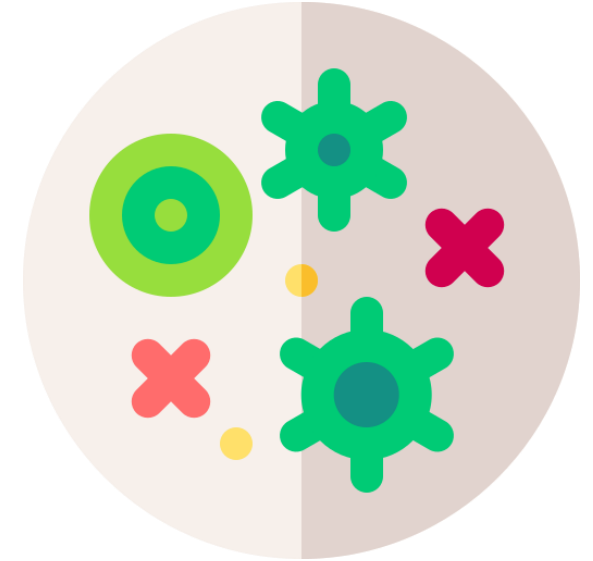

Antibiotic Resistance

A Closer Look at Bacteria and the Microbiome

Presentation for Grade 8 Students

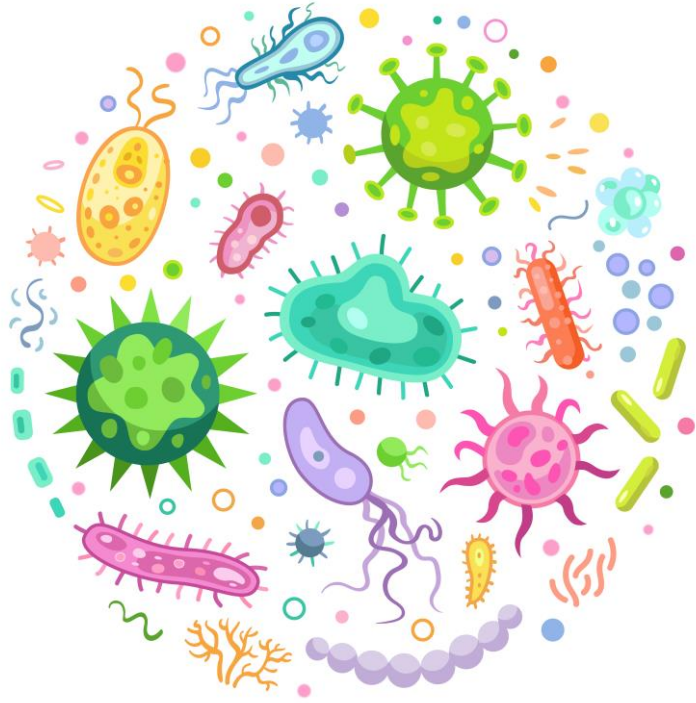


Today we will learn:

- 1) The differences between **bacteria and viruses**, and their role in health and illness
- 2) How **antibiotic resistance** develops and why it's a problem
- 3) How we can **prevent** the spread of infections

How YOU can prevent the spread of superbugs!

A Look Inside Our Microbiome



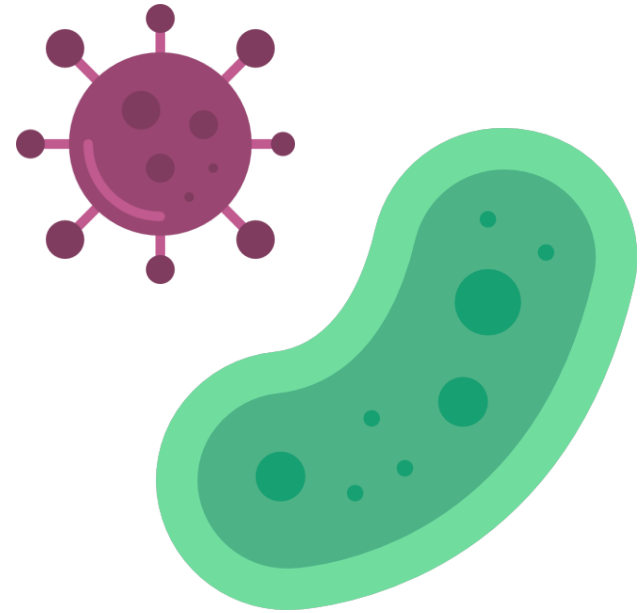
Your body contains 10-100 trillion micro-organisms!

This can include:

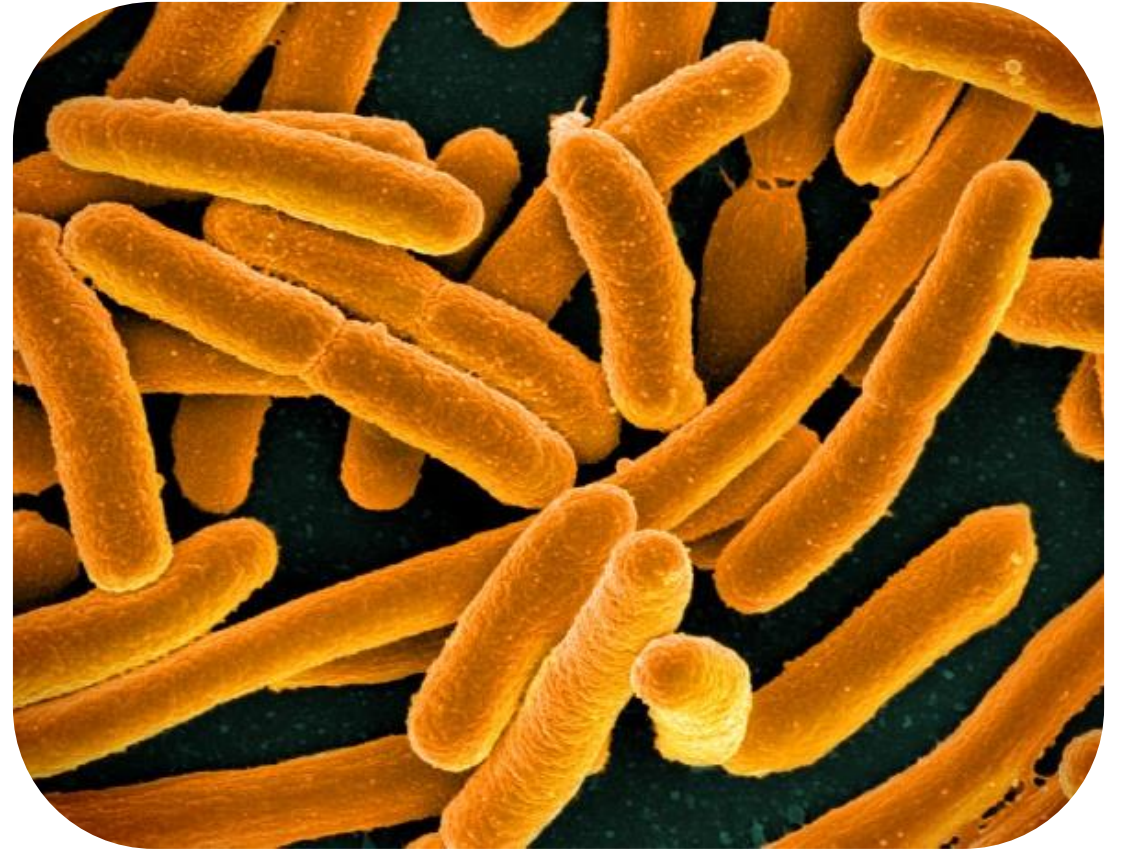
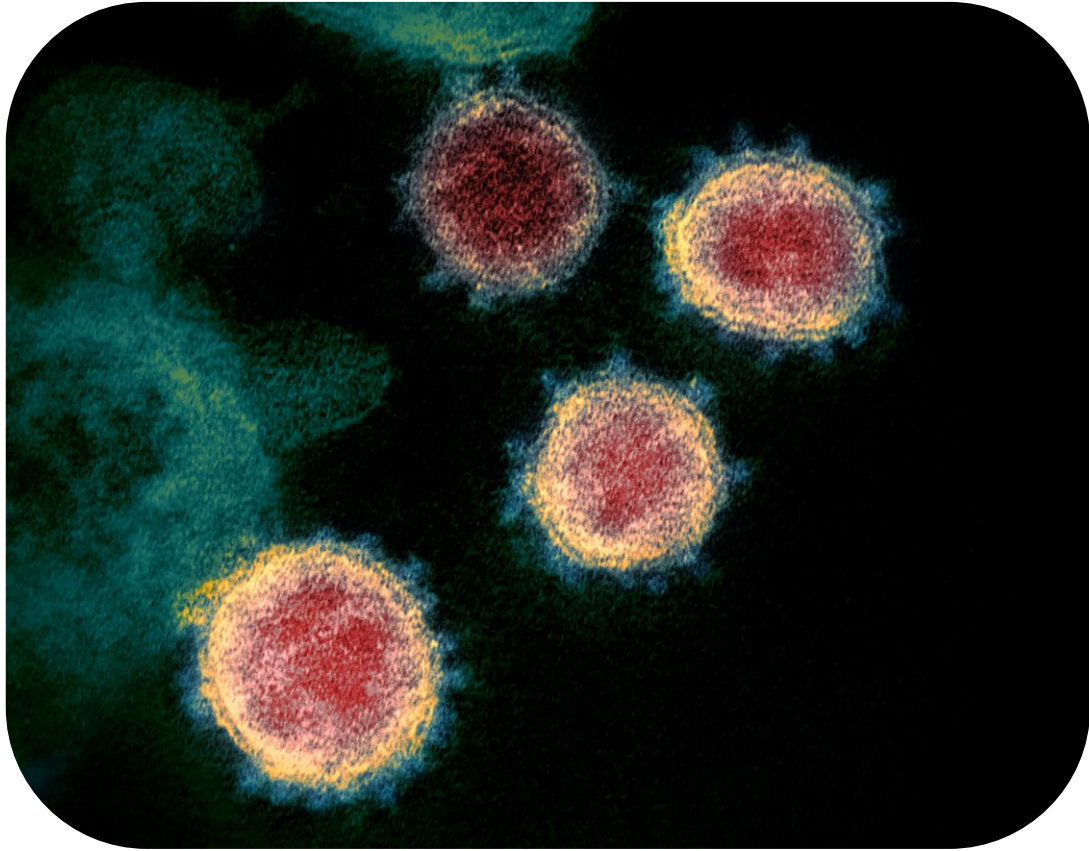
- **Helpful bacteria → commensals**
 - Help in digestion and nutrient absorption
 - Compete with bad bacteria and protect you from infection
- **Harmful bacteria → pathogens**
- **Viruses** that can also be harmful

