

# Bacteria and Antibiotic Resistance



Institut National de Santé Publique, d'Épidémiologie Clinique et de Toxicologie  
National Institute of Public Health, Clinical Epidemiology, and Toxicology

*...and health research is easy*

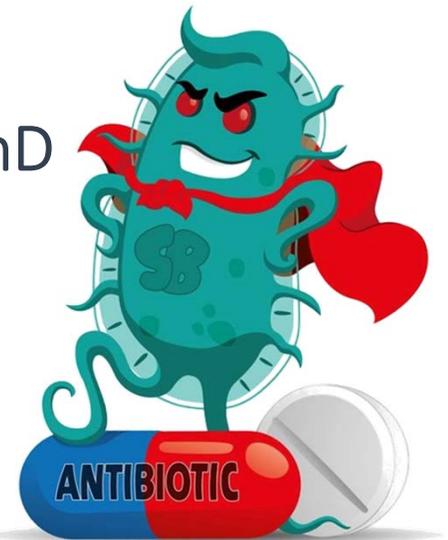
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Beirut-Lebanon, 2021

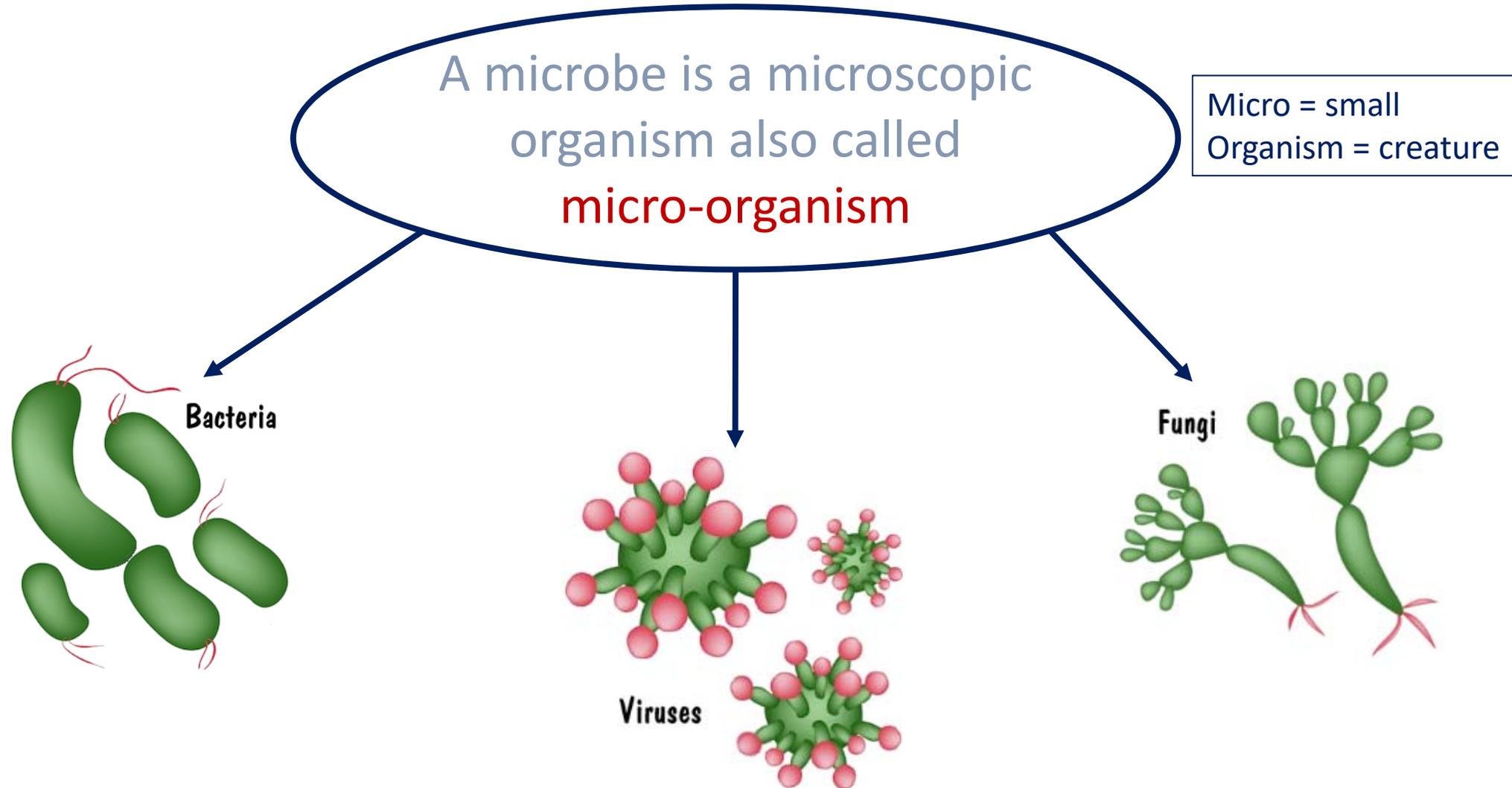


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<https://inspect-lb.org/wp-content/uploads/2021/02/AMR-Senior-English.pdf>

# What is a microbe?



# The size of living organisms

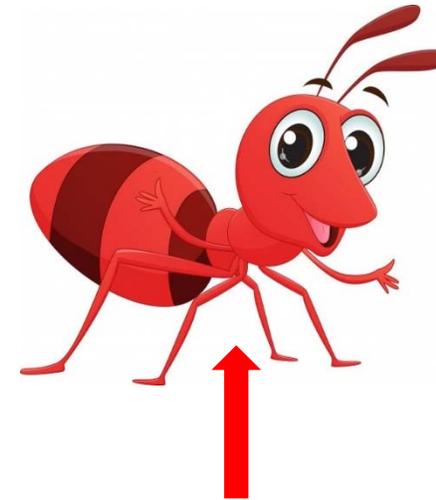
- The viruses range in size from 0.02 to 0.25 micron
- The smallest bacteria are about 0.4 micron in diameter
- The size of an ant is up to 52 millimeters



