

Charlie

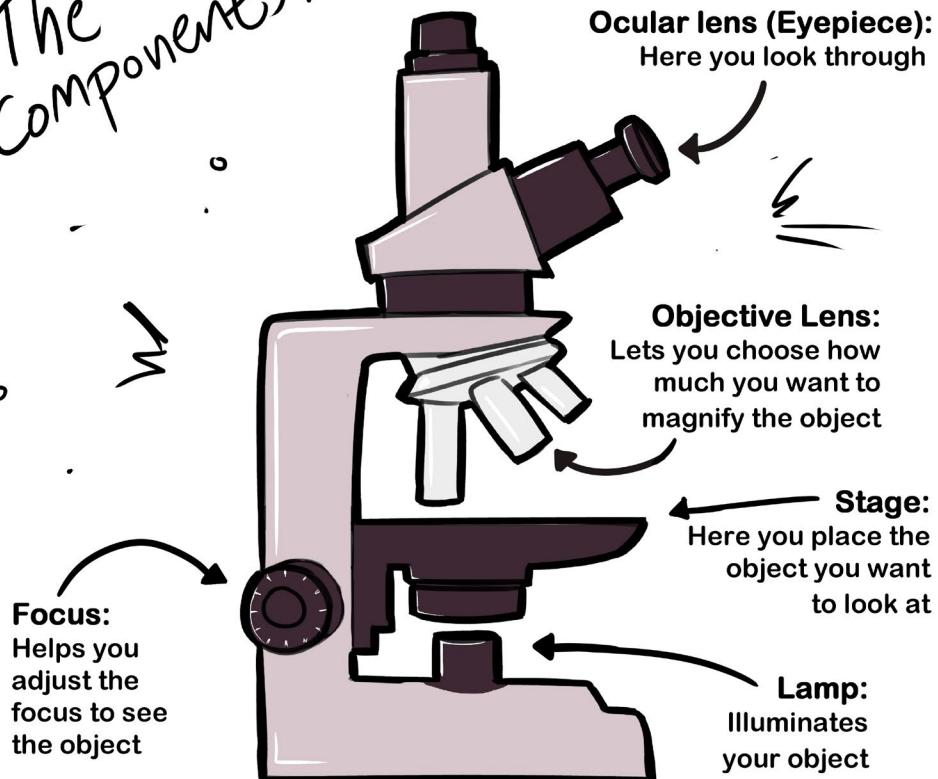
and the Magic Microscope



A Microscope

Helps you see very tiny things, like bacteria!

The Components:



Charlie

and the Magic Microscope

iGEM Stockholm

illustrated by
Angelos Miliadis



This is Charlie.



Charlie's parents
are scientists.



Every day, before they go to work, Charlie's parents bring her to school where she sees all her friends.

Today Charlie can't go to school.

"Why can't I go to school?" Charlie asks.
"They closed it for today because some friends of yours got sick." her mother answers.

"Why did they get sick?" Charlie keeps asking.

That is a good question. Her mother and father look at each other thinking about how to explain it so that Charlie can understand.

Her father looks at her and says "We will show you!"

Both of her parents disappear for a while and come back with a huge box. Charlie asks "What is in the box?" "That... is a microscope! It makes things you can't see with the naked eye visible! It is like a magnifying glass but for things that are a lot smaller." Charlie is confused.

She once got a magnifying glass for her birthday and used it to look at ants, but what could be smaller than ants?



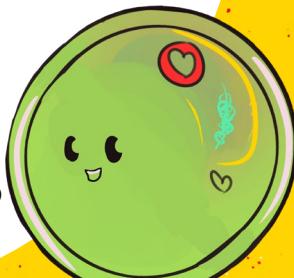
Her father sees the expression on her face and laughs. Her mother places the microscope on the table, switches on a light and puts a little piece of glass with a drop of water on it under a small tube. She says "Just look through this!" and points at the small tube of the microscope.





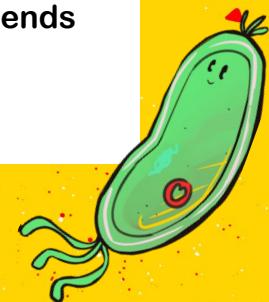
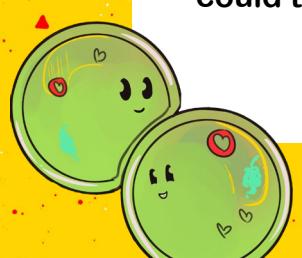
"This is the world of microbiology," her father explains. "Do you see these little moving creatures? What you see are microbes. We call them that since they are too small to be seen with the naked eye. They are everywhere you can imagine. On your skin, in your body, in the water and even in the clouds. One type of microbes are the bacteria. Some of them can make you sick and some of them can make you feel better. Your friends probably encountered some bacteria that made them sick."

