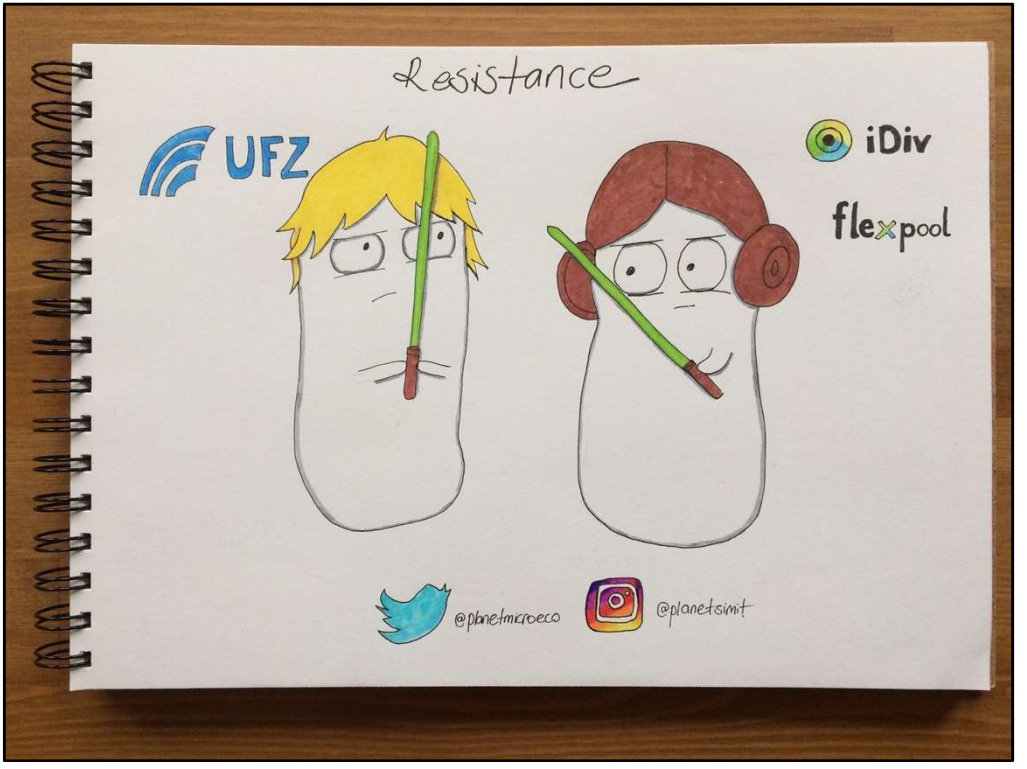
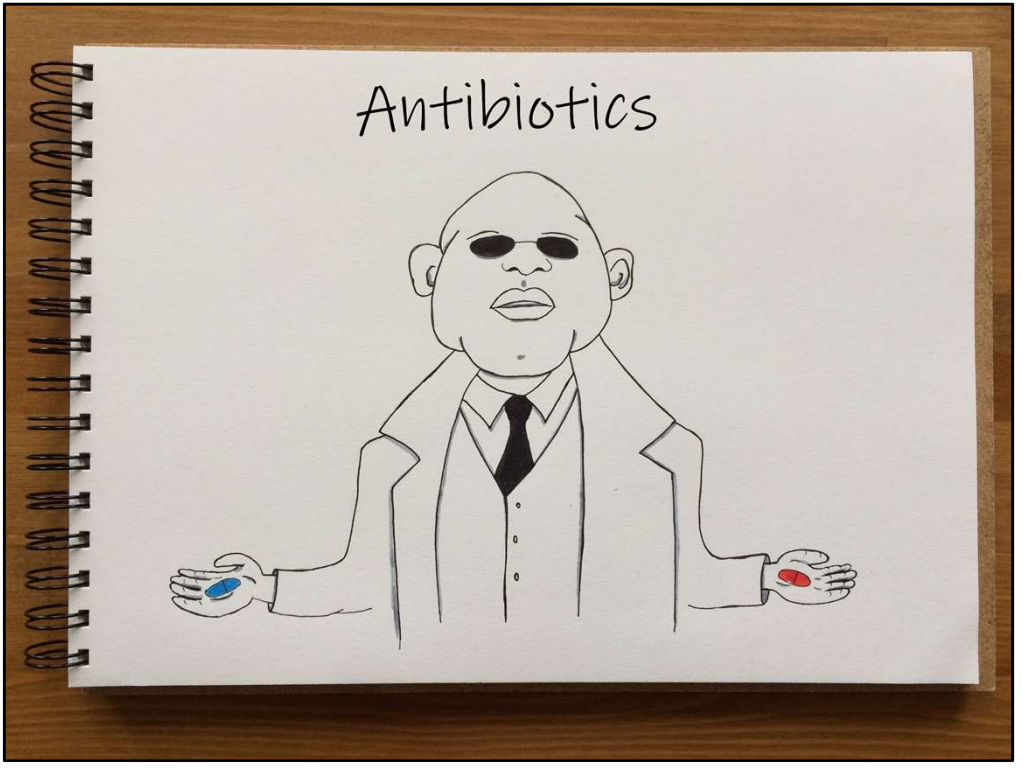


