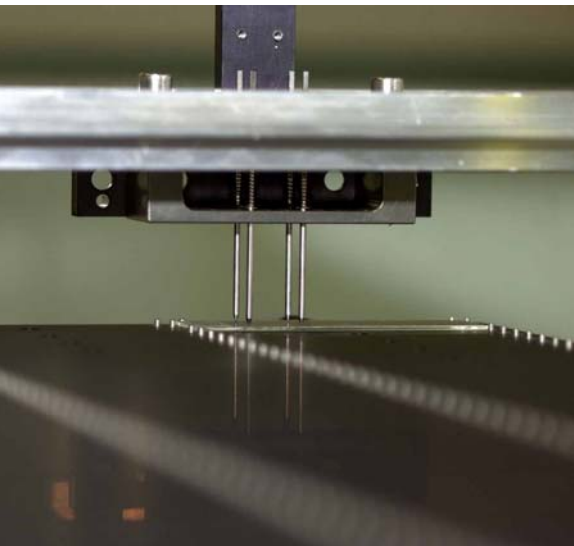
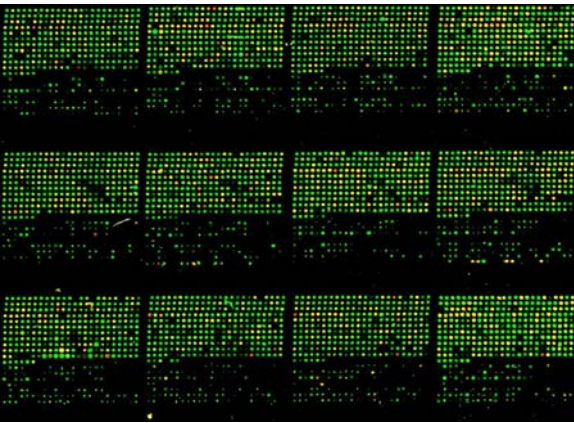


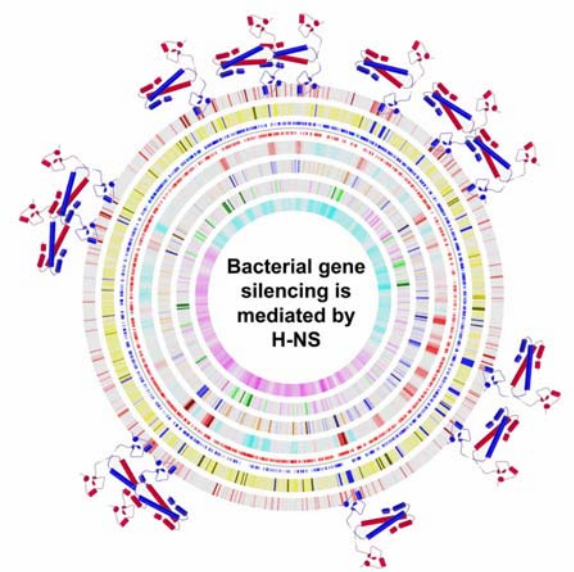
choosing ~ eating ~ living



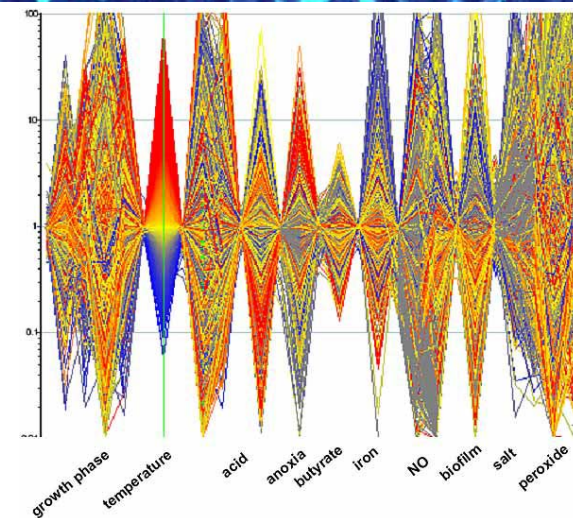
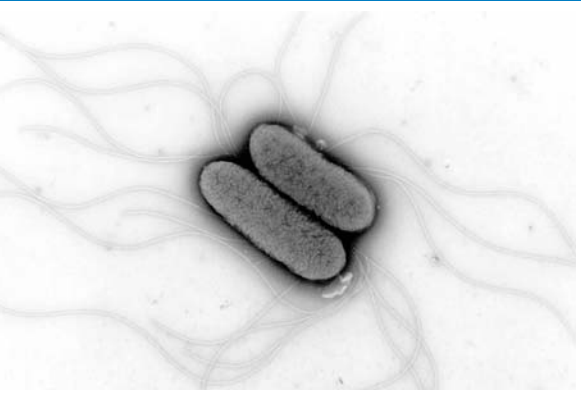
Transcriptomics

