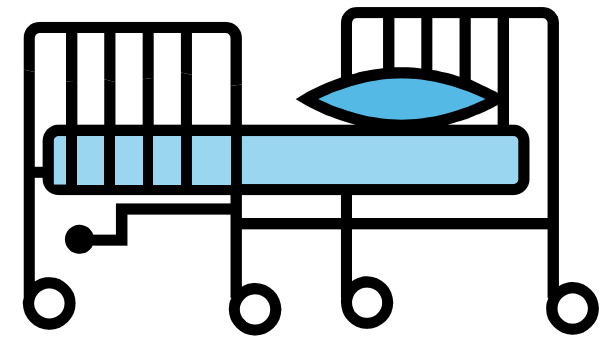
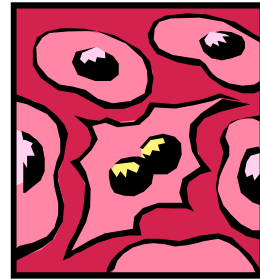


# Hospital Workshop Booklet



# Hospital Bugs

**Hygiene and cleanliness are very important in a hospital.**



However, hospitals are not the only places in which cleanliness is important.

You may think germs are something you don't have to worry about, that only the people selling toilet cleaners on TV are concerned with germs. But germs are tiny organisms that can cause disease - and they're so small (you need a microscope to see them) that they can creep into your system without you noticing.

The term 'germs' is really just a generic word for four different types of organisms: bacteria, viruses, fungi, and protozoa.

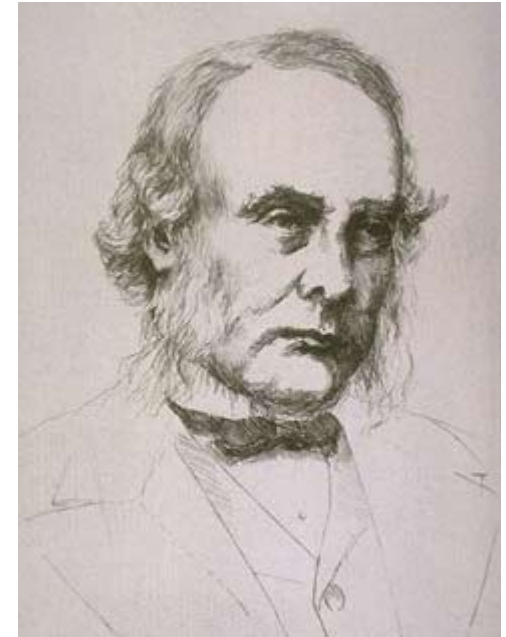
Reducing the spread of germs in hospitals, and the number of serious infections among patients, is vital for improving patient safety.

In fact, in outbreak situations, it is usually contaminated hands that are responsible for transmitting infections.

Effective hand decontamination has been shown to prevent the spread of infectious agents in clinical settings for over 150 years.

In the nineteenth century, the Scottish surgeon, Joseph Lister was made aware of the work of Louis Pasteur who had discovered (and had demonstrated beyond doubt) that the atmosphere teems with millions of invisible but living germs. An inspired piece of lateral thinking convinced Lister that if these germs could spoil wine and sour milk, they could also be responsible for wound infection.

**Before Lister facilities for washing hands did not exist in hospitals, and it was even considered unnecessary for the doctor to wash his hands before he saw a patient!**



### **Hospitals of the future:**

**According to some scientists, there will be no room for bacteria in the hospital of the future. They predict that a network of sensors will be dotted around hospitals to alert staff to any potential germs on the loose. Sensors could be fitted in sinks to ensure staff and visitors wash their hands before going into a patient's room.**

# Workshop

## How clean is clean?

This experiment demonstrates how difficult it is to get your hands really clean.



You are going to cover one of your hands with florescent cream to simulate germs, and keep the other hand clean. Follow the procedure below:

1. Wash and dry your hands. Your right hand can be your contaminated hand and your left uncontaminated. Cover the uncontaminated hand with a plastic glove.
2. The presenter will give you a small amount of florescent cream to rub into your contaminated hand. Rub the cream in very well.
3. Hold your contaminated hand under the UV lamp to show up the contamination.
4. Now shake your contaminated right hand with somebody else's uncontaminated left hand (remove glove). Then hold your left hand under the UV light. Has it become contaminated?
5. Now press your contaminated hand onto some of the hospital instruments. See how the contamination is transferred to the instruments by holding them under the UV lamp.

Now wash your hands to see if you can get rid of the contamination. Can you?