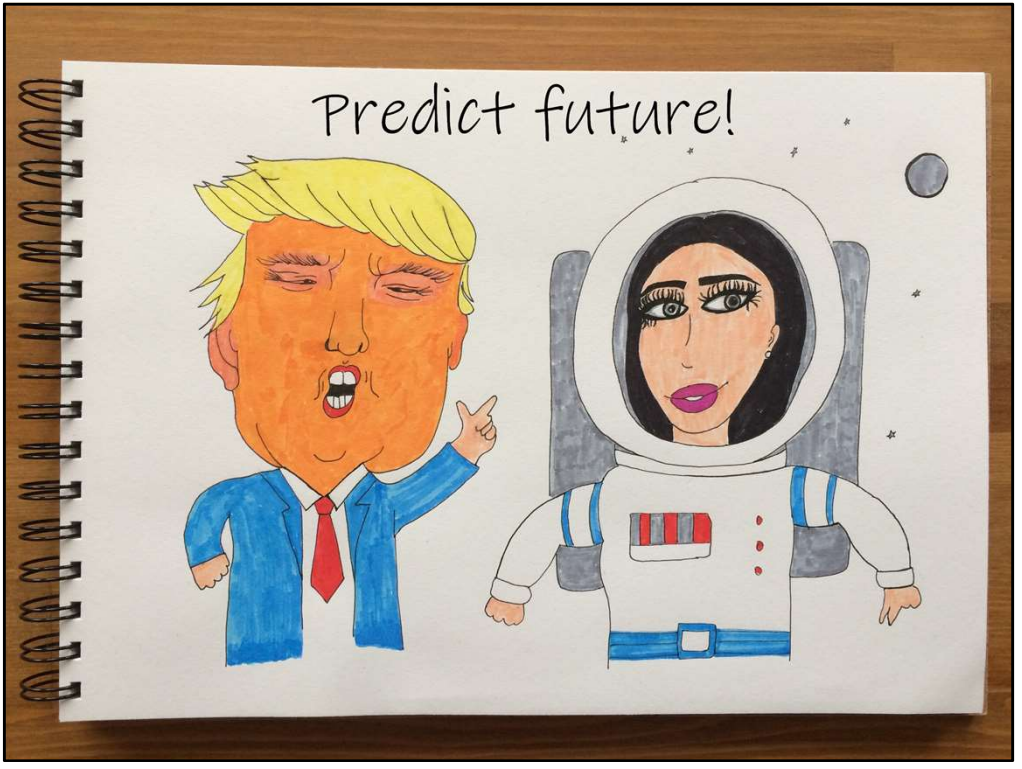
Today I am going to talk about another scientific crisis that you should be worried about. The survival story of antibiotic resistant bacteria. (It doesn't look so serious, but it is).



Most of you are able to sit and listen to me here, because antibiotics have saved you from deadly bacteria at some point in your life.

Today more and more bacteria survive against antibiotics. Thousands of people die from resistant bacteria every year. They are also released into the environment. What will happen next?

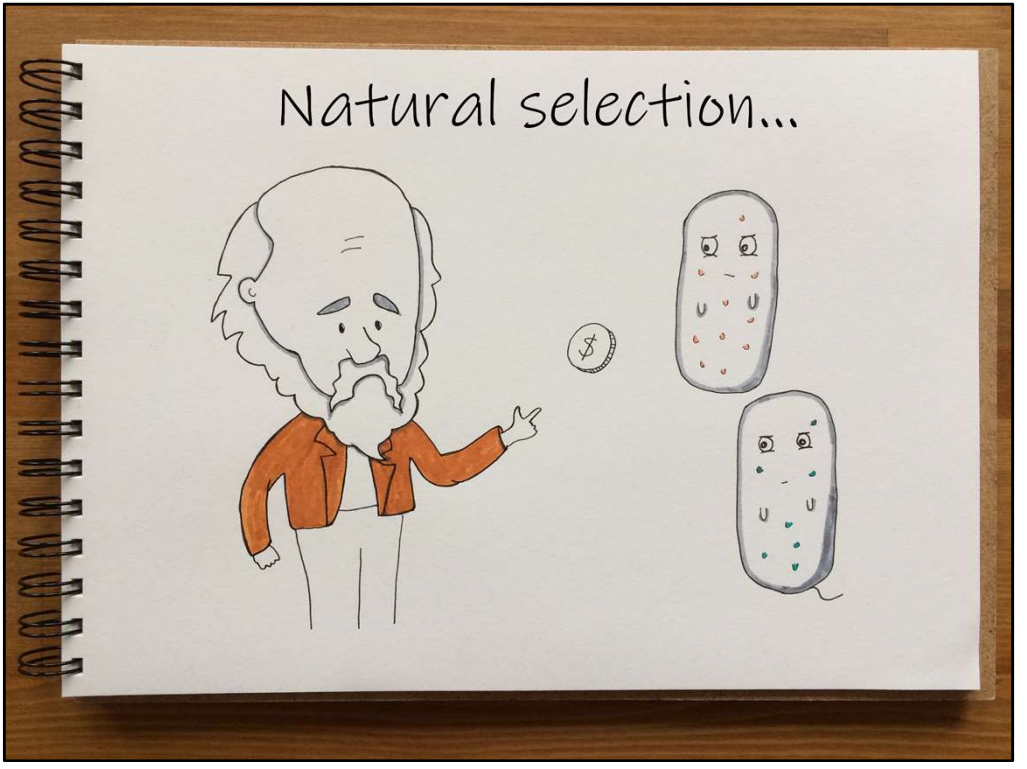
But before answering this, I want you to stop for a moment and imagine that you can pause time, fast forward it, and do it again and again, over and over.



