

# The Little Book of Bacteria

**Bacteria are so small you need a microscope to see them**

Some bacteria can reproduce every 20 minutes in the right conditions

A stylized illustration of a red bus with a white door, set against a solid red background. The bus is shown from a side-front perspective, facing right. It has multiple windows along its side and a large windshield at the front. The wheels are black with grey hubs. The overall style is simple and graphic.



1.5kg

Your gut contains 1.5kg of bacteria

**Bacteria in  
an there  
earth**

**0,000,000,  
0,000,000,  
00,000,000**

**Bacteria were on Earth long before dinosaurs**



# BACTERIA

## VERY IMPORTANT MICROORGANISMS

**MICROORGANISMS** are living creatures, so tiny you can't see them. It's a big word for something so small and so difficult to read!

**Say it like this: MY-CROW-ORG-A-NI-ZUM**

Microorganisms are everywhere: in the soil, in the air, in food and water and in our bodies.

There are lots of different microorganisms. They include

## BACTERIA, VIRUSES and FUNGI

Some can cause diseases and are often called germs. Some make food go off. Others are helpful and are used in food production, and to make antibiotics.

**This little book is about  
BACTERIA.**

Log onto the gallery on **Microbe World**  
**[www.microbeworld.org](http://www.microbeworld.org)** and look in the  
photo library to see colour pictures of different  
microorganisms.

## DID YOU KNOW?

It is said that there are five nonillion bacteria in the world.

(5,000,000,000,000,000,  
000,0,000,000,000,000,  
000, 000,000,000,000,  
000,000).

**Hi, I'm *Clostridium botulinum***

I am tough – and mean. If food isn't canned or bottled properly then I can cause food poisoning. I make nasty toxins which can make people very ill. But one toxin is also used in the beauty treatment often called Botox as it helps to relax the muscles.

## WORDFILE

Bacter**ium** = singular i.e. just one bacterium  
Bacteri**a** = plural i.e. two or more bacteria

Go to **www.cellsalive.com** and click on “cell cams”. Find the Bacteria Cam.

What happens to two bacteria in a few hours?

## BACTERIA FACTS

- Bacteria were the first living things to appear on Earth, about four billion years ago. Long before dinosaurs!
- Bacteria are found almost everywhere. They are in the frozen ice of the Antarctic, and in the boiling water around undersea volcanoes.
- Bacterium can split in two, to make new bacteria. In one night a single bacterium could produce one billion new bacteria.

## A Little look at microorganisms

# GOOD GUYS

## AND BAD GUYS

There are millions of different types of bacteria. Some look like sausages, some like footballs, others like strings of beads. They are so small you need a microscope to see them.

### Some types of bacteria are good.

- Good bacteria in food include the special types used to make **yoghurt** and **cheese**.
- Good bacteria in the soil make food that helps plants to grow.
- Good bacteria live on and inside the body. They're like '**pest control**' – they protect the body by helping it fight off harmful bacteria.

### BODY BACTERIA

To live, most bacteria need warm, damp places where there's lots to eat. So they especially like bodies!

Every single living human body has about **1,000,000,000,000,000** bacteria living on and inside it. They live between toes, in mouths and up noses, and under fingernails (do you bite your fingernails? **Eewww!**)

But most body bacteria live deep inside the digestive system - or gut - a long tube which runs all the way from the mouth (food in!) to the bottom (waste out!). Our good gut bacteria help digest our food, keep the gut working properly and are part of the body's defences.

### Some places where good bacteria live in the body

#### How they help

**Skin** - Keep down bad bacteria that can cause skin diseases



**Mouth** - Good bacteria work against the bad bacteria that cause smelly breath and tooth decay

**Gut** - Our good gut bacteria generally keep things healthy and make life difficult for the bad bacteria.

Hi, I'm **Streptococcus pyogenes**

I can cause tonsillitis by growing in your tonsils and making them swollen and red. I also give you a high temperature, headache and sickness – but antibiotics should get rid of me.