A Look Inside Our Microbiome

Viruses and **bacteria** can both cause illness in humans, but they are **very different**.



A Look Inside Our Microbiome

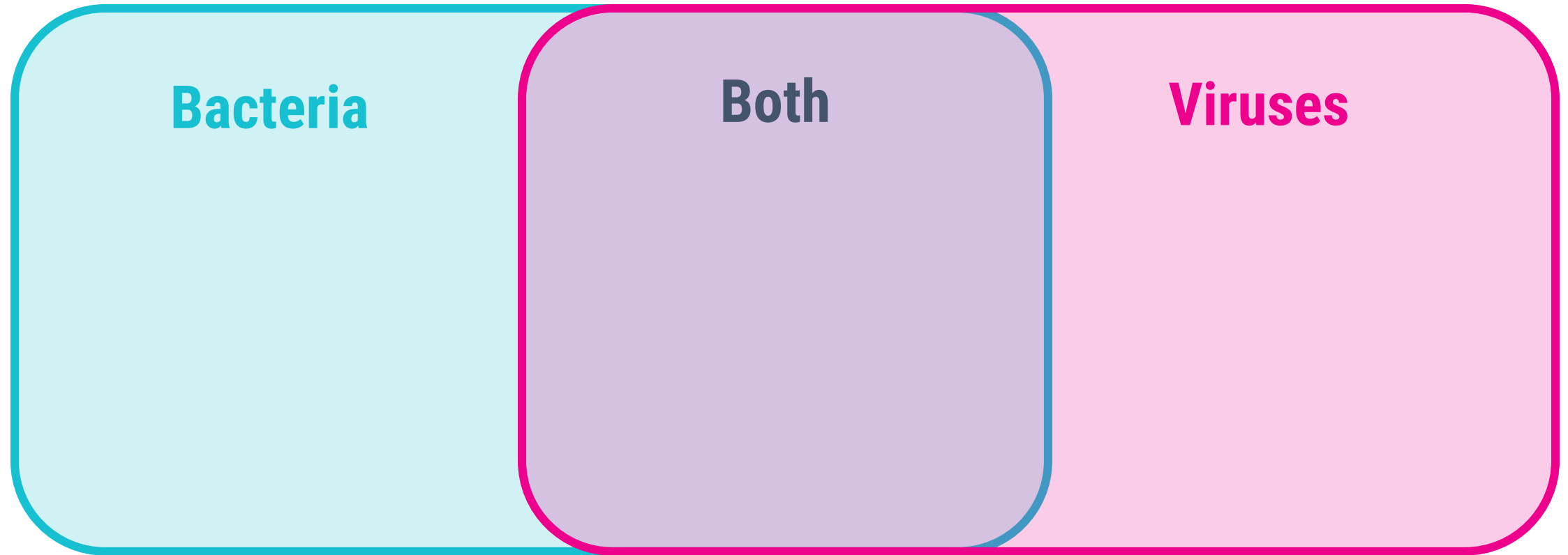


Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Activity 1: What are similarities and differences between bacteria and viruses?



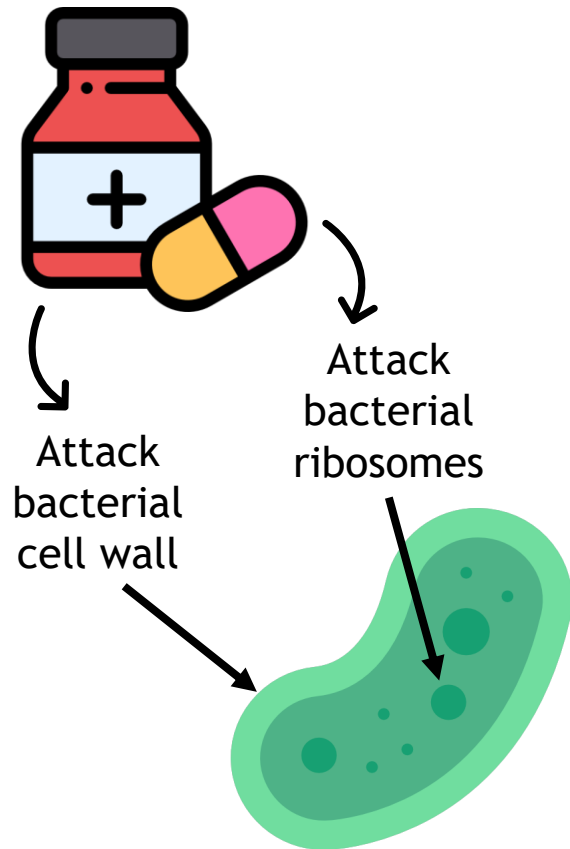
Bacteria and Viruses

Antibiotic Resistance



Illness Prevention

Illnesses caused by viruses	Illnesses caused by bacteria
<ul style="list-style-type: none">→ Common cold→ Influenza (flu)→ Chicken pox→ HPV→ Most sore throats→ COVID-19	<ul style="list-style-type: none">→ Strep throat→ Tuberculosis→ Urinary tract infections (UTIs)→ Salmonella→ Pertussis (whooping cough)

What are antibiotics?



- Medicines that are used to treat illnesses caused by **bacteria**.
- Antibiotics are designed to attack the **unique** structures and machinery of bacterial cells.
- Viruses are non-cellular, and have **different** structures and machinery than bacteria, so antibiotics cannot kill them.