How to clean your hands properly:



1. Wet hands with warm water
2. Apply liquid soap (antibacterial soap is best)
3. Rub hands together to lather
4. Scrub hands well, back and front, up to wrist, and between fingers – also clean under the nails (this should take at least 15 seconds to complete)
5. Rinse in warm, running water
6. Use a disposable towel to dry your hands
7. Turn off the tap using the disposable towel

## DNA and Hospitals of the Future



**Hospitals of the future will rely more and more on the genetic profile of patients - targeting specific ailments quickly and effectively**

Each of us is different, and all the information that makes us who we are (eg. hair, eye, skin colour; height; blood type; even partly how we behave) is contained in our DNA.

DNA (deoxyribonucleic acid) is a molecule found in each of our body cells. It is in the shape of a spiral staircase, one half inherited from our mother, and one half from our father.

In 1953, Watson and Crick, two scientists working in England, were the first to figure out how DNA stores chemical information. This made it possible for scientists to begin 'reading' the human 'book' of DNA.

In 2003 scientists finally completed recording the full book of human DNA. Now all that remains is for them to understand exactly what each 'word' and each 'sentence' means.

Every day we are learning more and more about how DNA controls the millions of chemical reactions within our bodies. This knowledge is allowing doctors to prescribe medicines that are more perfectly suited for each of our bodies and unique genetic makeup.

## Workshop

### Extract your own DNA

Perform a procedure common in hospitals today ie. extract a sample of human DNA. The DNA will be your own, which you can wear as a necklace - thereby showing off the most valuable thing in the world to you!



#### Procedure:

- Step 1: Collect cheek cells from the inside of your mouth
- Step 2: Break the cells open by adding a soap solution, releasing the cell contents and DNA
- Step 3: Add an enzyme and warm the solution to remove the proteins associated with the DNA, causing the DNA to untangle
- Step 4: Add some salt solution to neutralise the DNA strands, allowing them to come together again in the test tube
- Step 5: To force the thin DNA strands to clump together and become visible, the water molecules packed around the DNA need to be removed. This is accomplished by adding a cold, concentrated solution of alcohol
- Step 6: Once the DNA begins to form large visible clumps, some of it is removed and added to a necklace bottle



## The Race for fame that has brought benefits to Humanity

**As with most scientific breakthroughs, the discovery of the structure of DNA was the end result of the efforts of many people. Yet only a few of these people are well known today. Some even died without realising the magnitude of their contribution.**

A timeline of discovery:

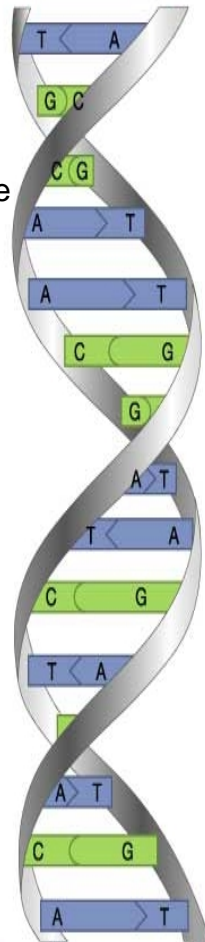
1929 – Levene, a scientist in the USA, identifies the main components of DNA (ie. a sugar molecule, a phosphate molecule, and four nitrogen bases: adenine, guanine, thymine, cytosine).

1937 – Astbury notices that DNA causes X-rays to disperse in a particular repetitive pattern, implying that DNA has a regular structure.

1950s – Three groups compete at trying to determine the structure of DNA:

- Wilkins and Franklin at King's College London
- Watson and Crick at Cambridge
- Linus Pauling (a famous scientist who eventually received two Nobel Prizes in his career) at Caltech in the USA.

Pauling incorrectly tries to build a model of DNA as a triple helix, and Rosalind Franklin mistakenly concludes that DNA cannot be a double helix.



1952 – a scientist named Chargaff informs Crick of his discovery that DNA always contains the same quantity of adenine as it does thymine, and guanine as it does cytosine (leading Watson & Crick to correctly conclude that these chemicals are paired, making up the central 'rungs' of the spiral staircase).

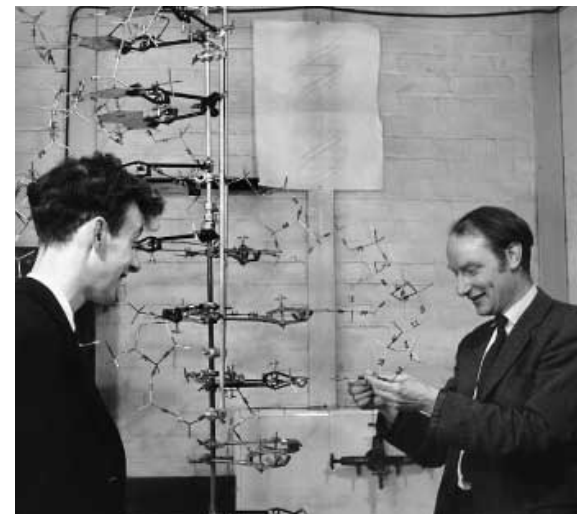
1953 – Watson & Crick acquire high quality DNA X-ray results produced by Wilkins and Franklin, enabling them to finally piece all the bits of evidence together, figuring out the shape of DNA.

