



FRONTIERS – EMERGING ISSUES OF GLOBAL CONCERN

**ANTIBIOTIC RESISTANCE:
CALLING ON CITIZENS TO HELP TACKLE THE PROBLEM**

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FRONTIERS QUIZ

Question 1: Antibiotics are powerful medicines that help fight:

- (a) Viruses
- (b) Bacteria
- (c) All microbes

Question 2: Antibiotic resistance happens when my body becomes resistant to antibiotics:

- (a) True
- (b) False

Question 3: Antibiotic-resistant bacteria can spread to humans through:

- (a) Contact with a person who has an antibiotic-resistant infection
- (b) Contact with something that has been touched by a person who has an antibiotic-resistant infection
- (c) Contact with a live animal, food or water carrying antibiotic-resistant bacteria.
- (d) All the above

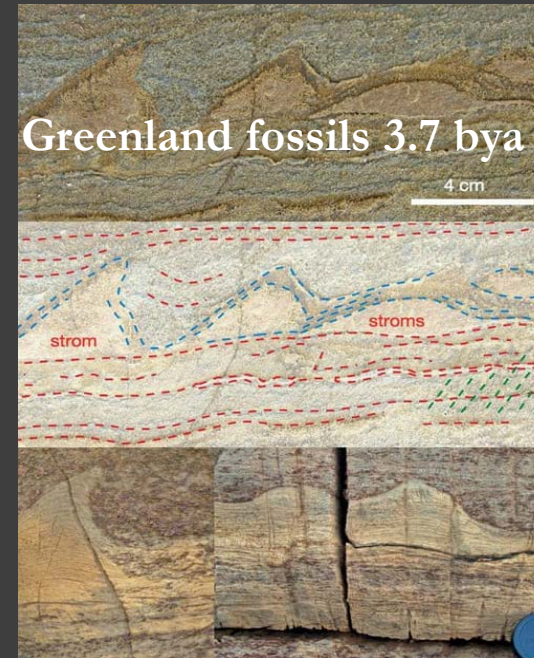
Question 4: What can happen if I get an antibiotic-resistant infection?

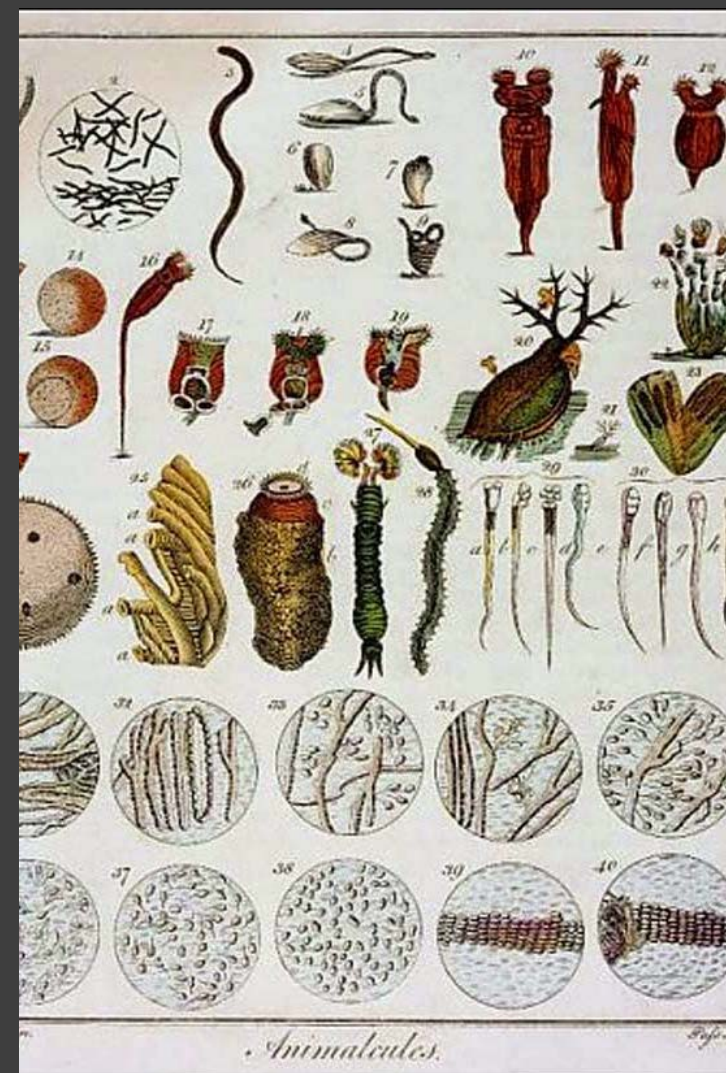
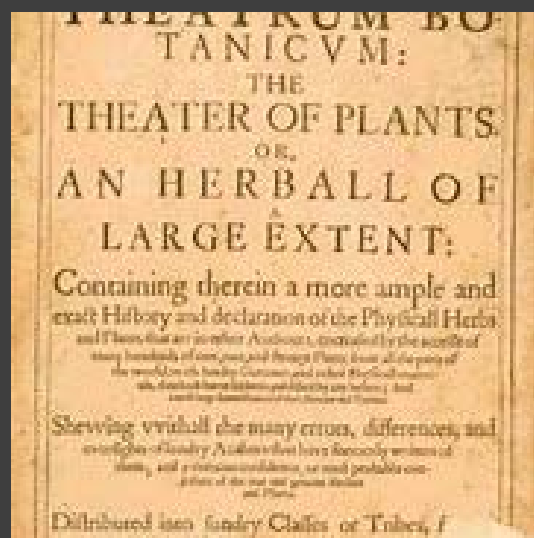
- (a) I may be sick for longer
- (b) I may have to visit my doctor more or be treated in hospital
- (c) I may need more expensive medicines that may have side-effects
- (d) All the above

Question 5: I can help tackle antibiotic resistance if I:

- (a) Share my antibiotics with my family when I am sick
- (b) Get antibiotics as soon as I feel sick - either directly from the pharmacy or a someone with the same symptoms
- (c) Throw away any left-over antibiotics into the toilet
- (d) Stop taking the antibiotics as soon as I feel well
- (e) Keep my vaccinations up to date