**Streptococcus pyogenes**

### Some types of bacteria are bad.

Bad bacteria can cause diseases in people, animals, trees and plants. These diseases can sometimes spread to others.

If you cut yourself and don't clean it properly, bad bacteria can get in and cause an infection. The cut will become hot and sore, and there may be yellow gooey liquid (pus) inside.

Bad bacteria in food can cause food poisoning.

**GOOD GUYS**



Go **Lactobacillus!**

Just stop it!

**NOOOOOOO!**

**BAD GUYS**



**Come on Strep!**

### DID YOU KNOW?

- Scientists have invented a lollipop that's good for teeth!
- The orange-flavoured, sugar-free lollipop contains a natural ingredient that kills the bad bacteria that cause tooth decay.





# BACTERIA

## AND FOOD

Some good bacteria are put into food on purpose. The bacteria change it to make different, **tasty** food.

Yoghurt is made by mixing certain **special bacteria** with milk. The bacteria turn the milk's natural sugars into acid and make the milk go thick. The acid gives it that sour taste.

Other foods made using bacteria are **cheese, salami, pickles and vinegar**.

Bad bacteria can also get into food, and that's **bad news**. They can cause food to spoil (go off) and some can even cause food poisoning.

**Food poisoning** means tummy pain, and sometimes sickness and diarrhoea.

**Hi, I'm Lactobacillus**

My name means 'milk' and 'rod' – the rod describes my shape and milk as I like growing there. I am used to make lots of fermented foods such as pickles, yoghurt and Swiss cheese.

I am also found in your small and large intestine.

Special strains of lactobacilli are probiotics. When consumed in probiotic drinks or foods, these bacteria can survive in the gut and top up the good bacteria in the intestines, which helps keep the harmful bacteria in check. You can find one type of me in the probiotic drink Yakult.



### BE FOOD SAFE!

- Wash your hands and tie long hair back before preparing food
- Make sure everything that touches your food is really clean
- Keep fresh foods in the fridge
- Don't eat food after the "USE BEFORE" date

### DID YOU KNOW?

- Every year two million people in the UK get food poisoning - That's a lot of sore tummies!



### SEE FOR YOURSELF

Look at labels of food in your fridge at home. Check "**USE BY**" or "**USE BEFORE**" dates. If the date has already passed, bad bacteria might be starting to grow there. Learn more at [www.eatwell.gov.uk/asksam](http://www.eatwell.gov.uk/asksam)

Sometimes food that has bad bacteria in it looks bad, or smells bad. But often you don't know it's unsafe until it makes someone **sick** after eating it.



Make yoghurt at home from ordinary milk and plain (unflavoured) yoghurt.  
Check out [www.microbiologyonline.org.uk](http://www.microbiologyonline.org.uk)

Go to <http://pubs.caes.uga.edu/caespubs/pubed/B693.htm> and see pictures of colonies grown from bacteria found on fingers, hair, an apron and even a cockroach!

LOOK IT UP

# BACTERIA

## AND MEDICINES

Some bad bacteria cause **illness** by producing poisons, known as toxins. Some toxins are nastier than others.

Some antibiotics stop the bacteria growing, by messing them up inside. Others make holes in the bacteria's cell walls, or "skin", so they **explode!**

The first antibiotic that was used successfully was called penicillin and it comes from a type of **mould** (a type of fungus).

Another antibiotic, called streptomycin, is made by bacteria that live in soil. It was the first drug to **cure the killer disease** tuberculosis.

Unfortunately, if antibiotics are used a lot, the bacteria can get used to them so the medicine doesn't work any more.

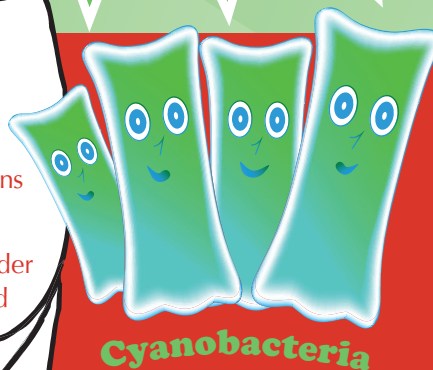
What's more, when antibiotics are taken to **kill bad bacteria** in the body, they also kill some of the friendly gut bacteria, and that's not good either!