The information that tells living things how to survive is encoded in their genes. Each gene is made up of a specific sequence of DNA. This information is often called the book of life, but unlike many books it isn't read from cover to cover, instead different genes are read and used by cells in different situations. When a gene is being used a chemical copy, or transcript, of that gene is produced from RNA. So we can tell what is happening inside a cell by looking at what RNA is present. This is called transcriptomics.

We place a spot of each gene on a slide to make a microarray. The RNA from our sample bacteria sticks to the corresponding gene on the slide. By making the RNA fluoresce we can see which genes are active. Our robot can print 13000 spots on one slide allowing us to look at what all the genes in a bacterium are doing in one experiment. This means that we can understand how bacteria are surviving in their environment, causing disease or making food rot.



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Salmonella

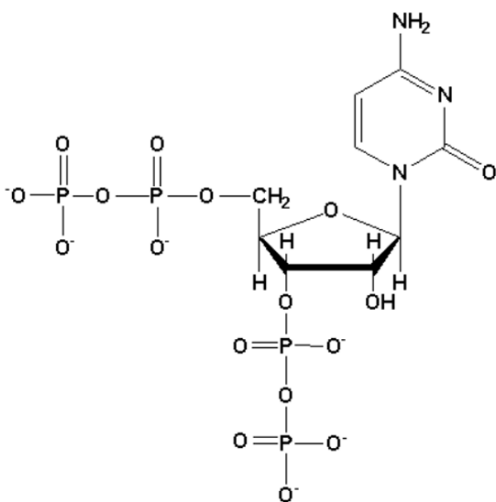
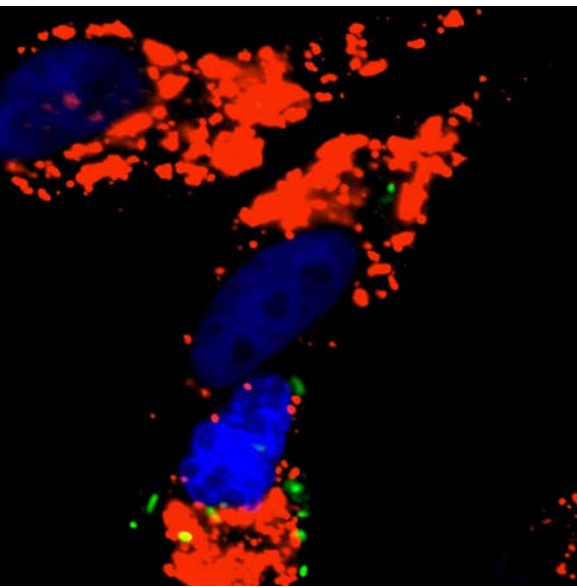
Salmonella is a major cause of food poisoning and kills about 100 people per year in the UK. We mainly get *Salmonella* from contaminated chicken and eggs. It is destroyed by proper cooking; most infections are due to inadequate cooking or cross-contamination of foods that are eaten raw (such as salad).

This clever bacterium makes us ill by invading the cells lining our gut or immune cells designed to kill it. It injects proteins into the gut cell that make it engulf the bacterium. Once inside, the bacterium alters the mechanisms the human cell normally uses to protect itself. In this way *Salmonella* can survive when other bacteria would die.

To successfully infect us, *Salmonella* must survive our gut's defences such as stomach acid, low amounts of iron and oxidative stress. We have used DNA microarrays to define which genes *Salmonella* uses in response to environmental stresses. We call this collection of gene expression profiles EnviCom.

IFR holds data from many thousands of microarray hybridizations. The need to organise, store and interrogate these data is vital if we are to maximize their value. Using a database to highlight similar, or opposing, patterns of gene expression, we can discover how the cell switches on groups of genes under different conditions. This has helped us define interactions between infection-relevant regulatory networks.

