

12 GLOSSARY

Blood-brain barrier

A functional concept developed to explain why many substances that are transported by blood readily enter other tissues, but do not enter the brain. The 'barrier' functions as if it were a continuous membrane lining the vasculature of the brain. These brain capillary endothelial cells form a nearly continuous barrier to entry of substances into the brain from the vasculature.

Calcium efflux/influx

The release/uptake of calcium ions from a sample into a surrounding solution.

Cancer

Diseases characterized by the uncontrolled and abnormal division of eukaryotic cells and by the spread of the disease (metastasis) to disparate sites in the organism.

Carcinogens

Natural and artificial agents, mostly chemicals and types of radiation, that increase the frequency with which cells become cancerous.

Case-control study

An investigation into the extent to which a group of persons with a specific disease (the cases) and comparable persons who do not have the disease (the controls) differ with respect to exposure to putative risk factors.

Cell cycle

The cyclical process of growth and cellular reproduction in unicellular and multicellular eukaryotes. The cycle includes nuclear division, or mitosis, and cell division, or cytokinesis.

Chromosomal mutation (aberration)

The variation from the wild-type condition in either chromosome number or chromosome structure.

Chromosome

The genetic material of the cell, complexed with protein and organized into a number of linear structures. It literally means 'coloured body,' because the threadlike structures are visible under the microscope only after they are stained with dyes.

Chronic exposure

Exposure lasting for very long periods, e.g. significant periods of the working life.

Cohort study

An investigation involving the identification of a group of individuals (the cohort) about whom certain exposure information is collected, followed by ascertainment of the occurrence of diseases at later times. For each individual, information on exposure can be related to subsequent disease experience.

Coil

Arrangement of current carrying wires for the purpose of producing a magnetic field. Some common types: Helmholtz coils, Merritt coils.

Confidence interval (CI)

An interval calculated from data when making inferences about an unknown parameter. In hypothetical repetitions of the study, the interval will include the parameter in question on a specified percentage of occasions (e.g. 95% for a 95% confidence interval).

Conductivity, electrical

The scalar or vector quantity which, when multiplied by the electric field strength, yields the conduction current density. It is the reciprocal of resistivity. Expressed in siemens per meter ($S\ m^{-1}$).

Continuous wave

A wave whose successive oscillations are identical under steady-state conditions.

Current density

A vector of which the integral over a given surface is equal to the current flowing through the surface. The mean density in a linear conductor is equal to the current divided by the cross-sectional area of the conductor. Expressed in ampere per square meter ($A\ m^{-2}$).

DC

Abbreviation for 'direct current', but also used to indicate constancy of fields, see 'Static field.'

Diamagnetic

A weakly magnetic material with relative permeability slightly less than one.

Dielectric constant

See permittivity.

Direct effect

A biological effect resulting from direct interaction of EMF with biological structures.

Dizziness

Dizziness may be experienced as lightheadedness, feeling like you might faint, being unsteady, loss of balance, or vertigo (a feeling that you or the room is spinning or moving).

Dosimeter

An instrument that can be worn on the body of a person for measuring exposure over time.

Dosimetry

Measurement, or determination by calculation, of internal electric field strength or induced current density, of the specific energy absorption, or specific energy absorption rate distribution, in humans or animals exposed to electromagnetic fields.

DNA (deoxyribonucleic acid)

This polymeric molecule (consisting of deoxyribonucleotide building blocks that in a double-stranded, double-helical form) is the genetic material of most organisms.

ECG

An electrocardiogram (ECG) is a test that records the electrical activity of the heart. An ECG is used to measure the rate and regularity of heartbeats, as well as the size and position of the chambers, the presence of any damage to the heart, and the effects of drugs or devices (such as a pacemaker) used to regulate the heart.

Electric field strength

The force (E) on a stationary unit positive charge at a point in an electric field. Measured in volt per meter ($V\ m^{-1}$).