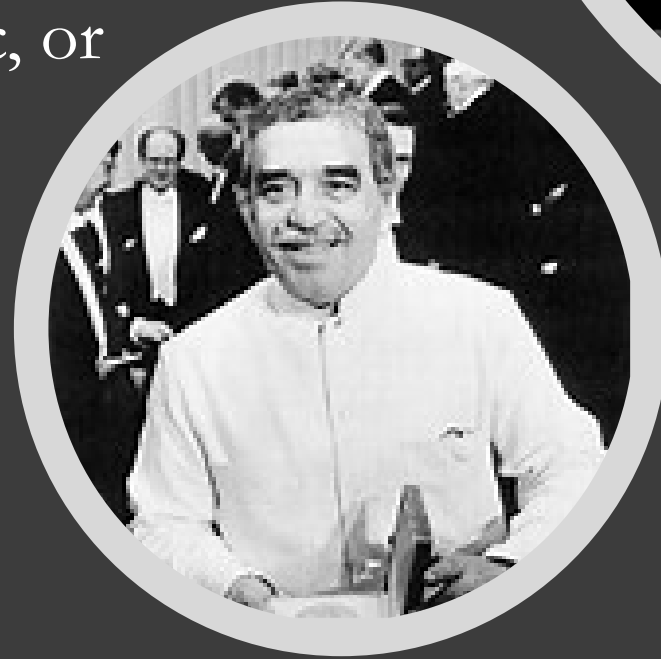
BACTERIAL ORIGINS





One sometimes finds, what one is not looking for. When I woke up just after dawn on September 28, 1928, I certainly didn't plan to revolutionize all medicine by discovering the world's first antibiotic, or bacteria killer. But I suppose that was exactly what I did.