1953 – Watson & Crick build the first accurate model of the DNA double helix, before Franklin even realises they used her data.

1957 – Crick predicts the correct relationship between DNA and associated proteins, and how replication occurs.

1958 – Rosalind Franklin dies from cancer likely caused by working with X-rays.

1962 – Watson, Crick & Wilkins receive the Nobel Prize for Physiology or Medicine.



Watson and Crick with one of their original DNA models

# Modern & Future Hospitals - using DNA to beat cancer



**Manchester's Christie Hospital recently developed a way of genetically modifying the body's defensive T-cells and turning them into 'supercells', able to conquer the most malignant of cancerous tumours.**

Our bodies contain infection-fighting cells called T-cells. Apart from seeking out and killing foreign bacteria and viruses, T-cells also naturally eliminate small tumours. Unfortunately our bodies do not contain enough T-cells to destroy large cancerous tumours. Cancer cells also often manage to cleverly camouflage themselves to avoid being detected by T-cells.

Through a new technique called **T-cell Therapy**, T-cells are extracted from a cancer patient and genetically modified to help them recognise and zone in on malignant cancerous tumours. The T-cells are then multiplied 1000-fold, and injected back into the patient. With this massively increased and specialised army of T-cells, the patient is far better equipped to eliminate even the most aggressive forms of cancer.

Early results of this technique have been described as 'spectacular', and some scientists even predict that a cure for all types of cancer could be available on the NHS within five years.

Learning to read and understand the 'book' of human DNA is beginning to produce astonishing benefits for humanity.

## Build your own DNA model at home

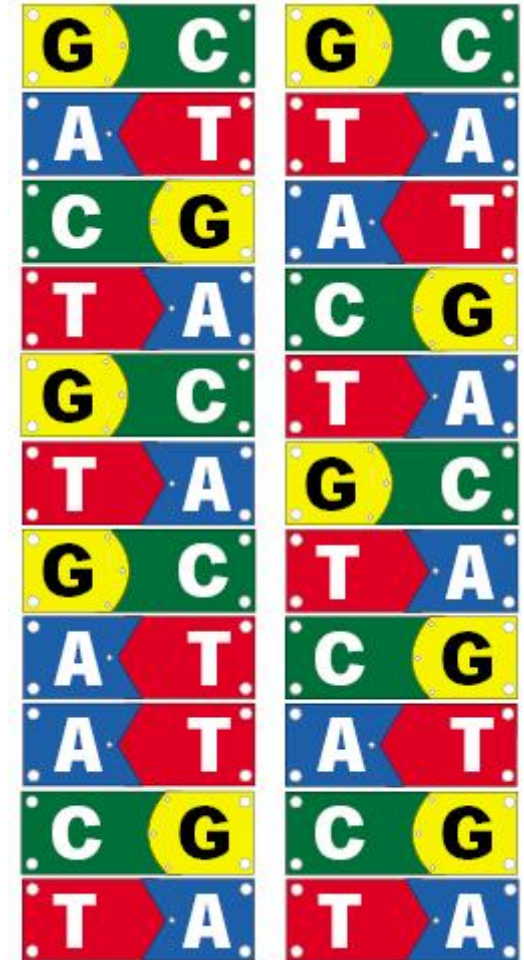
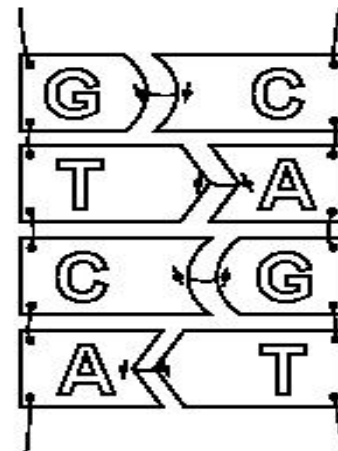
**You can make your own DNA model using the paper pieces below.**

First, make around 10 copies of the A, T, G and C shapes on the next two pages.

Colour each of the four nitrogen base shapes a different colour.

A stands for Adenine  
C stands for Cytosine  
G stands for Guanine  
T stands for Thymine

Cut out the shapes and use a hole punch to make the holes at the ends. Fasten pairs of shapes together using paper fasteners or string.



To make your model, thread two long pieces of string through the holes (don't forget to tie a knot at one end!)

Remember the DNA rules:  
**C always goes with G**  
**A always goes with T**

