

LUNA & SIMON

BIZARRE BACTERIA AND PECULIAR PLASMIDS



'Luna & Simon – Bizarre Bacteria and Peculiar Plasmids' is written by Jamie Hall and Edward Ross. Illustrated by Edward Ross.

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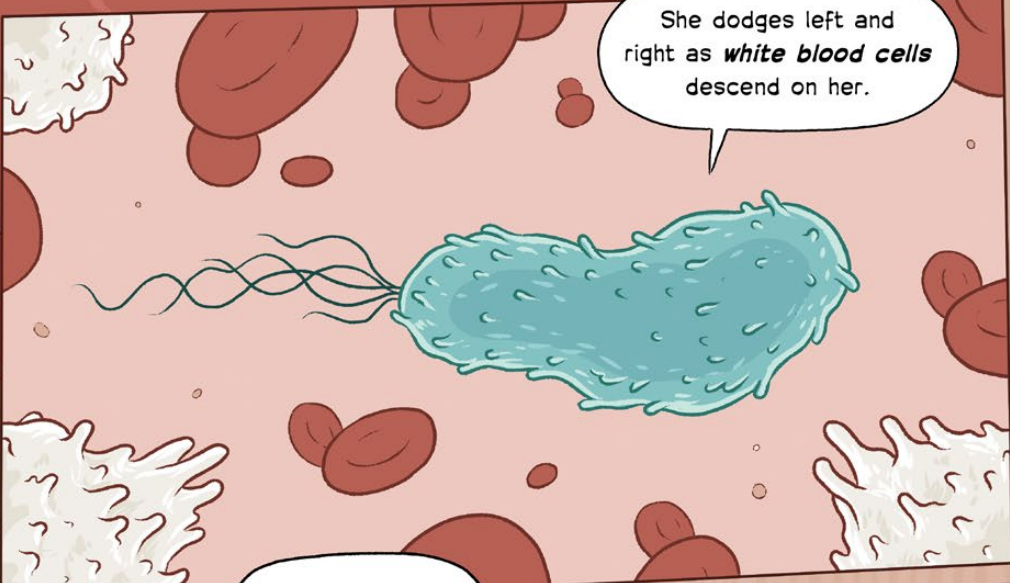
LUNA & SIMON

BIZARRE BACTERIA AND PECULIAR PLASMIDS

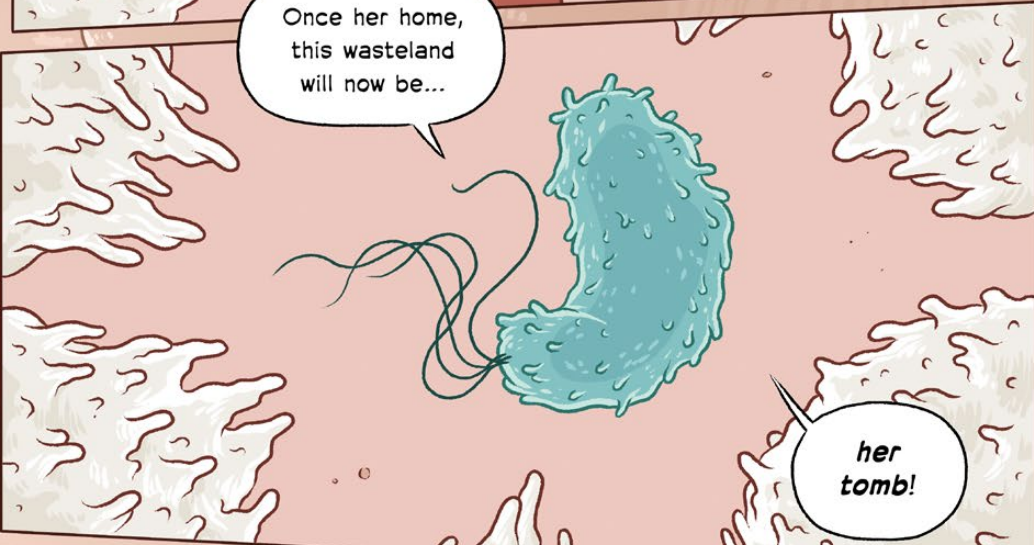


*WRITTEN BY JAMIE HALL AND EDWARD ROSS.
ILLUSTRATED BY EDWARD ROSS.*

Luna the Bacterium blasts through the dangerous wilderness of the human bloodstream.



She dodges left and right as **white blood cells** descend on her.

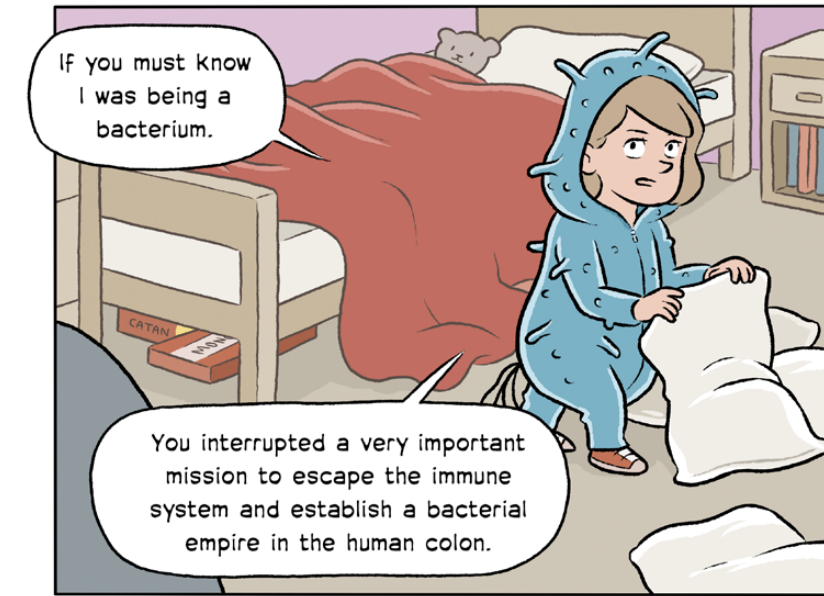


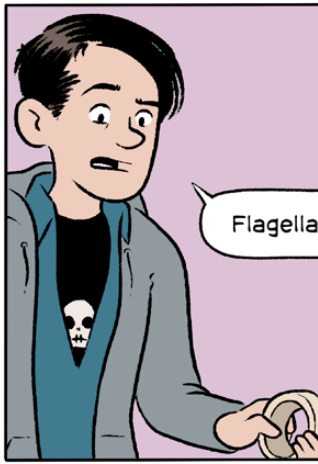
Once her home, this wasteland will now be...

her tomb!