0.25 micron



0.4 micron



52 millimeters

I want to learn more about BACTERIA

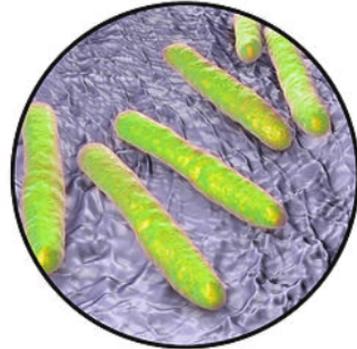


# Bacteria as seen on a microscope

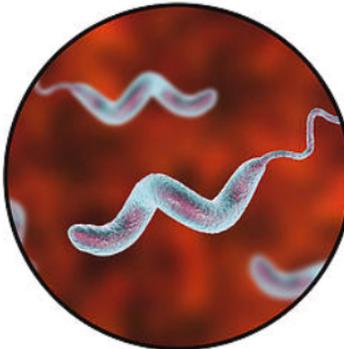
## Three major shapes of bacteria



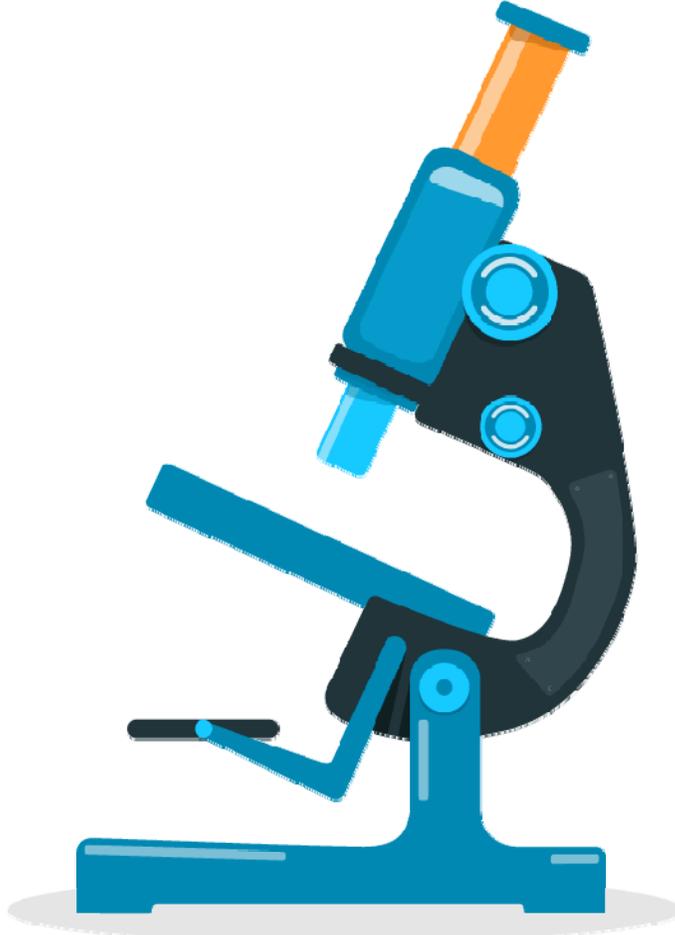
Spherical



Rod-like

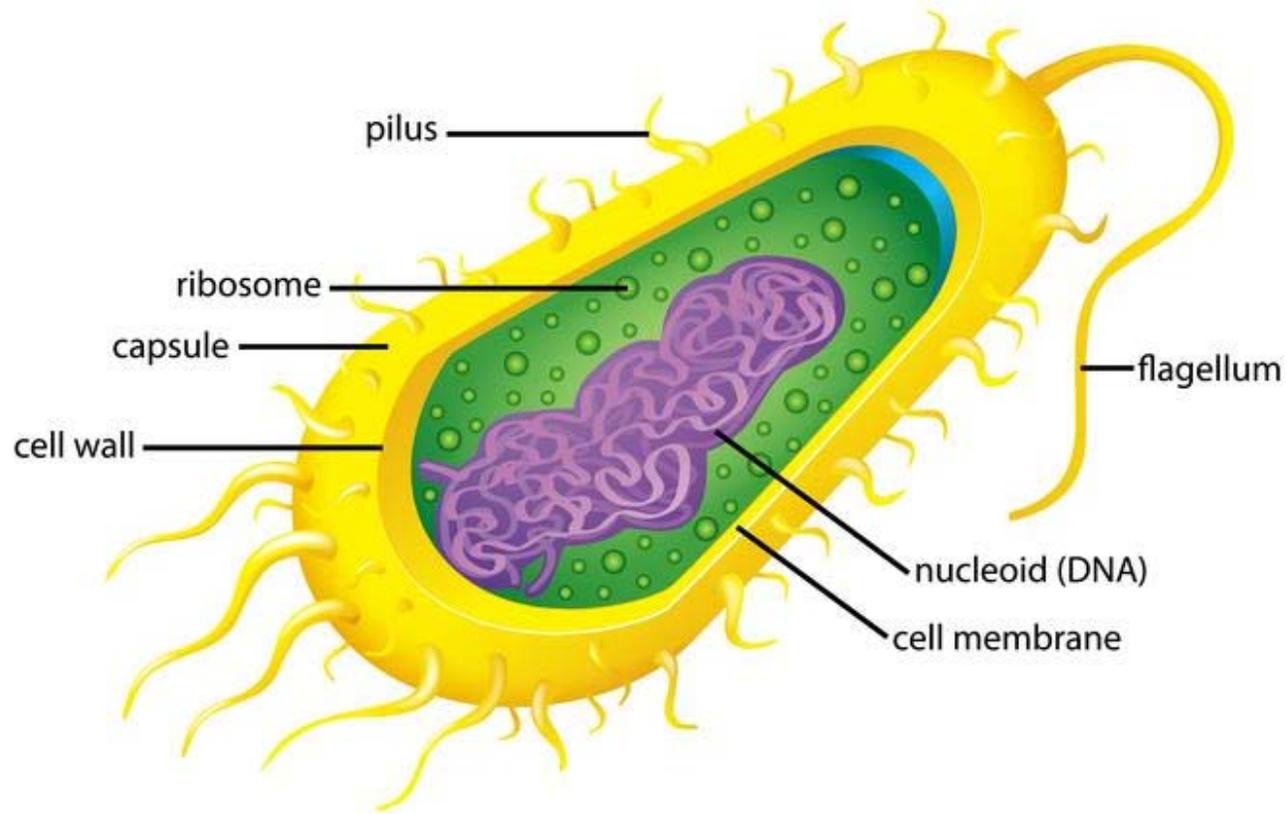


Spiral

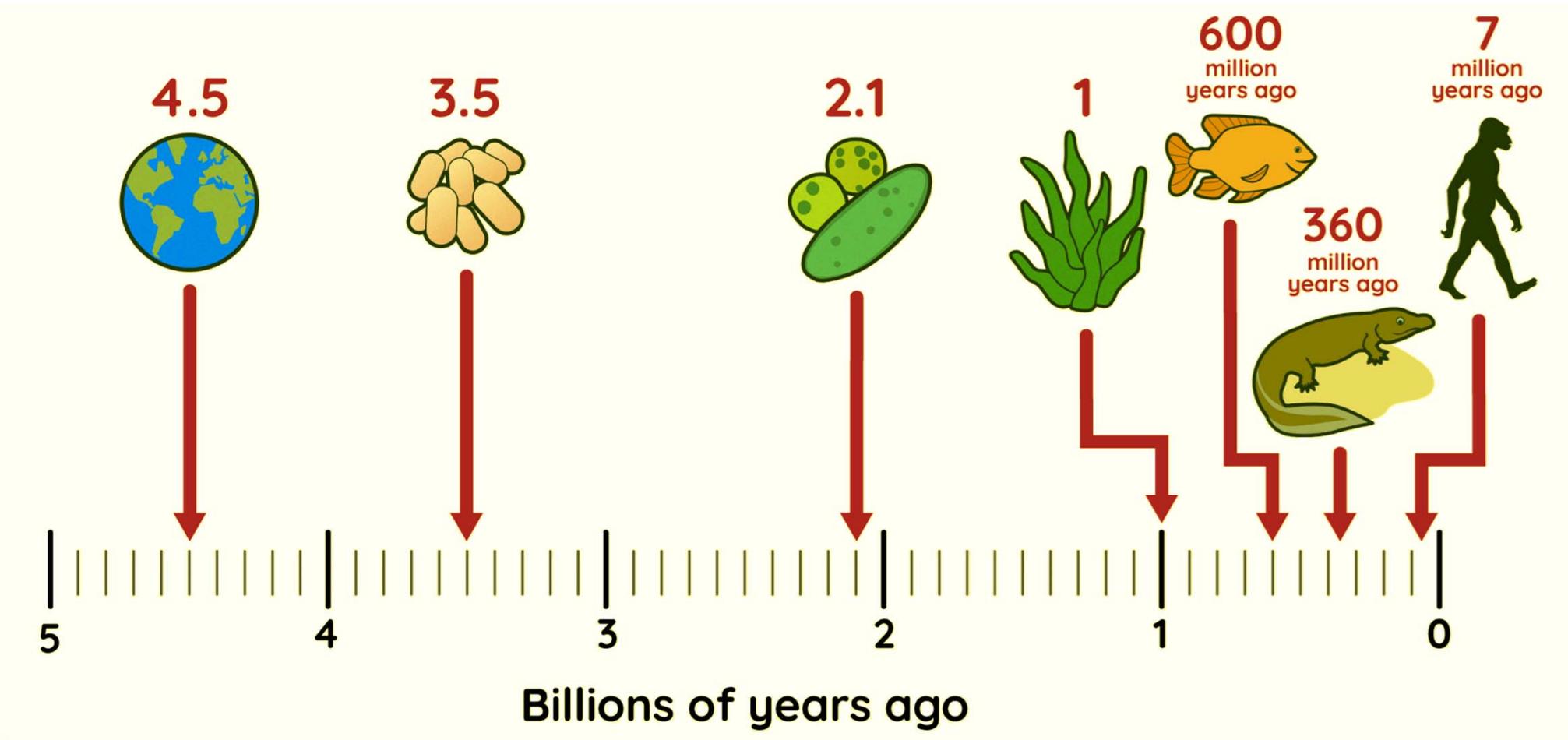


# Difference between bacteria and humans

Bacteria are made of just **ONE cell**. Humans are made of multiple cells.