Illnesses caused by viruses	Illnesses caused by bacteria
<ul style="list-style-type: none">→ Common cold→ Influenza (flu)→ Laryngitis→ Chest colds (bronchitis)→ Most sore throats <p style="text-align: center;"> Do NOT use antibiotics</p>	<ul style="list-style-type: none">→ Strep throat→ Tuberculosis→ Urinary tract infections (UTIs)→ Some types of pneumonia→ Pertussis <p style="text-align: center;"> Can use antibiotics</p>

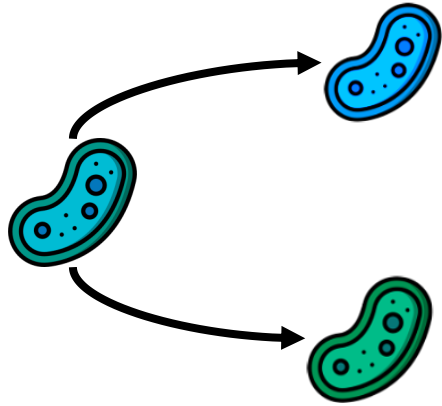
What are the harms of using antibiotics when we don't need them?

Overuse of antibiotics can lead to **antibiotic resistance**

(Optional) Watch this video on antibiotic resistance:

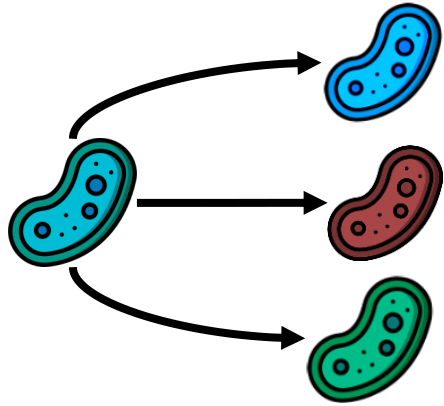
youtu.be/qDluMg9lqn8

How does antibiotic resistance develop?



Bacteria mutate **at random**.

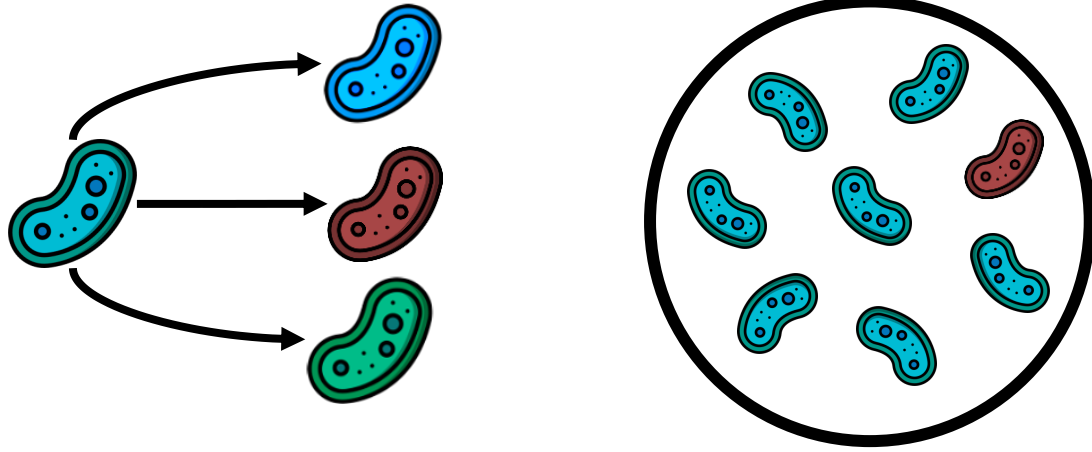
How does antibiotic resistance develop?



Bacteria mutate **at random**.

Some bacteria can happen to develop a mutation that makes them **resistant** to antibiotics.

How does antibiotic resistance develop?

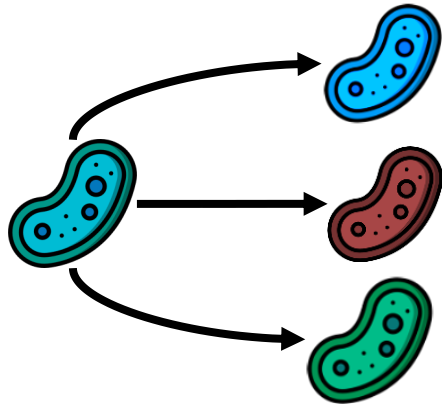


Bacteria mutate **at random**.

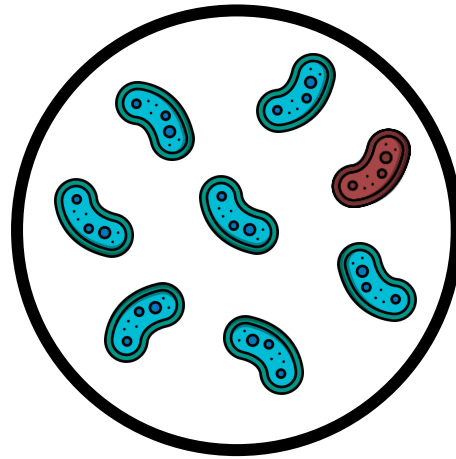
Some bacteria can happen to develop a mutation that makes them **resistant** to antibiotics.

Normally, **good bacteria** take up space in our body and prevent any **resistant** bacteria from taking over.

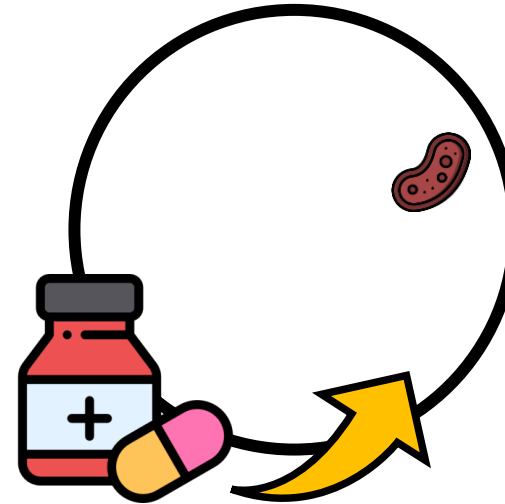
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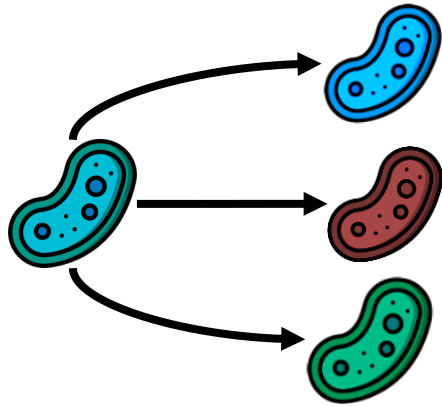


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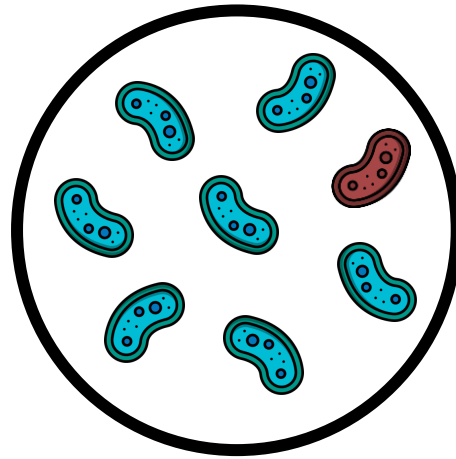


When we use antibiotics, we **kill** susceptible (non-resistant) bacteria, but the **resistant bacteria survive**.

