

Acrocentric

Describes a chromosome on which the centromere is found towards one end, so that the chromosome has one long arm and one very short arm.

AFP

See *Alpha fetoprotein*

Allele

One of two or more alternative forms of a gene or DNA sequence at a specific chromosomal location.

Allelic variants

Two or more alternative forms of a gene or DNA sequence.

Alpha fetoprotein

An albumin-like protein produced by the fetus, found in the amniotic fluid and in the mother's blood. Levels in the maternal serum are measured in screening for chromosomal disorders and neural tube defects.

Alpha globin

A polypeptide sub-unit of the haemoglobin molecule. This is usually written as α -globin.

Alzheimer disease

A progressive form of dementia, usually commencing in middle or old age. It is characterised by loss of short term memory, inappropriate behaviour and slowness of thought.

Amino acid

The small organic molecule forming the basic units of proteins.

Amniocentesis

Withdrawal of a sample of the amniotic fluid surrounding a fetus in the uterus by piercing the amniotic sac through the mother's abdominal wall. As the amniotic fluid contains fetal cells, cell cultures can be tested for some genetic and chromosomal disorders. This is usually performed during the second trimester.

Amniocyte

Fetal cell found in the amniotic fluid surrounding a fetus in the uterus.

Amyloid precursor protein

The precursor for β -amyloid, a protein that accumulates in senile plaques and cerebral blood vessels in the brains of people with Alzheimer disease.

Analyte

Any chemical to be analysed.

Aneuploidy

A condition where the number of chromosomes is not an exact multiple of the haploid number (23 in humans). Usually refers to an extra copy of a chromosome (trisomy) or the absence of a copy of a chromosome (monosomy).

Anticipation

The appearance of a disease at an earlier age and/or with increasing severity in successive generations.

APP

See *Amyloid precursor protein*

Ataxia

Uncoordinated muscle action resulting in shaky movements and unsteady gait.

Autosomal dominant

A character encoded by a gene on an autosome that manifests in both heterozygotes and homozygotes. Requires only one affected parent to pass it on to offspring.

Autosomal recessive

A character encoded by a gene on an autosome that does not manifest in the heterozygote but manifests in the recessive homozygote.

Autosome

Any of the 22 nuclear chromosomes other than the sex chromosomes.

Balanced translocation

The exchange of genetic material between non-homologous chromosomes where the rearrangement does not result in a net loss or gain of genetic material.

Beta globin

A polypeptide sub-unit of adult haemoglobin. This is usually written as β -globin.

BRCA1, BRCA2

Tumour suppressor genes. Germline mutations in these genes predispose to breast and ovarian cancer.

C282Y

A common mutation in the HFE gene.

CAG repeats

Repeated sequential occurrences of the nucleotide triplet cytosine-adenine-guanine.

Carrier

A person who bears a gene for an abnormal trait without showing any signs of the disorder. The carrier is usually heterozygous for the gene concerned, which is recessive.

Also used for a person who has a balanced chromosome rearrangement.

Cascade testing

Identification within a family of carriers of a particular mutation following ascertainment of an index case.

CBAVD

See *Congenital bilateral absence of the vas deferens*

Centromere

Region of constriction on a chromosome that separates the two arms, and where the sister chromatids are held together.

CFTR

The cystic fibrosis transmembrane regulator gene. The protein encoded by CFTR is involved in chloride channel activity. Mutations in the CFTR gene cause the recessive condition, cystic fibrosis.

Chelation

The binding of a metal ion to an organic molecule to form a complex. The chelation of iron by desferrioxamine in β -thalassaemia patients allows the removal of excess iron from the blood after prolonged blood transfusion.

Chorionic villi

Folds of the membrane surrounding an embryo that will form the fetal part of the placenta.

Chorionic villus sampling

A fetal sampling technique in which a sample of chorionic villus is taken after the 10th week of pregnancy. The cells so obtained can be subjected to chromosomal or biochemical studies to determine if any abnormalities are present in the fetus.

Chromatid

One of the two identical strands of a chromosome, connected at the centromere after replication of the chromosome.