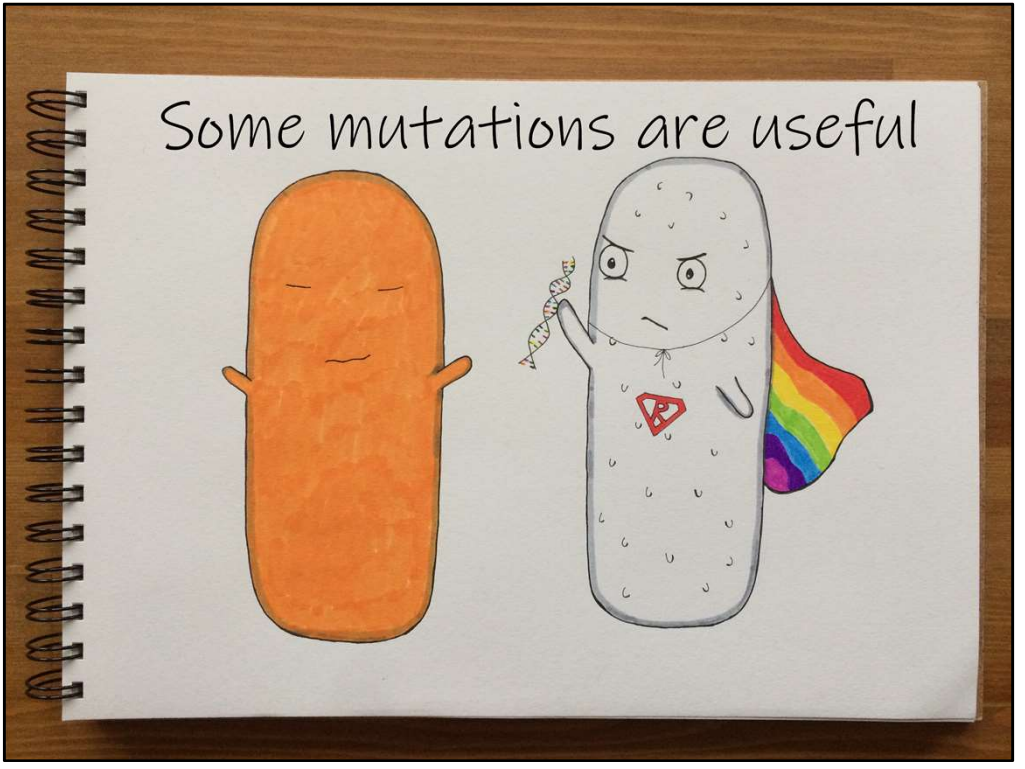
With this ability, you could change a lot of parameters, like in a computer model, to understand how we are here now and what the future might look like.

You can’t really do that with humans, animals, or plants but, it is possible with microbes. They are small, they grow and they adapt really fast.

