

the mother's uterus. This carries oxygen and nutrients to the baby. Carbon dioxide and other waste passés the other way. After six months, the baby is moving a lot – and the mother can really feel it! Then, about nine months after fertilization, muscles in the uterus begin to contract and push the baby out of the mother's body. After many hours, and often a lot of pain, the baby is born.

On a cold winter afternoon in Hangzhou, China, Meilin Guosung breathes air for the first time, and cries. She is one of 44,000 healthy babies born in the country every day. She can't move well, talk, eat food, or understand the world around her, but it won't take her long to learn. Children are born with as many brain cells as adults, but the neurons in places like the cerebrum aren't connected. This is why babies can't control their senses or their bodies very well. Every time a baby tries to do something, neurons in the brain make new connections, and things like moving become a little easier. This is how we all learn.

In about thirteen months, Meilin will try to walk for the first time. It won't be easy, and she will fall over a lot. But finally, she will take a few steps, then fall into her parents' arms. By the time Meilin is three years old, there will be a trillion new connections in her brain. By then, she will walk and talk easily, and even dance to C-pop music!

## 10 When things go wrong

In May 1996, Beck Weathers was lost in a terrible storm near the top of Mount Everest. At 8,000 metres there wasn't much oxygen to breathe, and the temperature was  $-40^{\circ}\text{C}$ . Slowly, Beck became weaker and weaker, then he fell down. Soon he couldn't move his body at all – not even to blink. When some climbers found Beck, they thought that he was dead and left him. But amazingly, after lying outside in the



A storm on Everest



snow for nearly twenty-four hours, Beck Weathers stood up and walked down the highest mountain in the world.

Eight climbers died in that storm, but Beck lived. As he lay in the snow, his body moved blood to his organs, and away from his skin and muscles. Because he didn't move, he didn't use much energy or oxygen, and he didn't lose as much heat. One by one, Beck's organs began to slow down, so his heart and lungs could work slowly and keep him alive. But later, Beck's brain did something extraordinary. It sent blood back to his muscles, and he found the energy to get up and walk. It's an amazing story, and it shows how good the human body is at staying alive. And every minute of every day, your body is working hard to keep you alive too. It has to mend damage and fight germs all of the time.

## An illness

Every time you eat, drink, or breathe, germs go into your body. You already have ten times more germs inside you than human cells! Most of these germs are good for you, but sometimes a dangerous germ like a virus can make you very ill.

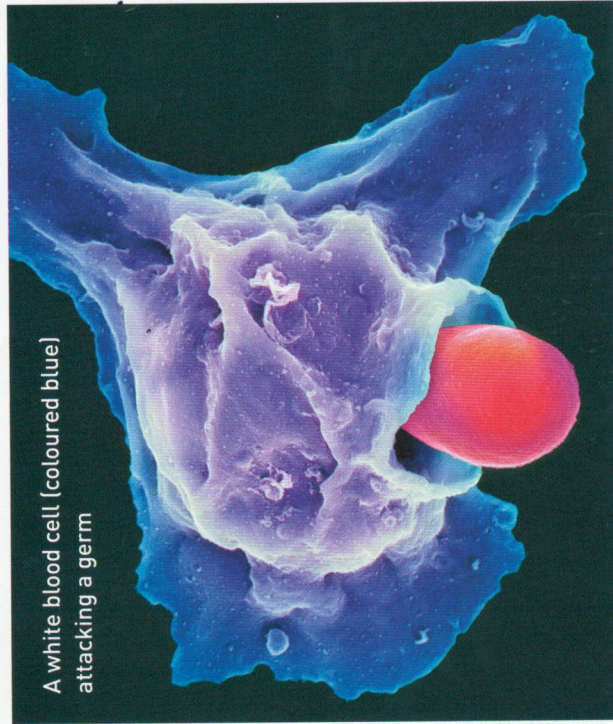
It's a winter evening, and Claire is sitting on the bus on her way home from work. The person behind her is ill. He coughs, and millions of viruses go into the air. Claire breathes some of them in. Most of the viruses are caught in her nose and destroyed, but a few of them reach the back of her throat. There, they go into her cells. Chemicals inside the virus change each cell into a 'virus factory': the cell starts producing thousands of new viruses.

Special cells called white blood cells are moving through Claire's body all of the time. Like soldiers in a tiny army, they are watching for dangerous germs. When they find one,

they try to kill it! A few days after the bus ride, Claire's white blood cells are fighting the virus in her throat. They are killing damaged cells before they can produce more viruses. But this makes Claire's throat very painful. She starts to cough.

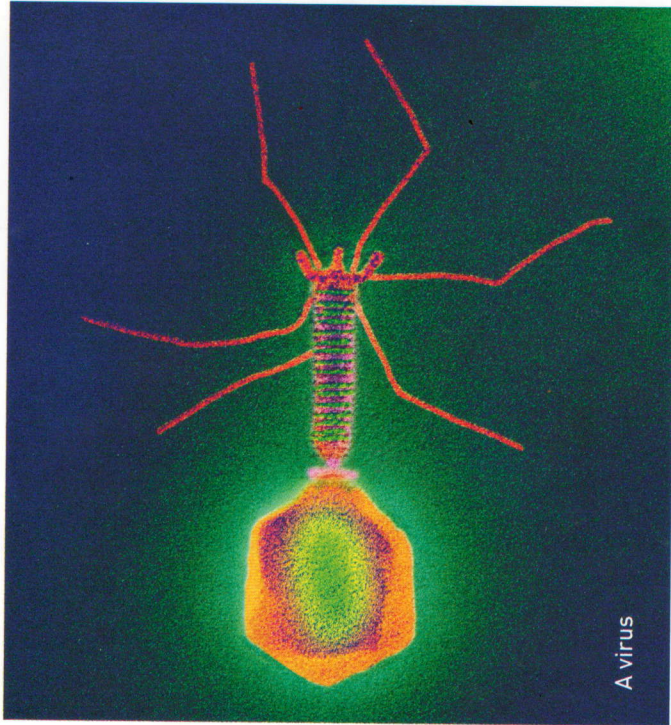
Claire's white blood cells produce chemicals to tell the brain and other cells what's happening. But these chemicals make Claire's body hurt everywhere. At the same time, Claire's body temperature goes up. It's another way to try and kill the virus in her throat, but it makes her feel terrible. Claire's head hurts badly, and she just wants to go to bed. Her body is telling her to rest.