Electromagnetic energy

The energy stored in an electromagnetic field. Expressed in joule (J).

Electromagnetic fields or EMF

The combination of electric and magnetic fields in the environment. This term is often confused with 'electromagnetic radiation' and can therefore be misleading when used with extremely low frequencies for which the radiation is barely detectable.

Electrostatic fields

Electric static fields produced by fixed potential differences.

ELF

Extremely low frequency (in the range of 1 - 300 Hz) electromagnetic fields.

Enzyme

A protein that facilitates a biochemical reaction in a cell.

Exposure dose

The amount of a chemical or physical agent in the environment that a person comes into contact with over a period of time.

Exposure, long-term

This term indicates exposure during a major part of the lifetime of the involved biological system. It may, therefore, vary from a few weeks to many years in duration.

Exposure assessment

The evaluation of a person's exposure by measurements, modelling, information about sources or other means.

Exposure metric

A single number that summarizes exposure to an electric and/or magnetic field. The metric is usually determined by a combination of the instrument's signal processing and the data analysis performed after the measurement.

Expression (genetic)

The process by which the information in a gene is used to create proteins.

Ferromagnetic

Strongly magnetic materials with relative permeabilities that are non-linear functions of the applied magnetic field.

Field characteristics

Detailed physical properties of electric or magnetic fields such as the magnitude, frequency spectrum, polarization, modulation, etc.

Free radical

An unchanged atomic or molecular species with an unpaired electron. In the context of this book, spin-correlated free radicals form the basis for a proposed mechanism by which magnetic fields may interact with biological tissue. Not to be confused with freely diffusing free radicals that are not systematically affected by magnetic fields.

Frequency

The number of sinusoidal cycles completed by electromagnetic waves in 1 second. Expressed in hertz (Hz).

Gauss (G)

Older unit of magnetic flux density. 1 gauss = 10^{-4} tesla (T).

General public

Those persons who do not fall under the definition of workers.

Geomagnetic field

Magnetic field originating from the Earth (including the atmosphere). Predominantly a static magnetic field, but includes some oscillating components and transients.

Gradient magnetic field

A magnetic field that is not spatially uniform. The rate at which the magnetic field changes as a function of location, which is measured in units of tesla per meter (T m^{-1}).

Heart rate

The measurement of the number of heartbeats per minute.

High-voltage DC lines

High voltage direct current lines operating at up to 500 kV, usually for the transmission of electricity over long distances.

Indirect effect

Health effects resulting from impairment of functioning of biomedical equipment caused by electromagnetic interference from external sources.

Magnetite

Magnetite, also known as lodestone, is a magnetic mineral form of iron oxide. Biogenic magnetite form the basis for a proposed mechanism by which magnetic fields influence biological systems.

Magnet

An object that has a (static) magnetic field.

Magnetic field

An vector quantity, H , specifies a magnetic field at any point in space, and is expressed in ampere per meter (A m^{-1}). See also magnetic flux density.

Magnetophosphenes

The sensation of flashes of light caused by induced electric currents stimulating the retina.

Magnetostatic fields

Static fields established by permanent magnets and by steady currents.

Magnetic flux density

A vector field quantity, B , that results in a force that acts on a moving charge or charges, and is expressed in tesla (T). The magnetic flux density

is often called the magnetic field, because the two terms differ only by a proportionality factor in vacuum (air).

Magnetic Resonance Imaging (MRI)

A diagnostic imaging technology that exploits the tendency of nuclei with magnetic moments (typically protons) to precess about static magnetic fields at frequencies proportional to the local value of the static magnetic field. Resonant radiofrequency fields excite these nuclei and are later received from relaxing nuclei, effectively reporting their locations. Magnetic field gradients are used to spatially encode the region of interest.

Magnetic Resonance Spectroscopy (MRS)

MRS uses principals similar to those used in MRI. However, uniform static magnetic fields are used without magnetic field gradients in MRS. The molecular environment near the relaxing nuclei cause differences in received frequencies. Frequency components of the resulting spectra provide a chemical analysis of the region of interest. MRS may be done *in vivo* in MR scanners. Most MRS is done *in vitro* on machines that accept only small chemical samples.