— *Alexander Fleming*





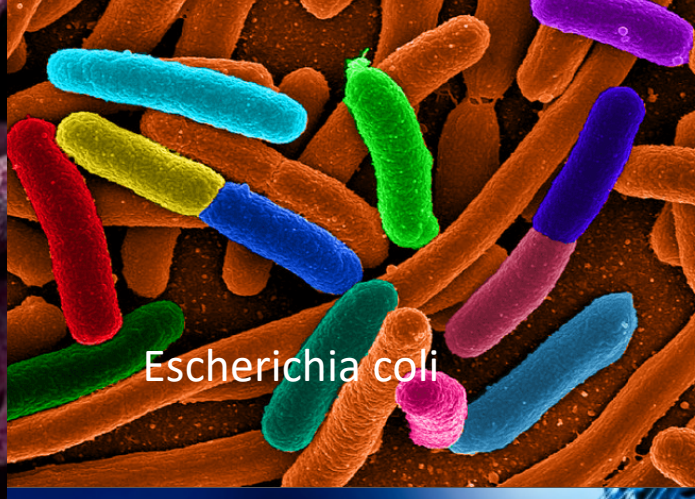
Tuberculosis



Pasturella



Campylobacteria



Escherichia coli



Streptococcus



Vibrio cholera



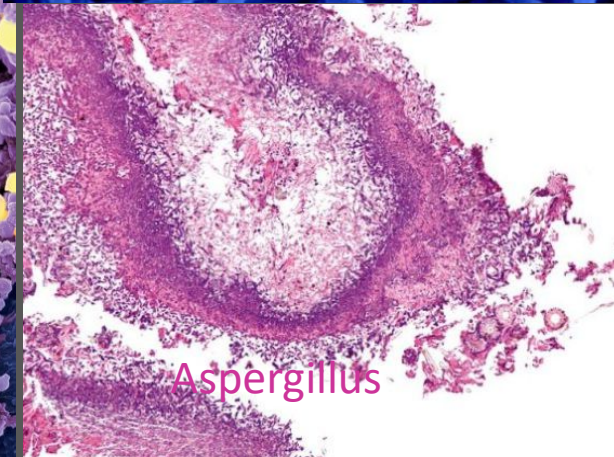
Salmonella



Legionella



Staphylococcus



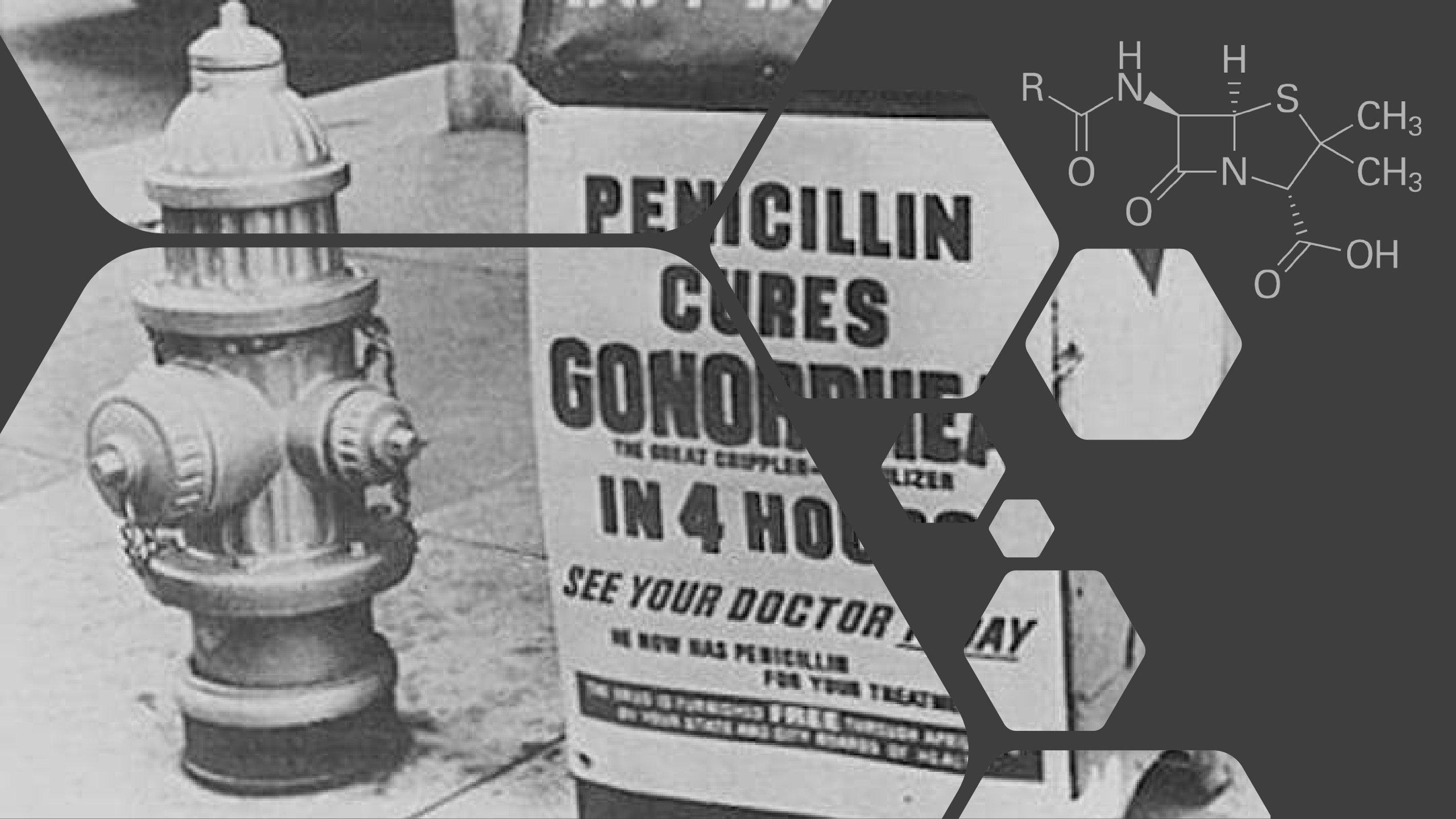
Aspergillus



Brucella



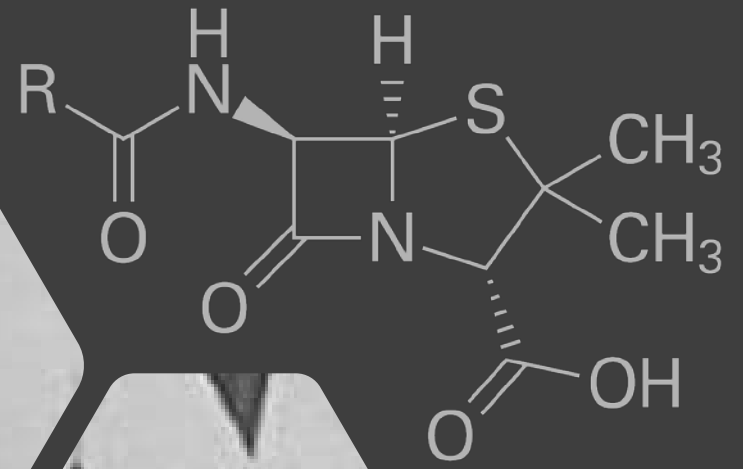
Cholera



PENICILLIN
CURES
GONORRHEA
THE GREAT CRIPPLER
IN 4 HOURS

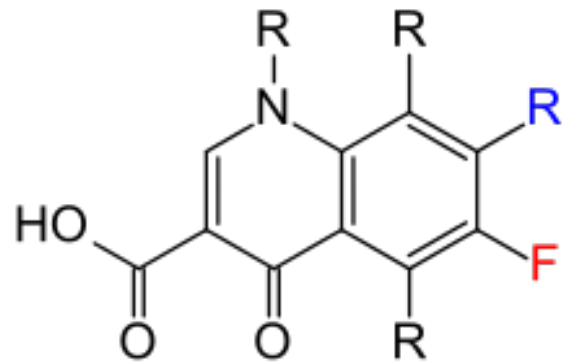
SEE YOUR DOCTOR TODAY

HE NOW HAS PENICILLIN
FOR YOUR TREATMENT

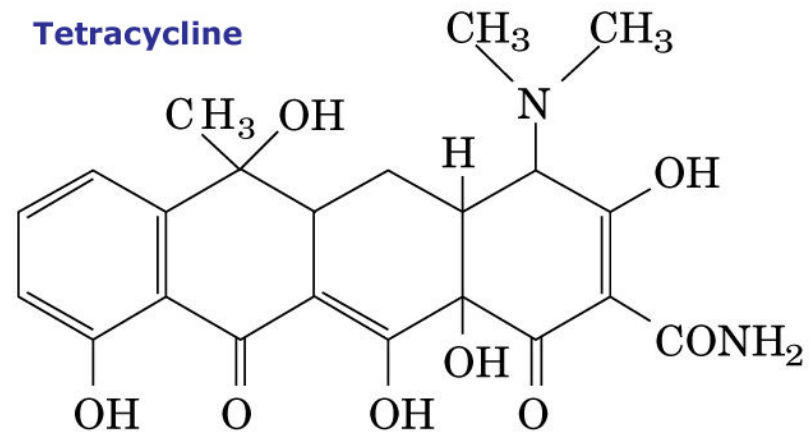


ANTIBACTERIAL AGENTS

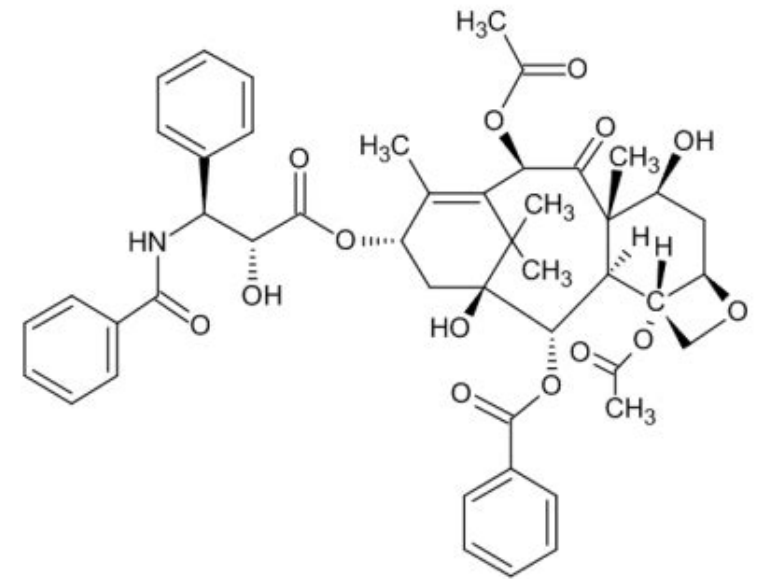
Fluoroquinolone



Tetracycline



Micrococcin



Antimicrobial resistance and the environment

The environment is key to antibiotic resistance. Bacteria in soil, rivers and seawater can develop resistance through contact with resistant bacteria, antibiotics, and disinfectant agents released by human activity. People and livestock can then be exposed to more resistant bacteria through food, water, and air.