Chromosomal

Of or pertaining to chromosomes. A chromosomal disorder is one that is a result of the addition, deletion or rearrangement of whole chromosomes or parts of chromosomes.

Chromosome

Threadlike structure made of DNA and proteins, which contains genes along its length.

Cilia

Hairlike structures lining the epithelium of the upper respiratory tract, the beating of which removes foreign particles.

Clonal

Genetically identical cells with a single common ancestor.

Codon

A sequence of three bases in DNA or RNA that specifies a particular amino acid.

Compound heterozygote

An individual who is affected with an autosomal recessive disorder having two different mutations in homologous alleles.

Congenital bilateral absence of the vas deferens

The absence at birth of both of the pair of ducts in males that conduct spermatozoa from the epididymis to the urethra.

Consanguineous

Sharing a common ancestor within a few generations.

Consanguinity

See consanguineous.

Consultand

The individual seeking, or referred for, genetic counselling.

Crossing over

The exchange of chromosome material between homologous chromosomes during meiosis.

CVS

See *Chorionic villus sampling*

Cystic fibrosis

An autosomal recessive genetic condition in which the exocrine glands of affected individuals produce an abnormally thick mucus that blocks the intestines and lung passageways and produces scarring and lesions in the lungs.

Cytogenetics

The study of chromosomes and their abnormalities in number, structure and function.

Deletion

A type of chromosomal aberration or mutation at the DNA level in which there is loss of part of a chromosome or one or more nucleotides.

ΔF508 (DeltaF508)

A deletion of three base pairs (one codon) in the CFTR gene. The most common mutation causing cystic fibrosis.

De novo mutation

A new mutation arising in a fetus that was not present in the parents.

Deoxyribonucleic acid

A double-stranded helical molecule consisting of a sugar and phosphate backbone, and four nitrogenous bases (adenine, thymine, cytosine and guanine). The sequence of these bases forms a code that determines the amino acid sequence of all proteins in the body.

Derivative chromosome

Chromosome that has been altered as a result of a translocation.

Desferrioxamine

A drug that combines with iron in body tissues and fluids and is used to remove excess iron in patients with β -thalassaemia who receive regular blood transfusions.

Dinucleotide

Two nucleotides.

- Diploid**
Having two copies of each chromosome. Most somatic cells are diploid.
- Disomic**
Having two copies of a particular chromosome.
- Dizygotic**
Arising from two separate zygotes. Dizygotic twins are also known as fraternal twins.
- DNA**
See *Deoxyribonucleic acid*
- Duplication**
Presence of an extra copy of chromosome material.
- Dynamic mutation**
A triplet repeat expansion mutation that readily changes repeat number from one generation to the next.
- Euchromatin**
Chromatin that is light-staining during interphase, and is believed to contain genes that are actively transcribed.
- Exocrine gland**
A type of gland that secretes its product by way of ducts that open onto an epithelial surface.
- Exon**
The transcribed regions of a gene that are retained after mRNA splicing, usually coding for amino acids.
- Familial adenomatous polyposis**
An inherited cancer syndrome characterised by the presence of more than 100 colorectal adenomas.
- FAP**
Familial adenomatous polyposis
- Five prime**
This is normally written as 5' but is pronounced 'five prime'. A label for the end of a DNA sequence closest to the start of the transcription that proceeds in a 5' to 3' direction. The name is derived from the order in which the five carbon atoms of the deoxyribose molecule are numbered.
- Founder effect**
The high frequency of a gene in a population due to that population being derived from a small number of ancestors, one or a few of whom carried that gene.
- FMR1**
The name of a gene. The presence of an expanded triplet repeat (see Triplet repeat) in this gene causes fragile X syndrome.
- Fragile X premutation**
A triplet repeat expansion in the FMR1 gene that is larger than the normal range but not sufficiently large to cause fragile X syndrome.
- Fragile X syndrome**
An X-linked genetic condition caused by a triplet repeat expansion in the FMR1 gene. It results in a wide range of developmental, physical and behavioural problems.
- Frameshift mutation**
The addition or deletion of a number of base pairs that is not a multiple of three, resulting in the transcription reading frame of the gene being changed.
- Fraternal twins**
Twins arising from two separate zygotes. Fraternal twins are also known as dizygotic twins.

