

## C

**C. elegans:** *Caenorhabditis elegans*, a nematode or roundworm, the first animal to have its genome completely sequenced and all the genes fully characterised.

**Cancer:** Synonym for a malignant neoplasm – that is, a tumour (qv) that grows progressively, invades local tissues and spreads to distant sites (see also [tumour](#) and [metastasis](#)).

**Candidate gene:** A gene that has been implicated in causing or contributing to the development of a particular disease.

**Carcinogenesis:** The origin, causation and development of tumours (qv). The term applies to benign as well as malignant neoplasms and not just to carcinomas (qv).

**Carcinogenicity bioassay:** Tests carried out in laboratory animals, usually rats and mice, to determine whether a substance is carcinogenic. The test material is given throughout life to groups of animals at different dose levels.

**Carcinogens:** The causal agents which induce tumours. They include external factors (chemicals, physical agents, viruses) and internal factors such as hormones. Chemical carcinogens are structurally diverse and include naturally-occurring substances as well as synthetic compounds. An important distinction can be drawn between genotoxic (qv) carcinogens which have been shown to react with and mutate DNA, and non-genotoxic carcinogens which act through other mechanisms. The activity of genotoxic carcinogens can often be predicted from their chemical structure - either of the parent compound or of active metabolites (qv). Most chemical carcinogens exert their effects after prolonged exposure, show a dose-response relationship and tend to act on a limited range of susceptible target tissues. Carcinogens are sometimes species or sex-specific and the term should be qualified by the appropriate descriptive adjectives to aid clarity. Several different chemical and other carcinogens may interact, and constitutional factors (genetic susceptibility, hormonal status) may also contribute, emphasising the multifactorial nature of the carcinogenic process.

**Carcinoma:** Malignant tumour arising from epithelial cells lining, for example, the alimentary, respiratory and urogenital tracts and from epidermis, also from solid viscera such as the liver, pancreas, kidneys and some endocrine glands. ([See also 'tumour'](#)).

**Case-control study:** (Synonyms - case comparison study, case referent study, retrospective study) A comparison is made of the proportion of cases who have been exposed to a particular hazard (e.g. a carcinogen) with the proportion of controls who have been exposed to the hazard.

**Cell cycle (cell cycle arrest):** The cell cycle is a series of events involving the growth, replication, and division of a eukaryotic cell. Cell cycle arrest: A regulatory process that halts progression through the cell cycle during one of the normal phases (G1, S, G2, M).

**Cell transformation:** The process by which a normal cell acquires the capacity for neoplastic growth. Complete transformation occurs in several stages both *in vitro* and *in vivo*. One step which has been identified *in vitro* is 'immortalisation' by which a cell acquires the ability to divide indefinitely in culture. Such cells do not have the capacity to form tumours in animals, but can be induced to do so by extended passage *in vitro*, by treatment with chemicals, or by transfection with oncogene DNA. The transformed phenotype so generated is usually, but not always, associated with the ability of the cells to grow in soft agar and to form tumours when transplanted into animals. It should be noted that each of these stages of transformation can involve multiple events which may or may not be genetic. The order in which these events take place, if they occur at all, *in vivo* is not known.

**Cholinergic:** A substance which is capable of producing, altering or releasing the neurotransmitter acetylcholine.

**Chromosomal aberrations:** Collective term of particular types of chromosome damage induced after exposure to exogenous chemical or physical agents which damage the DNA. (see clastogen).

**Chromosome:** In simple prokaryotic organisms, such as bacteria and most viruses, the chromosome consists of a single circular molecule of DNA containing the entire genetic material of the cell. In eukaryotic cells, the chromosomes are thread-like structures, composed mainly of DNA and protein, which are present within the nuclei of every cell. They occur in pairs, the numbers varying from one to more than 100 per nucleus in different species. Normal somatic cells in

humans have 23 pairs of chromosomes, each consisting of linear sequences of DNA which are known as genes (qv).

**Chronic effect:** Consequence which develops slowly and has a long-lasting course (often but not always irreversible).

**Chronic exposure:** Continued exposures occurring over an extended period of time, or a significant fraction of the life-time of a human or test animal.