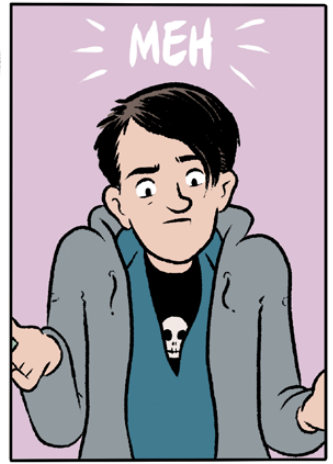
Luna?



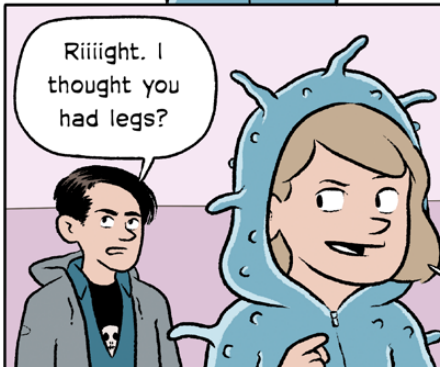


Flagella?

I'd been reliably informed you were good at science. Aren't you meant to be revising for your exams?



These are my flagella - little tails I can whip around to swim through the body.



Riiiiight. I thought you had legs?

Not me! I'm a bacterium. You know... single celled? Invisible to the naked eye?

The reason you should wash your hands, even though we both know you *don't*?



You're so weird.

Oh Simon, only interested in the things you can see. You know there's a whole invisible world out there to explore.



Not just out there... *inside you*.



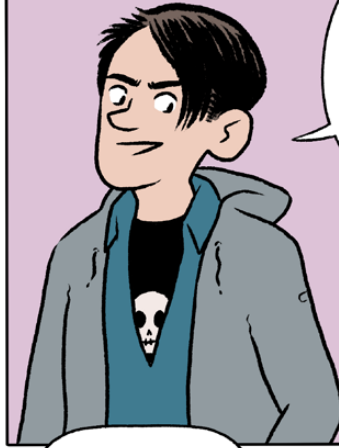
Er, heh heh. Sorry.

There are more bacteria in a handful of soil than there are people on the entire planet.



We go around acting like we're so important, but bacteria have been successful on planet Earth for *billions of years!*

I get it! They're tiny. They're invisible. They're pointless. A bit like *you!*



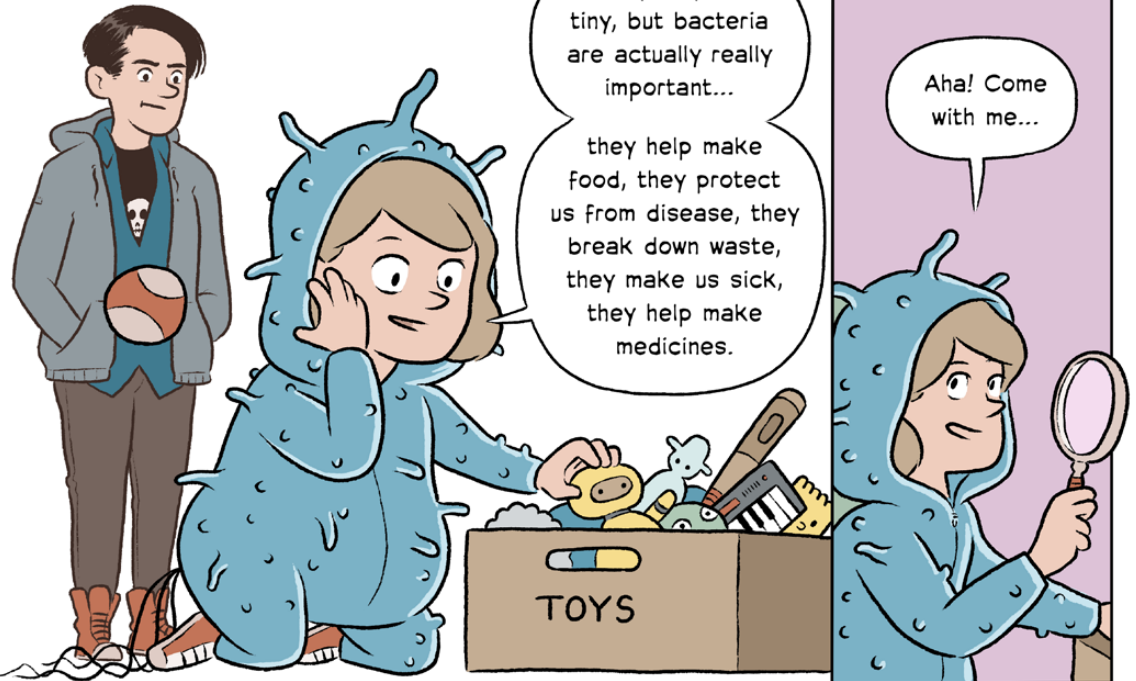
You obviously *don't* get it.