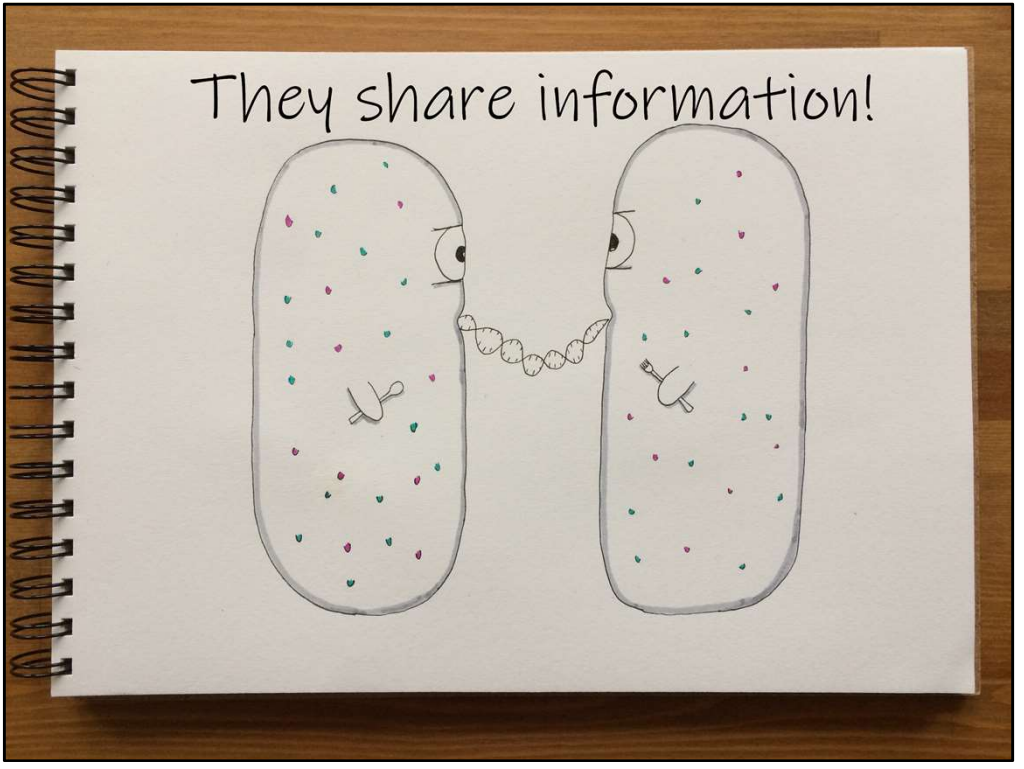
Look around you: your neighbor, your body, your dog's poop – they're all covered in millions of bacteria. They even survive in boiling water, alcohol or radioactive waste!



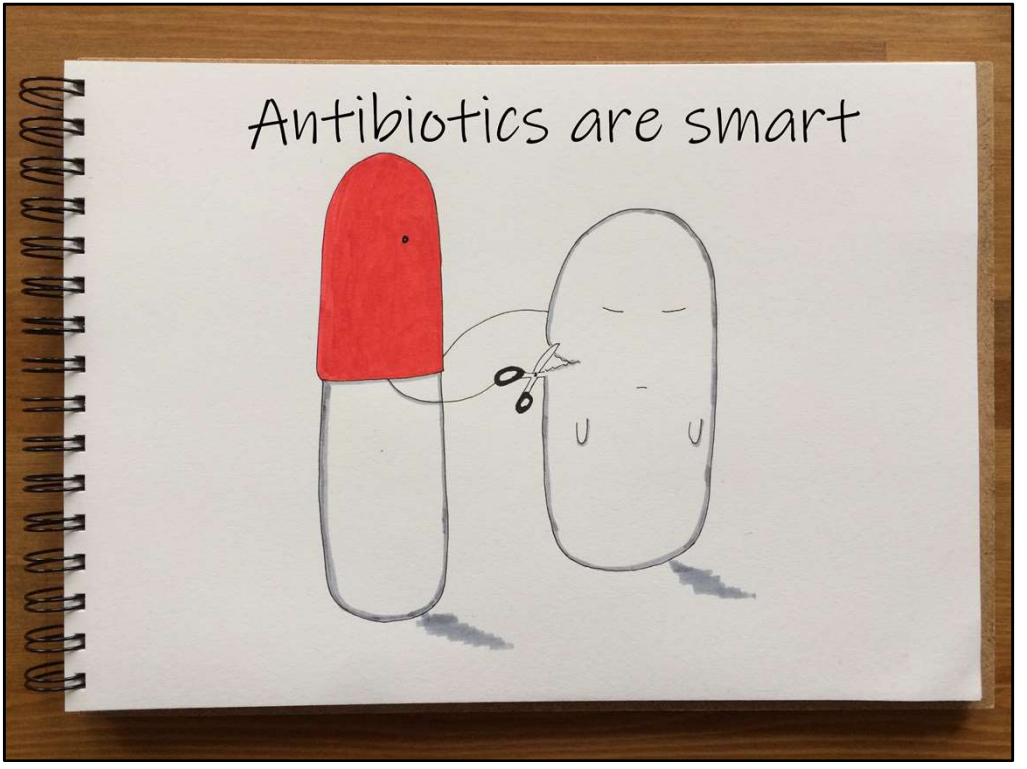
But how do they survive the extreme environments, parasites, predators or drugs we design to kill them? As you all know, the answer lies in Darwin's theory of natural selection.