Up to **75% of antibiotics** used in aquaculture may be lost into the surrounding environment

70% of antibiotics are used by animals

Manure fertilizers cause antibiotic contamination in surface runoff, groundwater and drainage networks

Human antibiotic use jumped **36%** in the 2000s

Antimicrobial use for livestock will jump **67%** by 2030

Antibiotics are increasingly used to boost animal growth in intensive farming, especially in developing countries

Antibiotics can be absorbed by plants and crops

Major waste flows including wastewater, manures and agricultural run-off contain antibiotic residues and antibiotic-resistant bacteria

Wastewater treatment plants **cannot** remove all antibiotics and resistant bacteria

Up to **80% of consumed antibiotics** are excreted through urine and faeces

30% of antibiotics are used by humans

Antibiotic resistant bacteria may be present in **raw source water** and **treated drinking water**

Antimicrobial concentrations in most effluents are **too low to be lethal** to exposed bacteria, but may be sufficient to induce antimicrobial resistance

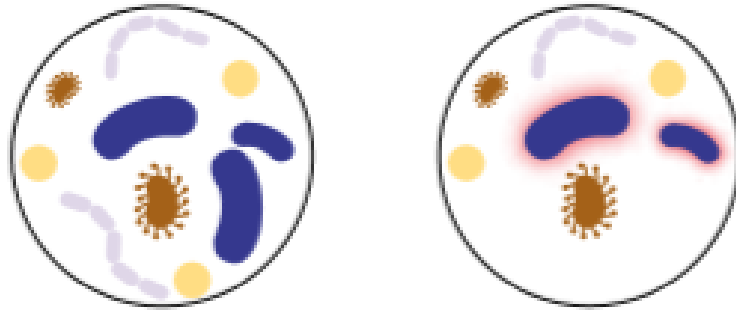
A vast array of **contaminants in municipal and industrial wastewater** increases pressure on bacteria to become resistant

More than 50% of municipal solid waste ends up in landfills and open dumps. This can include unused or expired drugs.

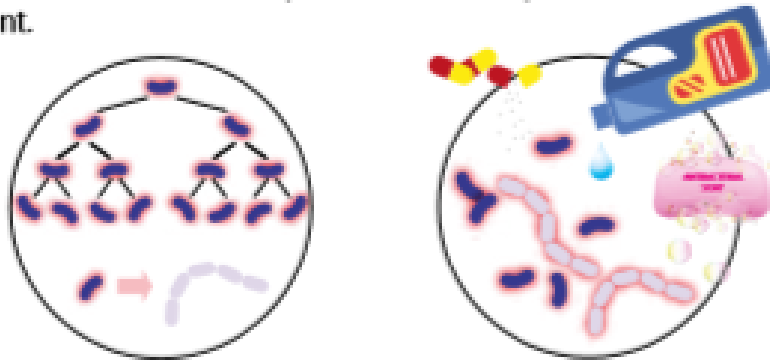
Multi-drug resistant bacteria are prevalent in marine waters and sediments in close proximity to aquaculture, industrial and municipal discharges

Inadequately treated water
Improper disposal
Agricultural run-off

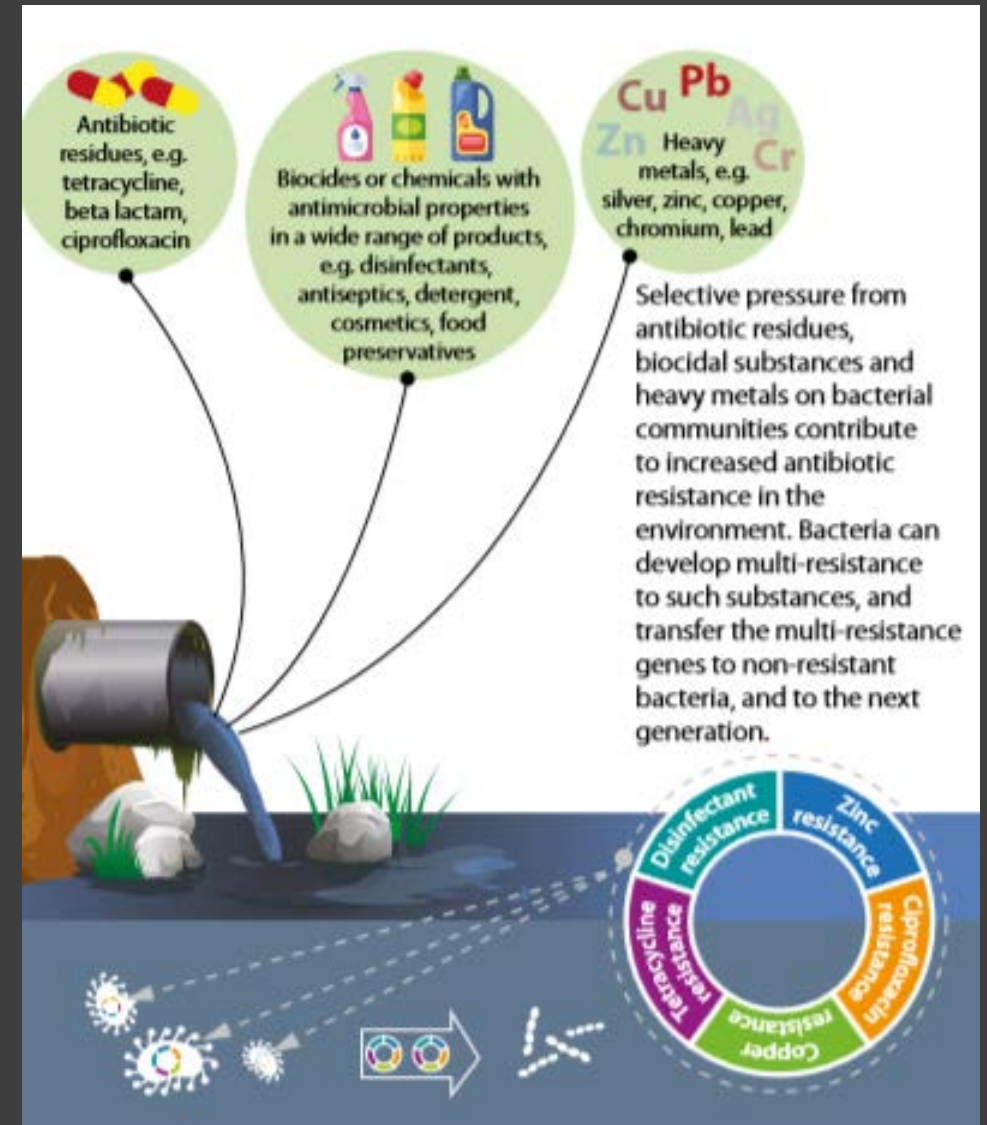
NATURAL SELECTION AND CO-SELECTION OF RESISTANCE