But if your doctor doesn't give you antibiotics for a **cough or a cold** don't be surprised. These illnesses are caused by viruses not by bacteria, so the antibiotics won't work!



### We are cyanobacteria!

Cyano means blue in Greek and we have this name as we can be blue in colour but also green, red or brown! We use the sun to grow through photosynthesis and like plants contain chlorophyll.



Cyanobacteria

## DID YOU KNOW?

- Check out the online games section on [www.buginvestigators.co.uk](http://www.buginvestigators.co.uk) to learn what happens to your body bugs when you take antibiotics.
- Pencillin was discovered in 1928 by Sir Alexander Fleming. But it was a complete accident. Mould contaminated his Petri dishes and he noticed the mould stopped the bad bacteria growing.

# BACTERIA

## AND THE ENVIRONMENT

### Bacteria work in the soil

Good bacteria and fungi found in the soil are known as **decomposers**. It means they break down dead plants and animals and **recycle** them into **plant food**. This makes soil better for plants and trees to grow in.

One family of bacteria lives in the roots of living plants and trees. They make special lumps – called **nodules** – on the roots. These nodules take nitrogen gas from the air and convert it to compounds that help plants grow.

### SEE FOR YOURSELF

**Make your own compost!** Collect dead leaves and keep them piled up in a corner of the garden for a few months. Over time bacteria and fungi make the leaves soggy and they break up into a mush that's full of nutrients that are good for plants.

[www.bbc.co.uk/gardening/gardening\\_with\\_children](http://www.bbc.co.uk/gardening/gardening_with_children)

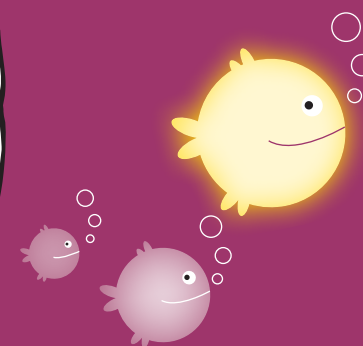
### Bacteria changed our world

Billions of years ago, there was no oxygen on Earth. Then the first life forms appeared: **bacteria**. Some of these, called **cyanobacteria**, used the sun's energy to grow through a process called **photosynthesis**, and produced a lot of oxygen. This eventually changed the atmosphere of the Earth to the one we are able to breathe today. The presence of oxygen in the atmosphere made it possible for more complex living organisms to evolve – such as **humans**.

While **cyanobacteria** are still important today, sometimes they can be a problem in hot weather, when they grow too much in lakes and make the water poisonous.

## DID YOU KNOW?

- A teaspoon of soil contains more than **100 million** live bacteria. If you could weigh the bacteria in an acre of farmland it would be as heavy as **two cows!**
- Some fish have a light organ powered by **luminous bacteria**. This helps them see each other in the underwater darkness of the sea. **Spooky!**



# BACTERIA

## IN THE GUT

The **digestive system**, or **gut**, is one long tube that starts at the mouth and ends at the bottom. It has lots of twists and turns in between.

A few very hardy bacteria actually live in the stomach. This is amazing because the stomach contains **acid** so strong it could dissolve a razor blade! (**Acid? Sounds horrible**, but it's used to break food down into mush so it can be digested properly.)

But most of the good bacteria in bodies live in the **intestines**, especially the **large intestine**.

### WHAT GOOD BACTERIA IN THE INTESTINES DO

- Break down leftover food bits
- Help keep the gut healthy
- Keep harmful bacteria from taking over
- Make vitamin K, which helps with repairs after injury
- You can even eat good bacteria. Next time you're in the supermarket look for the word "**probiotic**" on foods such as yoghurt drinks. **Probiotic drinks** contain living friendly bacteria that are able to live and grow in the gut, giving extra help to the body's own good bacteria.



