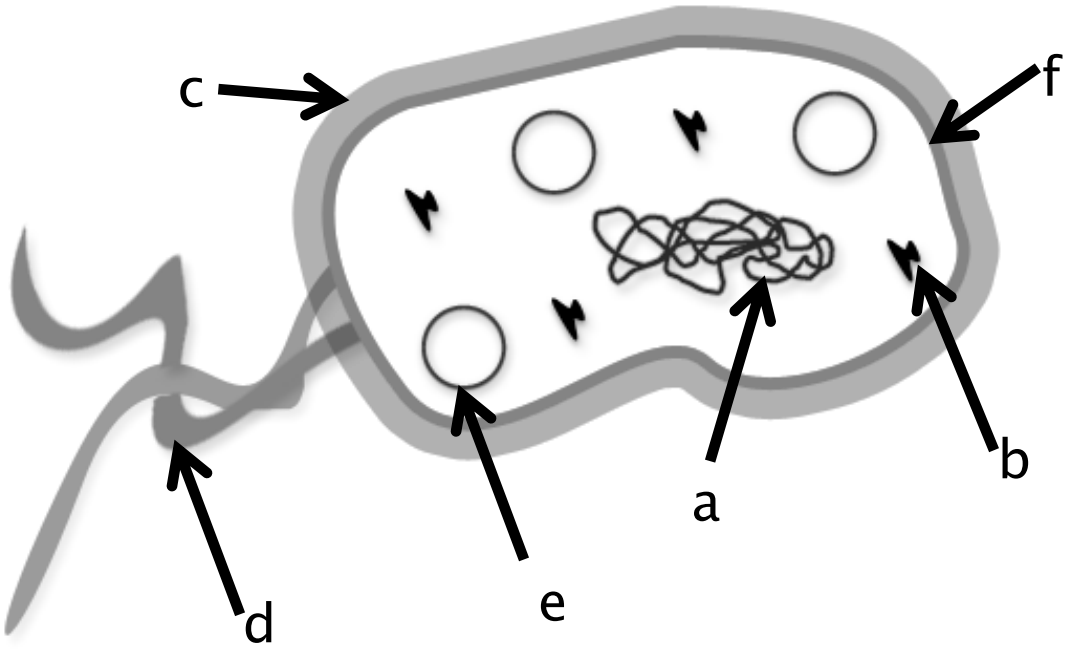
UNIVERSITY OF Southampton
School of Chemistry




Label the parts of the bacteria from these descriptions:

**Flagellum**
This is a long hair like structure that rotates to help the bacteria move

**DNA**
DNA in bacteria forms a closed loop that super coils in the cell to save space

**Ribosome**
A small organelle which is used for the manufacture of proteins

**Cell membrane**
A thin flexible 'sack' that contains the cell and regulates the movement of substances in and out of the cell

**Plasmid**
A small loop of DNA that can be transferred between bacteria

**Cell wall**
A thick rigid structure that surrounds and protects the cell

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Practical questions

Using the microscope focus on a single colony:
What is the magnification of the microscope?

How large would something 1cm long appear?

Approximately how large is a bacterial colony? How did you estimate this?

If a bacteria has an area of 1μm$^2$ long (1mm=1000μm) how many would be found in your colony size?
What assumptions did you make? (See the introduction to assumptions and the worked example if you are having trouble)

Take the plate with the bacteria on it and describe what it shows, be sure to note down colours.

Now place the plate in the UV box. What has changed?

Why do we use UV light?

What is doing the fluorescing?

A guide to assumptions and estimation

Assumptions make finding an answer simpler but the end result is less exact.

E.g. 10456x3988 can be simplified to 10000x4000 however the answer is less exact; 40000000 rather than 41498528 it is however in the right sort of area.

You essentially smooth over the details to get an answer which is in the right sort of area.

Estimation is a great skill to use alongside a calculator. After you have put all your numbers in does the answer look like it's in the right sort of area? Does it make sense?

Worked example

If a bacteria has an area of 1$\mu m^2$ (1mm=1000μm) how many would be found in the colony size 2mm?

Ok so lets say I estimated the colony to be a circle 2mm across. So the area of our colony is Pi X Radius$^2$ or Pi X Radius X Radius.

Radius = half diameter so we do the calculation Pi X 1 X 1= 3.142$mm^2$.

To find out the area of a bacteria in $mm^2$ we must divide its size in $\mu m^2$ by 1000 giving us 0.001$mm^2$.

To find out how many we have we must divide the area of our colony by the area of our bacterium 3.142/0.001 which gives us 3142 bacterium per colony.

What assumptions did you make?

The first assumption is that the bacterial colony is a perfect circle as it is made up of thousands of bacteria this is not the case but is close enough.

The second assumption is that the colony only has two dimensions. This is certainly not the case as bacterial colonies grow in three dimensions so many bacteria are piled on top of each other. It is not a very good assumption but will do for now.

We assumed that the bacteria perfectly fill the area this is a good assumption as bacteria are not rigid so fit very well together.

Does it look realistic? Well it's a large number but no way near large enough. Given the three dimensional nature of colonies it can be estimated that there are around 100 million bacteria per colony! However if you have shown your working and stated your assumptions there is nothing wrong with the result.