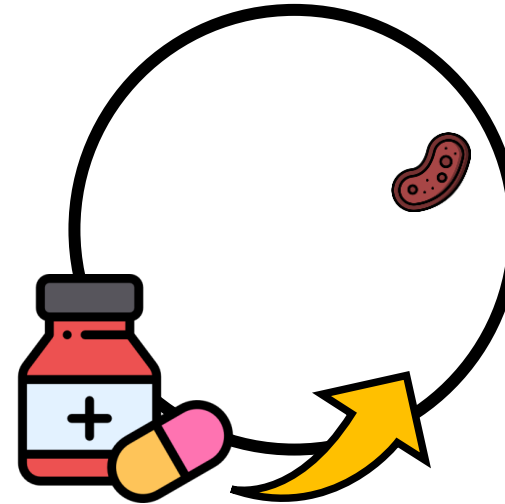
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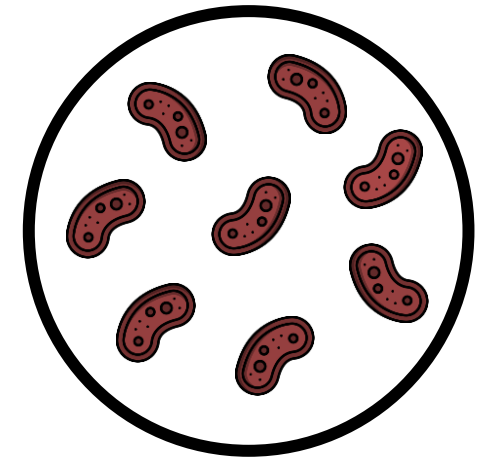
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Normally, **good bacteria** take up space in our body and prevent any **resistant** bacteria from taking over.



When we use antibiotics, we **kill** susceptible (non-resistant) bacteria, but the **resistant bacteria survive**.



The **resistant bacteria** now have lots of space to **grow and flourish**.

This is **natural selection in action!**

Activity 2



Terry is feeling sick. He found some antibiotics in his medicine cabinet. What could happen if:

- Terry took the leftover antibiotics and his illness was actually caused by a **virus**?
- Terry took the leftover antibiotics and his illness was actually caused by **bacteria**?
- Terry went to the doctor who gave him antibiotics to take?

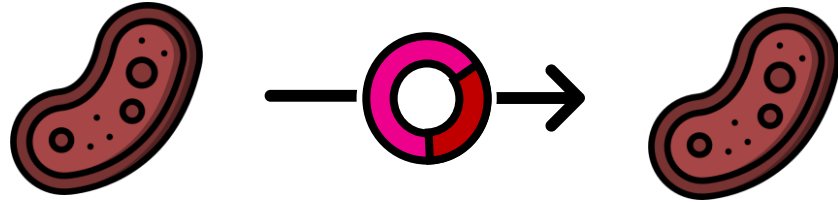
Think about **good bacteria**, **bad bacteria**, and the risk of **antibiotic resistance** in each case

How does antibiotic resistance spread?



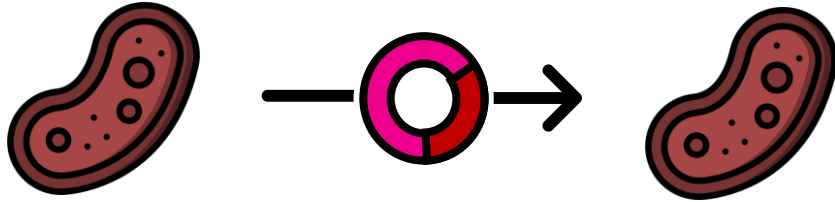
Resistant bacteria can transfer their resistant gene to other bacteria through **conjugation**

How does antibiotic resistance spread?

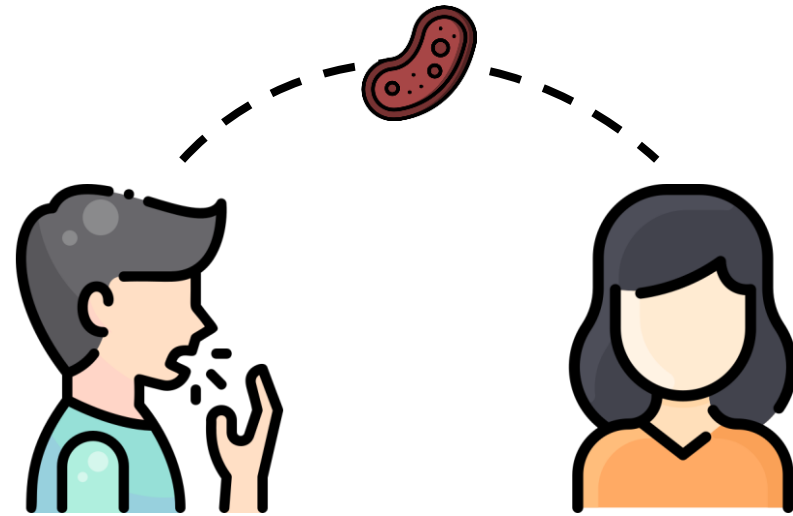


Resistant bacteria can transfer their resistant gene to other bacteria through **conjugation**

How does antibiotic resistance spread?



Resistant bacteria can transfer their resistant gene to other bacteria through **conjugation**



Spread from person to person

Why is antibiotic resistance a problem?

The spread of antibiotic resistance means that the drugs that we normally use to treat infections **no longer work**.

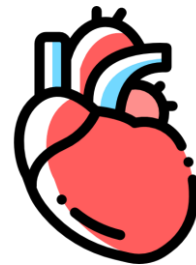
Antibiotics are **life-saving treatment** in many situations:



Surgery



Childbirth



Transplant



Even small cuts
and scrapes!

How can we stop the spread of antibiotic resistance?

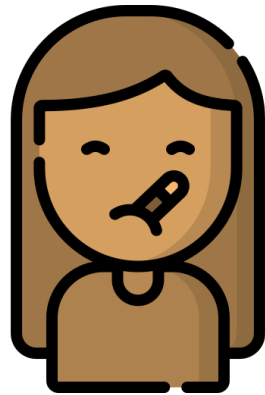
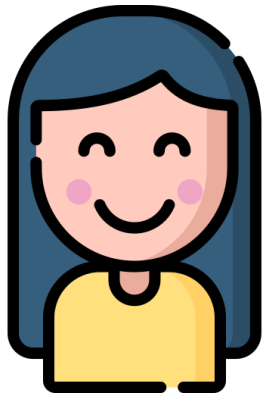


Every time we use antibiotics, we provide a **selection pressure** for bacteria to develop resistance.

It's our job to limit our use of antibiotics, so that they work when we really need them.

This way, we can **preserve antibiotics** now and for the future

How can we preserve antibiotics?



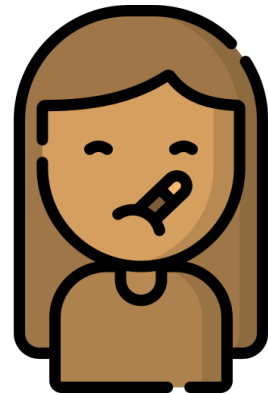
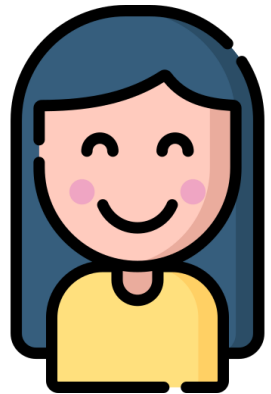
Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

How can we preserve antibiotics?

Prevent infections – if you don't get sick, you don't need antibiotics!



Bacteria and Viruses

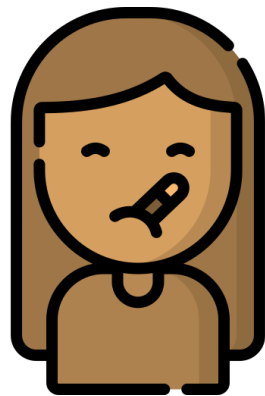
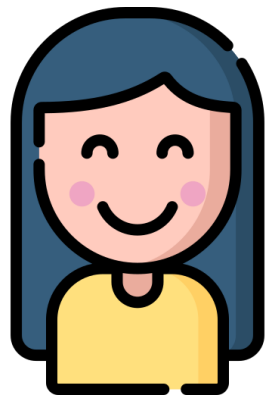
Antibiotic Resistance

Illness Prevention

How can we preserve antibiotics?

Prevent infections – if you don't get sick, you don't need antibiotics!

When we **do** get sick, only use antibiotics if we need to – ask your doctor!

