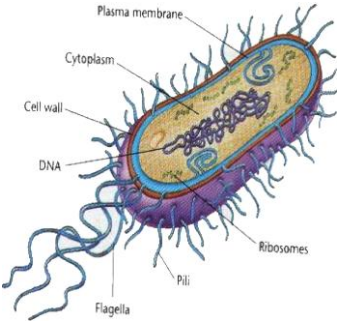
Make your own bacteria!

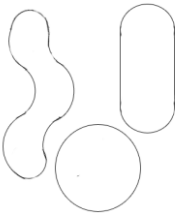


Bacteria: a single-celled microorganism with no membrane-bound nucleus.

Bacteria are found everywhere from soil to acidic hot springs.

You can make your own bacteria to take home and love using our pointers below.

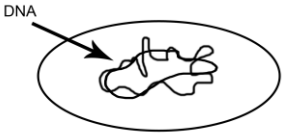
1. Cut two pieces of felt to your desired bacteria shape



Bacteria tend to come in 3 main shapes:

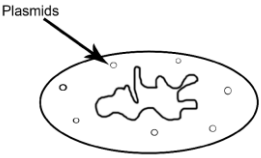
Round like staphylococcus
Rod-shaped like salmonella
Spiral shaped like *Treponema pallidum* (the bacteria which causes syphilis)

2. Fill it up with DNA…



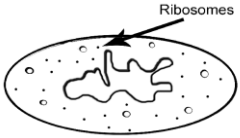
Bacteria are prokaryotes which means they don't have a membrane-bound nucleus. A bacteria's DNA usually takes the form of a single circular chromosome located in an irregular body called the nucleoid.

Bacteria may also have plasmids – smaller circles of DNA - which are distributed in the cell separately from the main chromosome and contain genes, not essential for survival (for example antibacterial resistance)



Use thread or felt to give your bacteria

3. …and ribosomes

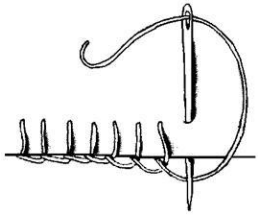


Ribosomes are microscopic "factories" found in all cells, including bacteria. They translate the genetic code contained in DNA, into amino acids—the building blocks of proteins.

Glue, sew or draw some ribosomes onto your bacteria.

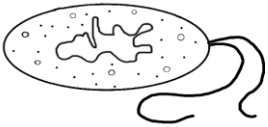
4. Sew together and stuff

Most bacteria has a rigid cell wall and a thin cell membrane which surrounds the fluid, or cytoplasm, inside the cell. Bacteria are often classified according to how their cell wall reacts to a technique called Gram staining. Gram positive bacteria stain violet due to the presence of a thick layer of peptidoglycan in their cell walls. Gram negative bacteria do not stain violet as their thinner peptidoglycan walls do not retain the crystal violet stain.



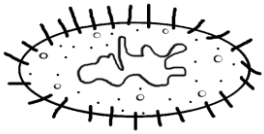
Stuff your bacteria with shredded paper and sew or glue the pieces together (with purple thread or otherwise depending on whether your bacteria is gram negative or positive)

5. Add some hair (or a tail)



Some bacteria have flagella (tail-like projections) to help them move.

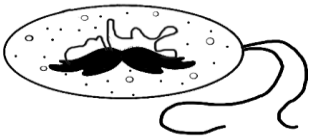
Others have hair-like structures called fimbriae, which they use stick to surfaces such as human body cells, or pili, which are used to connect two bacterial cells to one another.



Use wool to give your bacteria flagella, fimbriae or pili.

6. Anything else?

Bacteria are rather simple organisms with fairly few intracellular structures. But in the spirit of creativity you don't need to stop there. What else will your bacteria have?



Voila! You're done!

Microbe quiz!

Microbes – bacteria, along with viruses, fungi, protozoa, algae and archaea – affect every aspect of life on Earth. But how much do you know about these tiny life forms?

1. Bacteria and viruses are often confused, despite differing in a number of ways. Bacteria are complex compared with viruses – the latter comprise of only a protein coat covering a core of genetic material (either DNA or RNA).