Claire's body has got many different types of white blood cell. Some of them kill damaged cells. Others catch germs and destroy them, and some make special proteins called antibodies. Antibodies fit into germs like a key fits into a



A white blood cell (coloured blue) attacking a germ





A virus

lock. They help other cells to find and destroy the germs. There are lots of different germs, and different antibodies to fight each one. This is how vaccination works. Doctors give you a dead or weak germ, and your body makes antibodies to fight it. In this way, you will be ready if you get the real germ.

Deep inside Claire's bone marrow, white blood cells with the right antibodies begin to divide. Soon, thousands of cells will produce antibodies to fight the virus. Claire is beginning to win the battle.

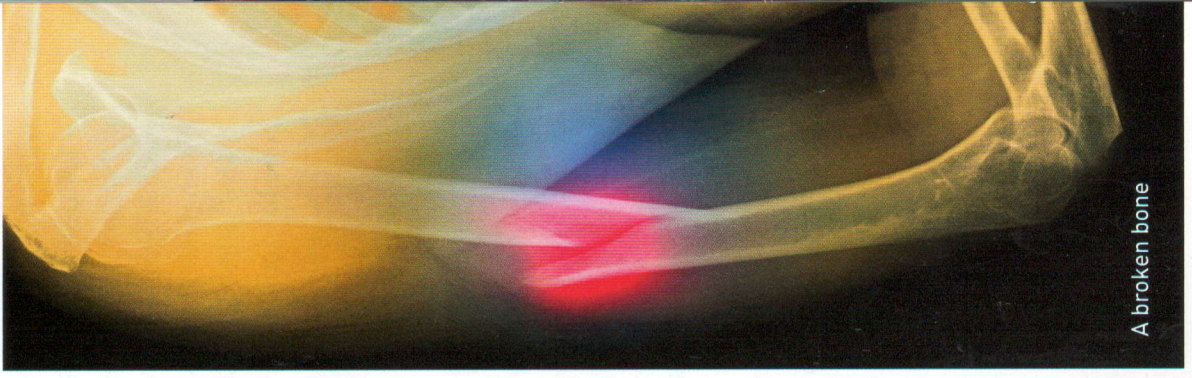
A week later, Claire feels much better. She has beaten the virus, and the new antibodies will stay in her tissues for years. If Claire catches the same virus again, her body will be ready.

## An accident

Fifteen-year-old Sergio is running down the stairs at school when he falls and breaks a bone in his left arm. As it breaks, it tears muscles and damages hundreds of capillaries deep inside the arm. Sergio doesn't feel much at first because glands near his brain produce endorphins – chemicals to stop the pain. This is your body's way of helping: if you don't feel pain for a while, you can escape from danger more easily.

A few hours later, Sergio is in hospital. His arm looks much bigger because his body has sent fluid and nutrients to the broken bone. It also hurts a lot – Sergio's brain wants him to be careful now, and not use the arm. Already, his body is trying to mend the damage. Millions of blood cells called blood platelets have joined together around the broken bone. They've made a sheet of cells called a blood clot. More blood clots have also closed the holes in Sergio's capillaries.

Sergio isn't bleeding any more, and something amazing has already begun to happen. Inside his bone



A broken bone



marrow, special cells called stem cells have begun to divide more quickly than usual. Stem cells can change into any type of cell in your body, like cells for making new bone. A few days later, millions of cells are busy mending the bone in Sergio's arm. Some of them make proteins to join the pieces together. Others cover the blood clot – and themselves – with minerals. Slowly, these minerals become new bone.

Five weeks after Sergio fell down the stairs, the broken bone has joined together. The new piece of bone is much stronger and thicker than before, but in about a year it will become thinner again. Then Sergio's bone will look the same as it did before.

## Growing old

Every day, billions of cells in your body die, but you don't die because cells can copy themselves. One cell divides into two new cells, so you can grow and mend damage. But if the body is so good at mending itself, why do people grow old and die?

Over a long time, dangerous chemicals begin to damage the body. They come from the air that we breathe and the things that we eat and drink. Other dangerous chemicals are made naturally by your cells. These things damage organs like the liver and the heart, and they can destroy DNA too. Cells with damaged DNA die, and as people get older the body also produces fewer and fewer new cells. This means that it can't fix damage easily any more.

And some parts of your body don't make any new cells at all. You produce new skin cells all of your life, but a baby is born with all the heart muscle fibres and most of the brain cells that it will ever have. If you hit your head very hard, millions of brain cells die – so you really need to look after yourself!

We still don't understand all of the reasons why people get older. But the good news is that people are living longer and staying healthier than in the past. A hundred years ago, 'lucky' people lived for about sixty years. Now, many people live to eighty, ninety, or even a hundred. Every year we discover new medicines, new ways to mend – or even grow – organs, and other ways to fight damage and disease. At the same time, people all around the world are studying how we grow old. One day, they may find a way to stop it!



A new right hand