Gamete

A mature sex cell: the ovum of the female or the spermatozoon of the male. Gametes are haploid, containing half the normal number of chromosomes.

Gel electrophoresis

The separation of chemicals in an agarose gel by virtue of their size and electric charge.

Gene therapy

Treatment of disease by addition or insertion of a functional gene or genes.

Gene

A segment of DNA or RNA that acts as the controlling unit for the formation of a functional polypeptide or RNA product.

Genetic counselling

The provision to individuals or families of information, counselling and support regarding a genetic condition that may affect their family.

Genetic counsellor

A qualified health professional whose role is to provide information, counselling and support to individuals or families with regard to a genetic condition that may affect their family.

Genomic DNA

The whole complement of an individual's DNA.

Genotype

The genetic constitution of an individual, or more specifically the genetic information carried by a pair of alleles that determines a particular characteristic.

Germine

The cells that give rise to gametes.

Germline mosaicism

The presence in the gonads of more than one genetically distinct line of germ cells.

Globin

A polypeptide forming part of the haemoglobin molecule.

Gonadal mosaicism

The presence of two or more genetically distinct germ cell lines having arisen from one zygote, but differing due to a somatic mutation or non-disjunction.

Guthrie card

A piece of blotting paper used in the examination of a drop of a newborn baby's blood to exclude the presence of several congenital conditions, which may include phenylketonuria, cystic fibrosis and congenital hypothyroidism.

Haem

The iron-containing component of haemoglobin that binds oxygen.

Haematopoiesis

The process of production of blood cells and platelets that continues throughout life to replace aged cells. In healthy adults, haematopoiesis is confined to the bone marrow (intramedullary haematopoiesis), but in embryonic life and in early infancy, as well as in certain diseases, it may occur in other sites (extramedullary haematopoiesis).

Haemochromatosis

An autosomal recessive genetic condition of iron absorption and storage caused by mutations in the HFE gene.

Haemoglobinopathy

A disorder caused by either qualitative or quantitative abnormalities of haemoglobin.

Haploid

Having one copy of each chromosome. Gametes are haploid cells.

Haplotype

The genotype of a group of closely linked loci.

Hemizygous

The presence of a single copy of a gene. Usually refers to a gene on the X chromosome in males.

Hereditary non-polyposis colorectal cancer

An inherited cancer syndrome predisposing to cancer, predominantly bowel cancer and endometrial cancer. Mutation in mismatch repair genes can cause this autosomal dominant condition.

Heterochromatin

Dark-staining DNA that is usually not transcribed and consists of repetitive sequences.

Heterozygote advantage

The selective advantage of heterozygotes over homozygotes for a given locus. Acts to maintain the relatively high frequency of an allele in a population.

Heterozygous

The presence of two different alleles at a particular locus in an individual.

HFE

Mutations in the HFE gene cause the autosomal recessive condition haemochromatosis.

High performance liquid chromatography

A method of separating compounds based on properties such as size, charge and polarity.

HNPCC

Hereditary non-polyposis colorectal cancer

Homologous

1. DNA or amino acid sequences that are very similar to each other.
2. Chromosomes that pair during meiosis, one derived from the mother, one from the father.

Homologue

One of two proteins of very similar structure.

Homotetramer

A protein complex made up of four identical subunits.

Homozygous

The presence of two identical alleles at a given locus in an individual.

HPLC

See *High performance liquid chromatography*

Human chorionic gonadotrophin

A hormone produced by the placenta during pregnancy. Levels in the maternal serum are measured in screening for chromosomal disorders and neural tube defects.

Huntingtin

A protein of unknown function produced in all parts of the body. A specific triplet repeat expansion mutation in the gene coding for huntingtin leads to Huntington disease.

Immunocytochemistry

The use of specific antibodies to detect a protein in a biological specimen.