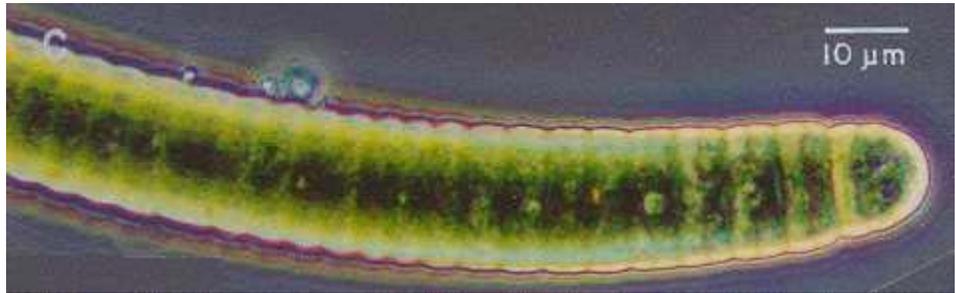
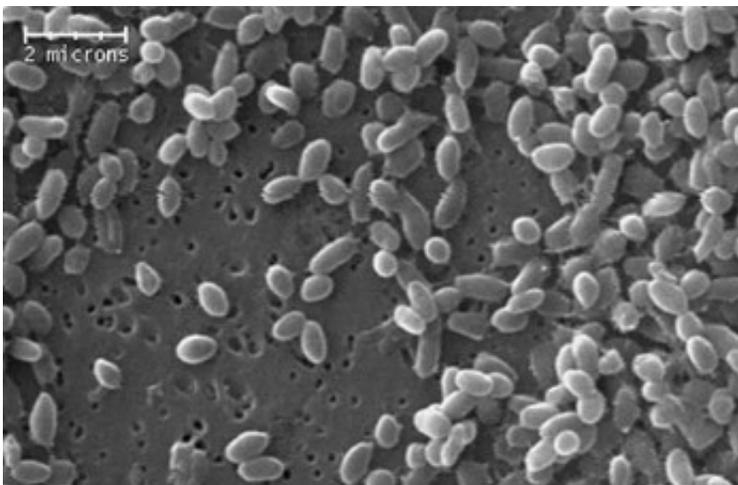
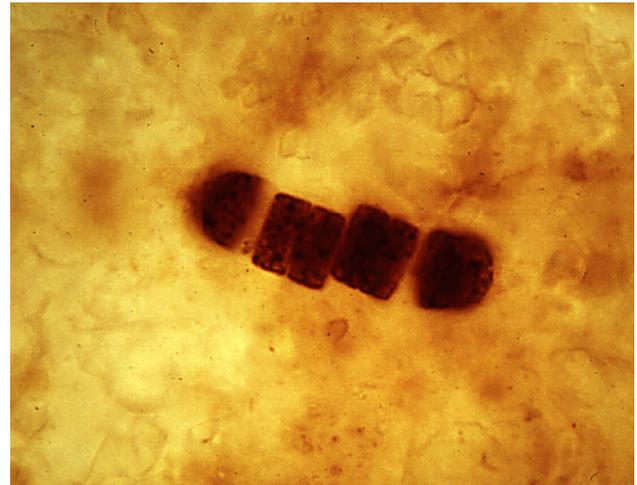
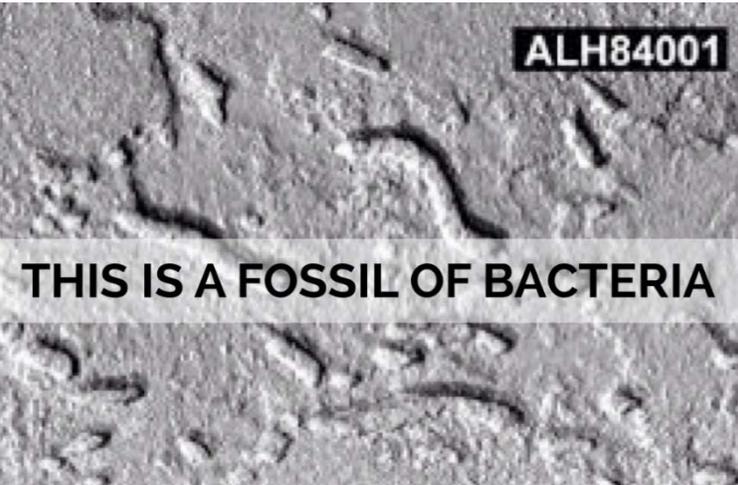


# Bacteria existed on earth before humans



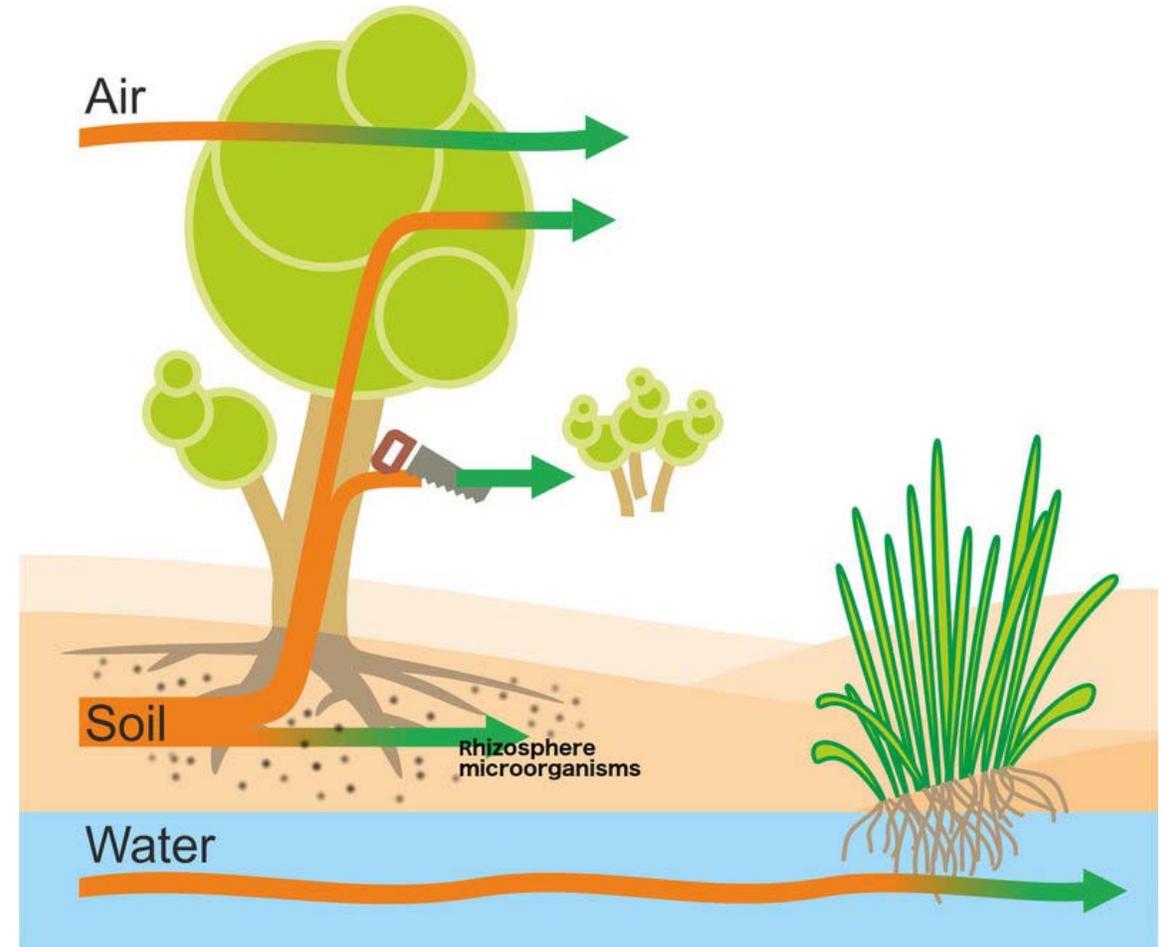
Source: American Museum of Natural History. <https://www.amnh.org/explore/ology/marine-biology/what-do-you-know-about-life-on-earth>

# Evidence: Fossils of bacteria



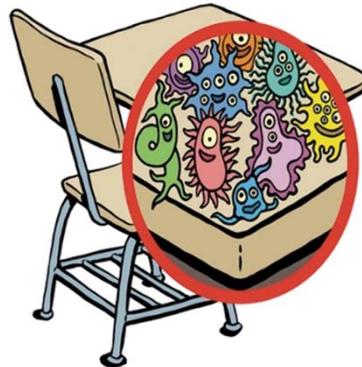
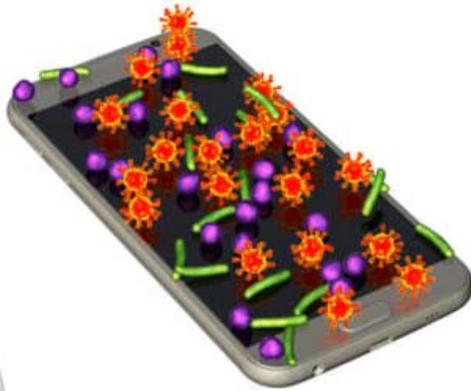
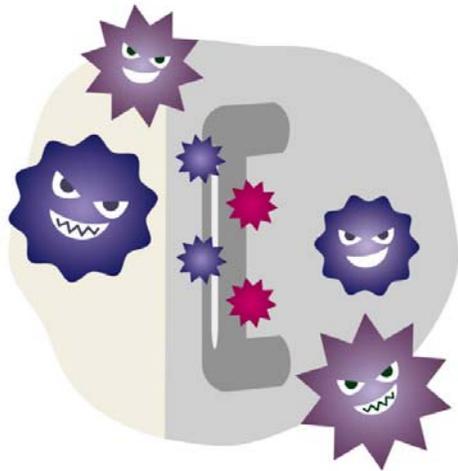
# Where are the bacteria found?