They may be tiny, but bacteria are actually really important...

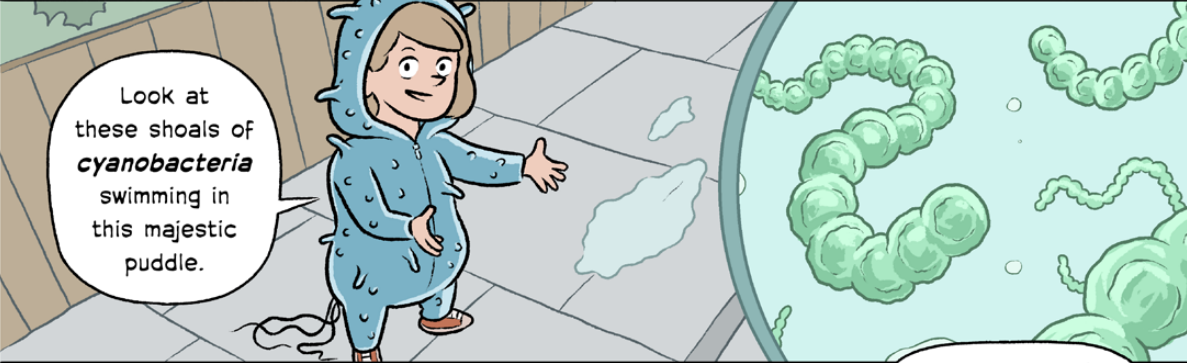
they help make food, they protect us from disease, they break down waste, they make us sick, they help make medicines.

Aha! Come with me...

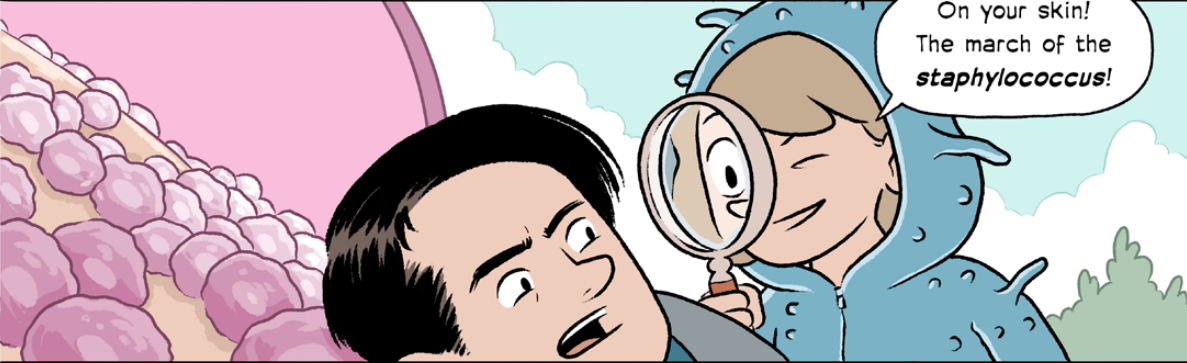




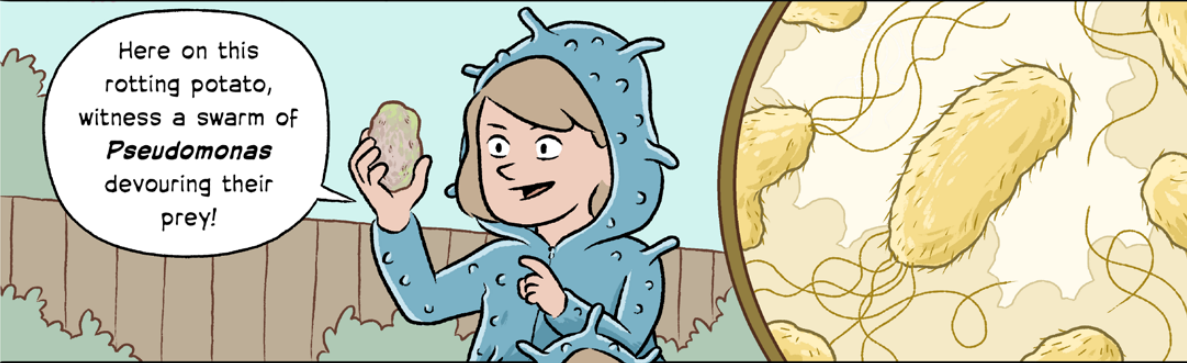
Here amongst the plant roots. The Hidden Kingdom of *Rhizobia*!



Look at these shoals of *cyanobacteria* swimming in this majestic puddle.



On your skin! The march of the *staphylococcus*!