Incidence

The number of new cases of a condition in a population over a given amount of time.

Inhibin A

A protein hormone secreted by the corpus luteum and the placenta, present in maternal serum during pregnancy.

Insertion

Addition of chromosomal material or DNA sequence of one or more nucleotides within the genome.

Interphase

The period of the cell cycle between cell divisions when DNA is replicated and repaired.

Intracytoplasmic sperm injection

The injection with a fine needle of a single sperm into an egg. If it fertilises it may be implanted in a woman's uterus with the intention of pregnancy.

Intragenic

Within a gene.

Intron

A section of a gene that is transcribed into mRNA but is then spliced out during formation of the mature mRNA, and therefore not used as a template for protein synthesis.

Inversion

A rearrangement of a chromosome where the chromosome appears to have been broken in two places, and the middle piece reinserted in the reverse direction.

Isoform

An alternative form of a protein resulting from differential transcription of the relevant gene, either from alternative promoter or alternate splicing.

IT15 gene

The gene that codes for huntingtin, a protein of unknown function. A specific mutation in this gene may lead to Huntington disease.

Karyotype

The chromosomal constitution of a cell or individual. Also refers to a photographic or diagrammatic representation of the chromosomes from one cell.

Linkage

The occurrence of two genes or specific DNA sequences (at different loci) being inherited together due to being located close to each other on a particular chromosome.

Linkage analysis

The method of following the segregation of a disease within a family in relation to polymorphic markers to predict the likelihood of a person carrying the disease allele.

Lipase

A digestive enzyme that causes the breakdown of lipids.

Loci

Plural of locus.

Locus

A physical site on a chromosome, used to describe the position of a gene.

Manifesting carrier

A heterozygote for a recessive condition who shows symptoms of that condition. Most often used to describe female carriers of X-linked recessive conditions who have the condition.

Marker DNA

A polymorphic sequence of DNA linked to a gene causing a condition that can be used to track the inheritance of the gene within a family.

Maternal serum screening

The measurement of analytes in a pregnant woman's blood to predict the risk of chromosomal anomalies.

Meconium

The first stools of a newborn baby that are sticky and dark green, and composed of cellular debris, mucus and bile pigments.

Meiosis I

The first division of meiosis resulting in halving of the chromosome number.

Meiosis II

The second division of meiosis in which the two chromatids of each chromosome separate, resulting in two gametes.

Meiosis

Cell division in which haploid gametes are formed from diploid germ cells.

Metacentric

Describes a chromosome on which the centromere is found near the middle of the chromosome so the two arms are of similar length.

Metaphase

The stage of meiosis and mitosis where homologous chromosomes are lined up with their pairs along the centre of the cell.

Microsatellite instability

Variations in the length of regions of repetitive DNA (microsatellites) present in somatic cells compared to the germline. Can be a marker of inherited bowel cancer.

Missense mutation

A single-base substitution mutation that results in a codon that specifies a different amino acid.

Mitosis

Cell division producing two identical diploid progeny from a single diploid cell.

Mismatch repair (MMR) genes

Genes encoding proteins involved in the repair of DNA. Mutations in these genes can cause hereditary non-polyposis colorectal cancer.

Monozygotic

Arising from one zygote. Monozygotic twins are also known as identical twins.

Mosaic

Describes an individual with two or more genetically distinct cell lines derived from a single zygote, differing because of mutation or non-disjunction.

mRNA

Messenger ribonucleic acid. The transcript of a gene upon which polypeptides are formed. mRNA is synthesised in the nucleus, then transported to ribosomes in the cytoplasm where protein synthesis takes place.

Multiplex PCR

The use of several pairs of primers in one polymerase chain reaction, each of which initiates the amplification of a particular section of DNA.

Mutation

A change in genetic material of a single gene, or in the number or structure of the chromosomes.

Neural tube defect

An error in the development of the embryo resulting in the incomplete formation of the neural tube. Spina bifida is an example of a neural tube defect.

Newborn screening

The screening of newborn babies for presymptomatic detection and early treatment of genetic disease. Newborns are screened most commonly for hypothyroidism, cystic fibrosis, phenylketonuria and other rare metabolic conditions.