- Bacteria can live anywhere
- They are found everywhere



# Where are the bacteria found?

Bacteria can live on objects and surfaces for a long period: from **1-4 hours** or **days** to more than **6 months!**



# Where are the bacteria found?

Bacteria can live **ON** and **IN** the human body

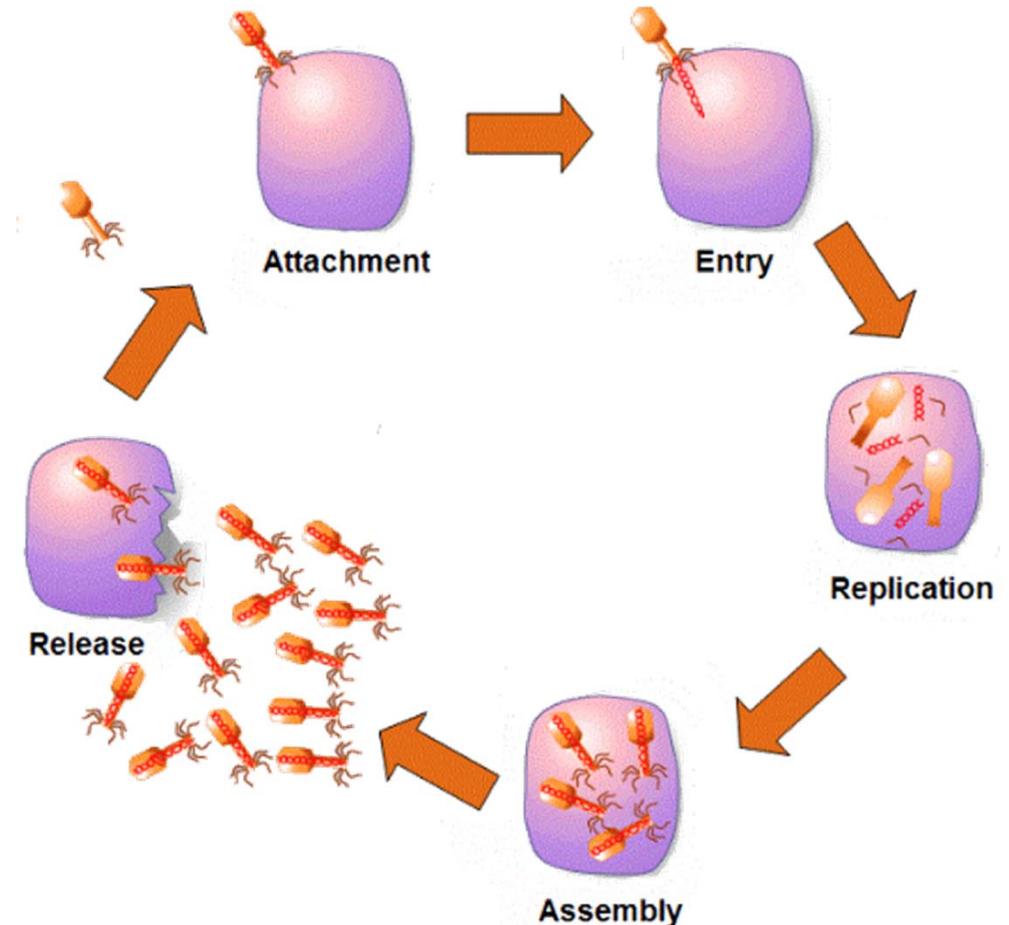


What is the difference between VIRUSES and BACTERIA?

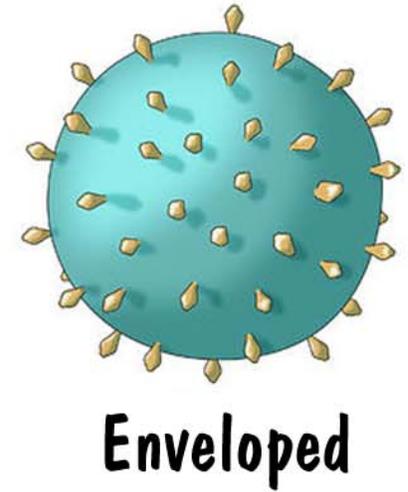
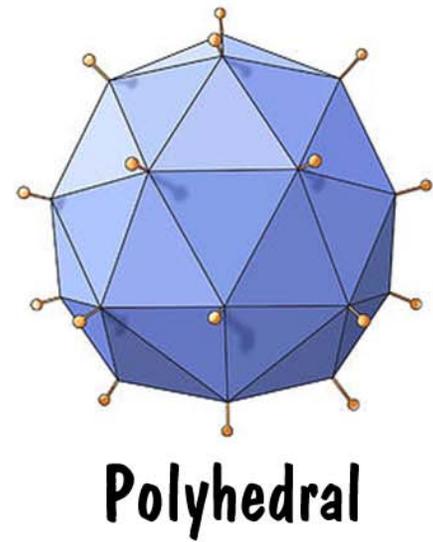
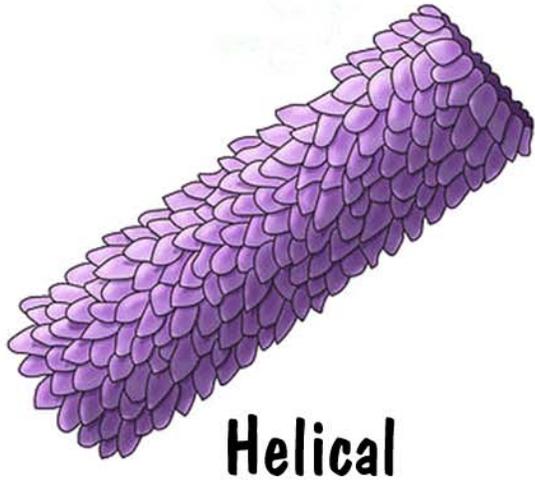
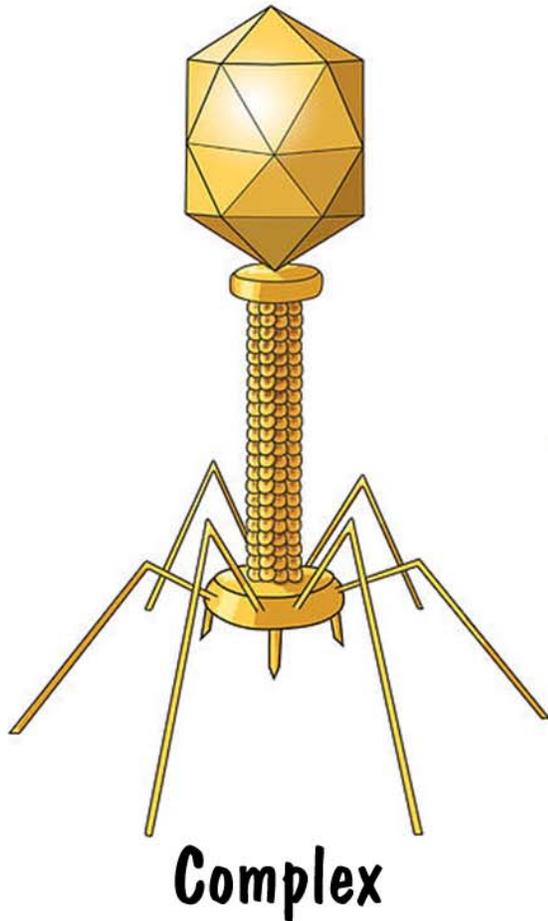


# What are viruses?

- The smallest of human microbes
- Harmful to humans
- Cannot survive everywhere
  - They need to be inside living host cells to live and reproduce
  - A host can be a human or an animal



# Virus shapes

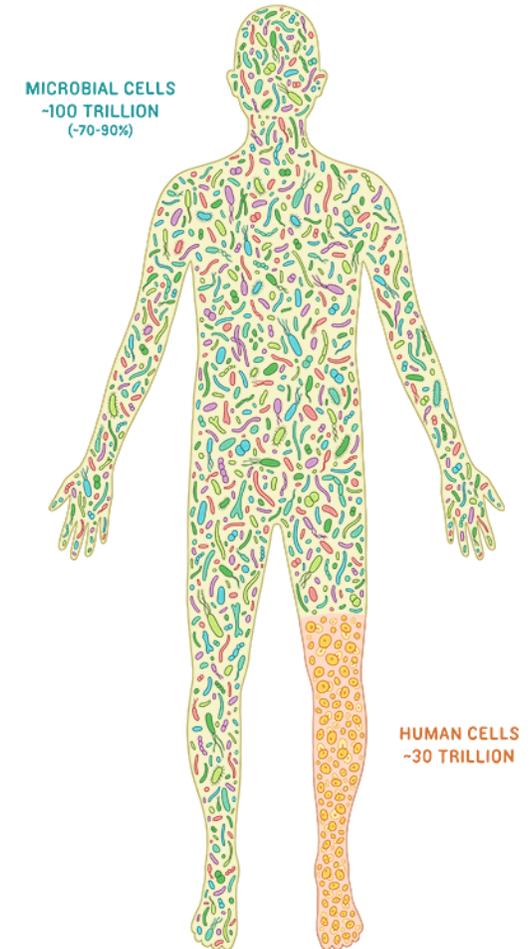
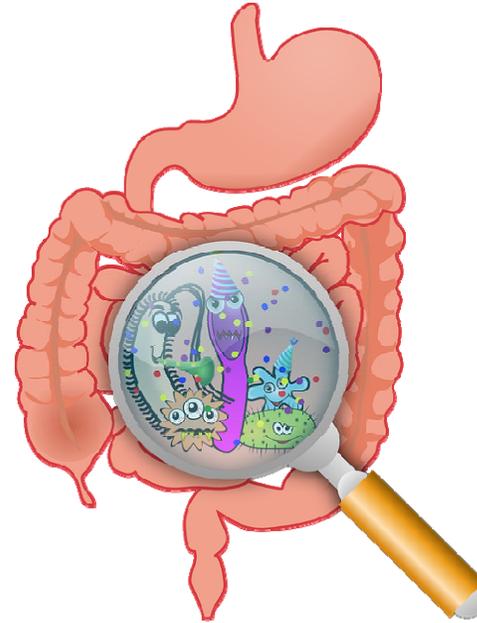


Since viruses are enemies, are bacteria **FRIENDS OR ENEMIES?**



# Friendly bacteria are good for humans

- **Friendly** bacteria are called **normal flora**
- Billions of bacteria **INSIDE** and **ON** our body
- They are important for good health
- In our body, they weigh approximately **TWO KILOS!**
- They help in the digestion process (lactobacillus)