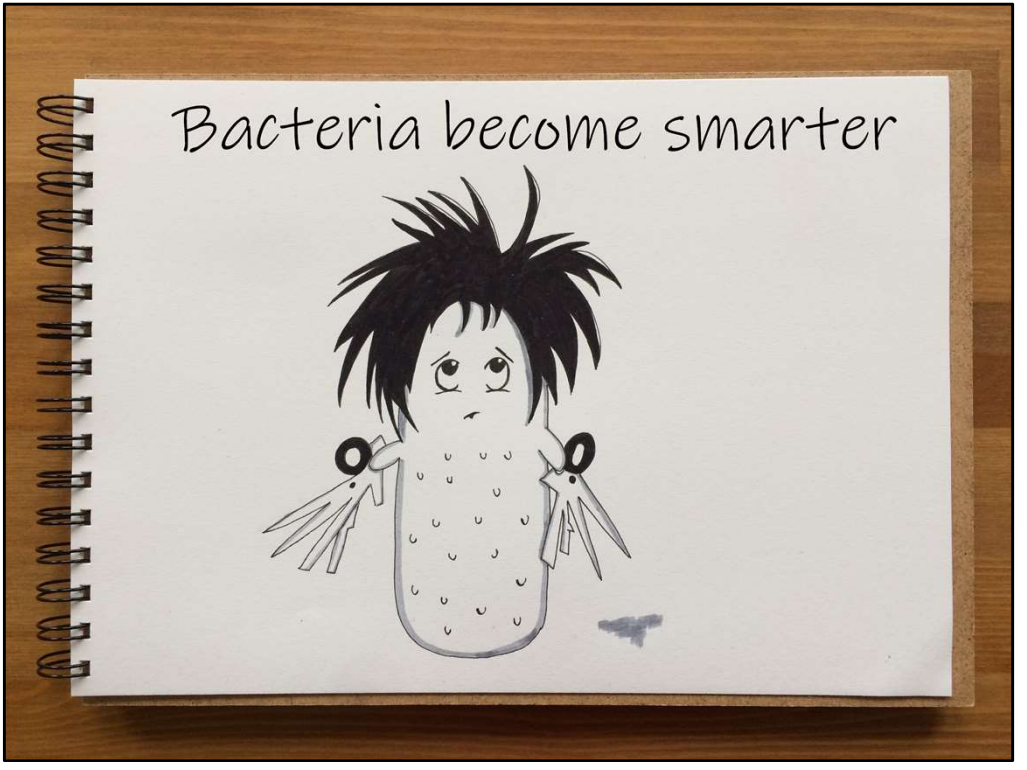
Any of these single celled organisms can undergo mutations. While some of them are useless, some are useful and give them power to resist. They can then spread all over.



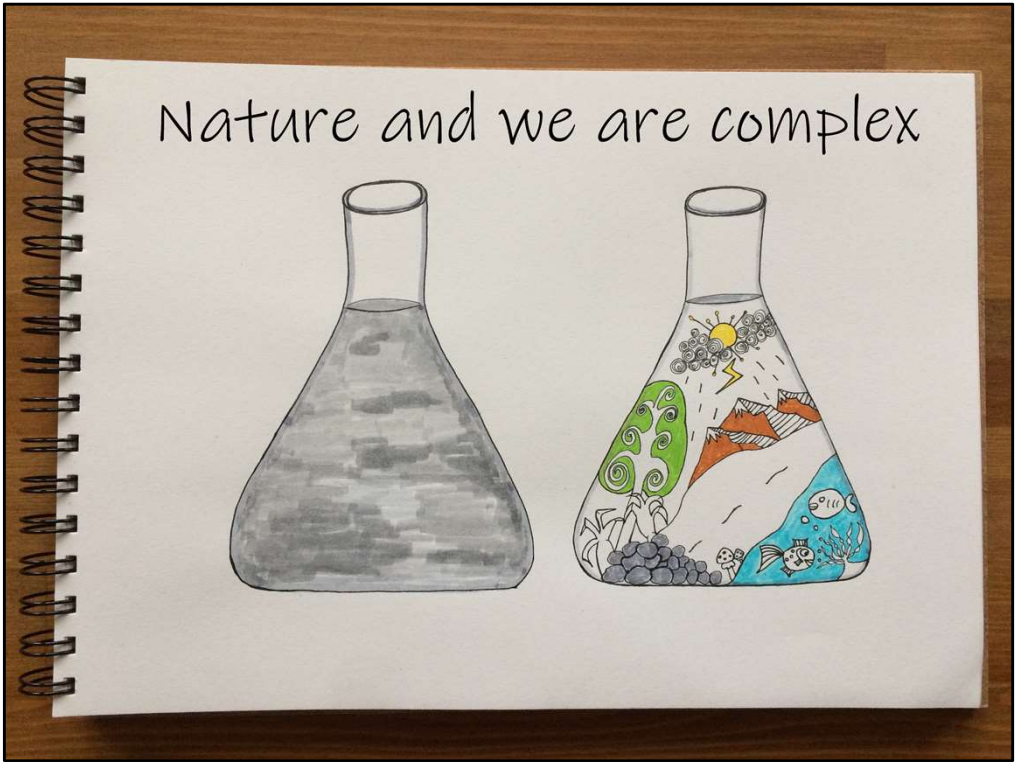
The key to their evolution is the transfer of information. They can rob from the dead ones, share with their partners or viruses can carry them from one to another.