Charlie is thrilled. She can't stop thinking about the little creatures. Do they speak with each other? She asked herself how some of them can make you sick and how some of them can help keep you healthy.



When Charlie goes to bed she wishes she could tell the bacteria to leave her friends alone.

Suddenly, she has an idea.



Charlie goes downstairs. The microscope is still on the kitchen table. She looks through that small tube again that her father showed her to look through, but everything is dark. Charlie searches for a switch. Click! A little light turns on. She tries again and there they are! Little microbes in different shapes floating from one side to the other. She is following a little one with her eyes. "Hey!" she says "Are you a bacterium?" Nothing happens... She looks up and rubs her eyes. She yawns... and blinks. She then opens her eyes.

"Yes, I am a bacterium." a friendly voice responds. Charlie holds her breath and turns around. She looks into the friendly face of a little creature, who looks like a bean with many hairs and three tails.

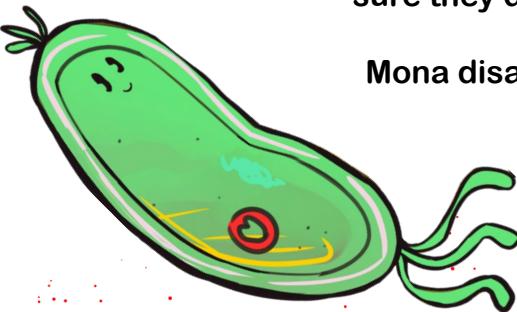
"What is your name? Charlie asks.
"Mona." the bacterium answers.
"And with whom do I have the pleasure?"
"My name is Charlie" she answers hesitantly.
"Why do you have tails?" Charlie asks.
"These tails are actually my flagella!
With these I can swim through water and control in which direction I want to go. They are like your legs!"



Charlie is stunned by the occurrence of Mona. "Can you talk to each other from bacterium to bacterium?" Mona laughs and responds, "Yes, we send each other messages, everyone can receive them. Through these messages, we'll know where we can find food or if there is any close danger."

Charlie was very glad to hear that. "Well, can you tell the other bacteria to leave my friends alone? I can't go to my school and play with them as long as they are ill."

Mona looks at Charlie pityingly and says, "I am very sorry, Charlie, if your friends are ill because of some relatives of mine! You have to know that this can happen when they get in parts of your body where they don't belong. I am pretty sure they didn't do it on purpose!"

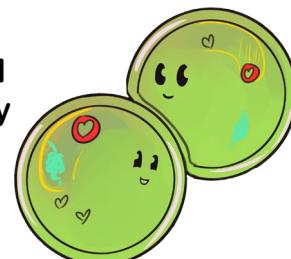


Mona disappears very fast as her flagella starts to spin.

After some time, she comes back followed by two other similar looking bacteria. They look very friendly, Charlie thinks.

"Hello Charlie, my name is Fido!"

"And my name is Tobi! We wanted to tell you how sorry we are that you can't play with your friends. We are very nice bacteria. Our relatives live in your gut and help you to digest the food you eat."



These must be some of the good bacteria her parents mentioned.

Fido adds "We also help to make food like cheese or bread. We are the ones who make it so delicious. We don't want you to think badly of all bacteria."

Charlie is truly amazed. She didn't know that they are doing so many good things. Suddenly she sees another bacterium swim by. Tobi explains "This is Colin! He is actually a neighbor of our relatives in the human gut. I heard his family is helping scientists at their workplace. They call them 'E. coli.'"



Charlie remembers that her parents are scientists and she makes a mental note to ask her parents, if they get help from Colin's relatives at work.

Mona says "We can't make your friends feel better instantly but Fido's and Tobi's families are helping you and your friends to stay healthy. Don't worry, your friends will be feeling much better soon."

Charlie responds "That is very nice of you! I hope my friends will feel better soon and I can tell them all about it!" Mona, Fido and Tobi smile at Charlie as she turns off the microscope light.

When Charlie wakes up the next morning her parents had already made her breakfast.

"Good morning Charlie! Your school teacher called. The school has opened again."

"I have to tell them about Mona, Fido, Colin and Tobi." Charlie jumps for joy.