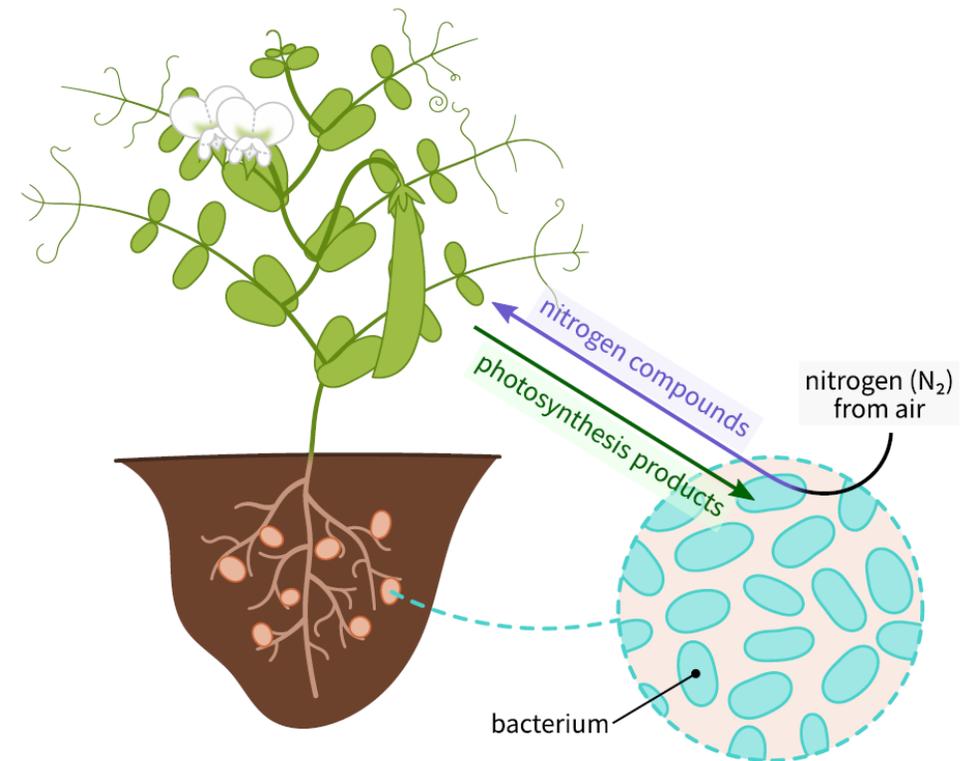


# Friendly bacteria are good for nature

Useful to produce food (lactobacillus)

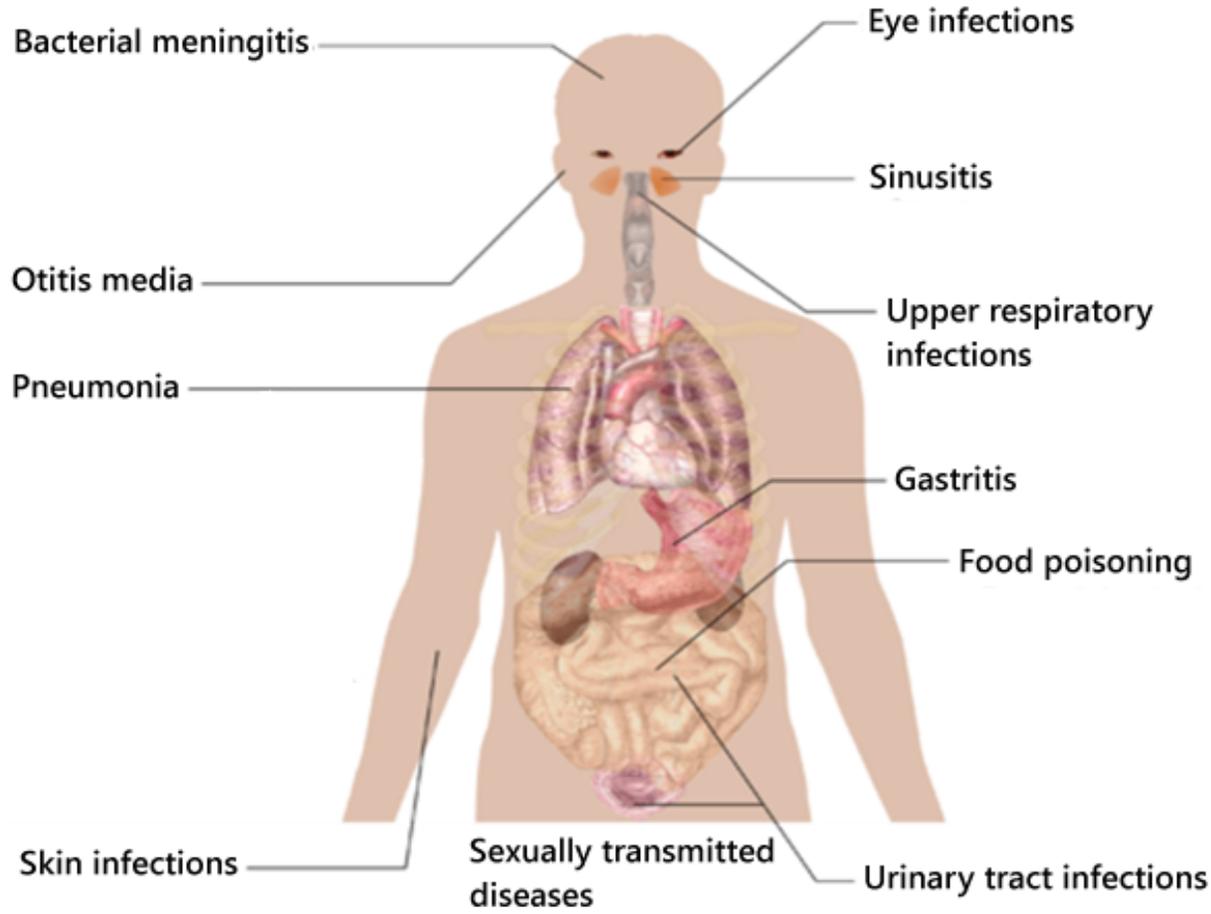


Useful for plant growth (rhizobacterium)



# Enemy bacteria

- **Enemy** bacteria are called **pathogens**
- They produce **toxins**, harmful for our body
- They can cause many diseases



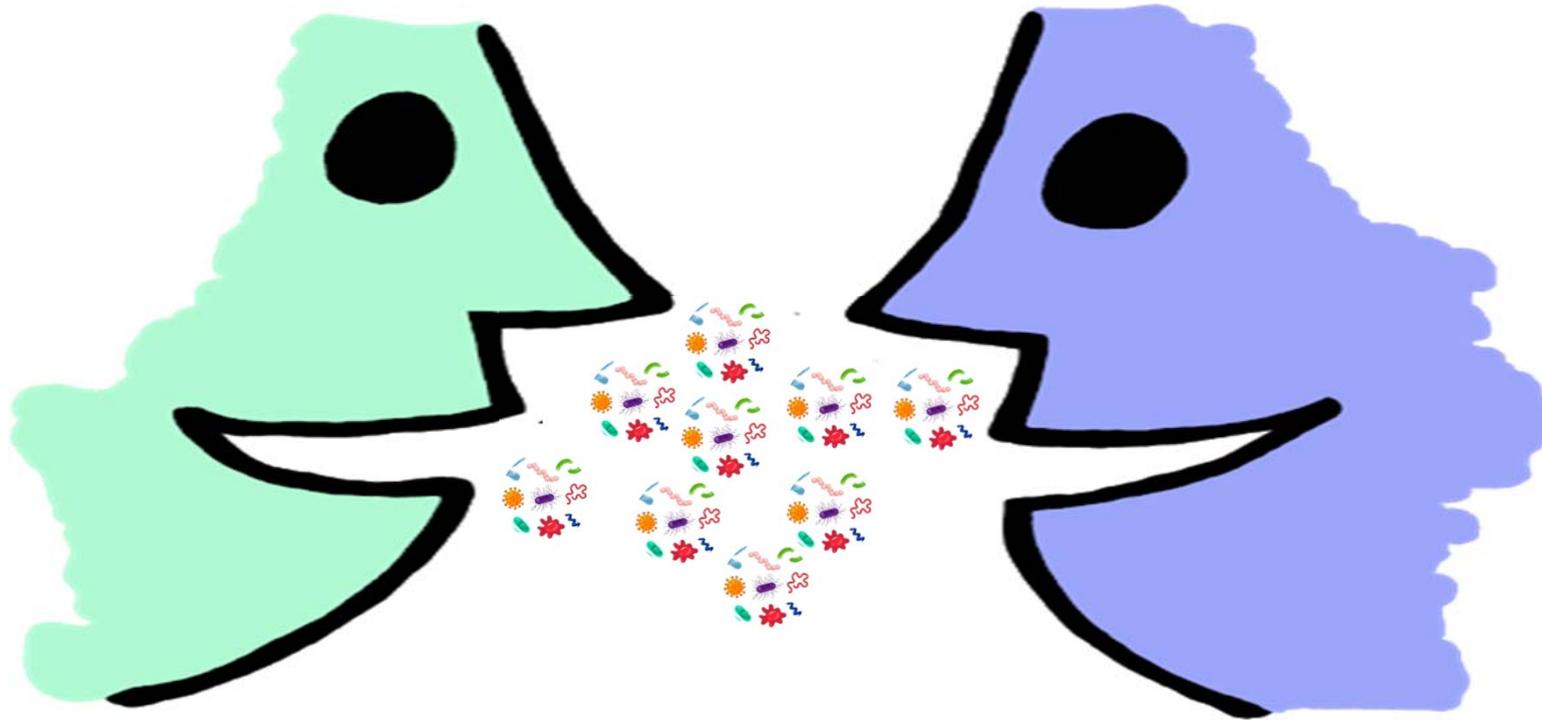
# Bacteria and viruses can spread by

Shaking hands (**direct contact**)