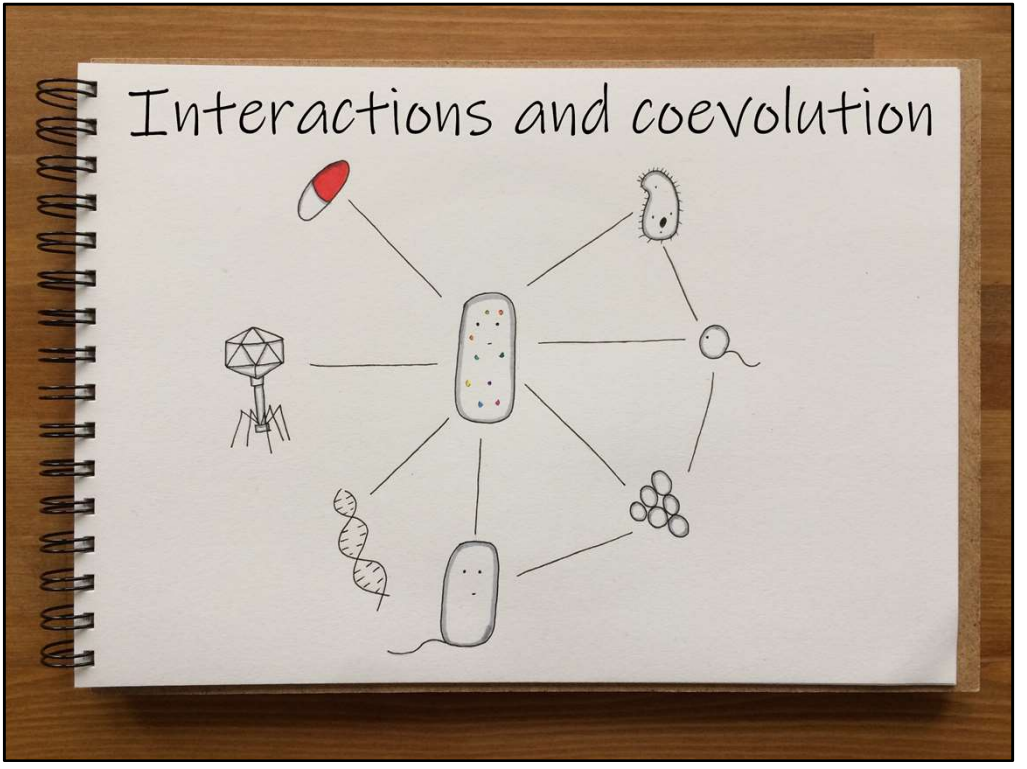
Antibiotics are smart. They damage the bacteria like disturbing the bacterial cell wall or by preventing a process such as DNA and protein synthesis. Bacteria can adapt and become intelligent too.



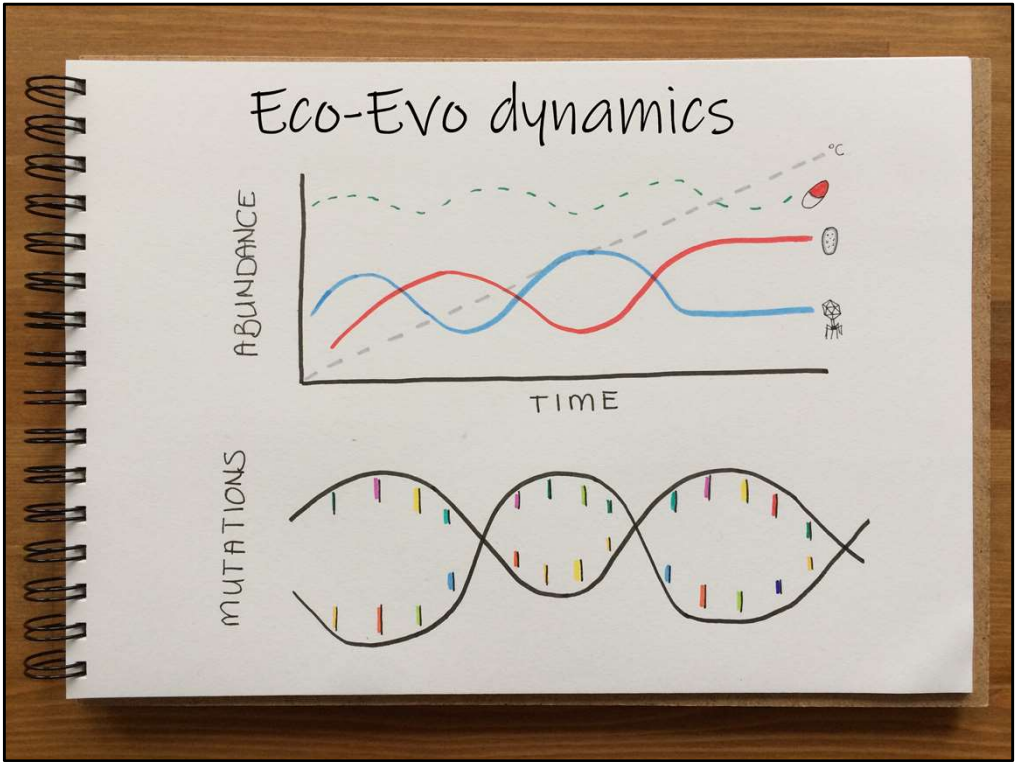
Researchers know that bacteria learn how to change the target of antibiotics, discard or destroy them via new mutations, using the genes they have or even just cheating the others.



