

Jargon buster

Image 1: The structure of DNA A double helix with base pairing¹

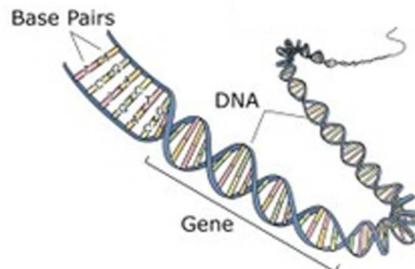


Image adapted from: National Human Genome Research Institute

Allele An allele is one of two or more versions of a gene. An individual inherits two alleles for most genes, one from each parent.² The exception are sex-linked genes on the X and Y chromosomes in men, where a single X chromosome is inherited from the mother and a single Y chromosome from the father. Women have two X chromosomes (and no Y).

Atom An atom is the smallest unit of an element that demonstrates the chemical properties of that element.

Bacteria Bacteria are small single-celled organisms. Bacteria are found almost everywhere on Earth and are vital to the planet's ecosystems. The human body is full of bacteria, and in fact is estimated to contain more bacterial cells than human cells. Most bacteria in the body are harmless, and some are even helpful. A relatively small number of species cause disease.³

Base The basic unit of our genetic instructions: DNA instructions are encoded in the sequence of its chemical 'letters' or bases. There are four bases: adenine (A), cytosine (C), guanine (G) and thymine (T). Another base, uracil (U) replaces T in RNA.⁴

Base pair A base pair is two chemical bases bonded to one another forming a "rung of the DNA ladder."⁵ See image 1

Cell A cell is the basic building block of living things.⁶

Chromosome A chromosome is an organized package of DNA (each comprising a single molecule) found in the nucleus of the cell. Different organisms have different numbers of chromosomes. Humans have 23 pairs of chromosomes. Each parent contributes one

¹ DNA, Genes and Chromosomes. See <http://www2.le.ac.uk/projects/vgec/highereducation/topics/dna-genes-chromosomes> (accessed 2 March 2018)

² National Institute of Health. National Human Genome Research Institute. "Talking Glossary of Genetic Terms." See <https://www.genome.gov/glossary> (accessed 2 March 2018)

³ Op. cit., note 2

⁴ yourgenome, (2017). Bases. See <https://www.yourgenome.org/glossary/bases> (accessed 2 March 2018)

⁵ Op. cit., note 2

⁶ Op. cit., note 2

chromosome to each pair so that offspring get half of their chromosomes from their mother and half from their father.⁷

CRISPR-Cas9 CRISPR-Cas9 is a genome editing tool that is creating a buzz in the science world. It is faster, cheaper and more accurate than previous techniques of editing DNA and has a wide range of potential applications. CRISPR is a molecular system that guides a protein called Cas9 towards a chosen sequence of DNA. Cas9 cuts the DNA at that chosen sequence.⁸

DNA Deoxyribonucleic acid. The DNA molecule consists of two strands that wind around one another to form a shape known as a double helix. It carries genetic instructions used in development, general functioning and reproduction in all living things.⁹ See image 1

DNA sequencing DNA sequencing is a laboratory technique used to determine the exact sequence of bases (A, C, G, and T) in a DNA molecule.¹⁰

Dominant The stronger version of a pair of alleles. Dominant alleles show their effect even if there is only one copy in the genome, for example the allele for brown eyes.¹¹

Double helix The structure formed by double-stranded molecules of DNA.¹² It has the shape of a twisted ladder.

Enzyme A biological catalyst that is almost always a protein. It speeds up the rate of a specific chemical reaction.¹³

Evolution Adaptation based on the process of natural selection. Successful organisms survive and reproduce while unsuccessful ones die off.¹⁴

Gene drive Gene drives use genetic recombination to ensure that a gene is copied across from one DNA strand to its paired DNA strand. This means that the gene and its associated trait are passed on to all subsequent generations, even if the gene confers a disadvantage on the species.¹⁵

Gene The gene is the basic physical unit of inheritance. Genes are passed from parents to offspring and contain the information needed to specify traits. Genes are arranged, one after another, on structures called chromosomes.¹⁶ See image 1

⁷ Op. cit., note 2

⁸ yourgenome, (2017). What is CRISPR-Cas9. See <https://www.yourgenome.org/facts/what-is-crispr-cas9> (accessed 2 March 2018)

⁹ Op. cit., note 2

¹⁰ Op. cit., note 2

¹¹ yourgenome, (2017). Dominant. See <https://www.yourgenome.org/glossary/dominant> (accessed 2 March 2018)

¹² yourgenome, (2017). Double helix. See <https://www.yourgenome.org/glossary/double-helix> (accessed 2 March 2018)

¹³ Op. cit., note 2

¹⁴ yourgenome, (2017). Evolution. See <https://www.yourgenome.org/glossary/evolution> (accessed 2 March 2018)

¹⁵ The Royal Society. 2017 Potential and risks of recent developments in biotechnology. See <https://royalsociety.org/~media/news/2017/venki-ramakrishnan-aaas-speech-gene-tech-18-02-17.pdf?la=en-GB> (accessed 6 March 2018)

¹⁶ Op. cit., note 2

Gene therapy The treatment of a disease by introducing modified DNA into the cells of the patient.¹⁷

Genetic engineering Genetic engineering refers to the direct manipulation of DNA to alter a cell or an organism's characteristics in a particular way. It is used by scientists to enhance or modify the characteristics of an individual organism.¹⁸

Genetic inheritance The process by which genes and characteristics are passed down from parent to offspring.¹⁹

Genetic material Genetic material can be a gene, a part of a gene, a group of genes, a DNA molecule, a fragment of DNA, a group of DNA molecules, or the entire genome of an organism.