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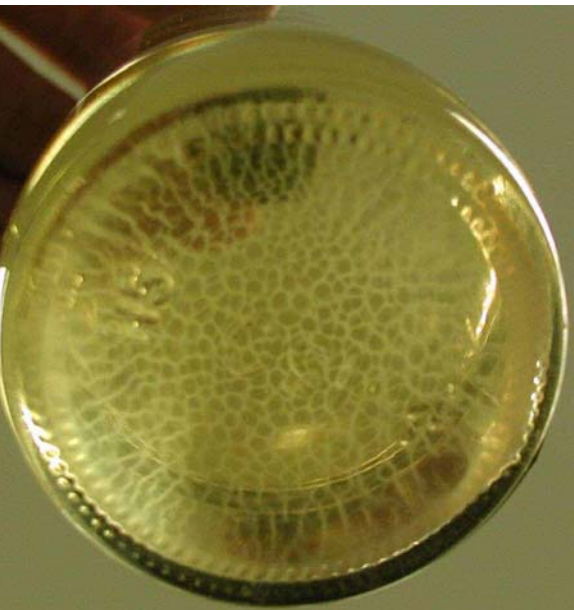
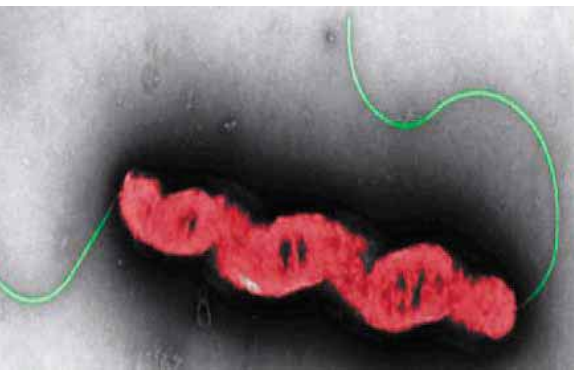
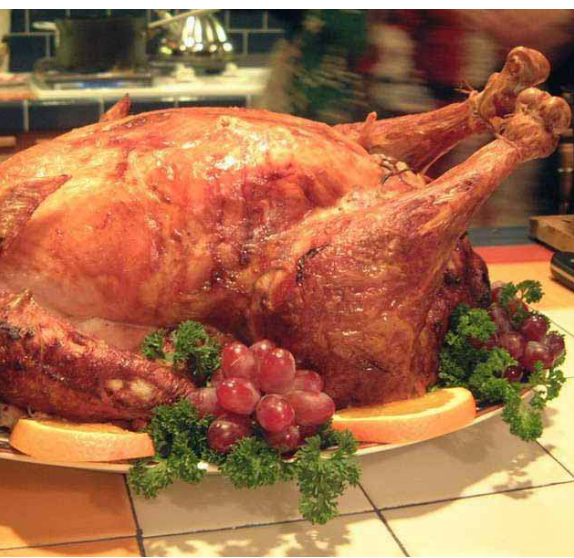


Salmonella uses particular genes which encode the proteins that it needs to invade our bodies. As making these proteins requires lots of energy, the bacteria ensure that they are only made at the right time – when the bacteria are in your gut. Many different things control when these infection proteins are made. One of them is a molecule called ppGpp.

We know that ppGpp is needed to control the genes that cause infection as *Salmonella* lacking this molecule are no longer able to infect cells. The bacteria lacking ppGpp could become a new vaccine against *Salmonella*.

We removed the ppGpp from the *Salmonella* by deleting the genes that are needed to make it. Deleting genes and testing the resulting *Salmonella* strain is a good way to confirm that those genes are required for infection. We plan to make 4700 different strains of *Salmonella* each with a different gene deleted. This will generate a good resource for the future which will allow research to progress more quickly.

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Campylobacter

If you have ever cooked a chicken or turkey, you know that you should always check to make sure it's cooked properly; but have you ever wondered what would happen if you ate under-cooked chicken? Most likely, you would be poorly, and the most common cause of food poisoning is the bacterium *Campylobacter*.

Campylobacter lives naturally inside the guts of chickens and turkeys. Inside birds, the bug is harmless, but inside us, it can cause diarrhoea and in some rare cases, it can cause more serious damage to the nervous system (Miller-Fisher and Guillain-Barré syndrome).

At IFR, we are interested in the mechanisms *Campylobacter* uses to survive in the environment (i.e. in broiler houses) and in us. The genome of *Campylobacter* contains small regions where a single base of the genetic code is repeated up to 12 times. This can result in genes being switched on or off which may help the bacteria to evade the immune system.

In the laboratory, we typically grow bacteria in swirling nutritious media, but in nature, bacteria are usually found attached to surfaces surrounded by a sort of bacterial 'glue' making them more resistant to being killed. These structures are called biofilms, and we are exploring this mode of growth in *Campylobacter*. By understanding the biology behind biofilm growth, we can devise new technologies to reduce the natural reservoir of this dangerous pathogen.