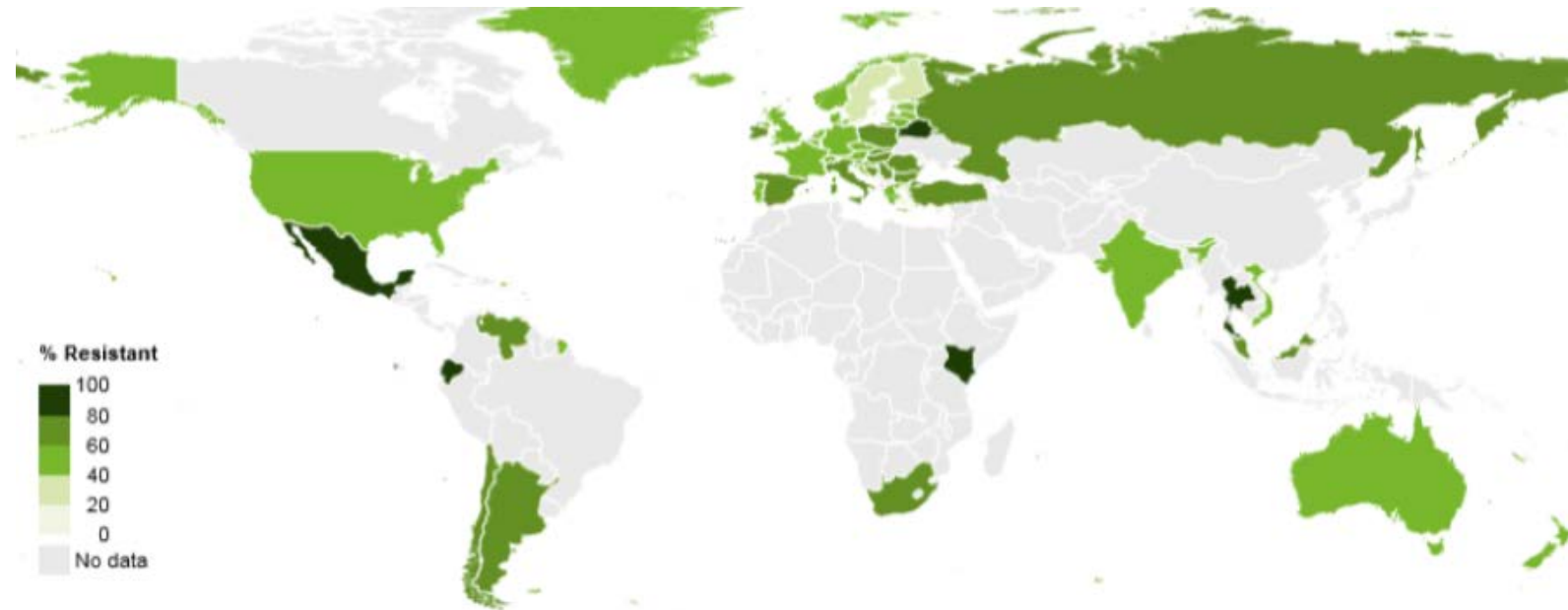
In the microbial world, competition always occurs between organisms by way of producing antibiotic molecules to inhibit others from thriving. Susceptible organisms perish. However, bacteria and fungi are known to have developed defence mechanisms to resist the antibiotic attack and survive, or in other words, become antibiotic resistant.



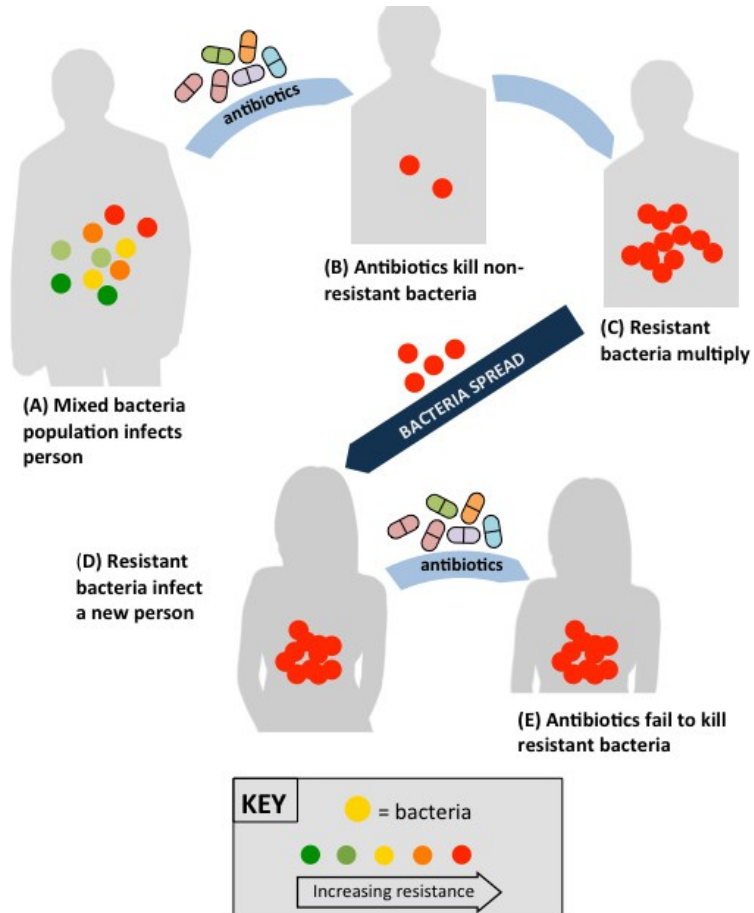
Resistance genes can pass to the next generation, and even between un-related bacteria via horizontal gene transfer. Overuse and misuse of antibiotic drugs as well as increased exposure to antimicrobial substances in the environment increases selection for antibiotic resistance among bacteria.



