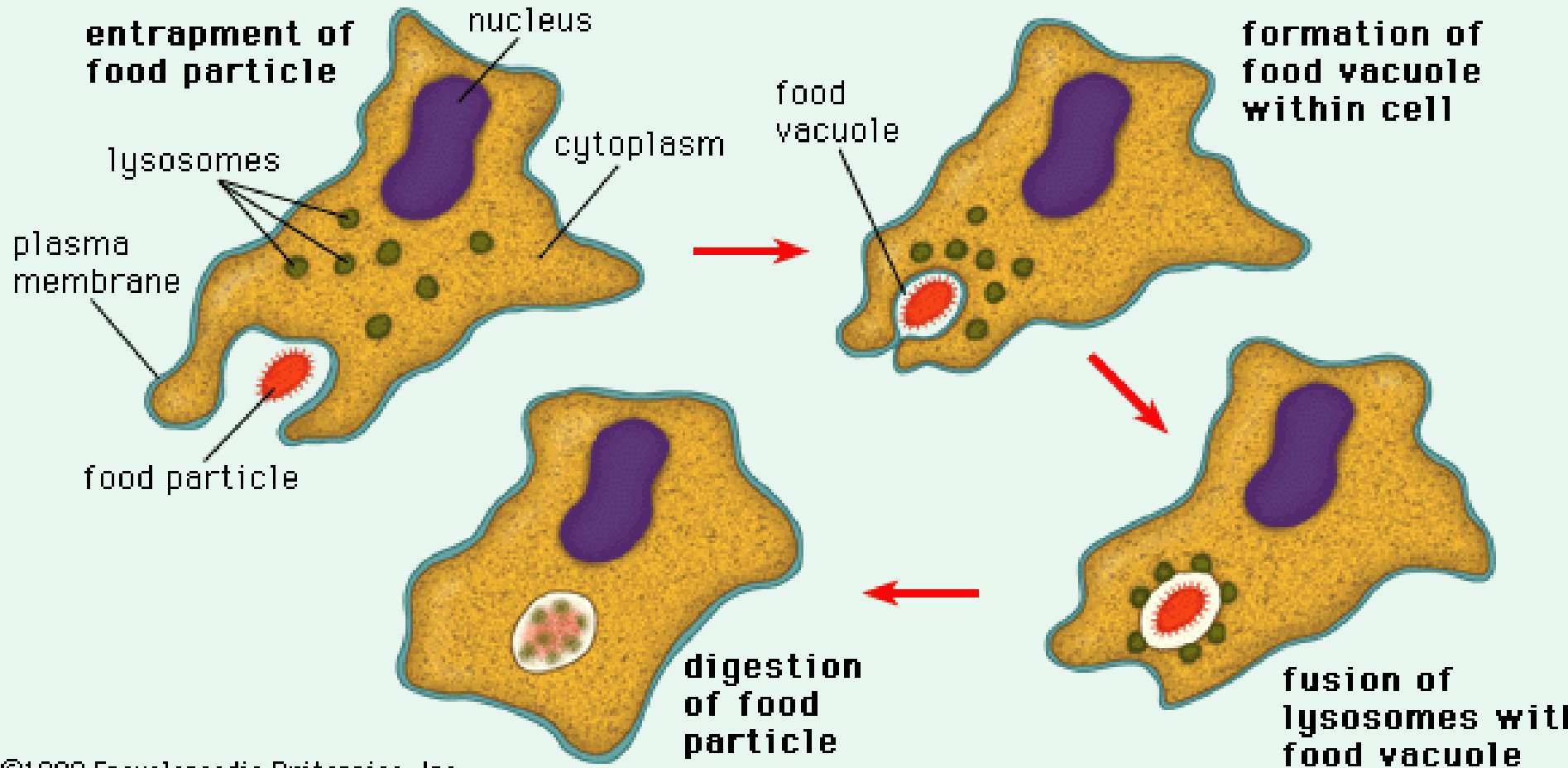
Swollen lymph nodes = infection!