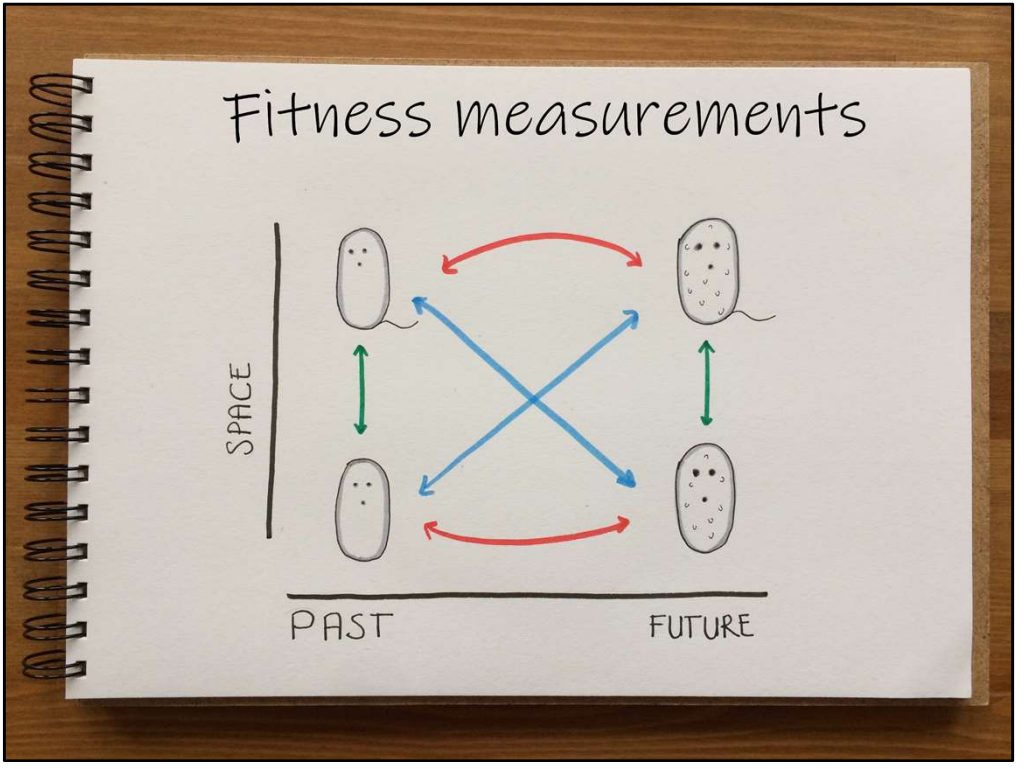
We have been trying to understand how bacteria survive against antibiotics. But what we forget is the diversity and complexity of bacteria's environment. This is what my research focuses on.