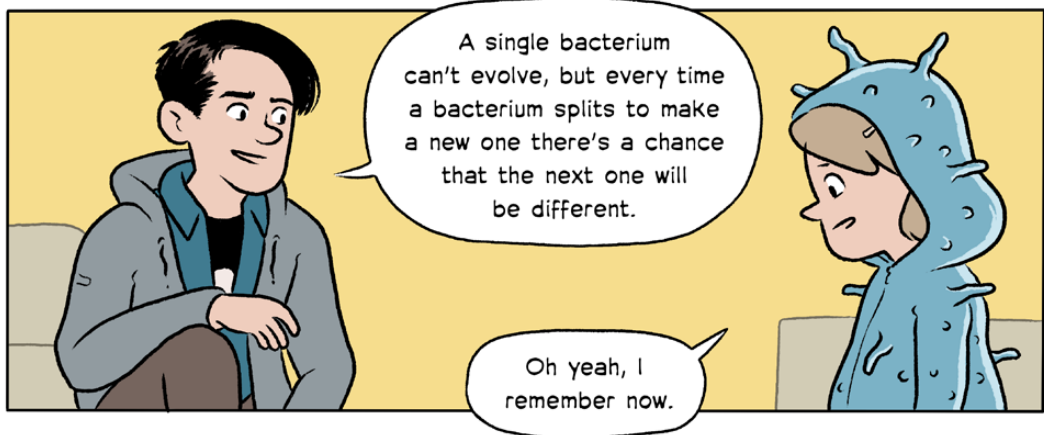
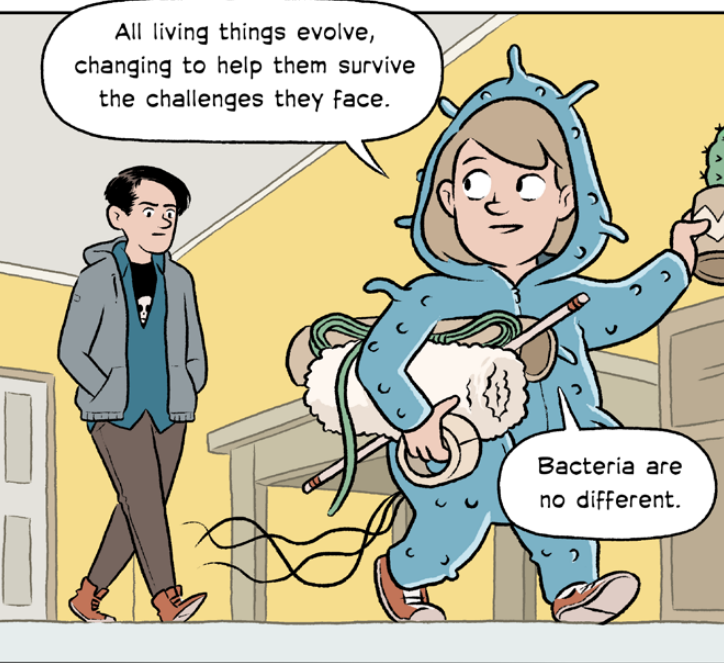
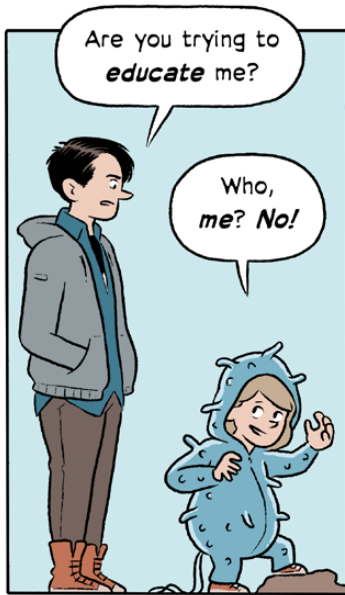


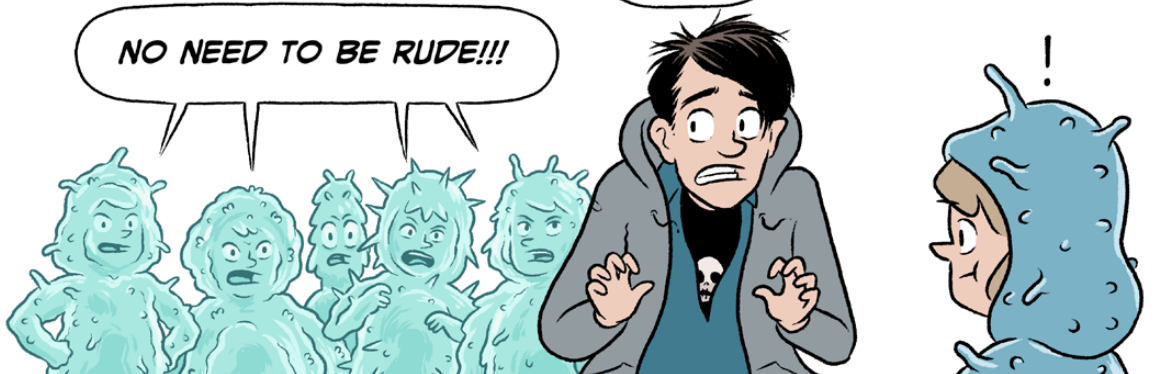
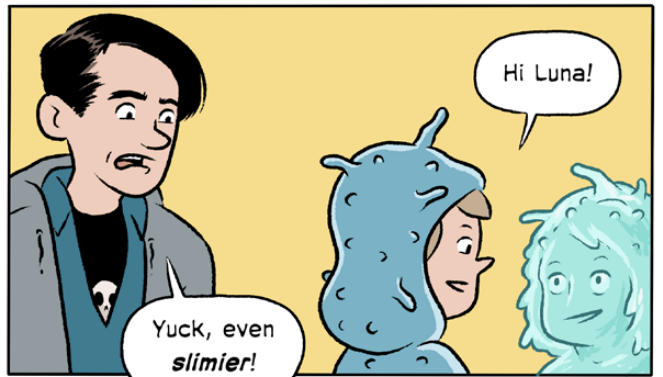
Here on this rotting potato, witness a swarm of *Pseudomonas* devouring their prey!



Picture them! From the freezing upper reaches of the atmosphere to the bone-crushing depths of the ocean where steaming gases burst out of the Earth...

The bacteria are triumphant!

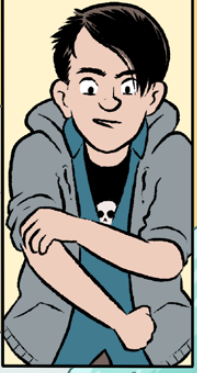




Luna! This is getting out of hand!

Oh no, so many Lunas! We've got to stop them, they'll trash the house!

Leave it to me.



I'll get these tiny ones. They're easy!



Argh! These slimy ones are too slippery to get a hold of!



