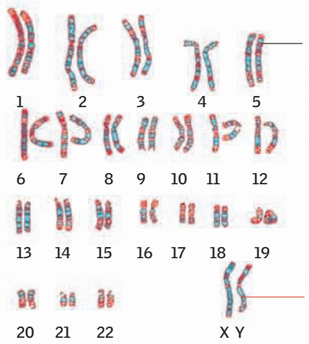
Genome in Sight!

One of the most far-reaching and extraordinary scientific achievements is the deciphering of the human genome. This is the complete set of hereditary information contained in the DNA of human chromosomes. In less than 20 years, with a combination of original genetic techniques and the power of computers, scientists glimpsed the location of all the genes, including those that determine eye color, hair type, blood type, and even a person's sex. ●

Genetic dictionary

The 46 human chromosomes, together with mitochondrial DNA, contain all a human being's genetic information. Knowing the location and function of each gene or group of genes is useful for several reasons. It enables us to know if an illness stems from a defect in a gene or group of genes and even to correct the illness through gene therapy. We can also better understand any potential interaction among genes that are near each other in a chromosome and the effects of that interaction. Studying the human genome can even reveal the origin of our species among the primates.



AUTOSOMES are the 22 pairs of human chromosomes, excluding the sex chromosomes.

SEX CHROMOSOMES

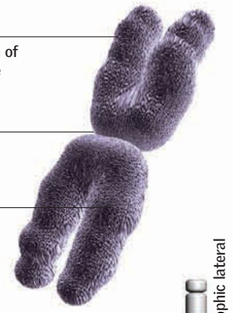
WOMEN have a pair of the same sex chromosome, called XX.

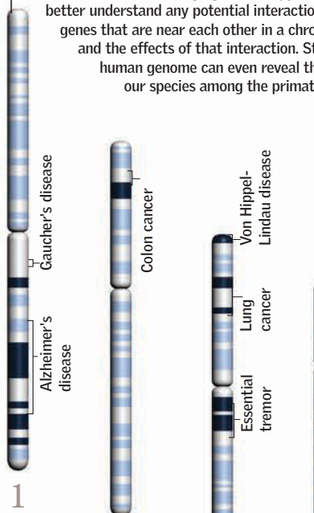
MEN have a chromosome pair made up of two different chromosomes, X and Y.

PLANT
25,000
genes

Chromosome

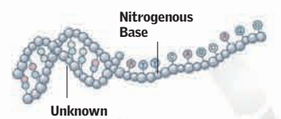
contains tightly coiled and folded DNA. It consists of sister chromatids that contain the same genes.





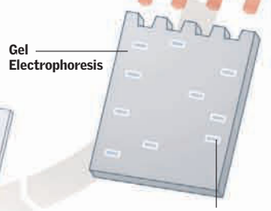
Sanger Method

Frederick Sanger, an English biochemist, devised an extraordinary method for deciphering the human genome by identifying the location of each nitrogenous base in the DNA. He divided human DNA into portions of different sizes and used the PCR technique to make thousands of copies. He then made in vitro copies of each DNA fragment using the cellular mechanism of DNA replication. He added his own twist to this process by using fluorescent dideoxynucleotides (ddNTP). These molecules compete with standard nucleotides during the DNA replication process.

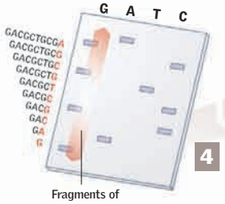


1 MULTIPLICATION
Each segment of DNA in which the sequence of bases is unknown is subjected to the polymerase chain reaction (PCR), which makes it possible to make thousands of copies of the same segment of DNA.

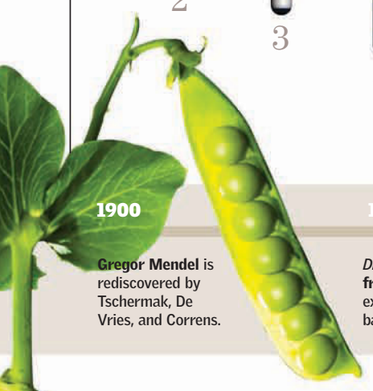
2 IN VITRO
Solutions with high concentration of a ddNTP, for example ddGTP, will produce copies of DNA of different length from standard nucleotides. It works because the DNA-copying process is interrupted if a ddNTP is inserted instead of a standard nucleotide.



3 ELETROPHORESIS
On a gel, the copies of DNA travel different distances according to their length. This movement is called electrophoresis.



4 PUZZLE
By placing the gel in front of UV light, the researcher can observe how the bases fit and form the exact sequence of bases of the unknown DNA segment.



1900 — **Gregor Mendel** is rediscovered by Tschermak, De Vries, and Correns.

1911 — *Drosophila melanogaster,* **the fruit fly,** is the subject of experiments by T.H. Morgan based on chromosomal theory.

1953 — James Watson and Francis Crick propose a structural model of DNA.

1955 — Discovery that the human species has **46 chromosomes**

1968 — The first description of a **restriction enzyme**

1974 — John Gurdon first used somatic nuclei to create **clones** of an amphibian larva.

1975 — F. Sanger develops a technique for deciphering the sequence of bases in DNA.

1981 — The first transgenic **rats** and **insects** are obtained.

1983 — Kary Mullis creates the **polymerase chain reaction technique.**

1993 — A plan is proposed to finish **sequencing** DNA in the human genome project.

1994 — The first **transgenic tomato** is made.

1998 — The genome sequencing of the *Caenorhabditis elegans* nematode is completed.

2003 — The magazines *Science* and *Nature* publish **the complete sequence of the human genome.**