A Quest for the Code of Life

Narration by David Walter.

“Tree of Life” Window designed by Kathy Shaw.

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Colour
Duration: 00:09:29:11

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<Opening titles>

<Walter narrates over film>

The city of Cambridge with its renowned university has a rich and bountiful scientific tradition. It was here that Sir Isaac Newton formulated his theories on gravity. And here too that James Watson and Francis Crick determined the double helix structure of DNA. Today at Hinxton, on the outskirts of Cambridge, a group of scientists are engaged on a project of such significance it’s been described as the biological equivalent of landing on the moon or splitting the atom.

In the tranquil Cambridgeshire countryside, a group of pioneers are decoding the very essence of life itself and in the process they’re radically changing our understanding of what makes us prone to disease. Their work may lead to new treatments for genetic disorders such as cystic fibrosis and offers hope in the fight against cancer. In the grounds of Hinxton Hall, the new Wellcome Trust Genome Campus has been created to ensure the UK is at the forefront of this global enterprise. The campus is home to the European Bioinformatics Institute, the Human Genome Mapping Project Resource Centre and the Sanger Centre.

Here in the Sanger Centre over three hundred staff, equipped with the very latest technology, are working round the clock to meet their ambitious goal of decoding more than a sixth of the human genome by the year 2002.

Every animal cell contains a number of chromosomes, tightly coiled spirals of deoxyribonucleic acid or DNA. When cells divide, each chromosome is duplicated. The duplicates then separate to form two new cells. The DNA molecule contains the code of life. It consists of four chemicals or bases: guanine, thymine, cytosine and adenine. Long sequences of DNA bases form instructions called genes. If DNA is the genetic alphabet, then genes are the meaningful sentences that convey important information. Every human being has the same basic genetic make-up and the full complement of human genes is known as the human genome.

Genes are the recipes for proteins which are essential for life. Different proteins perform different functions: some form muscle or skin, others control essential processes like reproduction or growth. When certain proteins fail to perform their allotted task, we can become ill and that's one reason why it is essential for us to identify all the bases and all the genes in the human genome. It's quite a job. There are three thousand million of these bases in a human cell and around a hundred thousand human genes.

In order to sequence the DNA, it first has to be chemically extracted from cells and broken down into small pieces. Tiny bacteria are then tricked into cloning or replicating these short sections of DNA so that scientists can work with many copies of the same section. The copies are then fed into narrow lanes or channels on these gel plates before being placed into a DNA sequencing machine.

Over the course of a 24 hour period using a process known as gel electrophoresis, a sequencing machine can now determine around fifty thousand consecutive bases which are recorded on a computer. Each of these coloured dots represents a single DNA base. This laboratory is effectively a production line for DNA sequencing. To date, the Sanger Centre has sequenced barely 1% of the human genome but the

sequencing operation is currently being scaled up and the Human Genome Sequencing Project, a vast global initiative, is scheduled to be completed by the year 2005. The man in charge of the Sanger Centre is the Cambridge biochemist Dr John Sulston.

<Sulston to camera and then speaks over film>

The discovery of the sequence, the code of life, is only the beginning. It's very important to realise that it's not the end of the process, it's only the end of the beginning. I think that this is certainly laying the foundations of a new biology and of new medical science. We shall understand the human body completely from the ground up.

<Walter narrates over film>

Opposite the Sanger Centre is the European Informatics Institute, the EBI. As the revolution in genetic sequencing produced an explosion of genetic data, it became necessary to develop powerful new computers and software to process and analyse this complex information. This new discipline is called bioinformatics. The EBI provides an essential channel through which sequencing information can flow to the outside world. As soon as new sequences are determined, they're posted on to the Internet in order that scientists from around the world can begin to analyse them. Researchers here estimate that every day ten thousand people access the EBI genetic databases.

Close to the EBI is the Medical Research Council's Human Genome Mapping Project Resource Centre. In this laboratory they're sequencing the genome of the Japanese fugu fish. The fugu is a culinary delicacy in Japan but it has to be prepared and cooked very carefully because some parts of the fish are highly poisonous. The fugu is destined to play a key part in genetic research because its genome is very small, yet remarkably similar to that of human beings. By sequencing the fugu genome, these scientists hope to be able to use the information they gather to help identify human genes. Additionally, this resource centre provides invaluable services to the

scientific community, including biological samples, sequence information and computer programmes to help scientists analyse genetic data. As the sequencing of the human genome nears completion, efforts will shift towards identifying all human genes and their precise functions.

The Wellcome Trust Genome Campus is built in the grounds of Hinxton Hall. The hall itself dates from the 1740s but there are indications that our Neolithic ancestors once worked in this area, and during work on the site, archaeologists found an Anglo-Saxon settlement here. During renovation work, an entire room full of extravagant regency murals was discovered. Known as the Pompeiin room, it has now been lovingly restored by a specialist team of restorers and gilders.

Today the main building and its various outbuildings have been carefully converted to provide the Genome Campus with a state of the art conference facility for three hundred delegates.

The man who steered this project through to completion is the Wellcome Trust's Programme Director, Dr Michael Morgan.

<Morgan to camera>

Scientists in this country have been the Cinderella in terms of support and for too long they've had inadequate facilities. We're making a statement here that scientists deserve good surroundings, excellent surroundings, in which to work. I personally don't feel we've done anything other than create a beautiful environment where we'll get first class results, first class environment. I think we do this in the projects we fund elsewhere in the universities – part of our philosophy, part of our philosophy to support scientists by providing appropriate facilities in which they can do the excellent work that they do and in which they will feel valued.

<Walter narrates over film>

The international programme to sequence the human genome offers the prospect of dramatic developments in medical science. We're about to take a giant leap in understanding the tree of life. Deciphering the genetic code will enable scientists to develop new therapies and to forecast ill health and thereby act to prevent it. Ultimately, we may even be able to correct genetic errors by replacing faulty genes with flawless copies.

The future holds many challenges but if we rise to them, the 21st century may become the age when the burden of genetic disorders is finally lifted.

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