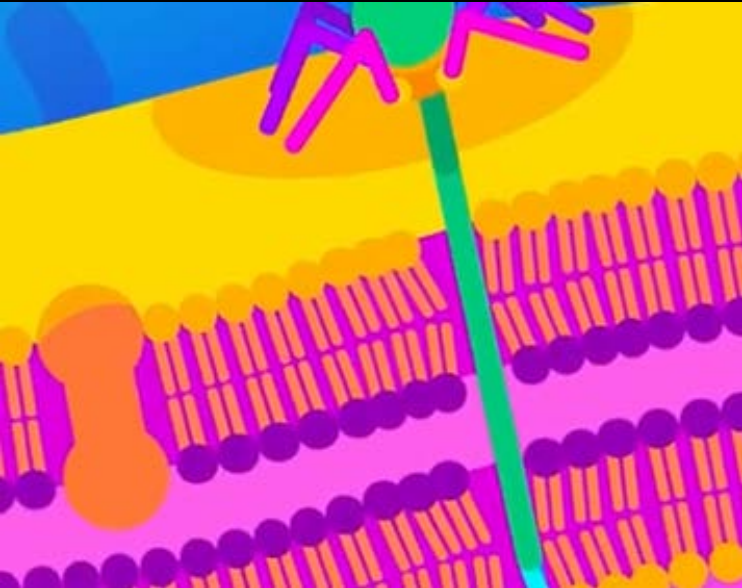
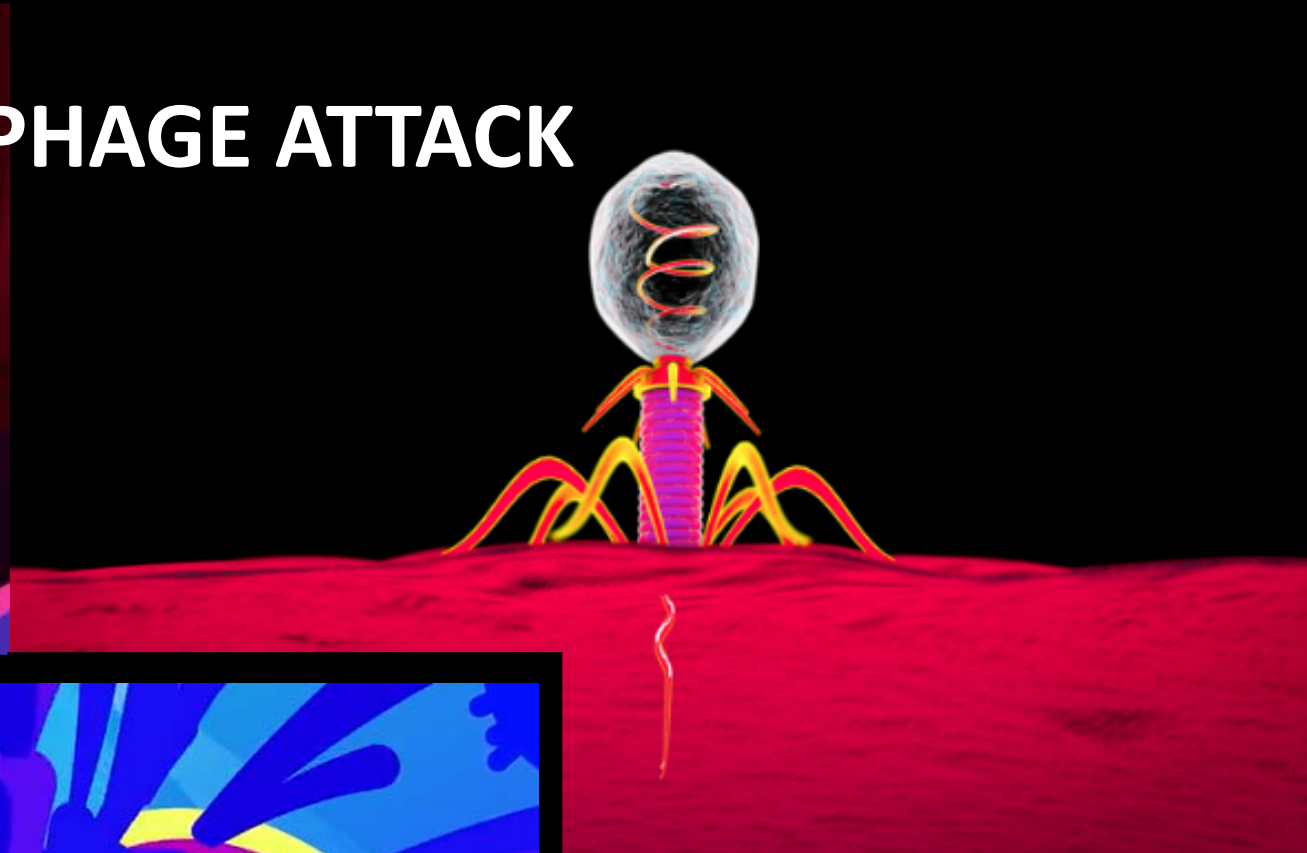
Percentage of invasive E. coli isolates resistant to Aminopenicillins