Genetic technologies Anything to do with understanding, making or adapting genetic material.

Genetic testing A tool for identifying changes in DNA that could increase the risk of developing a disease.²⁰

Genome editing A precise and efficient way of making specific changes to the DNA of a cell or organism. It can be used to add, remove or alter DNA in the genome.²¹

Genome The entire set of genetic instructions found in a cell. In humans, the genome consists of 23 pairs of chromosomes containing 3.1 billion bases of DNA sequence.²²

Germ cell see germline

Germline The germline is the cells that produce eggs and sperm as well as the eggs and sperm themselves that are used by sexually reproducing organisms to pass on genes from generation to generation. Egg and sperm cells are called germ cells.²³

GMO Genetically Modified Organism. An organism that has had its genome changed by direct manipulation of its genes in a way that does not happen normally in nature.²⁴

Molecule A molecule is a stable group of two or more atoms. DNA, proteins and RNA are all molecules.

¹⁷ yourgenome, (2017). Gene therapy. See <https://www.yourgenome.org/glossary/gene-therapy> (accessed 2 March 2018)

¹⁸ yourgenome, (2017). Genetic engineering/modification. See <https://www.yourgenome.org/glossary/genetic-engineering-modification> (accessed 2 March 2018)

¹⁹ yourgenome, (2017). What is inheritance? See <https://www.yourgenome.org/facts/what-is-inheritance> (accessed 2 March 2018)

²⁰ yourgenome, (2017). Genetic testing. See <https://www.yourgenome.org/glossary/genetic-testing> (accessed 2 March 2018)

²¹ yourgenome, (2017). What is genome editing?. See <https://www.yourgenome.org/facts/what-is-genome-editing> (accessed 2 March 2018)

²² Op. cit., note 2

²³ Op. cit., note 2

²⁴ yourgenome, (2017). Genetically modified organism (GMO). See <https://www.yourgenome.org/glossary/genetically-modified-organism-gmo> (accessed 2 March 2018)

Mutation A change that occurs in a DNA sequence. Mutations are relatively common in our DNA, but most have no detectable effect.²⁵

Natural selection The process where those organisms better adapted to their environment survive and pass on their beneficial characteristics to their offspring.²⁶

Nucleotide A nucleotide is the basic building block of nucleic acids. RNA and DNA are polymers made of long chains of nucleotides.²⁷

Off-target events (sometimes called off-target effects) An edit to the genome where the genome editing system cuts at a different place in the DNA to the one that was intended to be edited.²⁸

Organism Any living thing that exhibits the properties of life by itself. Bacteria, animals, fungi and plants are all organisms but viruses are not.

Proteins Proteins are an important class of molecules found in all living cells. A protein is composed of one or more long chains of amino acids, the sequence of which corresponds to the DNA sequence of the gene that encodes it.²⁹

Recessive When the allele of a gene shows its effect only if both copies in the genome are the same, for example the allele for blue eyes.³⁰

Recombinant DNA Recombinant DNA (rDNA) is a technology that uses enzymes to cut and paste together DNA sequences of interest. The recombined DNA sequences can be placed into vehicles called vectors that ferry the DNA into a suitable host cell where it can be copied or expressed.³¹

RNA Ribonucleic acid is a molecule similar to DNA, but single-stranded. The cell uses RNA for a number of different tasks, including the translation of information in the genome into proteins.³²

Selective breeding The process of breeding animals or plants to bring out particular desirable characteristics in future generations.³³

Somatic cell Any cell of the body except sperm and egg cells.³⁴

TALENs Transcription-Activator Like Effector Nucleases. A less versatile method of genome editing than CRISPR-Cas9, this system followed ZFNs and preceded CRISPR-Cas9.

²⁵ yourgenome, (2017). Mutation. See <https://www.yourgenome.org/glossary/mutation> (accessed 2 March 2018)

²⁶ yourgenome, (2017). Natural selection. See <https://www.yourgenome.org/glossary/natural-selection> (accessed 2 March 2018)

²⁷ Op. cit., note 2

²⁸ yourgenome, (2017). What is CRISPR-Cas9. See <https://www.yourgenome.org/facts/what-is-crispr-cas9> (accessed 2 March 2018)

²⁹ Op. cit., note 2

³⁰ yourgenome, (2017). Recessive. See <https://www.yourgenome.org/glossary/recessive> (accessed 2 March 2018)

³¹ Op. cit., note 2

³² Op. cit., note 2

³³ yourgenome, (2017). Selective breeding. See <https://www.yourgenome.org/glossary/selective-breeding> (accessed 2 March 2018)

³⁴ Op. cit., note 2

Trait A trait is a specific characteristic of an organism. Traits can be determined by genes or the environment, or more commonly by interactions between them.³⁵

Transgene A DNA sequence from another species that has been introduced by artificial means. The produced organism is called transgenic.³⁶

ZFNs Zinc-Finger Nucleases. One of the first methods of genome editing. It is used in somatic gene therapies and in research, but it is less easy to use than CRISPR-Cas9.

³⁵ Op. cit., note 2

³⁶ Op. cit., note 2