Her parents look at each other, very surprised. "Who are Mona, Fido, Colin and Tobi?"

"Some nice bacteria I have met!" Charlie responds.

Her parents laugh and her father says, "I am sure they will love to hear about it."

Charlie remembers to ask them about Colin. "Oh I was wondering do you get help from a bacterium at work? Something with E. coli?"

Now her parents are completely amazed. "Yes we do! They help us to explore the world of microbes and they can also help you make things like medicine if you want." Charlie would love to see that sometime. She starts thinking about becoming a scientist in the future.

When Charlie sees her friends, she tells them about how she met Mona, Fido, Tobi and Colin. She shares her knowledge in all the good things they can do for us humans.



FACTS

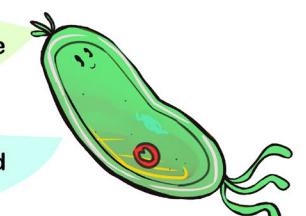
about bacteria

Microbiology is the name for research that explores the world of microorganisms. Microorganisms cannot be seen with the naked eye, and need a microscope. Bacteria are a type of organism that is studied.

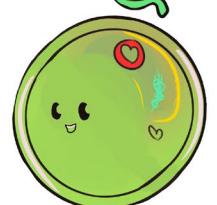
Mona belongs to the genus of *Sphingomonas*.
Sphingomonas can be found in water and a lot of other places like different soils or plants.



Fido belongs to the genus of *Bifidobacterium*.
Bifidobacteria are inhabitants of your digestive system. It is believed that the *Bifidobacterium* helps to digest the food you eat.



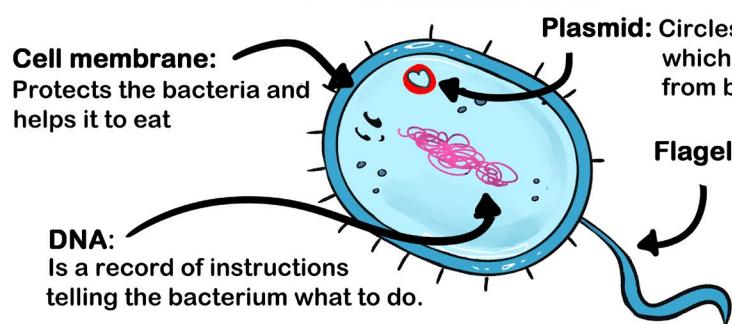
Tobi belongs to the genus of *Lactobacillus*.
Lactobacilli are inhabitants of your digestive system and help you to break down sugar.



Colin belongs to the genus of *Escherichia* and the species of *Escherichia coli*. *Escherichia coli* are inhabitants of the digestive system as well. They protect you from bad bacteria and help to produce nutrients. They are very important bacteria in Microbiology and Biotechnology.

Cell Components:

Cell membrane:
Protects the bacteria and helps it to eat



Plasmid: Circles of DNA, which can be passed from bacterium to bacterium

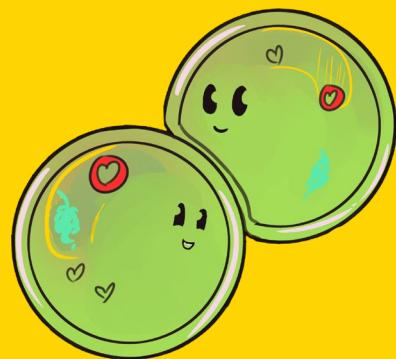
Flagella: Helps the bacteria to move around

DNA:
Is a record of instructions telling the bacterium what to do.

Little Charlie is sad, because her friends are sick. Charlie's parents show her a microscope to open the door to a whole new world - the world of microbiology. Charlie has some important questions for the little creatures. Go on a journey with Charlie to discover the world of microbes and learn what they can do for you!

The iGEM competition is a large competition within synthetic biology. It started in 2003 as a course at the american university MIT in Boston. Today, it's a year long interdisciplinary research project in which 310 teams from more than 40 countries participated in 2017.

iGEM Stockholm, which is our team, has developed this book to communicate basic knowledge of bacteria to young children. The project we are doing is much more than research; it is communication, finance, and human engagement. We hope to reduce the stigmas of bacteria and synthetic biology by introducing basic knowledge of our field to all parts of society.



Made by:
Nicolai Dorka
Vilma Lagebro
Puck Norell
Victoria Chu
Josephine Berg
Angelos Miliadis
Jonas Gummesson