What was responsible for each of the following – bacteria or viruses?

a) The deadly disease in the 1995 film 'Outbreak'
b) The common cold
c) The plague epidemic which took place in Britain between 1347 and 1351 – otherwise known as the Black Death

Answer:

a) Virus – it was caused by a fictional Ebola-like virus called the Motaba virus
b) Virus – caused by a rhinovirus
c) Bacteria - caused by the bacterium *Yersinia pestis* (the generally accepted causative organism of Black Death was Yersinia pestis. However there is still some debate over this as many believe it was a viral 'bleeding' (haemorrhagic) fever)

2. Bacteria are all around us – there are approximately 5 nonillion on the Earth. How many is this?

$5x10^{30}$ (or 5, 000, 000, 000, 000, 000, 000, 000, 000, 000, 000)

$5x10^{60}$ (or the number above with twice as many zeroes')

$5x10^{100}$ (or 5 followed by 100 zeros – far too many to write on this paper)

Answer : $5x10^{30}$

3. Cyanobacteria, also known as blue-green algae, are some of the oldest living organisms on Earth. Scientists have found fossils containing these microbes which date back more than 3 billion years.

Early cyanobacteria played a key role in helping to make Earth suitable for us to live on. How did they do this?

Answer: Cyanobacteria are photosynthetic - they use the Sun's energy to generate sugars from carbon dioxide, releasing oxygen in the process. Scientists think cyanobacteria helped shape and change the young planet's environment, eventually creating atmospheric oxygen that enabled other, more complex life forms to develop.

4. The bacterium *Escherichia coli* has been getting a bad press recently thanks to the recent outbreak of German food poisoning, but only some strains of the bacterium cause disease. Non-harmful strains of *E. coli* live in your gut all the time, as part of the normal body flora.

There are 10 times more microbes in the average human's digestive system than there are cells in the entire body.

Is this statement true or false?

Answer: True. This is approximately 1kg of microbes.

5. Many of the foods we eat have been made with the help of bacteria. Which of the following food products does NOT use bacteria in its production?

a) Yoghurt
b) Sauerkraut
c) Beer
d) Salami

Answer: c) Beer.

Lactic acid bacteria are used in the fermentation of milk to produce many dairy products such as yoghurt and cheese and of vegetables to produce sauerkraut, as well as in fermented meat products such as salami. Beer, on the other hand, is produced with the help of yeast which is a fungus, not a bacterium (though there are exceptions to this rule - unusually Berliner Weisse uses lactic acid bacteria in its production)

6. Bacteria are useful for a whole number of different things. Which of the following have bacteria been used for?

- To decontaminate oil spillages by breaking down chemicals in petrol and other pollutants
- To remove dangerous radioactive metal from water
- To act as natural batteries by making electricity from waste metal

Answer: The bacterium *Geobacter metalireducens* has been used for all three!

7. Bacteria reproduce by binary fission. Each bacterium, or single cell, will divide in two, splitting into two identical daughter cells which contain the same DNA as their parent cell.

In favourable conditions, some bacteria like *E. coli* can divide every 20 minutes.

Starting with one *E. coli* cell, how many cells will there be after 2 hours?

a) 16
b) 64
c) 128

Answer: b) 64. After 3 hours the number of bacteria will have risen to 512. After 7 hours there will be 2,097,152!

8. What's so special about the bacterium *Deinococcus radiodurans*?

a) It glows in the dark.
b) It can withstand blasts of radiation 1,000 times greater than would kill a human being.
c) It is magnetotactic – it contains magnetic particles that allow the bacterium to navigate using the earth's geomagnetic field.

Answer: b) It can withstand blasts of radiation. *Deinococcus radiodurans* has a remarkable ability to repair major damage to its own DNA. Scientists have also found that it is as resistant to dehydration as it is to radiation.

9. We often think that microbes are harmful but in fact the majority of them do not cause disease.

What percentage of microbes DO cause disease?

a) 12%
b) 10%
c) less than 5%

Answer: c) less than 5%

10. Bacteria have evolved to live in a range of environments. Those that live in extreme conditions are known as extremophiles.

Where have living bacteria NOT yet been found?

a) On Mars
b) In oil reservoirs a mile underground
c) In hairspray

Answer: a) On Mars. In 1996 scientists found a Mars meteorite that contained fossils they believed to show bacterial life forms but this is still unproven. Bacteria have been found living in hot springs, gold mines, Antarctic ice, oil reservoirs and even in hairspray!

A little Science London disclaimer: Lots of the science on this sheet is GREATLY simplified. For more information on bacteria and other microbes have a read of the online magazine *Microbiology Today* from the Society for General Microbiology. Or for a more friendly introduction to the topic try www.microbiologyonline.org.uk.

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