Non-disjunction

The failure of two chromosomes or chromatids to separate at anaphase resulting in an extra copy of the chromosome in one daughter cell, and no copy of that chromosome in the other daughter cell.

Nonsense mutation

A single-base substitution mutation resulting in the formation of a stop codon, and therefore a truncated protein.

Nuchal translucency

The translucent area on the back of the fetal neck visualised by ultrasound scan. It is caused by the accumulation of fluid between the skin and soft tissue.

Nucleotide

A single unit of a nucleic acid consisting of a sugar, a phosphate group and a nitrogenous base.

Nucleus

The membrane-bound organelle in eukaryotic cells containing the chromosomes.

Obligate carrier

An individual who, by pedigree analysis, must carry a particular gene.

Oestriol

A female sex hormone produced by the ovaries, present in maternal serum during pregnancy. Levels tend to be raised when the fetus has an aneuploidy, in particular trisomy 21.

Pancreatic enzymes

Digestive enzymes secreted by exocrine gland cells of the pancreas into the intestine.

PCR

See *Polymerase chain reaction*

Pedigree

A diagram of a family history showing family relationships, gender and status with respect to disease and other attributes.

Penetrance

The frequency with which a disease phenotype is expressed in individuals with the disease-causing genotype. When this is less than 100%, penetrance is referred to as 'incomplete'.

Phenotype

The physical characteristics of a cell or organism, as determined by the genes and influenced by the interaction between genes and environmental factors.

Point mutation

A change in a single nucleotide in a DNA sequence.

Polar bodies

The small cells produced from the oocyte during meiosis that do not go on to form functional egg cells.

Polyglutamine

A series of sequential glutamines in an amino acid sequence.

Polymerase

An enzyme that catalyses the creation of DNA or RNA from single nucleotides using an existing template.

Polymerase chain reaction

The repeated serial reaction involving the use of oligonucleotide primers and thermostable DNA polymerase that is used to amplify a particular DNA sequence of interest to enable genetic analysis.

Polymorphic

Describes a locus that has more than one allele occurring at a frequency of greater than 0.01 in the population.

Polymorphism

A locus that has more than one allele occurring at a frequency of greater than 0.01 in the population.

Positional cloning

The localisation of a gene to a particular region of a chromosome that then leads to its isolation.

- Postzygotically**
Occurring after fertilisation and the formation of a zygote.
- Predictive testing**
Genetic testing of an apparently unaffected person for a genetic condition or genetic predisposition.
- Pre-implantation genetic diagnosis**
The genetic testing of embryos prior to implantation in the womb.
- Premutation**
See *Fragile X premutation*
- Prenatal diagnosis**
The detection of a disease or other abnormality in a fetus.
- Prenatal testing**
The use of tests during a pregnancy to determine whether the unborn child is affected with a particular disorder. Methods include ultrasound, amniocentesis and chorionic villus sampling.
- Prevalence**
The number of current cases of a condition in a population.
- Primers**
The oligonucleotide sequences flanking the region of DNA to be amplified using PCR.
- Proband**
The first affected individual studied in an investigation of several related patients with an inherited or familial disorder.
- Promoter**
The region of DNA prior to the start of a gene that RNA polymerase recognises to enable the initiation of transcription.
- Protease**
A digestive enzyme that causes the breakdown of proteins.
- Proto oncogene**
A gene for a protein involved in the regulation of normal cell growth. A mutation in such a gene can lead to reduced regulation and uncontrolled cell proliferation; that is, cancer.
- Reading frame**
One of the potential ways of reading a nucleotide sequence as a series of triplets.
- Recombination**
The exchange between homologous chromosomes of sections of chromosomes during prophase I in meiosis.
- Recurrence risk**
The chances that a condition will recur in a family which already has one affected member.
- Restriction enzyme**
An enzyme that cleaves double-stranded DNA at a specific nucleotide sequence and produces fragments of DNA of different lengths. It is widely used in genetic research and diagnostic testing.
- Ribonucleic acid**
Usually abbreviated as RNA. A single-stranded polynucleotide, consisting of a sugar and phosphate backbone, and four nitrogenous bases (adenine, cytosine, guanine and uracil). The three main types of RNA play different roles in protein synthesis.
- RNA**
See *Ribonucleic acid*
- Robertsonian translocation**
A translocation between two acrocentric chromosomes where the two long arms are fused together at the centromere and the short arms and satellites are lost.