# Bacteria and viruses can spread by

**Close contact with a sick person**



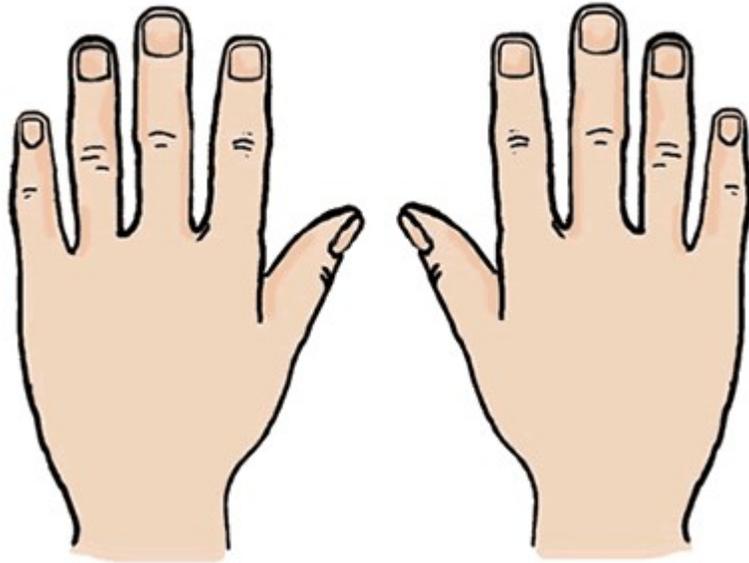
# Bacteria and viruses can spread by

## Sneezing or coughing



- **Coughing** spreads aerosols as far as 6 meters
- **Sneezing** spreads aerosols as far as 8 meters
- Aerosols **stay suspended** in the air for up to **10 minutes**

# Hand hygiene



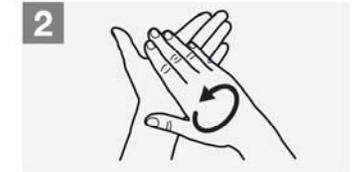
 Duration of the entire procedure: 40-60 seconds



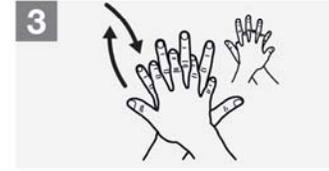
Wet hands with water;



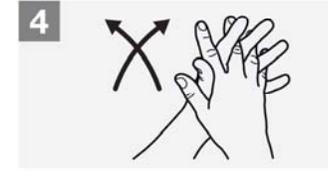
Apply enough soap to cover all hand surfaces;



Rub hands palm to palm;



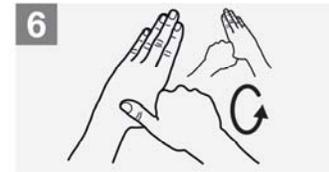
Right palm over left dorsum with interlaced fingers and vice versa;



Palm to palm with fingers interlaced;



Backs of fingers to opposing palms with fingers interlocked;



Rotational rubbing of left thumb clasped in right palm and vice versa;



Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



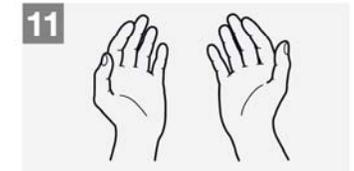
Rinse hands with water;



Dry hands thoroughly with a single use towel;



Use towel to turn off faucet;



Your hands are now safe.

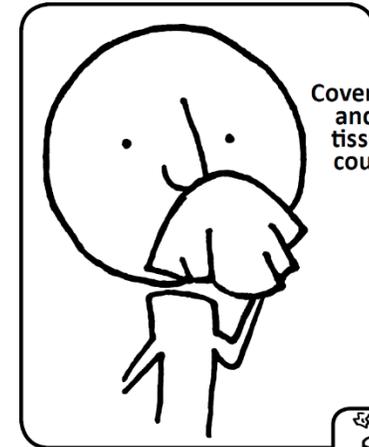
 ...and health research is easy

# Respiratory hygiene

If you have fever and cough or sore throat:

- Wear a mask
- Cover your mouth and nose with a tissue when you cough or sneeze
- Throw used tissues in the trash
- If you don't have a tissue, cough or sneeze into your elbow, not your hands

## Cover your Cough



Cover your mouth and nose with a tissue when you cough or sneeze

or cough or sneeze into your upper sleeve, not your hands

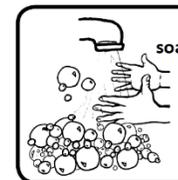


Put your used tissue in the waste basket.



## Clean your Hands

after coughing or sneezing.

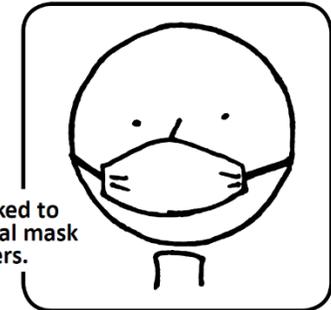


Wash with soap and water

or clean with alcohol-based hand sanitizer.



You may be asked to put on a surgical mask to protect others.



**m** DEPARTMENT OF HEALTH  
**APIC**  
ASSOCIATION FOR PROFESSIONALS IN INFECTION CONTROL AND EPIDEMIOLOGY INC.

What happens if I become sick?



# Defense mechanisms

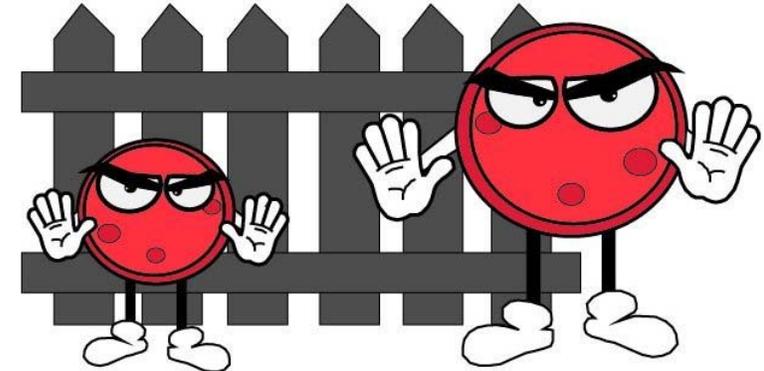
- Our body has many natural defense mechanisms
- Our body is extremely efficient at keeping us healthy
- It has three major lines of defense:
  - Physical barriers
  - Innate immunity
  - Adaptive immunity



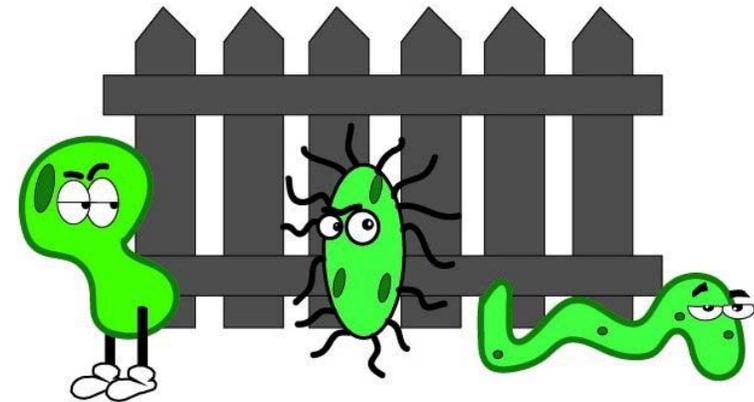
# Defense mechanisms: first line

## Physical barriers:

- Skin
- Tears
- Earwax
- Mucus
- Urine
- Stomach acid



Bacteria, viruses, and fungi are constantly invading



Sometimes some get around the barriers

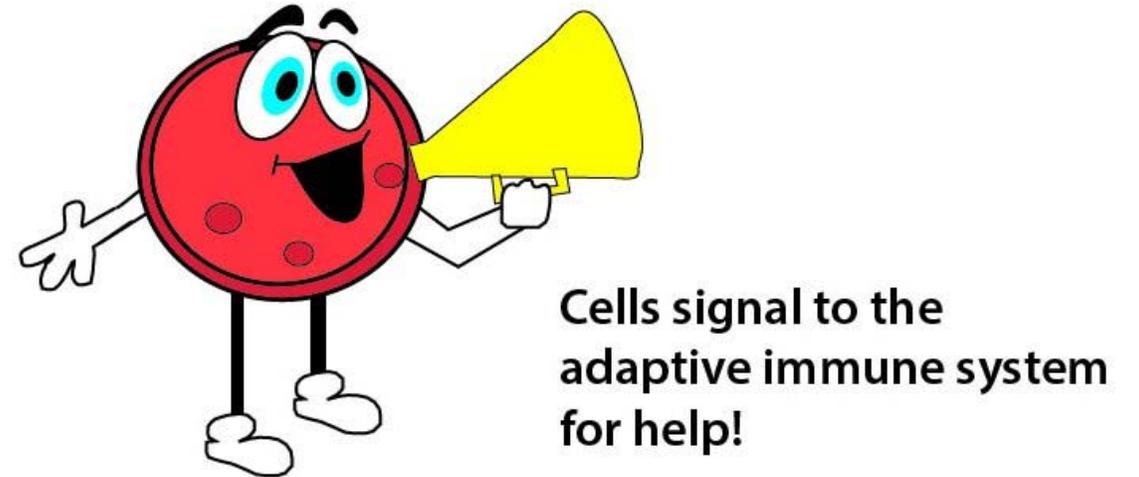
<https://decodingscience.missouri.edu/2017/11/29/engineering-the-immune-system/>

# Defense mechanisms: **second line**

Innate immune cells try to do what they can.