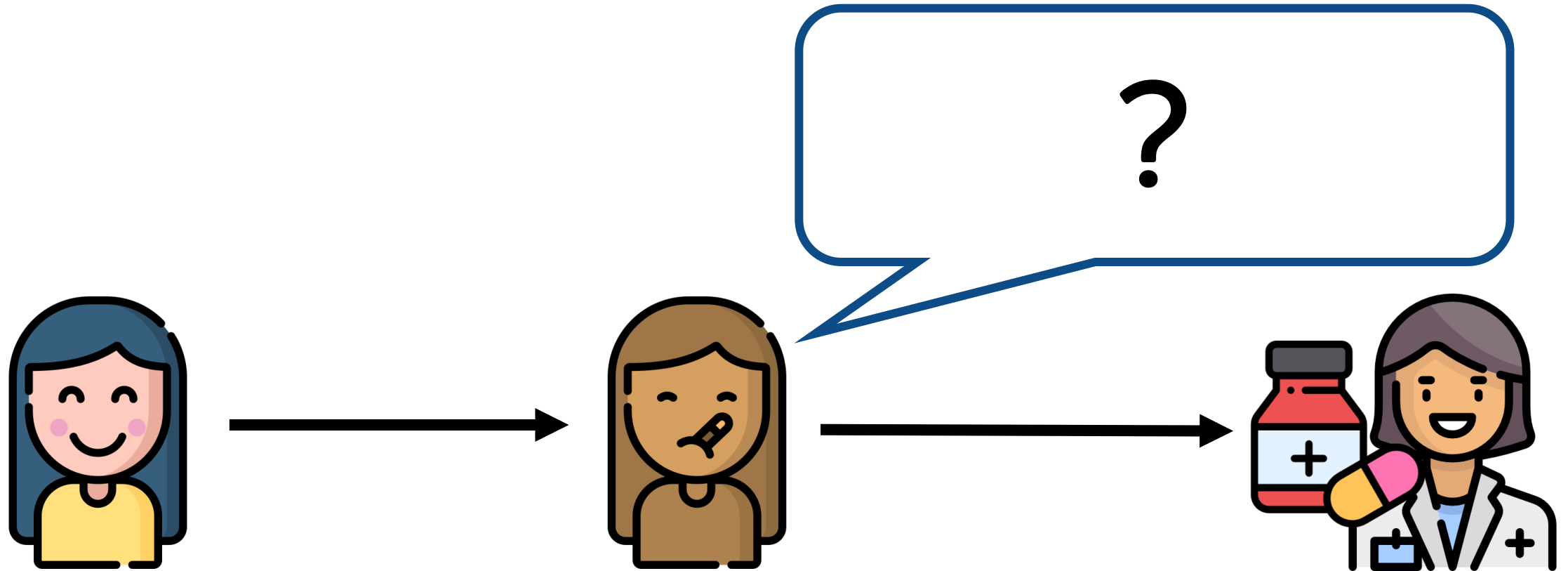


Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

How can we preserve antibiotics?

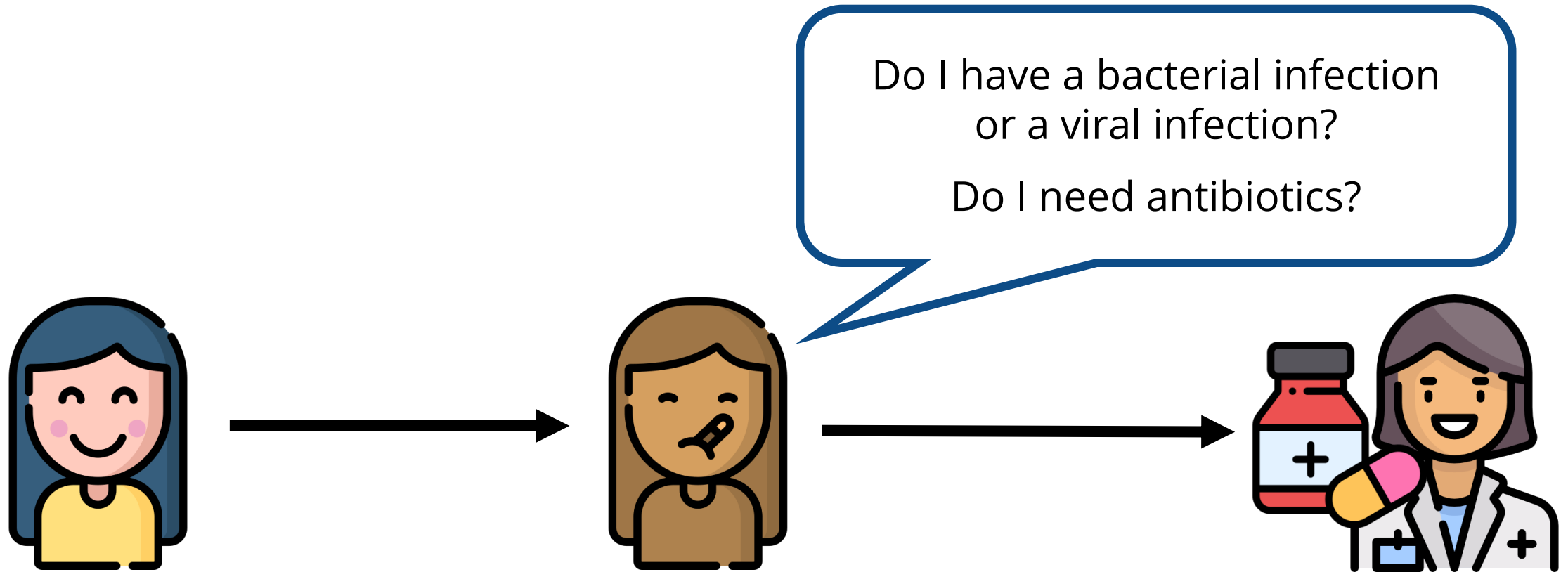


Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

How can we preserve antibiotics?



Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

How can we preserve antibiotics?

- Prevent infections – if you don't get sick, you don't need antibiotics!
- When we **do** get sick, only use antibiotics if we need to

Activity 3: Group Brainstorm

How can we prevent infections?

How can we prevent infections?

- Handwashing
- Stay home if sick
- Stay up to date on vaccinations
- Use antibiotics wisely

How can we prevent infections?

- **Handwashing**
- Stay home if sick, physical distance, masks
- Stay up to date on vaccinations
- Use antibiotics wisely



Handwashing

- Most common infections are spread by hands

Always dry your hands after washing!



- Removes more germs than washing alone
- Wet hands transmit germs more easily than dry hands
- Use clean towels

Handwashing – soap vs. sanitizer?



Plain soap and water

- Gets rid of bad bacteria and viruses
- Good bacteria are not easily removed by handwashing
- Need to dry hands!



Alcohol-based Sanitizer

- No water required
- Less drying time
- Does not cause antibiotic resistance
- Alcohol content should be over 60%
- Not effective if hands greasy or dirty
- Will kill good bacteria too

Avoiding antibacterial agents

- Alcohol-based sanitizers and plain soap do not cause resistance
- Some sanitizers and soaps have antibacterial agents:
 - **Triclosan**
 - **Quarternary ammonium compounds or “Quats”** – end in “nium”
ex. Benzalkonium chloride, benzylammonium chloride
- Can promote resistance
- Can also remove good bacteria

Hand Hygiene - what to choose?

- ✓ Regular soap
- ✓ Alcohol based sanitizers
- ✗ Triclosan
- ✗ Quaternary ammonium compounds (Quats)

Avoid “antibacterial” soaps and sanitizers

Antibacterial hand soap



Avoid contact with eyes. In case of contact, flush with water.

Ingredients: Aqua (Water), Sodium Lauryl Sulfate, Sodium Laureth Sulfate, Cocamidopropyl Betaine, Sodium Chloride, Cocamide MEA, Disodium Cocamido MIPA-Sulfosuccinate, Polyquaternium-7, Sorbitol, Glycerin, Propylene Glycol, Panthenol, Tocopherol Acetate, Fragrance, Triclosan, Cucumis Sativus (Cucumber) Fruit Extract, Equisetum Hiemale Extract, Salvia Officinalis (Sage) Leaf Extract, Thymus Vulgaris (Thyme) Extract, DMDM Hydantoin, Disodium EDTA.

Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Antibacterial hand soap



Avoid contact with eyes. In case of contact, flush with water.