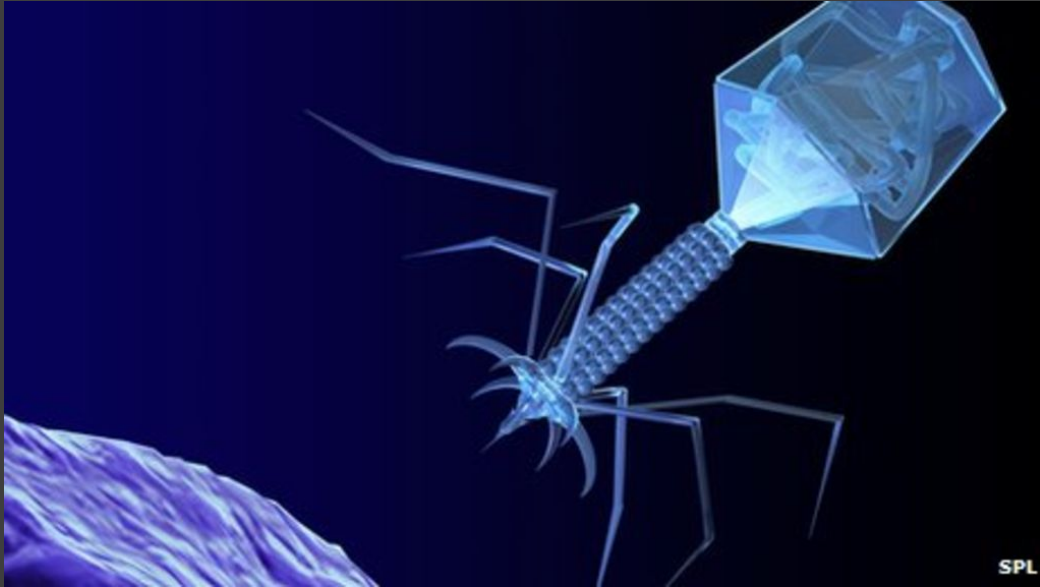


Courtesy of The Center for Disease Dynamics, Economics & Policy (CDDEP). For more resistance maps, visit <http://resistancemap.cddep.org/AntibioticResistance.php>

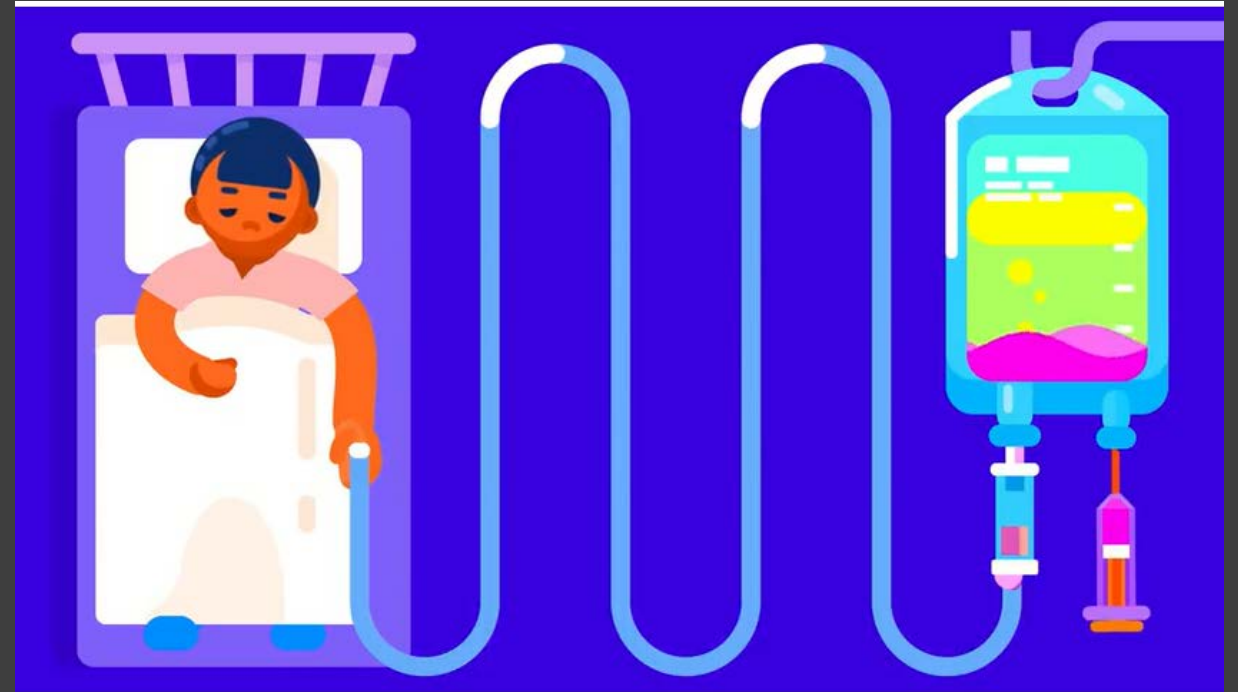
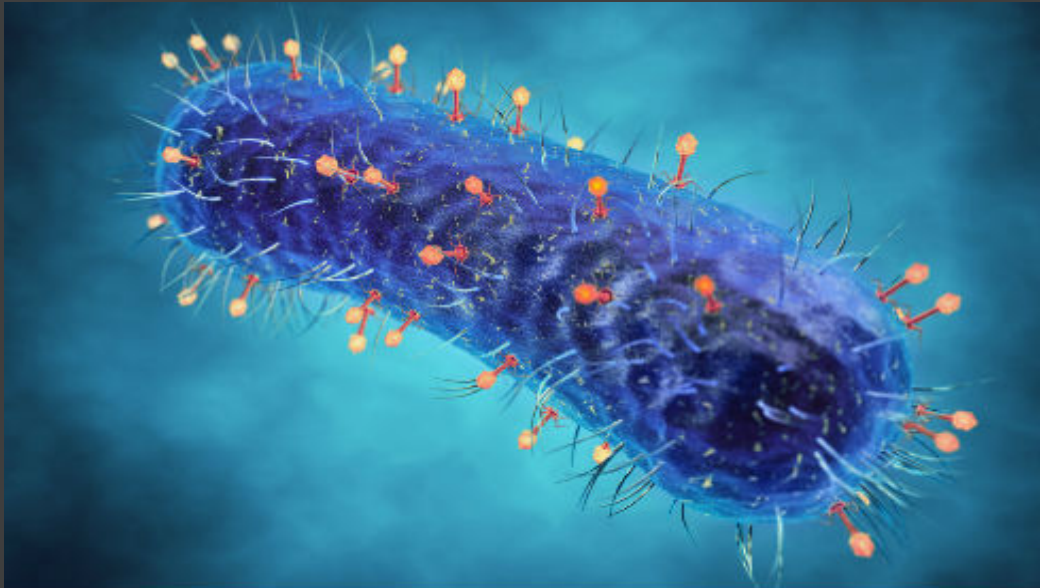