Sometimes backup is needed.

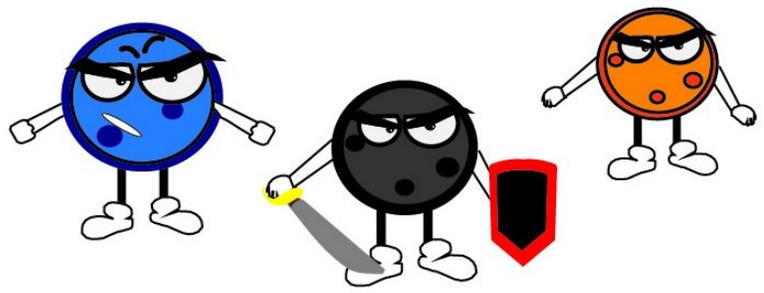


<https://decodingscience.missouri.edu/2017/11/29/engineering-the-immune-system/>

# Defense mechanisms: **third line**

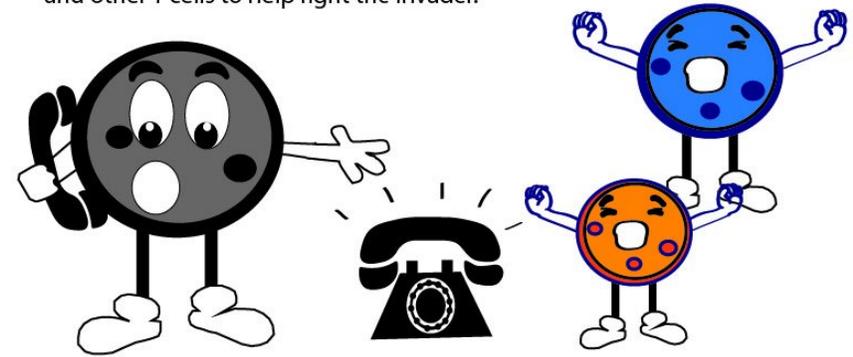
## Meet the team:

The Special Defense Unit: T cells and B cells



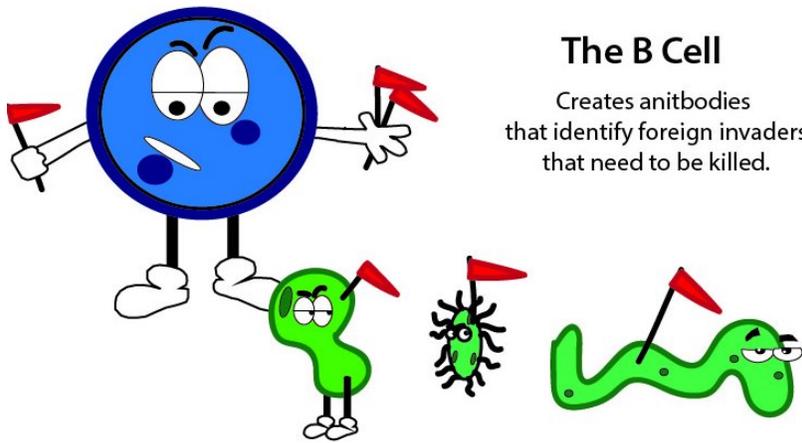
## The Helper

Uses chemical signals to call on the B cells and other T cells to help fight the invader.



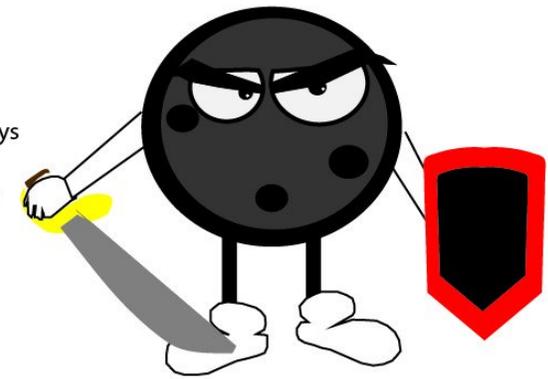
## The B Cell

Creates antibodies that identify foreign invaders that need to be killed.



## The Killer

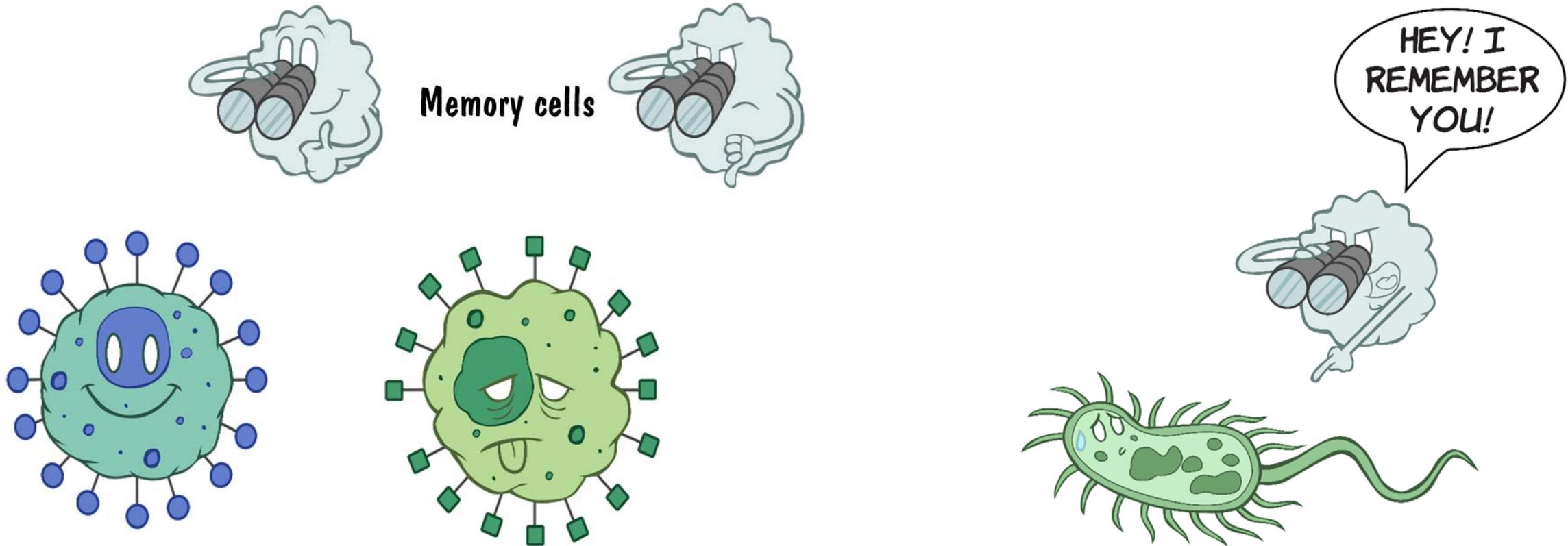
Identifies infected host cells and employs chemical signals to cause them to die and be eliminated from the body.



<https://decodingscience.missouri.edu/2017/11/29/engineering-the-immune-system/>

# Defense mechanisms: **third line**

The immune system is always on the watch to respond quickly to bacteria invasion.



What if our body still needs help?



If your body still needs help,  
antibiotics can treat



**ATTENTION!**

**ANTIBIOTICS  
CAN ONLY  
WORK ON  
BACTERIA**

So if I have the **flu** or **cold**, antibiotics cannot help!

✔ Correct!