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Triclosan

Quat

Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Plain soap



Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Plain soap



No Triclosan

No Quats



INGREDIENTS: AQUA (WATER), SODIUM LAURYL SULFATE, COCAMIDE DEA, COCAMIDOPROPYL BETAINE, GLYCERIN, ALOE BARBADENSIS GEL, TOCOPHERYL ACETATE (VITAMIN E), CITRIC ACID, SODIUM CHLORIDE, SODIUM CITRATE, BENZOPHENONE-4, METHYLCHLOROISOTHIAZOLINONE, METHYLISOTHIAZOLINONE, PARFUM (FRAGRANCE), EXT. VIOLET 2.

Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Alcohol based hand sanitizer



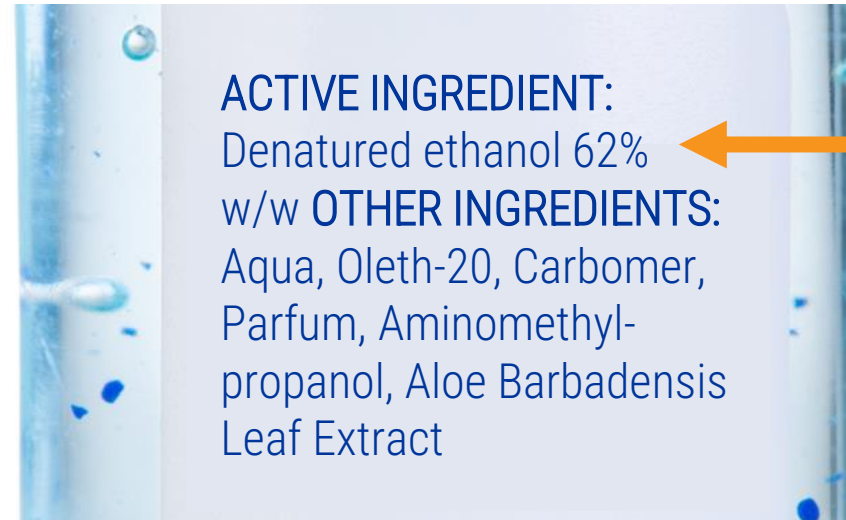
ACTIVE INGREDIENT:
Denatured ethanol 62%
w/w **OTHER INGREDIENTS:**
Aqua, Oleth-20, Carbomer,
Parfum, Aminomethyl-
propanol, Aloe Barbadensis
Leaf Extract

Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Alcohol based hand sanitizer



Alcohol

Make sure the hand sanitizer does not contain triclosan or quats. Some alcohol-based hand sanitizers do.

Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Antibacterial toothpaste



Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Antibacterial toothpaste



Triclosan

Regular toothpaste should have no triclosan in the ingredients.

Bacteria and Viruses

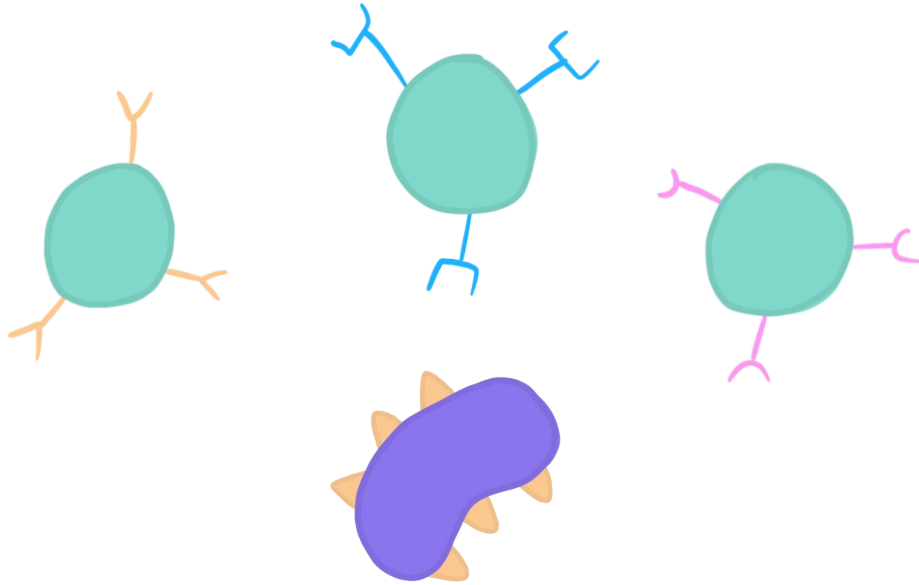
Antibiotic Resistance

Illness Prevention

How can we prevent infections?

- Handwashing
- Stay home if sick, physical distance, masks
- **Stay up to date on vaccinations**
- Use antibiotics wisely

Vaccines: Prepping the Immune System



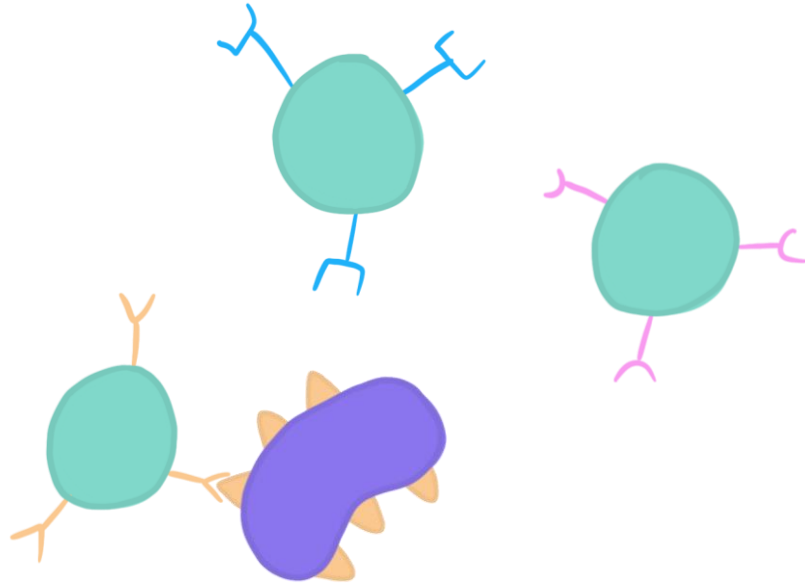
Your immune system can **learn** – once you've been infected by a pathogen, it remembers how to destroy it

Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Vaccines: Prepping the Immune System



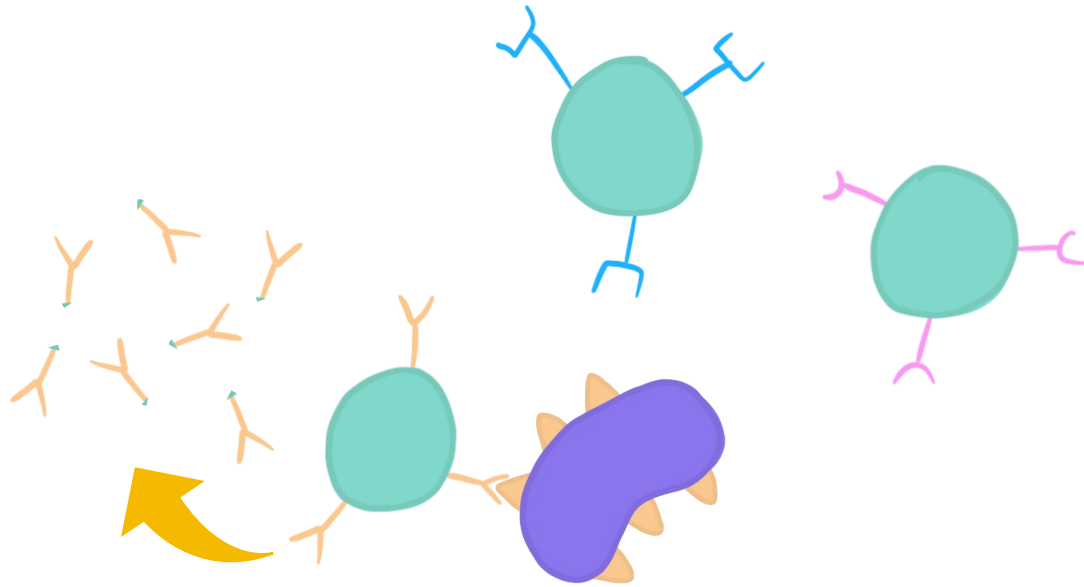
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Bacteria and Viruses

