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HUMAN GENOME PROJECT

BLUEprinting the body?

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As we know, chromosomes contain genes that determine our inherited physical traits and some behavioural patterns. But now, through the Human Genome Project (HGP) researchers have used powerful technology to map the sequence of bits of DNA (deoxyribonucleic acid), the acid molecule that is the major component of chromosomes. This provides scientists with a road map that shows the location of an estimated 90% of genes on every human chromosome.

What is the HGP?

Begun in 1990, the Human Genome Project is a 13-year effort coordinated by the United States Department of Energy and the National Institute of Health. The project was originally planned to last 15 years, but rapid technological advances have accelerated the expected completion date to 2003.

The project is expected to produce a sequence of DNA representing the functional blueprint and evolutionary history of the human species. However, only about 3% of this sequence is thought to specify the portions of our 50 000 to 100 000 genes that encode proteins.

The human genome is a set of chromosomes that contains the total genetic information for mankind. The human genome consists of 23 pairs of chromosomes. A single human chromosome may contain more than 250-million DNA base pairs and it is estimated that the entire human genome consists of about 3,2-billion base pairs. Thus an important part of basic and applied genomics is to identify and localise these genes in a process known as transcript mapping.

Why is this knowledge important?

The ultimate goal of genomic mapping and sequencing is to associate specific human traits and inherited diseases with particular genes at precise locations on the chromosomes. The successful completion of the project will provide an unparalleled understanding of the fundamental organisation of the human genes and chromosomes. It promises to revolutionise both therapeutic and preventative medicine by providing insights into the basic biochemical processes that underlie many human diseases.

The DNA being analysed in the HGP typically comes from small samples of blood or tissue obtained from many different people. Although the genes in each person's genome are made up of unique DNA sequences, the average variation in the genomes of two different people is estimated to be much less than I%.

What are the dangers?

Genetic information might be abused to 'engineer' human beings, to invade privacy or to discriminate against the genetically disadvantaged.

The screening of embryos could leave parents agonising over whether to terminate pregnancies based on events far in their children's future, and about what their own genes reveal in terms of desirable physical and mental traits. And

there's the question whether it's right to test people to determine whether they might develop specific incurable disease.

Private firms that have patented genes may also have too much control over life-saving diagnosis and treatments.

Who owns the information?
An important feature of this project is the US government's long-standing dedication to the transfer of technology to the private sector. By licensing technologies to private companies and awarding grants for innovative research, the project is catalysing the multibillion-dollar US biotechnology industry and fostering the development of new medical applications.

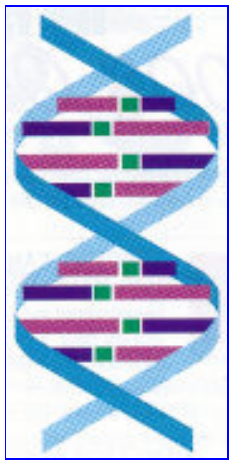
Those involved in the HGP include the Sanger Centre in London and a private US laboratory, Celera Genomics. Originally, Celera Genomics entered the gene-sequencing race with the intention of cashing in on its findings, perhaps through patents on individual genes. But in March this year US President Bill Clinton and British Prime Minister Tony Blair issued a joint statement declaring that the basic information on the human genome will be public property.

Solution to our medical problems?
Could be, but it will take years to interpret the new information. It's not an overnight, practical solution for all our medical problems. Besides, it is not enough to understand the genetic predisposition behind medical disorders. Research has found that environmental factors also play an important role in determining reasons for illnesses.

The question remains: Is the decoding of the human genome the greatest breakthrough in science or just another *small step* in unravelling the mystery of human life?

Human Genome Project aims to –

- identify all the 100 000 genes in the human DNA,
- determine the sequences of the 3,2-billion chemical base pairs that make up the human DNA,
- store this information in databases,
- develop tools for data analysis,
- transfer related technologies to the private sector, and
- address the ethical, legal, and social issues that may arise from the project.



A simple model of DNA's double helix structure. All human DNA is contained in 23 pairs of chromosomes, which contain an estimated 100 000 genes. The most important component of the chromosome is the single continuous molecule of DNA. This double-stranded molecule, shaped like a twisted ladder, is composed of linked chemical compounds known as nucleotides. Each nucleotide consists of three parts: a sugar known as deoxyribose, a phosphate compound and any one of four bases – adenine, thymine, guanine, or cytosine. These parts are linked together so that the sugar and the phosphate form the two parallel sides of the DNA ladder. The genetic code is specified by the order of adenines, thymines, guanines, or cytosines in the DNA ladder.

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