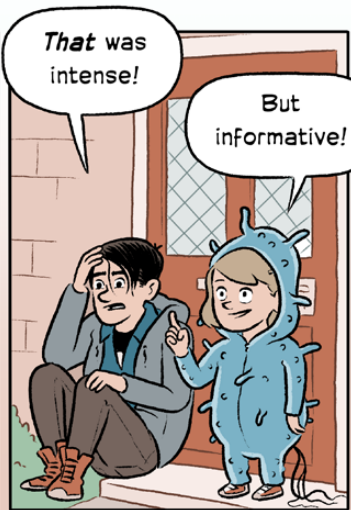
Oh no! The slimy ones! They're taking over!



Let's get out of here!

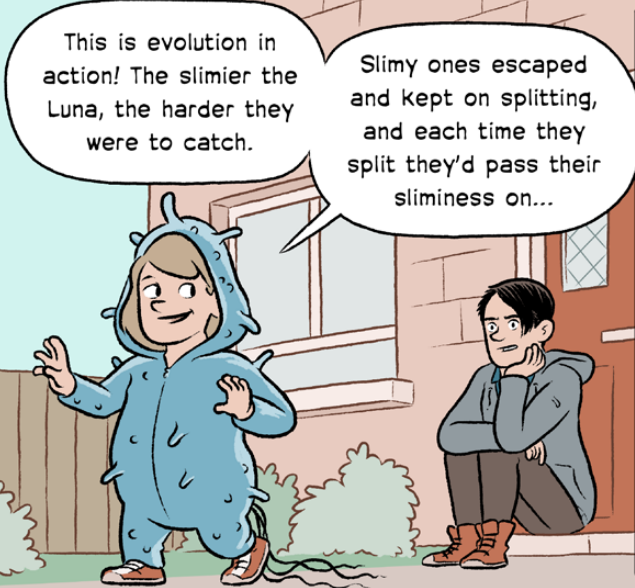


SLAM!



That was intense!

But informative!



This is evolution in action! The slimier the Luna, the harder they were to catch.

Slimy ones escaped and kept on splitting, and each time they split they'd pass their sliminess on...

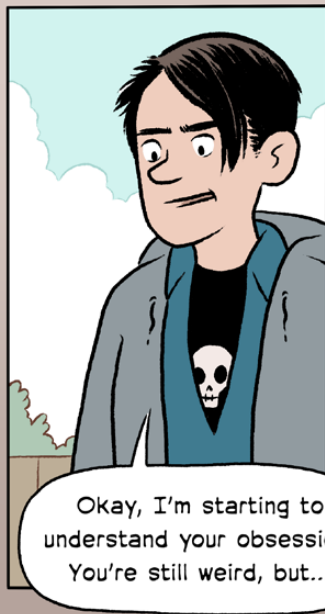


And that's how we ended up trashing the living room?

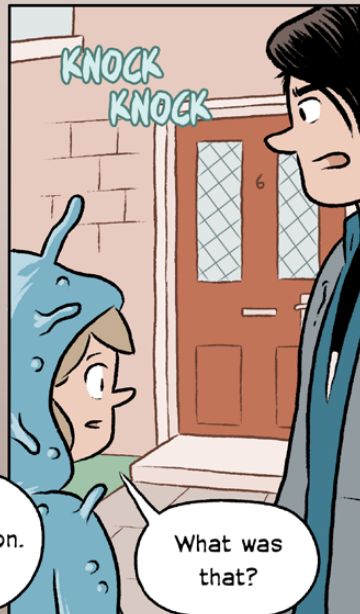
Er... yes.



All life evolves. But because a bacterium can end up with eight great-granddaughters in just an hour, and 16 million new relatives overnight, they can evolve much faster than bigger things.

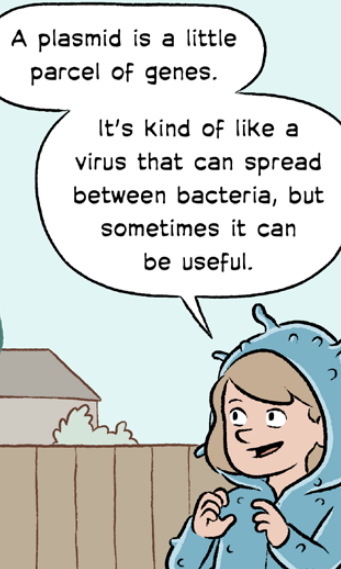
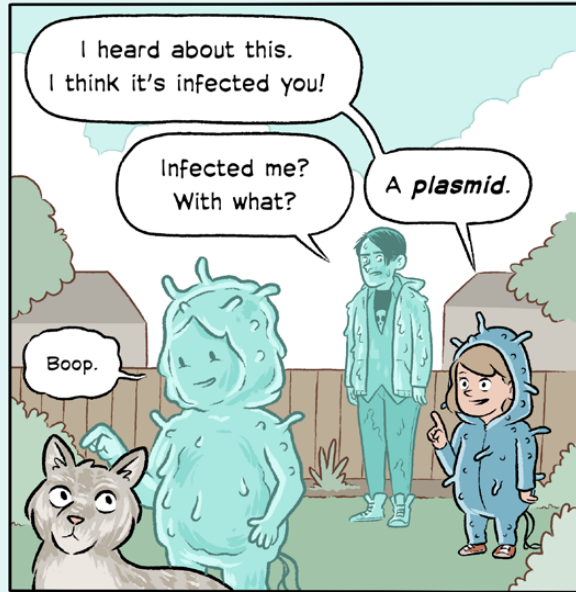
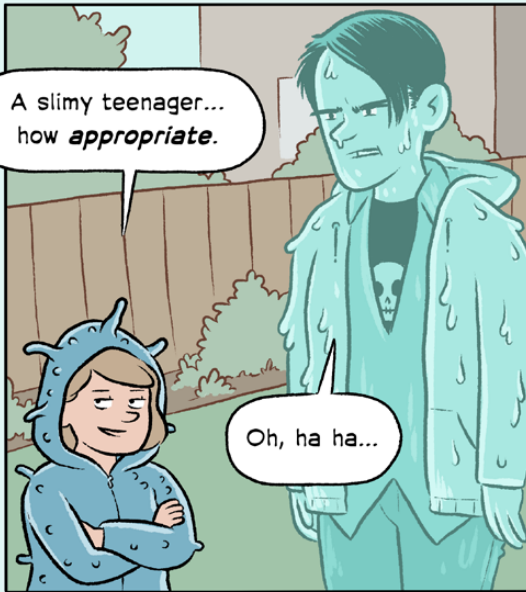


Okay, I'm starting to understand your obsession. You're still weird, but...