Antibiotic Resistance

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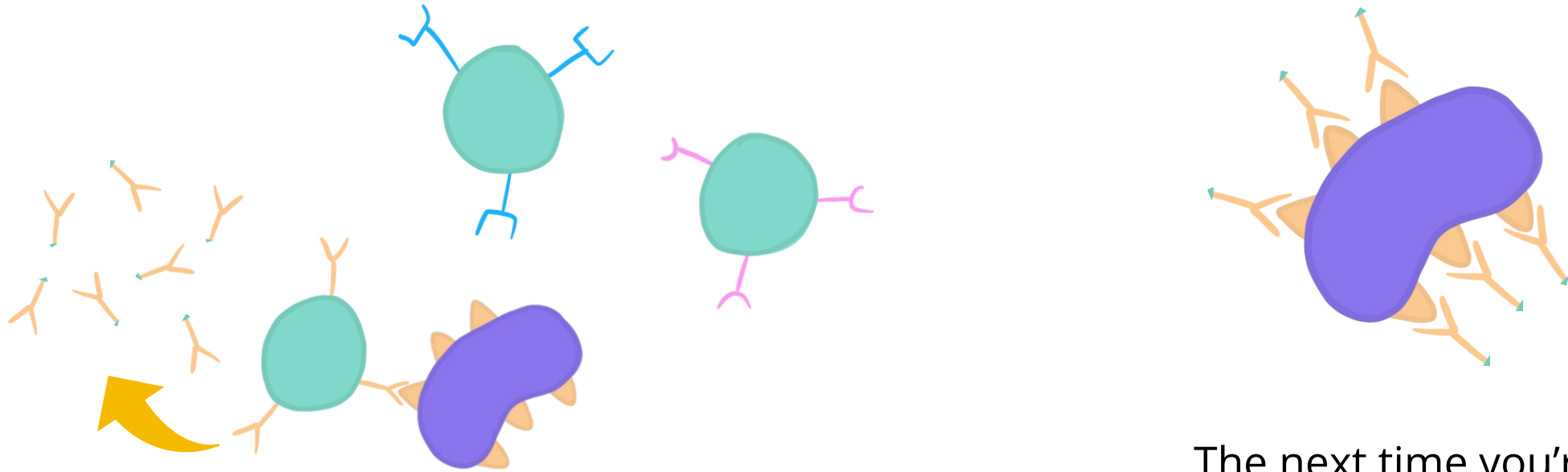
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Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Vaccines: Prepping the Immune System

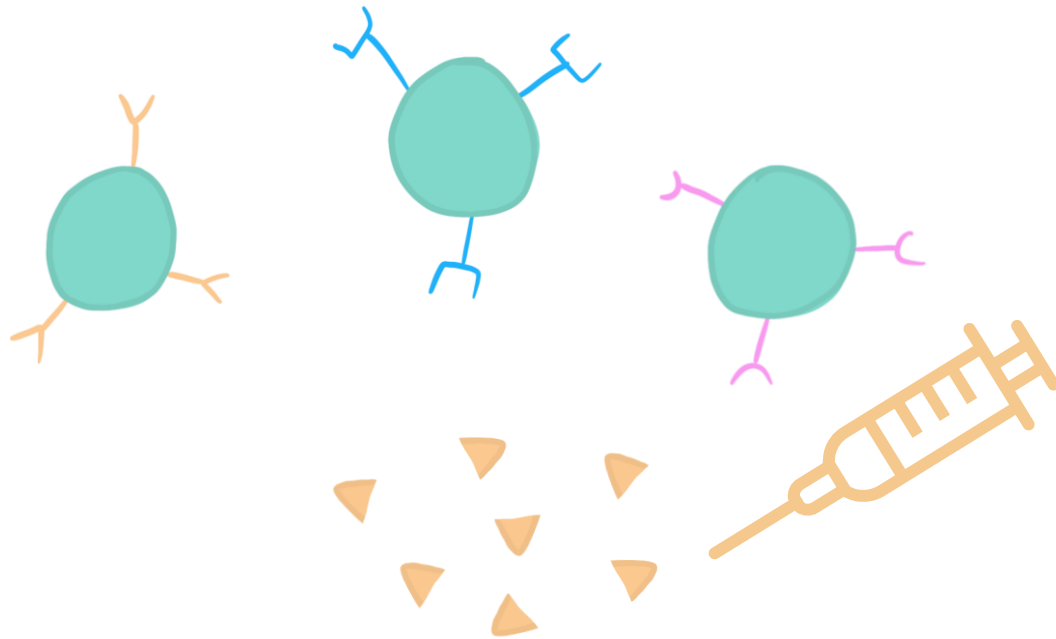


Your immune system can **learn** – once you've been infected by a pathogen, it remembers how to destroy it

The next time you're exposed to that pathogen, your immune system can quickly destroy it before you get sick

Vaccines: Prepping the Immune System

Vaccines contain an inactive pathogen or part of a pathogen



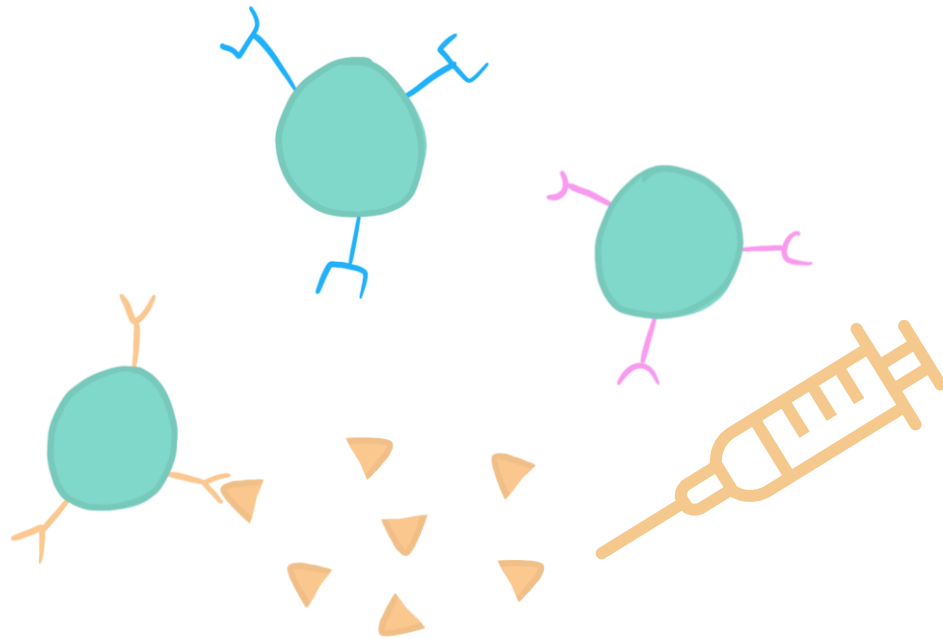
Bacteria and Viruses

Antibiotic Resistance

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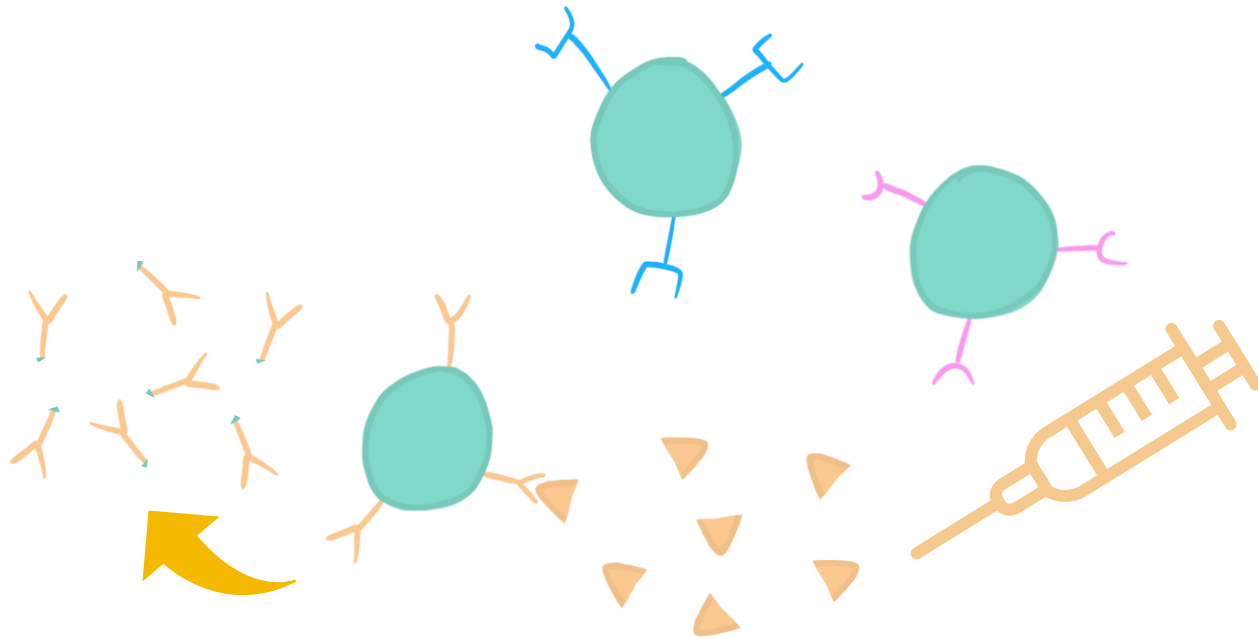
Bacteria and Viruses