Satellites

The region at the end of the short arm of acrocentric chromosomes separated from the rest of the chromosome by a thin stalk-like region.

Sex chromosomes

The pair of chromosomes involved in determining the sex of an individual. These are labelled X and Y.

Short tandem repeats

Short sequences of DNA that are repeated many times in tandem. When the number of repeats is polymorphic within a population, this can be used as a marker.

Sibship

A group of individuals with at least one parent in common.

Silent mutation

A single-base substitution where the altered nucleotide produces a codon that codes for the same amino acid, and therefore not changing the polypeptide sequence at all.

Single base substitution

The substitution of one nucleotide for another. Can result in one of four types of mutation: missense mutation, nonsense mutation, splice-site mutation or silent mutation.

Skewed X inactivation

The inactivation of one of X chromosomes in disproportionately more cells than the other.

Somatic cell

Any cell in the body except the gametes.

Spina bifida

A congenital abnormality where part of an individual's spinal cord is exposed due to incomplete formation of the skin and other tissue over it.

Splice site mutation

A change in DNA sequence resulting in abnormal splicing of the mRNA transcript. Splicing is the removal of introns from mRNA.

Splicing mutation

See *Splicing mutation*

Splicing

The removal of introns from the mRNA transcript.

Sporadic

A condition arising independently rather than being inherited.

Stop codon

A triplet of nucleotides that indicates where translation ceases.

STR

See *Short tandem repeats*

Submetacentric

Describes a chromosome on which the centromere is somewhat distant from the middle of the chromosome so the two arms are of different lengths.

Sweat electrolyte test

This is the most common diagnostic test for cystic fibrosis. Sweat production is stimulated by application of an electric current to a small area of skin, the sweat is collected and the NaCl content is determined. The test is inexpensive, sensitive and specific.

Syndrome

A collection of symptoms and signs with a single underlying cause.

Telomere

The region at the ends of a chromosome arm.

Tetramer

A molecule made up of four subunits.

Thermocycler

A machine that automates the temperature cycling in PCR reactions.

Three prime

This is normally written as 3' but is pronounced 'three prime'. A label for the end of a DNA sequence closest to the end of transcription that proceeds in a 5' to 3' direction. The name is derived from the order in which the five carbon atoms of the deoxyribose molecule are numbered.

Transcription factor

A protein that binds to DNA and is involved in the regulation of transcription.

Transcription

The process of making an RNA copy of a gene from the DNA template.

Transgenic mouse model

A strain of mice into which foreign DNA has been introduced and is stably inherited. Used as a model for human disease.

Translocation

The exchange of genetic material between non-homologous chromosomes.

Triplet repeat

Repeated sequential occurrences of a particular triplet of nucleotides.

Trisomy

The presence of three copies of a chromosome instead of the normal two.

Trypsinogen

The precursor of trypsin, a digestive enzyme secreted by the pancreas.

Tumour suppressor gene

Gene encoding a protein involved in the control of cell growth and/or division. Mutations in tumour suppressor genes contribute to uncontrolled cell division and the development of cancer.

Unbalanced translocation

The exchange of genetic material between non-homologous chromosomes where the rearrangement results in a net loss or gain of genetic material.

Variable expression

A range in the severity of a phenotype, presumably due to interactions with other genes and the environment.

X chromosome inactivation

The random transcriptional inactivation of one X chromosome in every somatic cell in a female, occurring early in embryonic development.

X linked recessive

A condition caused by a mutation in a gene on the X chromosome when there is not a non-mutated copy of the gene present.

Zygote

A diploid cell resulting from the fusion of a male and a female gamete.