KNOCK KNOCK

What was that?



You're walking along, minding your own business, when **bam!** You bump into someone and a tiny packet of genes passes into your body, changing you, maybe forever.

It could be something **great**, like Kevin's killer guitar skills...

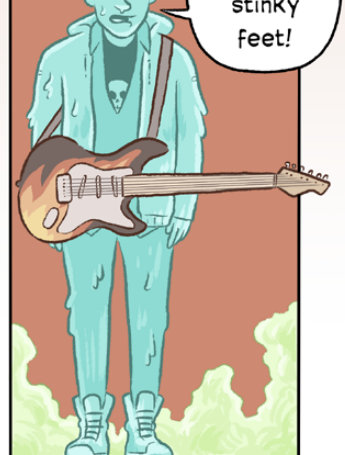
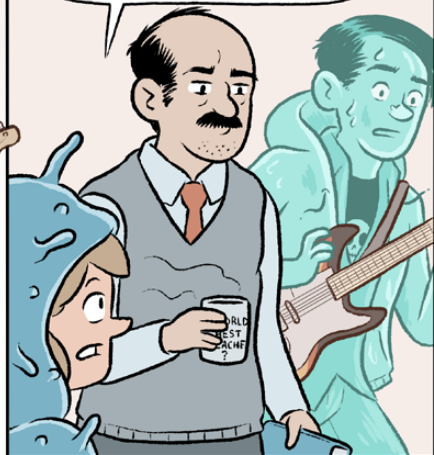
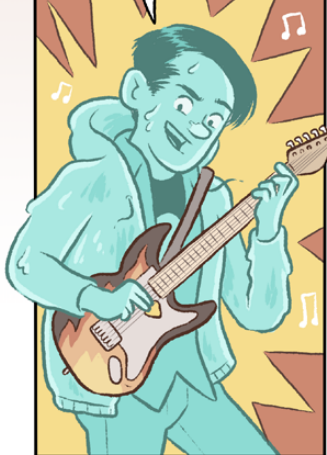


Hey, watch it!

Woah! **Awesome!**

Or it could be something useless... bad even.

Awww. Mr Boswell's stinky feet!



So while humans get their genes from their parents, bacteria can also get genes from their neighbours. Even if they're a different species!

Your experience with plasmids didn't really work out for you, huh?



I want to go home...



For bacteria, plasmids can be life changing. Because of plasmids, bacteria don't need to evolve gradually.

In one step, they can become resistant to disinfectants, eat different foods, or colonise new habitats.

Good for them, but not for us?

Well sometimes it might be helpful, but when bacteria suddenly become resistant to our medicines, it's a big problem.

Oh man, our parents are gonna *lose it!*

They must have kept evolving and dividing while we were gone!

What are we gonna *do*?!?

Wait.... I've got it!