**Clastogen:** An agent that produces chromosome breaks and other structural aberrations such as translocations. Clastogens may be viruses or physical agents as well as chemicals. Clastogenic events play an important part in the development of some tumours.

**Clearance:** Volume of blood or plasma, or mass of an organ, effectively cleared of a substance by elimination (metabolism and excretion) in a given time interval. Total clearance is the sum of the clearances for each eliminating organ or tissue.

**Clone:** A term which is applied to genes, cells, or entire organisms which are derived from - and are genetically identical to - a single common ancestor gene, cell, or organism, respectively. Cloning of genes and cells to create many copies in the laboratory is a common procedure essential for biomedical research.

**Coding regions:** those parts of the DNA that contain the information needed to form proteins. Other parts of the DNA may have non-coding functions (e.g. start-stop, pointing or timer functions) or as yet unresolved functions or maybe even 'noise'.

**Codon:** a set of three nucleotide bases in a DNA or RNA sequence, which together code for a unique amino acid.

**Cohort:** A defined population that continues to exist through time.

**Cohort study:** (Synonyms - follow-up, longitudinal study) The study of a group of people defined at a particular point in time (the cohort), who have particular characteristics in common, such as a particular exposure. They are then observed over a period of time for the occurrence of disease. The rate at which the disease develops in the cohort is compared with the rate in a comparison population, in which the characteristics (e.g. exposure) are absent.

**Combined exposure:** exposure to multiple chemicals by a single or multiple routes at the same or different times.

**Comet assay:** A genotoxicity assay in which DNA strand breaks in an individual cell are measured using single-cell gel electrophoresis. Cell DNA fragments assume a "comet with tail" formation on electrophoresis and are detected with an image analysis system. Alkaline assay conditions facilitate sensitive detection of double-strand and single-strand damage, as well as alkali-labile sites. Modifications to standard methodology enable detection of types of DNA damage, e.g. DNA-DNA or DNA-protein cross-links and base-oxidation.

**Complementary DNA (cDNA):** cDNA is DNA that is synthesised in the laboratory from mRNA by reverse transcription. A cDNA is so-called because its sequence is the complement of the original mRNA sequence.

**Confounding variable:** (synonym - confounder) An extraneous variable that satisfies BOTH of 2 conditions: (1) it is a risk factor for the disease under study (2) it is associated with the study exposure but is not a consequence of exposure. For example cigarette smoking is a confounding variable with respect to an association between alcohol consumption and heart disease. Failure to adjust for a confounding variable results in distortion of the apparent magnitude of the effect of the exposure under study. (In the example, smoking is a risk factor for heart disease and is associated with alcohol consumption but is not a consequence of alcohol consumption.)

**Congeners:** Related compounds varying in chemical structure but with similar biological properties.

**Continuous Data:** Quantitative data that can be measured and has an infinite number of possible values within a selected range.

**Copy number variants (CNVs):** Alterations in the DNA of a genome that results in the cell having an abnormal number of copies of one or more sections of the DNA. CNVs correspond to relatively large regions of the genome that have been deleted (fewer than the normal number) or duplicated (more than the normal number) on certain chromosomes.

**Covalent binding:** Chemical bonding formed by the sharing of an electron pair between two atoms. Molecules are combinations of atoms bound together by covalent bonds.

**Critical effect size (CES):** The magnitude of the adverse effect selected at which to determine the dose to serve as a point of departure in assessing the risk from exposure to a chemical. This term is often used synonymously with Benchmark Response (BMR). Choice of CES includes both statistical and

toxicological considerations.

**Cumulative exposure:** exposure to multiple chemicals on the basis of grouping them on some common characteristic, such as mode of action, adverse effect, or inclusion in a product formulation.

**Cytochrome P450 (CYP):** An extensive family of haem-containing proteins involved in enzymic oxidation of a wide range of endogenous and xenobiotic (qv) substances and their conversion to forms that may be more easily excreted. In some cases the metabolites produced may be reactive and may have increased toxicity. In other cases the substances may be natural precursors of hormones (e.g. steroids).

**Cytogenetic:** Concerning chromosomes, their origin, structure and function.