The Historical Context of Genome Editing

From the MSOE Center for BioMolecular Modeling

46 Human Chromosomes Counted (1956)

Central Dogma of Molecular Biology (1950's - 60's)
Genetic information flows from DNA to RNA to Protein

Watson and Crick model of double-stranded DNA proposed (1953)

Restriction Endonucleases (1970)
First restriction enzyme reported by Wilcox and Smith

Philadelphia Chromosome (1960)
Genetic defect linked to cancer

DNA cloning/Genetic Engineering (1970's)

Oncogenes first reported in chickens (1970)

Sanger DNA Sequencing (1977)
Fred Sanger describes method of sequencing DNA using dideoxy-nucleotide chain terminators

Reciprocal Translocation of Bcr-Abl (1973)
Translocation between chromosomes 9 and 22 shown to be associated with CML

Nucleosome Structure (1974)
First description of a nucleosome as the repeating structural subunit of chromatin

Asilomar Conference on Recombinant DNA (1975)
Discussion of ethical issues related to DNA experiments

Polymerase Chain Reaction (1983)
Kary Mullis develops technique to exponentially copy a particular DNA sequence

FISH technology (1982)
Fluorescent DNA probes used to visualize specific sequences

Zinc Finger Proteins (1993)
Multiple zinc finger domains reported in TFIIIA

CRISPR discovered (1993)
Near perfect palindromic repeats reported in salt-tolerant microbe.

Polydactyl Zinc Fingers (1998)
Zinc finger domains are modified to target different double-stranded DNA sequences

Dolly the sheep cloned through nuclear transplant (1996)
An international research project to determine the nucleotide sequence of human genome.

CRISPR sequences reported to contain foreign DNA…suggesting an adaptive immune system.

CRISPR protects microbes from recurring virus infection.

CRISPR system cuts DNA of foreign pathogens.

Transcription Activator Like Effector Nuclease proteins (TALENs) used to target DNA sequences.

Charpentier and Doudna describe single-guide RNA (2012).

Feng Zhang modifies CRISPR to edit mammalian genomes (2013).

The genome is a knot-free fractal globule.

Clinical trials investigating the use of ZFNs to confer resistance to HIV in AIDS patients.

Addgene distributes CRISPR reagents to 25,000 labs over next 3 years (2013).

The molecular structure of CRISPR Cas9 is reported by Jennifer Doudna’s group.

Researchers convene meeting to discuss ethical issues related to genome engineering.