BACTERIOPHAGE ATTACK



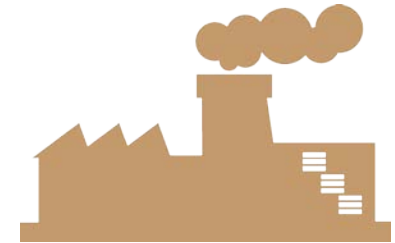
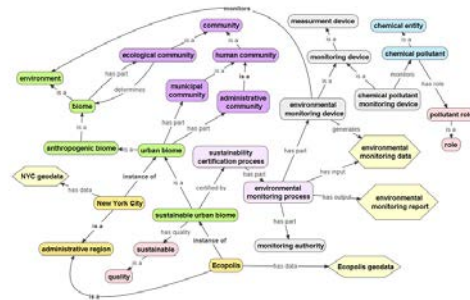
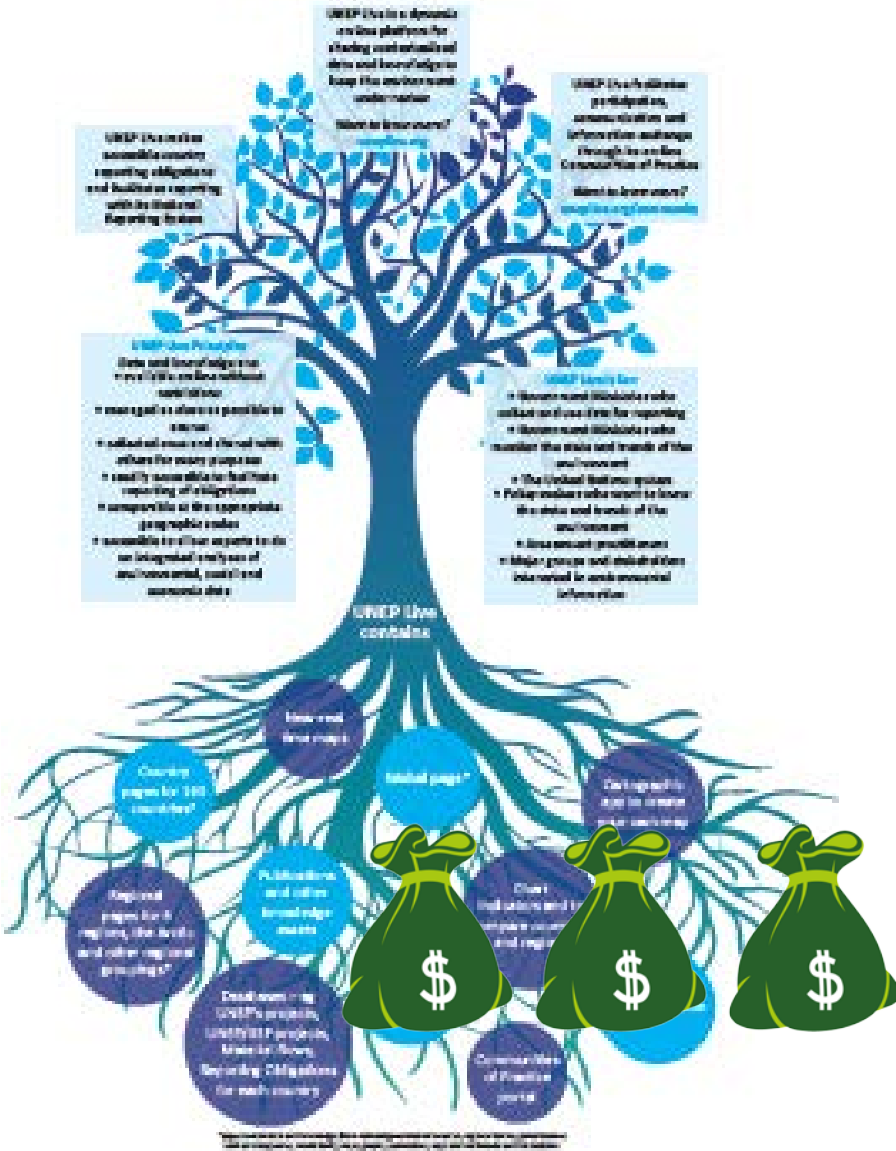


PHAGE THERAPY



Combinatorial Knowledge

Sharing information, growing knowledge









Grewia villosa
Commiphora africana
Acacia nilotica
Acokanthera schimperi
Bersama abyssinica
Dodomaea angustifolia
Plumbago zeylanica
Lippia kituiensis
Dombeya rotundiflora
Cassia abbreviate
Warburgia ugandensis
Croton dichogamus
Balanites aegyptiaca





Question 1: Antibiotics are powerful medicines that help to fight:

(b) Bacteria.

Question 2: Antibiotic resistance happens when my body becomes resistant to antibiotics:

(b) False

Question 3: Antibiotic-resistant bacteria can spread to humans through:

(d) All of the above

Question 4: What can happen if I get an antibiotic infection:

(d) All of the above

Question 5: I can help tackle antibiotic resistance if I:

(d) Keep my vaccinations up to date