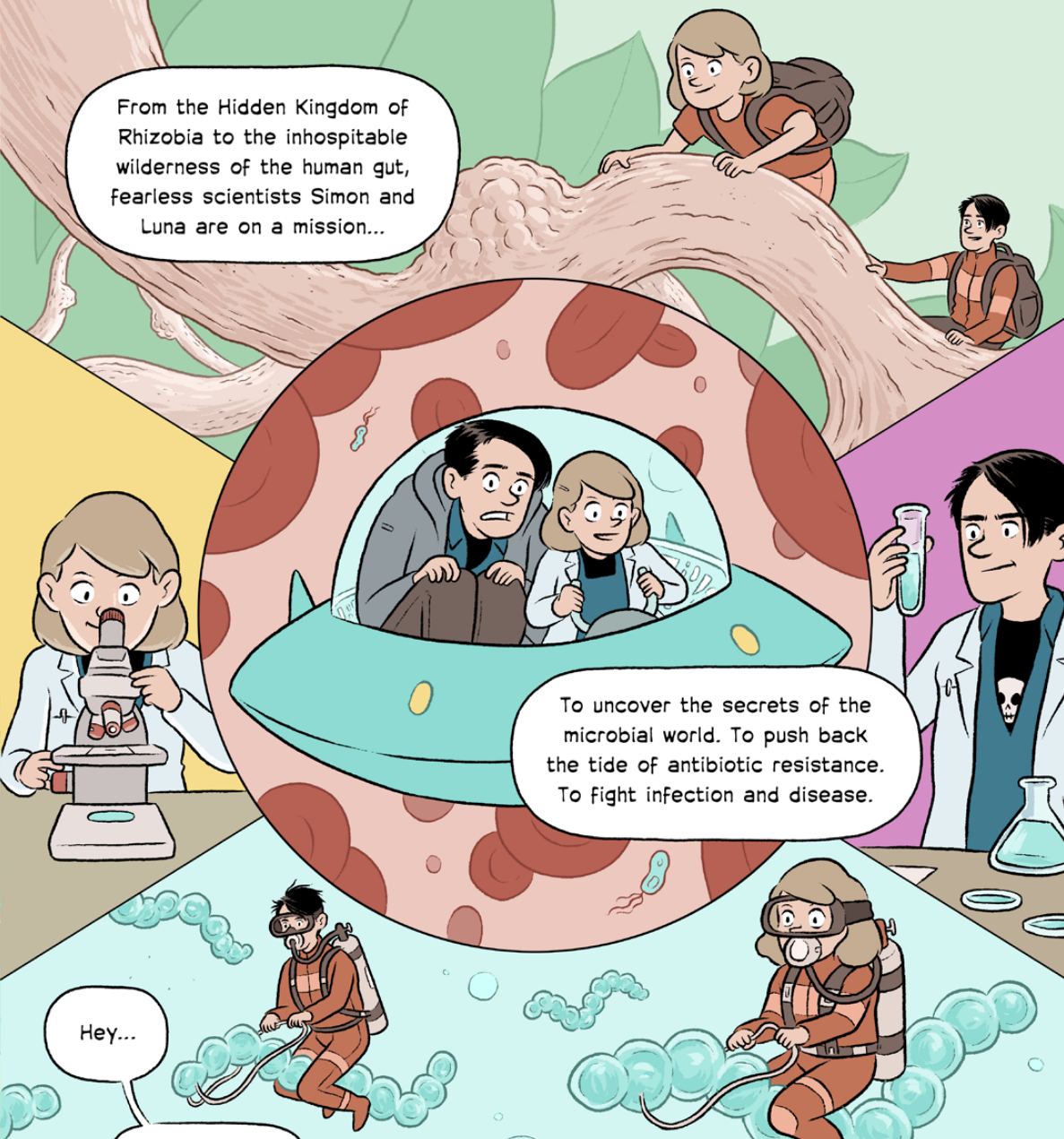
We need **SCIENCE!**

More science?!

Simon... You'd better believe it!

Let's get to work!

From the Hidden Kingdom of Rhizobia to the inhospitable wilderness of the human gut, fearless scientists Simon and Luna are on a mission...

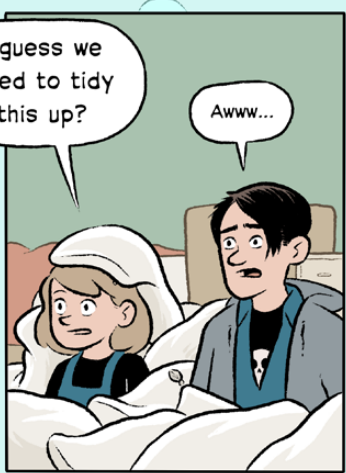


To uncover the secrets of the microbial world. To push back the tide of antibiotic resistance. To fight infection and disease.

Hey...



What are you kids up to?!



I guess we need to tidy this up?

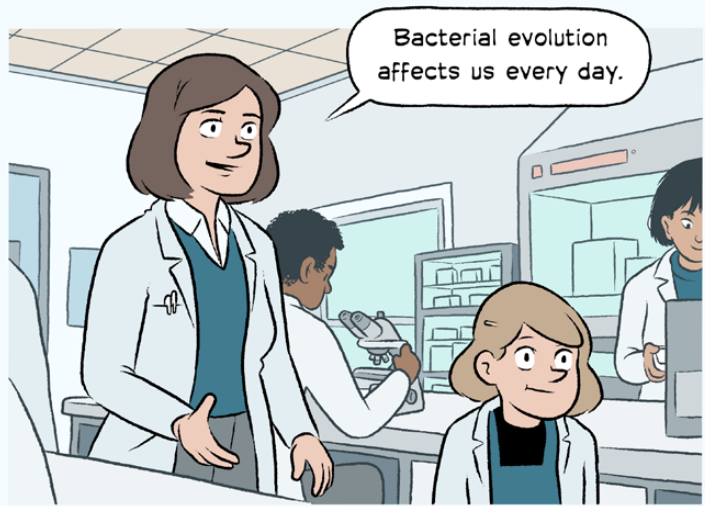
Awww...



You know Luna, That was strangely... fun!

Till next time darling brother.

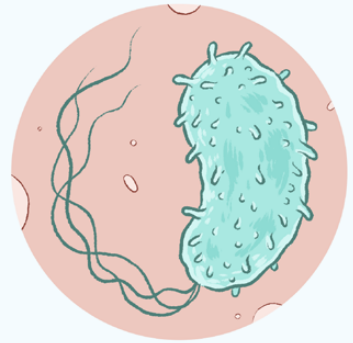
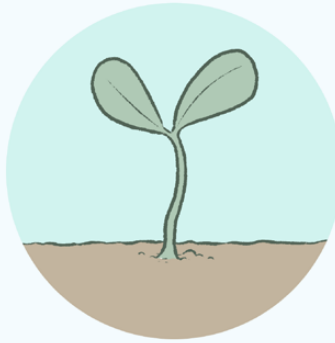
TALES FROM THE LAB!



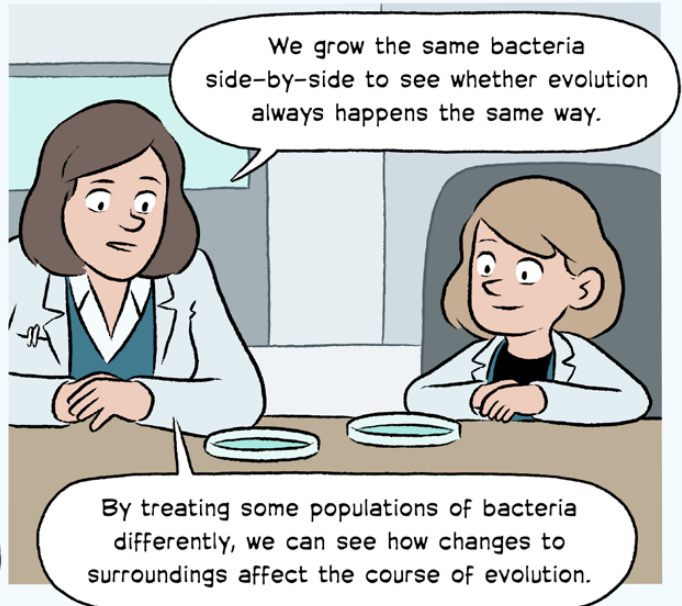
In hospitals, infections are more difficult to treat if they become resistant.

