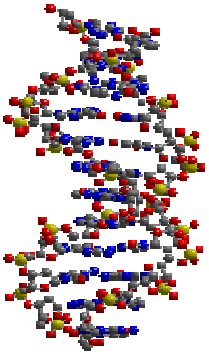
Cancer Genomics Terminology



Acquired Susceptibility Mutation: A mutation in a gene that occurs after birth from a carcinogenic insult.

Allele: One of the variant forms of a gene. Different alleles may produce variation in inherited characteristics.

Allele Heterogeneity: A phenotype that can be produced by different genetic mechanisms.

Amino Acid: The building blocks of protein, for which DNA carries the genetic code.

Analytical Sensitivity: The proportion of positive test results correctly reported by the laboratory among samples with a mutation(s) that the laboratory's test is designed to detect.

Analytic Specificity: The proportion of negative test results correctly reported among samples when no detectable mutation is present.

Analytic Validity: A test's ability to accurately and reliably measure the genotype of interest.

Apoptosis: Programmed cell death.

Ashkenazi: Individuals of Eastern European Jewish ancestry/decent (For example-Germany and Poland). Non-assortative mating occurred in this population.

Association: When significant differences in allele frequencies are found between a disease and control population, the disease and allele are said to be in association.

Assortative Mating: In population genetics, selective mating in a population between individuals that are genetically related or have similar characteristics.

Autosome: Any chromosome other than a sex chromosome. Humans have 22 pairs numbered 1-22.

Base Excision Repair Gene: The gene responsible for the removal of a damaged base and replacing it with the correct nucleotide.

Base Pair: Two bases, which form a "rung on the DNA ladder". Bases are the "letters" (Adenine, Thymine, Cytosine, Guanine) that spell out the genetic code. Normally adenine pairs with thymine and cytosine pairs with guanine.

BRCA1/BRCA2: The first breast cancer genes to be identified. Both are tumor suppressor genes. Mutated forms of these genes are believed to be responsible for more than half the cases of inherited breast cancer.

Candidate gene: A gene, located in a specific chromosomal region suspected of being associated with a disease, whose protein product is consistent with the known disease process.

Carcinoma: Any of the various types of cancerous tumors that develop in the outer layer of the body surface, lining of the digestive tract and other organs. Examples include lung, prostate cancer, and colon cancer.

Caretaker Genes: Genes that control the stability of the genome and prevent accumulation of mutations in gatekeeper genes.

Carrier: An individual who possesses one copy of a mutant allele (gene) and one normal gene. Carriers rarely develop disease but can pass mutated gene or normal gene to child.

CentiMorgan (cM): A unit of genetic distance. 1 cM=1% chance of recombination between 2 loci in meiosis.

Chromosome: One of the threadlike "packages" of genes, other DNA and associated proteins in the nucleus of a cell.

Clinical Sensitivity: The ability of a test to identify correctly those who have a disease/disorder.

Clinical Specificity: The ability of a test to identify correctly those who do not have the disease.

Clinical Utility: The usefulness associated with a test's introduction into practice.

Clinical Validity: A test's ability to detect or predict the associated disorder (phenotype).

Codominant: Alleles that are both completely expressed.

Codon: Three nucleotides in an mRNA sequence, which specifies a single amino acid.

Compound Heterozygote: Two different mutant alleles at a given locus.

Confirmatory Genetic Test: Determines whether an individual showing symptoms actually has the mutated gene. Genetic testing for an individual with symptoms may be necessary if the family history of the mutation is uncertain.

Congenital: Any trait or condition that exists from birth.

Consanguinity: Genetically related from a common ancestor, "blood relative".

Crossing Over: The exchange of pieces of DNA during the formation of eggs and sperm.

Cytogenic Map: The banded visual appearance of a chromosome when stained and examined under a microscope.

Deletion: The loss of a piece of DNA from a chromosome. Deletion of a gene or part of a gene can lead to a disease or abnormality.

Deoxyribonucleic Acid (DNA): The organic molecules inside the nucleus of a cell that carry the genetic instructions for making living organisms.