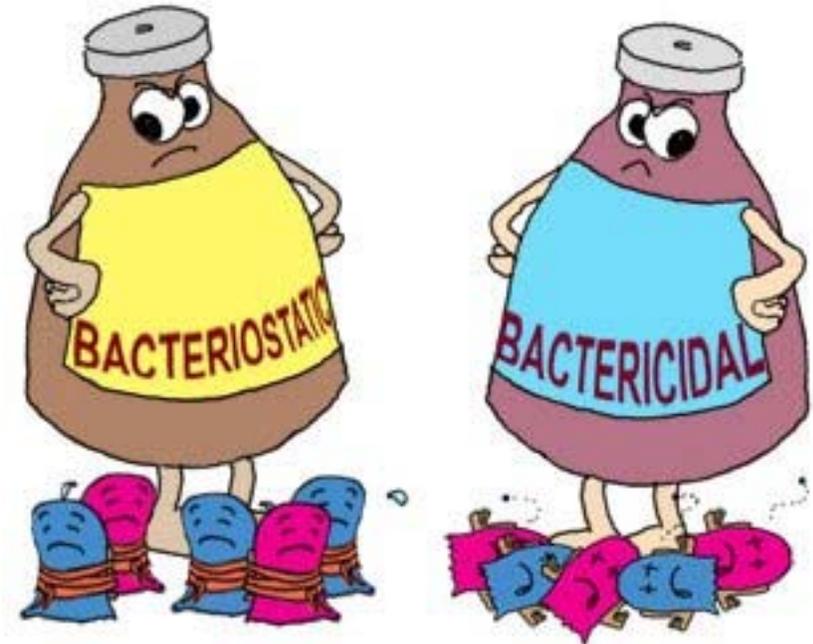


Tell us more about antibiotics



# What are **antibiotics**?

- Special medicines
- Prescribed by doctors to stop or kill **harmful bacteria**
- Antibiotics that stop bacteria are **bacteriostatic**
- Antibiotics that kill bacteria are **bactericidal**





**ATTENTION!**

**ANTIBIOTICS  
MISUSE OR  
OVERUSE LEADS  
TO ANTIBIOTIC  
RESISTANCE**

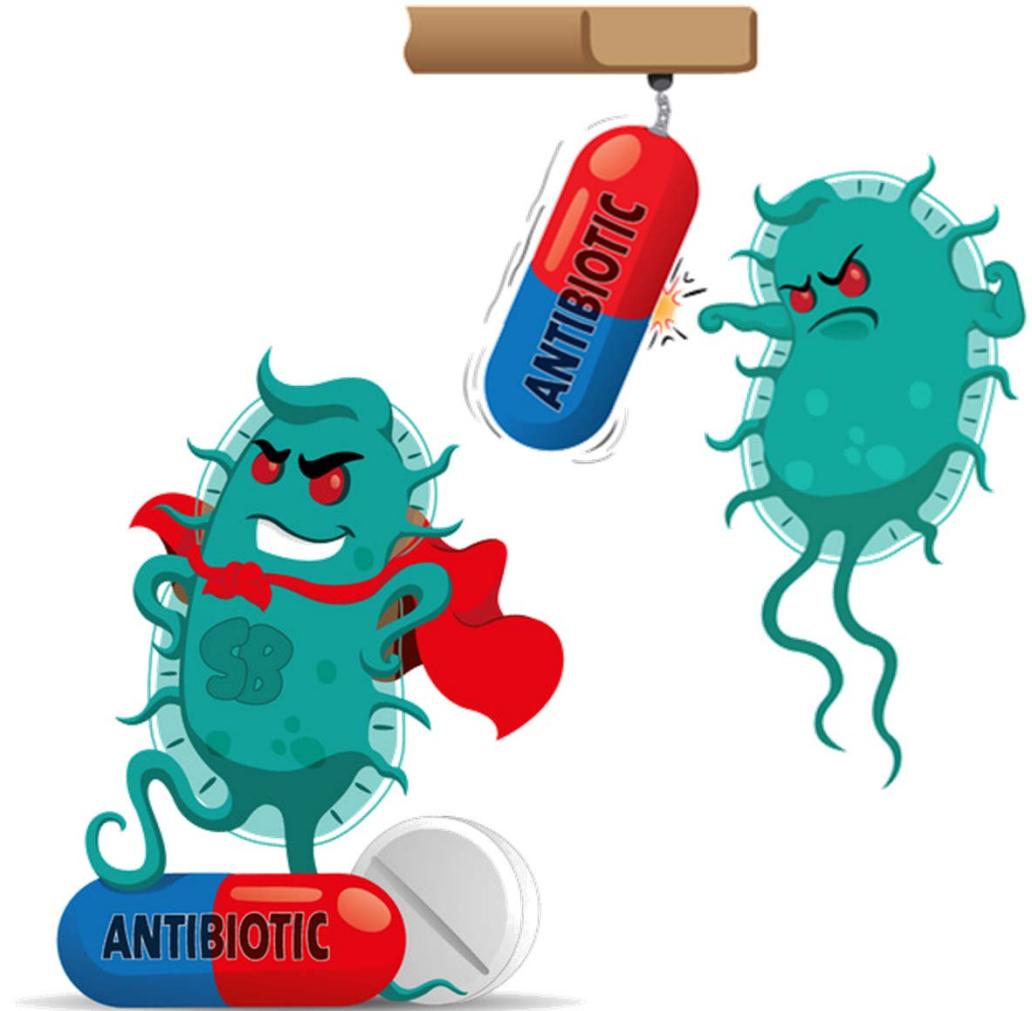
What is antibiotic resistance?



# Antibiotic resistance

- Before antibiotics were discovered, **harmful bacteria were dangerous.**
- Today, many bacterial infections are easily treated with antibiotics, but **bacteria are fighting back!**
- If bacteria win against antibiotics, then bacteria become **dangerous again.**

This is **ANTIBIOTIC RESISTANCE**



How does antibiotic resistance develop?



By using antibiotics the wrong way,  
that is antibiotic **misuse** or **overuse**.  
Always follow what the doctor says



# Antibiotic misuse



The doctor said to take the antibiotic for 7 days. I feel better now I will stop it before



I should follow what the doctor said and I will not stop the antibiotic before seven days



# Antibiotic **overuse**



The doctor said that I have cold or flu caused by viruses. An antibiotic will not work. I will take it anyway



I should follow what the doctor said and I will not take an antibiotic



The wrong use of antibiotics helps resistant bacteria become stronger and win the fight against antibiotics

If resistant bacteria win the fight, antibiotics will not work at all when you really need it



**NO antibiotics means:**

The antibiotic will not help you get better

You do have not a harmful bacteria

You are sick because of a virus

**Take the antibiotic for 7 days means:**

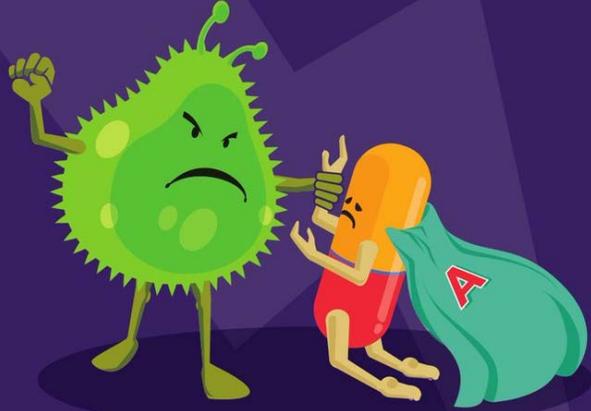
Do not stop the antibiotic before 7 days

It takes 7 days to destroy bacteria NOT LESS

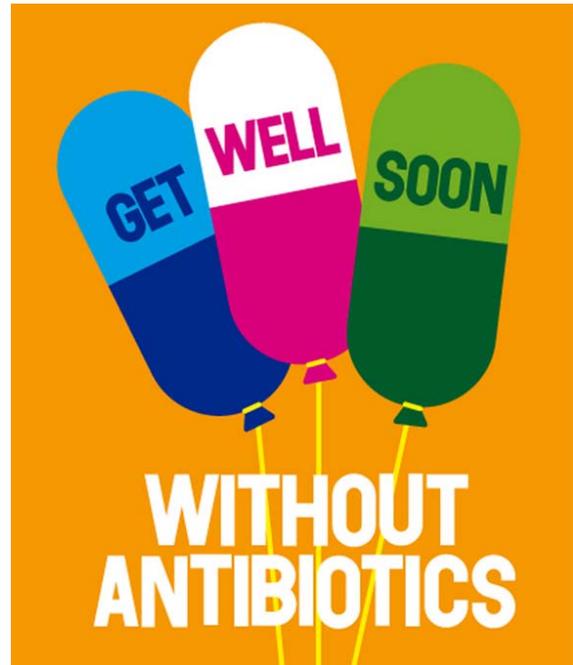


# DON'T LET SUPERBUGS WIN THE FIGHT

Preserve the power of antibiotics



# COLD? FLU? TAKE CARE NOT ANTIBIOTICS



A European Health Initiative





# the wrong use of antibiotics

# References

- <https://www.amr.gov.au>
- <https://www.canada.ca/en/public-health/services/antibiotic-antimicrobial-resistance.html>
- <https://www.cdc.gov/drugresistance/index.html>
- <https://www.england.nhs.uk/patient-safety/fighting-antimicrobial-resistance>
- <https://www.pasteur.fr/fr/centre-medical/fiches-maladies/resistance-aux-antibiotiques>
- <https://www.who.int/health-topics/antimicrobial-resistance>

# Clipart and illustration resources

- <http://cdc.gov>
- <http://clipart-library.com>
- <http://clipartmag.com>
- <http://www.biologybynapiet.com>
- <http://www.mutualistes.com>
- <https://archive.org>
- <https://bioclearearth.com>
- <https://cliparts.zone>
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