

The Scientist

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Double Helix Jubilee

Pg. 21 – Birth of an Icon

Pg. 22 – Ownership and Identity

Pg. 24 – Metaphors and Dreams

Pg. 27 – Judging DNA

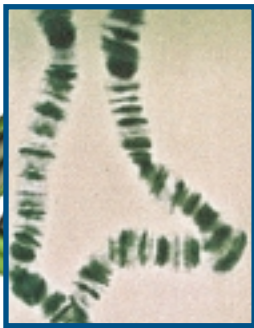
Timeline of DNA – DNA image by R. David Green

1869 Friedrich Miescher isolates "nuclein" from soiled bandages. It's DNA.



1900 Hugo DeVries, Karl Correns, and Eric Tschermak rediscover Mendel's laws.

1902 Archibald Garrod explains inborn errors of metabolism, linking inheritance to proteins.



1903 Walter Sutton and Theodor Boveri describe chromosome structure and function.

1904 William Bateson coins the term genetics.

1913 T.H. Morgan and Alfred Sturtevant at Columbia University chart the first genetic map.

1928 Frederick Griffith claims transforming factor transmits ability of bacteria to cause pneumonia in mice.



1929 Phoebus Levene describes building blocks of DNA, including bases of four types (A, C, T, G).



1944 Oswald Avery, Colin MacLeod, and Maclyn McCarty demonstrate that Griffith's bacterial transforming factor is not protein, but DNA.

1950 Alfred Hershey and Martha Chase use viruses to confirm DNA is the genetic material.

1953 James Watson and Francis Crick deduce DNA's conformation from experimental clues and model building.



1958 Matthew Meselson and Franklin Stahl demonstrate how DNA replicates.

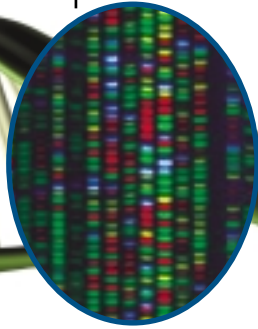
1952 Erwin Chargaff shows amounts of A and T, and G and C are equal. Maurice Wilkins and Rosalind Franklin use X-ray crystallography to reveal repeating structure of DNA.

1961-1963 Researchers crack the genetic code linking gene and protein. It is triplet and universal.

	U	C	A	G	
U	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr STOP STOP	Cys Cys STOP Trp	U C A G
C	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg	U C A G
A	Asp Asp Asp Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg	U C A G
G	Val Val Val Val	Ala Ala Ala Ala	Arg Arg Glu Glu	Gly Gly Gly Gly	U C A G

1968 Werner Arber, Hamilton Smith, and Daniel Nath describe uses of restriction enzymes.

1972 Paul Berg and colleagues create first recombinant DNA molecules, using restriction enzymes.



1977 Frederick Sanger, Allan Maxam, and Walter Gilbert pioneer DNA sequencing.

1980 Mark Skolnick, Ray White, David Botstein, and Ronald Davis create RFLP marker map of human genome.

1982 First recombinant DNA-based drug marketed.

1985 Kary Mullis invents PCR.



1986 The idea to sequence human genome is broached. Leroy Hood and Lloyd Smith automate DNA sequencing.

1987 US DOE officially begins human genome project.

1988 US NIH takes over genome project, James Watson at the helm.

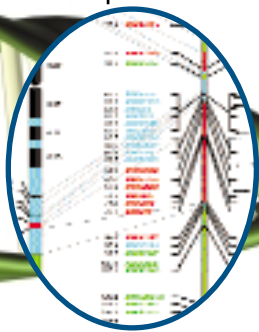
1989 NIH establishes National Center for Human Genome Research. Five percent of funds allocated to ethical, social, and legal issues.



1990 Sequencing of human and model organism genomes begins. BLAST algorithm developed to align DNA sequences.

*DNA Image:
R. David Green*

1991 J. Craig Venter invents EST technology.



1992 Wellcome Trust joins human genome sequencing effort. Cal Tech researchers invent BACs, crucial to clone-by-clone genome assembly. 1980 RFLP map of human genome updated.

1993 Francis Collins takes over Human Genome Project. Sanger Center opens in UK; other nations join effort. Completion projected 2005.

1995 Researchers at The Institute for Genomic Research publish first genome sequence of free-living organism: *Haemophilus influenzae*. Patrick Brown and Stanford University colleagues invent DNA microarray technology.

1996 International human genome project consortium establishes "Bermuda rules" for public data release.



1998 NIH begins SNP project to reveal human genetic variation. Celera Genomics proposes to sequence human genome faster and cheaper than consortium.

1999 Wellcome Trust forms SNP consortium. First human chromosome sequence published.

2000 Fruit fly genome sequenced, validating Celera's whole-genome shotgun method. Race to sequence human genome declared tie at White House, June 26.

2001 Mid-February, *Science and Nature* publish annotations and analyses of human genome.



2002 The age of "omics" dawns as researchers decipher, dissect, and compare genome architecture across the spectrum of biodiversity.