Diploid: The number of chromosomes in all cells, except gametes (sex cells). In humans there are 46 chromosomes (2 sets of 23 chromosomes) in a diploid nucleus.

Discordant: Members of a pair showing different characteristics.

Dominant: One member of an allele pair that manifests itself to the exclusion of the other.

Duplication: Production of one or more copies of any piece of DNA, gene or entire chromosome.

ELSI: Ethical, Legal, and Social Issues, usually as these apply to applications, education and research of human genetics, in general.

Empirical Recurrence Risks: Calculated using observed frequency of a trait in families rather than knowledge of exact inheritance pattern.

Exon: Protein coding sequence in a gene.

Expressivity: The extent to which traits from a gene appear in individuals.

Familial Adenomatous Polyposis (FAP): An inherited condition caused by a mutation in a gene that is inherited in an autosomal dominant way. The condition is characterized by the formation of polyps, also known as adenomas (because they are at a pre-cancerous stage, where they may or may not develop into cancerous cells).

Founder Effect: High frequency of a gene in a population founded by a small ancestral group.

Gamete: Egg or sperm, single set of chromosomes inherited from parent(s).

Gatekeeper Genes: A class of genes which directly regulate tumor growth by inhibiting growth or by promoting cell death.

Gene Amplification: An increase in the number of any particular piece of DNA. A tumor cell amplifies, or copies DNA segments naturally as a result of cell signals and sometimes, environmental events.

Gene-Environment Interaction: Phenotypes associated with an individual's genotype or genome type when exposed to different environmental conditions.

Gene-Gene Interaction: A collaboration of several different genes in the production of one phenotypic trait (or related group of traits).

Gene Therapy: This procedure involves replacing, manipulating, or supplementing nonfunctional genes with functional ones.

Genetics: The study of biological variation. Typically refers to a single gene and its effects.

Genetic Code: The instructions that tell the cell how to make a specific protein.

Genetic Counseling: A communication process for individuals and families who have a genetic disease or who are at risk for such a disease. Genetic Counseling provides patients with information about the condition, helps them make informed decisions and provides support group information and resources. A Genetic Counselor also ascertains risks for individuals and their families and discusses screening and management options.

Genetic Heterogeneity: A different gene mutation causing a similar phenotype.

Genetic Screening: Testing a population group to identify a subset of individuals at risk for having or passing down a specific genetic disorder.

Genetic Testing: Testing, done by extracting DNA from a biological sample to determine if an individual has certain mutations associated with inherited condition.

Genome: All of the DNA contained in an organism or a cell.

Genomics: The study of all the genes and how they interact with each other and the environment.

Genotype: The genetic makeup of an individual.

Haploid: The number of chromosomes in a sperm or egg cell, half the diploid number. In humans there is a single set of chromosomes, 23 in number, in a haploid nucleus.

Haplotype: The particular combination of a group of alleles present in a single chromosome, usually inherited as a unit.

Hardy Weinberg Equilibrium: The law that relates gene frequency to genotype in a population at equilibrium. This allows determination of carrier frequency of a trait whose frequency is known.

Hereditary Nonpolyposis Colorectal Cancer (HNPCC): A type of inherited cancer of the digestive tract, particularly the colon (large intestine) and rectum. Hereditary nonpolyposis colorectal cancer is responsible for approximately 2 to 7 percent of all diagnosed cases of colorectal cancer.

Heritability: The degree to which a given trait is controlled by inheritance.

Heterozygous: Possessing two different alleles of a particular gene.

Homozygous: Possessing two identical alleles of a particular gene.

Incomplete Penetrance: The absence of phenotype in obligate gene carrier.

Index case (proband): The family member whose phenotype leads to a family study.

Inherited: Traits transmitted from parents to offspring.

Insertion: A type of mutation where DNA is added to a chromosome. Insertion of DNA into a gene region can lead to a disease or abnormality.

Intron: Noncoding sequence in a gene. It is eliminated from mRNA before translated into protein.

Linkage: Proximity of two or more genes on a chromosome. These genes reside close together on the same chromosome.

Locus: The place on a chromosome where a specific gene is located.

Methylation: Reduced level of transcription due to attachment of methyl groups to DNA.