# How do WBCs fight infection?

1) Eat bacteria/virus in process called **phagocytosis**



2) Produce **antibodies**

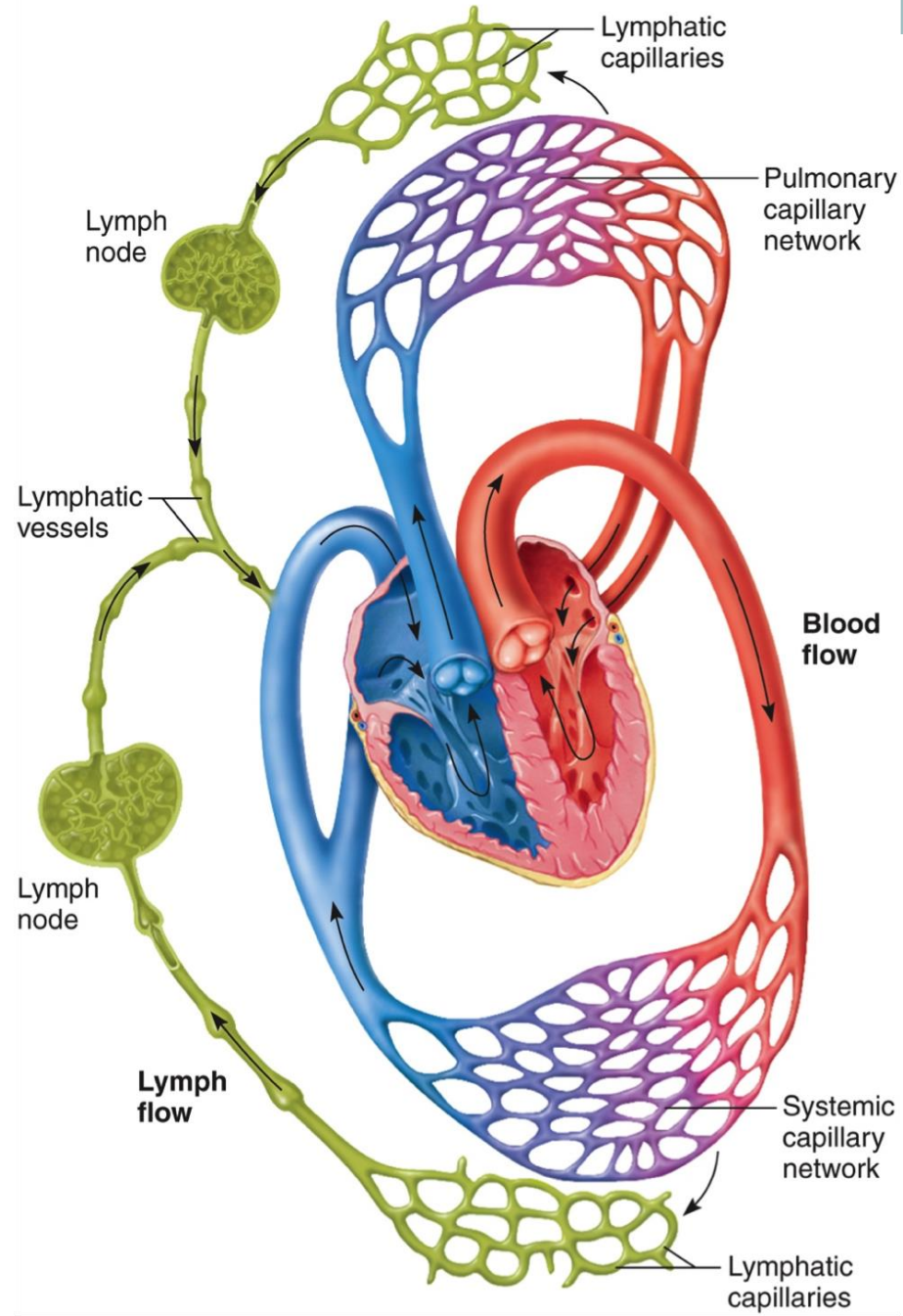


# Phagocytosis in action!



# Lymph and Blood

Lymphatic and circulatory systems work together









# Immunity & Vaccines



# Immune System

- **Immunity:** ability of the human body to protect itself against foreign antigens;
- **Antigens:** viruses, bacteria, abnormal cells or any other substances that can trigger a reaction of the immune system;
- **Antibody:** substance produced by certain white blood cells and that is able to neutralize a specific antigen.