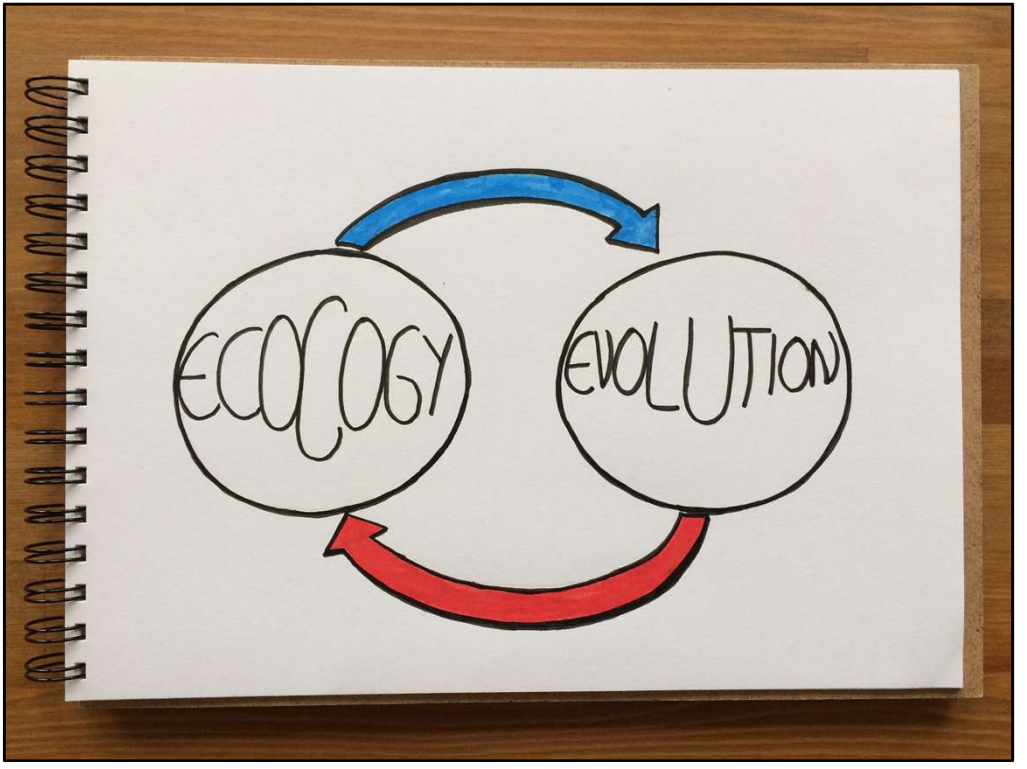
So, consider that bacteria have to deal with different environments and their predators chasing them down. They also have to interact and compete with other species, all have different traits.



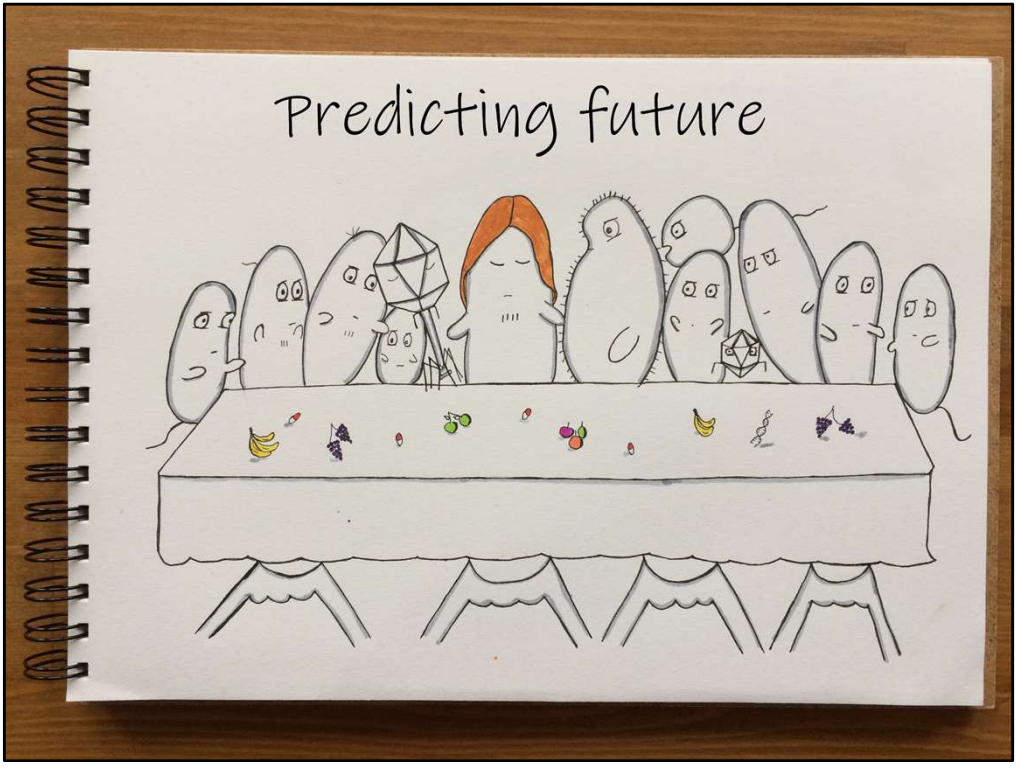
So, I track their ecological dynamics with antibiotics, predators, different types of communities and changing environments. I also look what is happening in the survivor's genes.



I freeze past generations, as well as contemporary and future survivors. I shift time and space. I make them compete against each other to see who is the most fit and who is weak.



What I eventually see is that their evolution depends on their ecology and their ecology depends on their evolution. Complex, dynamic and changing in time and space.



To predict the future, I have to pause time and ask over and over: How diverse is the community that they live in? How many of them are friends or competitors?

Also, are there any predators around? Is there enough food? Is it cold? Or is it hot? Do they have to compromise for all? (I'll show you the results next time.)

But now think, it is like pausing this moment, replaying it again, over and over, changing parameters each time and watching until I evolve and survive this talk. Thank you!