In soil, bacteria can evolve to help plants grow, and they can evolve to cause plant disease.

Bacterial evolution can help break down our waste, and we can harness it to generate new fuels.



But, to predict and control these bacteria, we need to understand them.



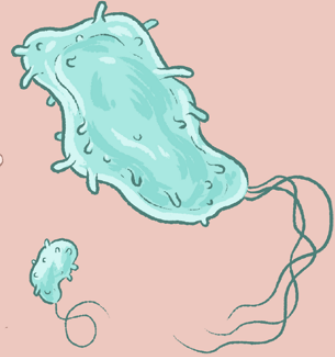
Lab experiments have shown bacteria evolving to eat new types of food, to escape predators, to cope with higher temperatures, and more!



We keep the original 'ancestor' strains in the freezer. A few weeks back in time can mean hundreds of generations for bacteria!

They're ready to be defrosted and revived so we can directly compare them with their evolved descendants.

We can also look at the genes of our lab evolved strains, revealing the mutations that make them different.

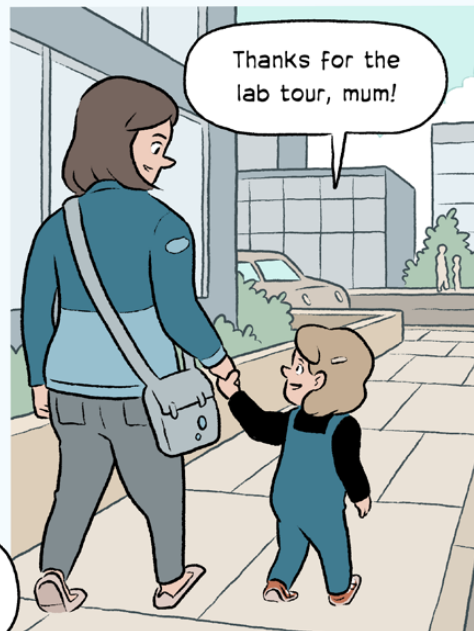
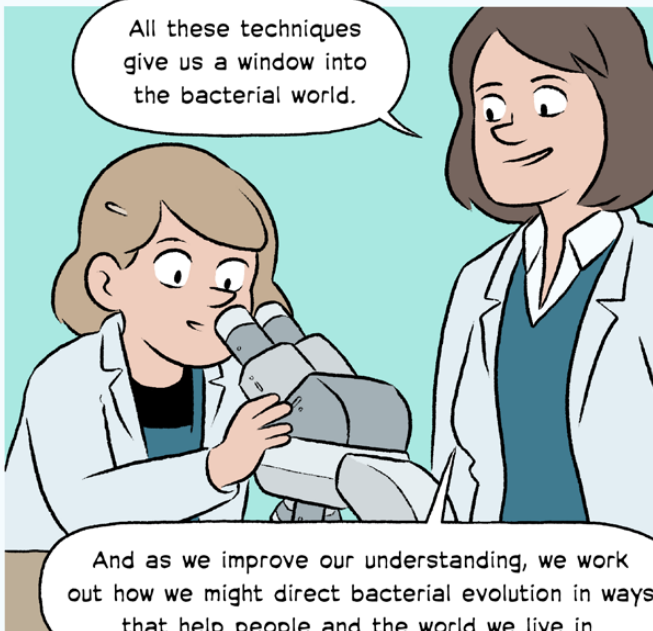


Got any ice cream in there?

All these techniques give us a window into the bacterial world.

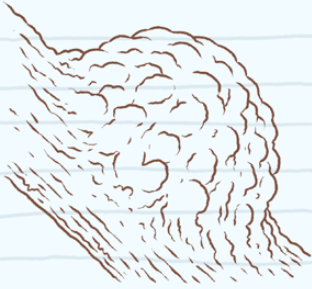
And as we improve our understanding, we work out how we might direct bacterial evolution in ways that help people and the world we live in.

Thanks for the lab tour, mum!



A Spotter's Guide to Bacteria

A note on size: bacterial cells can vary in size but are usually very small. For example, you can line up about 500 *E. coli* cells in 1 mm. You often need a microscope to see bacteria directly, but we can see the signs of microbial life all around us.



Rhizobium can live inside the roots of plants like clover and peas, forming 'nodules'. Inside the nodule, ***Rhizobium*** fixes nitrogen from the atmosphere to feed the plant. In turn the plant provides food that it made by photosynthesis.

Cyanobacteria are photosynthetic, getting their energy and food from sunlight, and producing oxygen in the process. ***Prochlorococcus*** are the most abundant cyanobacteria, producing about 20% of the oxygen we breathe.



Staphylococcus is commonly found on our skin or in our noses. Normally it causes no problem, but ***Staphylococcus aureus*** can cause a nasty infection if it gets past our body's defences.

Pseudomonas are common in soil and water. Some ***Pseudomonas*** cause disease in plants, animals, or humans, but others can protect plants from disease. Sometimes, the ability of ***Pseudomonas*** to infect or to protect can be transferred by plasmids.



soooooo many tails!
Sometimes they just have one :C

More information about microbiology can be found in books like 'A Field Guide to Bacteria' by Betsey Dexter Dyer, 'Life at the Edge of Sight' by Scott Chimileski and Roberto Kolter, and 'I Contain Multitudes' by Ed Yong.

*Join **Luna** and her sulky brother **Simon** as they explore the weird and wonderful world of **microbes**.*

Read about the diversity of bacterial life, and the strange ways in which microbes continue to evolve and change our world.



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