Michigan Cancer Genetic Alliance (MCGA): The Michigan Cancer Genetics Alliance (MCGA) is a collaborative network that provides leadership, education, and advocacy in issues relating to cancer genetics in Michigan. The organization also promotes research and communication, serves as a resource for expert information, and facilitates translation of cancer genetics research into practice. (http://www.migeneticsconnection.org/cancer/)

Michigan Informed Consent Law: Recommendations from the Governor's Genetic Privacy Commission led to a set of laws passed on March 15, 2000. The genetics privacy package of bills included SB 593, which requires informed consent to be obtained before predictive or presymptomatic genetic testing can be performed.

Mismatch Repair Genes: A class of genes that repair/correct base pairs that are not properly bonded (A=T, C=G).

mRNA: A series of templates for protein synthesis from DNA.

Multifactorial: A trait or disease resulting from interplay of multiple genes and environmental factors.

Mutagen: Environmental agent capable of inducing genetic mutation, most are carcinogens.

Mutation: A permanent structural alteration in DNA. Some mutations can have no effect (nonsense mutation), can be beneficial or at times cause harm to the organism.

Nonrandom Mating: Selection of a mate with preference for (or aversion to) a particular genotype.

Nucleotide: Another name for a base, the building blocks of DNA with an added molecule of sugar and phosphoric acid.

Oncogene: A gene that is capable of causing the transformation of normal cells into cancer cells. These genes normally regulate cell growth.

Oncogenic Viruses: Viruses capable of causing tumor development. An example would be the Human Papilloma Virus.

Pedigree/Family Health History: A diagram of a family's genealogy that shows family members' relationships to each other and the frequency or occurrence of a particular trait or disease.

Penetrance: The extent that an inherited mutation results in illness or trait.

Pharmocogenetics/Pharmocogenomics: The study of genetic basis for differences in response to drugs.

Phenocopy: A phenotype produced by environmental factors that mimics a genetically determined trait.

Phenotype: The observable traits or characteristics of an organism.

Philadelphia Chromosome: The rearrangement of chromosome 22 and chromosome 9. This occurs in the bone marrow of chronic myelogenous leukemia.

Polymerase Chain Reaction (PCR): A lab technique for amplifying a short segment of DNA.

Polymorphism: A variation in the sequence of DNA among individuals found in at least 1% of the population

Predictive Genetic Test: Genetic testing to identify people who are at an increased risk for developing a certain types of disease or disorder.

Prenatal Genetic Test: Genetic testing to determine whether a fetus has a gene that causes a disease/disorder.

Presymptomatic Genetic Test: A genetic test for individuals at risk for a hereditary disease before the onset of symptoms.

Proband: See *index case*.

Proto-oncogene: A normal gene that can become an active oncogene by a mutation.

Public Health Genomics: Incorporating genomics into Public Health practices to promote healthy lifestyles and behaviors.

Ribonucleic Acid (RNA): RNA codes for amino acid sequences, which are combined to form proteins.

Recessive: A condition/trait/genetic disorder that appears only in patients who have two copies of a gene. The exception to this is X-linked recessive where the carrier only needs one copy of the gene to show the disorder.

Risk Assessment: A method of describing an individual's chance of being diagnosed with/or developing a disease or disorder. Utilized to determine appropriateness of genetic testing, referral to specialists and to draw attention to lifestyles and behaviors that may need to be modified.

Suicide Gene: A strategy for making cancer cells more vulnerable to chemotherapy.

Telomere: The tip of a chromosome.

- ***p arm:*** The short (top) portion of a chromosome.
- ***q arm:*** The long (bottom) portion of a chromosome.

Teratogen: Environmental agent, behavior, or chronic disease that causes harm to a developing fetus.

Transcription: The synthesis of RNA or DNA template.

Translation: Synthesis of protein on a RNA template.

Tumor Suppressor Gene: A protective gene that normally limits the rate of cell division and growth. When inactivated, permit cells to grow without restraint. BRCA1 and p53 are well-known tumor suppressor genes.

Most definitions have been taken from the National Human Genome Research Institute's web site www.genome.gov/ and Biology-online, www.biology-online.org/dictionary.