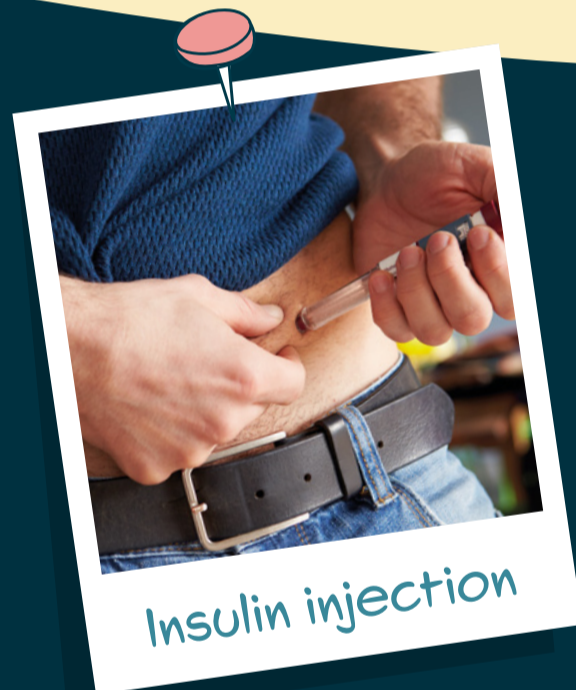


# Biotechnology



Biotechnology is the use of biological organisms or enzymes in the synthesis, breakdown or transformation of materials in the service of people. People have used biotechnology for thousands of years to make bread, cheeses, wine and beer, but in the last century, since the discovery of antibiotics, things have moved on rapidly. In the 21st century, most of the medical developments with the greatest potential to improve human health involve biotechnology.



Insulin injection

## Making medicines

Biotechnology has given us genetically engineered organisms ranging from bacteria to cows and sheep, producing life-saving medicines including vaccines and blood-clotting factors. Genetically modified bacteria can make the lung surfactant needed for premature babies to survive and the insulin needed by thousands of people with diabetes. Monoclonal antibodies can be made to carry medicines to targeted cells.

## Personalised medicines

Our ability to read and analyse the human genome is developing all the time. Results from the Human Genome Project, the 1000 Genomes Project and the 100,000 Genomes Project are being used to design specifically targeted therapeutic molecules. Our growing understanding of the human genome is leading the way to the development of personalised medicine. Future biotechnological developments may lead to individually designed medicines. These will interact with personal genetic combinations enabling doctors to treat disease more effectively and to minimise any side effects.



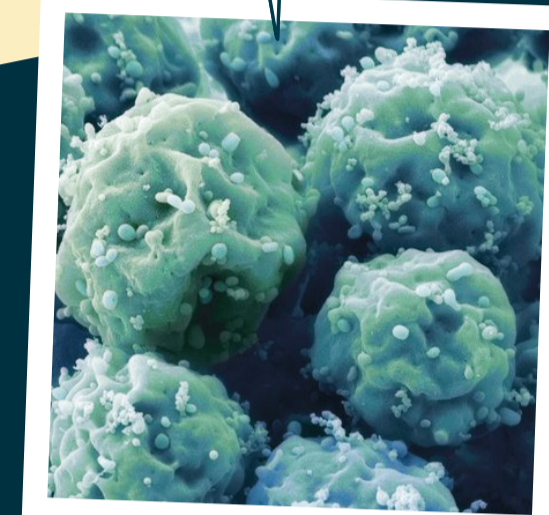
More effective treatment

## Reading the genes

The speed and accuracy with which we can analyse genomes from pathogens to people has increased by orders of magnitude since it first became possible. Analysing the first human genome took years – then days and is decreasing continuously. Developments in both computer technology and biology give us an ever-increasing ability to collect and analyse big data fast. Knowledge of the human genome has resulted in the development of gene probes to test for genetic diseases. In future they may be used to diagnose genetic tendencies towards problems such as cancer or heart disease. We can also use genome sequencing to identify pathogens, allowing us to treat them effectively and track infection routes.



Genome sequence



Stem cells

## New parts for old

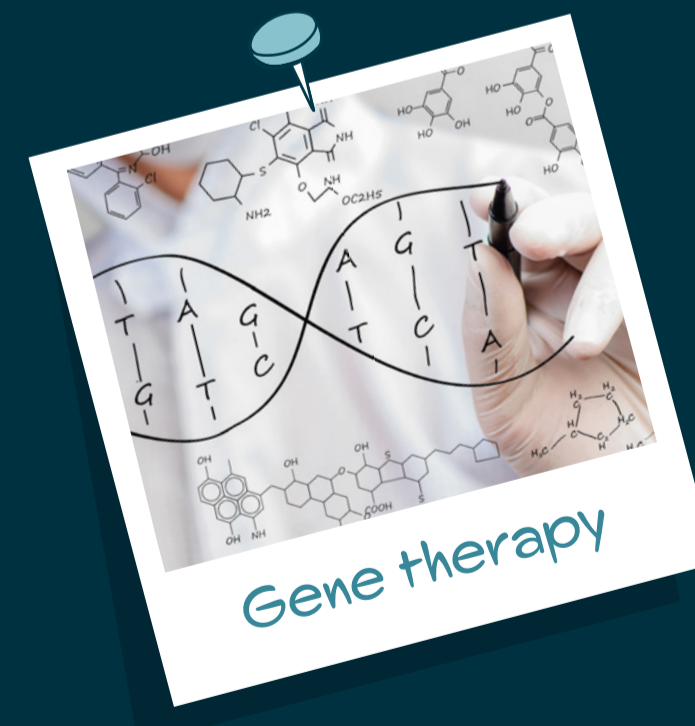
Some of the latest developments in biotechnology involve stem cells, derived from embryos or adults. They have the potential to grow and develop into new tissues or organs which can be used to replace others which are worn out or diseased. Trials using stem cells have included attempts to restore lost sight, and to repair damaged hearts and damaged tendons. The technology still has massive potential.

## Testing, testing

Medicine benefits from many sensitive tests which indicate the presence or absence of substances like sugar or hormones in body fluids. Biotechnological advances in the use of immobilised enzymes and monoclonal antibodies mean these tests have become very rapid and accurate. A pregnancy test used to take weeks – it now takes minutes.



Testing



Gene therapy

## Mending the genes

Gene therapy is one area of medical biotechnology which is an experimental technique. It is hoped gene technology will help scientists develop ways to correct the mistakes in the DNA code which lead to genetic diseases. Research and trials are under way to treat conditions ranging from cystic fibrosis and severe combined immunodeficiency (SCID) to rare forms of inherited blindness.