# Immunity

- **Non-specific immunity:**
- The general structures that the body uses to help protect itself
- Ex: Skin acts as **a barrier** and is one of the mechanisms of **non-specific immunity**
  
- **Specific immunity:**
- The use of targeted antibodies
  - These are only good against **one particular antigen**

# Naturally vs Artificially Acquired Immunity

- **Naturally acquired immunity:**
- Immune defenses acquired by **exposure** to the antigen in a natural way
  - Ex: you **catch a cold** (virus) or step on a dirty nail and **come in contact** with bacteria
- **Artificially acquired immunity:**
- Through the use of a **vaccine**

# What are Vaccines?

- Vaccines usually contain an agent that resembles the disease – often made from **weakened or killed** forms of that microbe (virus or bacteria)
- Provide **active acquired immunity** to a **particular disease**
  - **Active** because there are **antibodies ready** for an attack
  - **Acquired** because you **weren't born** with it, you **acquired** it via the **vaccine**

<https://www.youtube.com/watch?v=rb7TVW77ZCs>

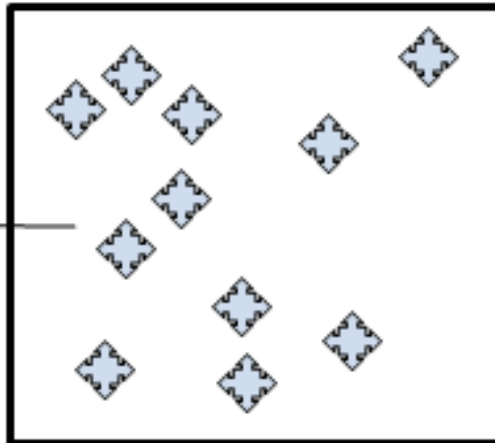
# How do vaccines work?

- When the vaccine is **injected** into the body it triggers the body's **immune system**
- The immune system will recognize the vaccine as a threat and **create antibodies** to destroy it
  - This means the next time the body sees this type of threat it will be able to very **quickly recognize and get rid of it** because it already has the antibodies or at least knows how to make them

# HOW A VACCINE WORKS

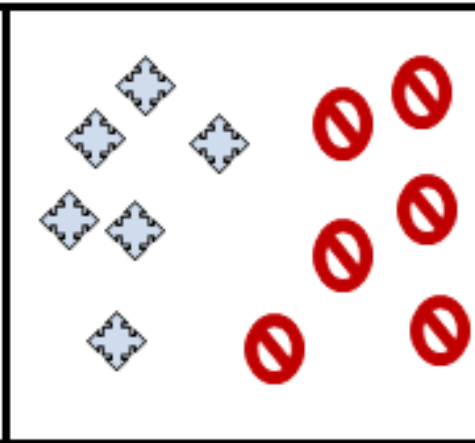
## Creating Immunity

1



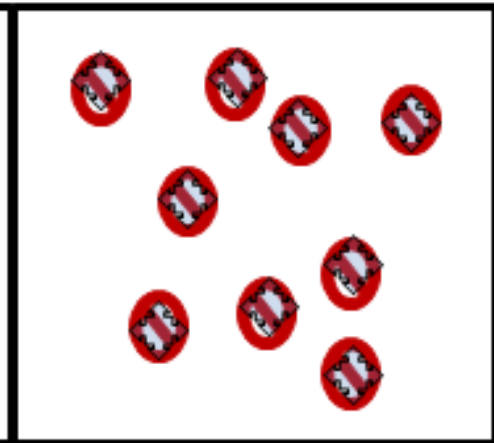
A weakened form of a disease antigen – that may be dead or living – is injected into the body.

2



The body reacts to the antigen by creating antibodies to attack it.

3



If the certain antigen ever enters the body again, the body's immune system antibodies will be able to fight against it.





[https://www.youtube.com/watch?v=FZ\\_jNGKCIWs](https://www.youtube.com/watch?v=FZ_jNGKCIWs)