### DID YOU KNOW?

- If a person's gut could be stretched out straight it would be about **nine metres long, as long as a bus!**
- Down in everyone's gut are lots of different types of bacteria - **some good, some bad. A healthy balance is important.**
- If the gut gets irritated by too-spicy food it will try and get rid of it - **fast**. Just like when it's infected by bad bacteria. The spicy food shoots through our gut and the result is diarrhoea.

### THE GUT

**Small intestine**

**Stomach**

**Large intestine**

**Hi, I'm Bifidobacterium**

I can be recognised quite easily as I often have a distinct 'Y' shape. Breast fed babies have lots of us in their gut. We like breast milk as it helps us to grow more. This is good because we help protect babies from illness.

*Bifidobacterium*

Check out the diagram on [www.guthealth.org.uk](http://www.guthealth.org.uk) and look at The Gut to see the different parts of the digestive system.

Use your mouse to click on the words "small intestine" and "large intestine" to see where the good bacteria live

**Look it up**

### DID YOU KNOW?

For a healthy gut it's important to:

- **Eat lots of fruit and vegetables** – aim to eat some five times a day.
- **Drink lots. Water is best** – between six and eight glasses a day.
- **Be active – walk, run, cycle** – for at least an hour every day. Scientists say this is what all 11-year-olds need to stay healthy, yet fewer than one in twenty British children manage it!



# QUIZ

Choose the correct answers

## 1. How do bacteria reproduce (make new bacteria)?

- a. they have little baby bacteria
- b. they split in two
- c. they find them in fish

## 2. What do you need to see bacteria?

- a. a telescope
- b. a microscope
- c. a dictionary

## 3. Bacteria especially like to live in places that are...?

- a. warm and damp
- b. dry and dusty
- c. noisy

## 4. The "USE BY" or "USE BEFORE" date on food means...?

- a. Safe to eat before this date if stored properly
- b. Safe to eat after this date
- c. Safe for guinea pigs to eat

## 5. What are antibiotics?

- a. Vitamins
- b. Poisons
- c. Medicines that kill bacteria

**Give yourself ten points for every correct answer:**

**50**

Congratulations you are a 'bacterial' expert!

**30-40**

You are well on your way to becoming a whizz-kid on bacteria.

**20-30**

There are still some facts you need to get to grips with.

**Under 20.**

Oh dear. Have another read of this booklet and try again!

(Answers) 1b 2b 3a 4a 5c

# CONTACTS

**[www.yakult.co.uk](http://www.yakult.co.uk)** - Information about Yakult probiotic drinks

**[www.loveyourgut.com](http://www.loveyourgut.com)** - Information from Yakult on how to have a healthy gut

**[www.e-bug.eu/](http://www.e-bug.eu/)** - A pan-European resource for kids of primary and secondary age to learn about microorganisms

**[www.buginvestigators.co.uk](http://www.buginvestigators.co.uk)** - Games and activities to learn about good and bad bugs, for kids in years 5, 6 and 7

**[www.cellsalive.com](http://www.cellsalive.com)** - More detailed information about microorganisms, with some great pictures

**[www.bbc.co.uk/schools/ks2bitesize](http://www.bbc.co.uk/schools/ks2bitesize)** - Try the quizzes and fun activities on the BBC Schools Science website

**[www.microbeworld.org](http://www.microbeworld.org)** - the American Society for Microbiology site about microbes of all kinds with great pictures and video clips

**<http://archive.food.gov.uk/hea/index2.html>** - Learn about handling food safely and do quizzes

**[www.corecharity.org.uk](http://www.corecharity.org.uk)** - CORE is a charity giving advice on gut and liver disease

**[www.theguttrust.org](http://www.theguttrust.org)** - The Gut Trust is a charity providing advice on irritable bowel syndrome

**[www.microbiologyonline.org.uk/faq](http://www.microbiologyonline.org.uk/faq)** - microbe facts and information from The Society for General Microbiology

Up Close Micro Bugs. Harrison. Franklin Watts 2007

The Best Book of Bugs. Llewellyn. Kingfisher 2005

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