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Bacteria and Viruses

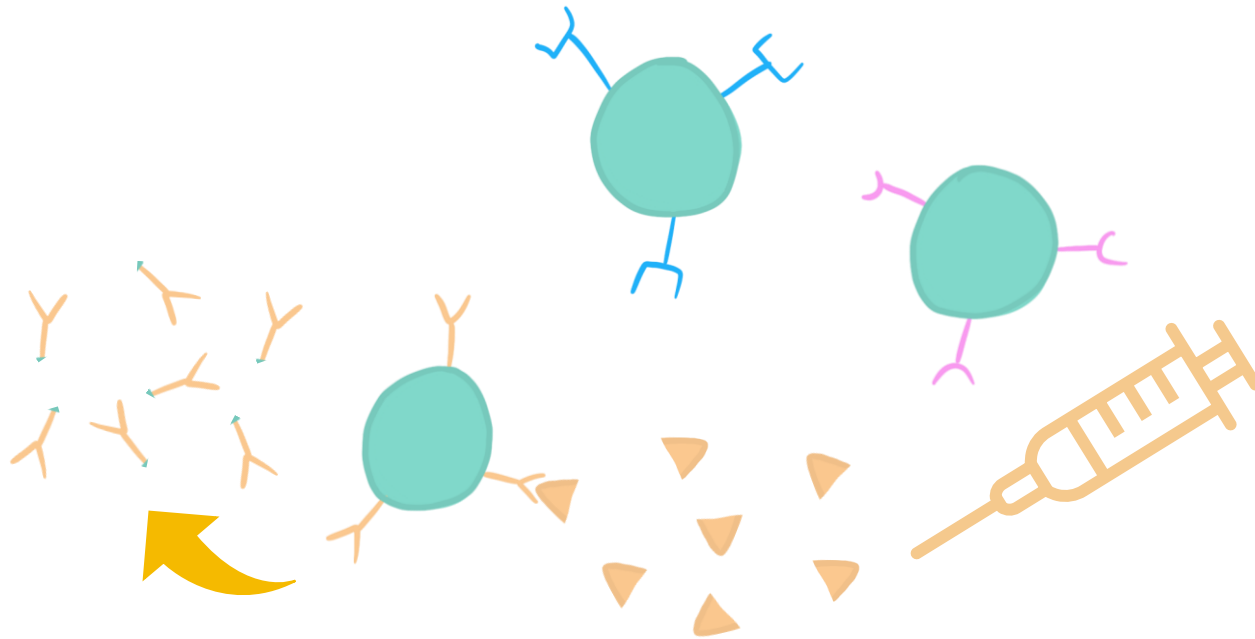
Antibiotic Resistance

Illness Prevention

Vaccines: Prepping the Immune System

Vaccines contain an inactive pathogen or part of a pathogen

Vaccines help your immune system **learn** without having to get sick first.



If you get exposed, your immune system is ready to protect you

Bacteria and Viruses

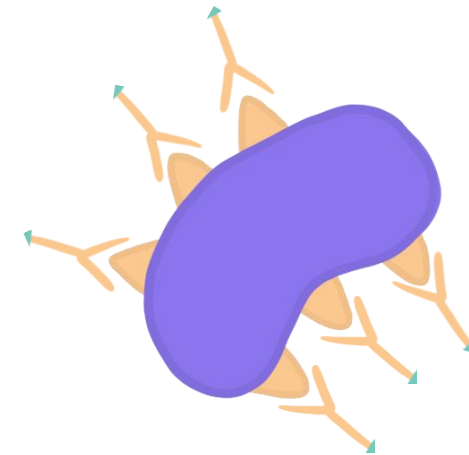
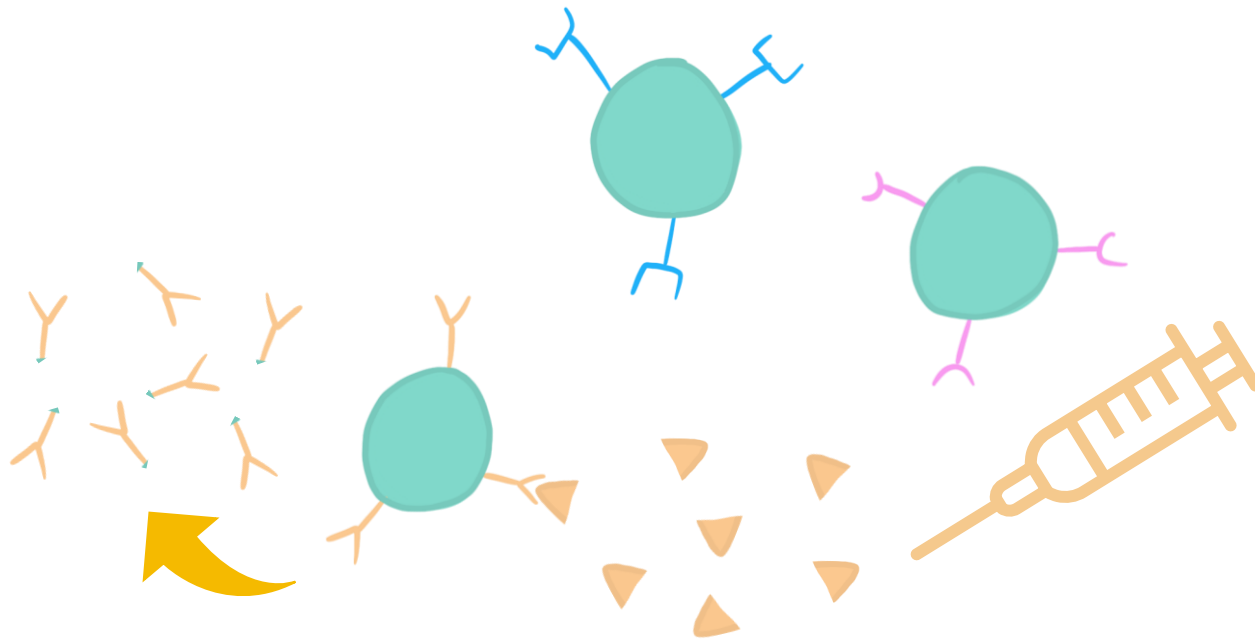
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If you get exposed, your immune system is ready to protect you

Bacteria and Viruses

Antibiotic Resistance

Illness Prevention

Vaccines: Prepping the Immune System



- There are vaccines that prevent bacterial infections, such as pneumonia and meningitis
- Other vaccines prevent against viral infections (ex. HPV, COVID-19)
- Routine vaccinations are given in **Grade 9**

How can we prevent infections?

- Handwashing
- Stay home if sick, physical distance, masks
- Stay up to date on vaccinations
- **Use antibiotics wisely**

What we learned today

- 1) That **bacteria and viruses are different**. They both can cause illness but only bacterial illnesses can be treated with antibiotics
- 2) Use **antibiotics wisely**. Bacteria can become resistant to antibiotics, so ask your doctor how to appropriately use antibiotics when they are prescribed to you
- 3) By **preventing illness**, we can minimize antibiotic use and stop the spread of superbugs

Questions?



Thank you!



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