Microwaves

Electromagnetic radiation with the frequency range of 300 MHz - 300 GHz.

Mutagen

A substance that is able to cause a mutation.

Mutation

Any detectable and heritable change in the genetic material not caused by genetic recombination.

Non-ionizing Radiation (NIR)

Includes all radiations and fields of the electromagnetic spectrum that do not normally have sufficient energy to produce ionization in matter. These are characterized by energy per photon less than about 12 eV, which is equivalent to wavelengths greater than 100 nm or frequencies lower than 3×10^{15} Hz.

Occupational exposure

All exposure to EMF experienced by individuals in the course of performing their work.

Odds ratio (OR)

The ratio of the odds of disease occurrence in a group with exposure to a factor to the odds in an unexposed group. Within each group, the odds are the ratio of the numbers of diseased and non-diseased individuals.

PAH

Polycyclic aromatic hydrocarbon.

Paramagnetic

A weakly magnetic material with relative permeability slightly greater than one.

Permeability

The scalar or tensor quantity whose product by the magnetic field strength is the magnetic flux density. Note: For isotropic media, the permeability is a scalar; for anisotropic media, a matrix. Synonym: absolute permeability. If the permeability of a material or medium is divided by the permeability of vacuum (magnetic constant) μ_0 , then the result is termed relative permeability (μ). Unit: henry per meter (H m^{-1}).

Permittivity

A constant defining the influence of an isotropic medium on the forces of attraction or repulsion between electrified bodies, and expressed in farad per meter (F m^{-1}). Relative permittivity is the permittivity of a material or medium divided by the permittivity of vacuum, ϵ_0 .

Phosphenes

Weak visual sensations that occur in response to magnetic fields or by direct electrostimulation. The effect is believed to result from the interaction of the induced current with electrically excitable cells in the retina.

Power density

In radio wave propagation, the power crossing a unit area normal to the direction of wave propagation. Expressed in watt per square meter (W m^{-2}).

Public exposure

All exposure to EMF experienced by members of the general public, excluding occupational exposure and exposure during medical procedures.

Plasma membrane

Lipid bilayer that surrounds the cytoplasm of both animal and plant cells.

Protein

One of a group of high-molecular weight, nitrogen-containing, organic compounds of complex shape and composition.

Radiofrequency (RF)

Electromagnetic energy with frequencies in the range 3 kHz - 300 GHz.

Relative permeability

(Absolute) permeability (q.v.) divided by the permeability in vacuum. A value near one signifies that the material is only weakly magnetized by an external field.

Relative risk (RR)

The ratio of the disease rate in the group under study to that in a comparison group, with any required adjustments for confounding factors such as age. For rare diseases, the relative risk is practically the same as the odds ratio.

Ribonucleic acid (RNA)

A usually single-stranded polymeric molecule consisting of ribonucleotide building blocks. RNA is chemically very similar to DNA. The three major types of RNA in cells are ribosomal RNA (rRNA), transfer RNA (tRNA), and messenger RNA (mRNA), each of which performs an essential role in protein synthesis (translation). In some viruses, RNA (rather than DNA) is the genetic material.

Root mean square (rms)

Certain electrical effects are proportional to the square root of the mean of the square of a periodic function (over one period). This value is known as the effective or root-mean-square (rms) value, since it is derived by first squaring the function, determining the mean value of the squares obtained, and taking the square root of that mean value. Often used for averaging the magnitude of time-varying electric and magnetic fields.

S.I.

Abbreviation for the International System of units.

Static field

A field that does not vary with time. In most environments, electric and magnetic fields change with time, but their frequency spectrum has a component at 0 Hz. This 'quasi-static' component of the field can be measured by averaging the oscillating signal over the sample time.

Systolic and diastolic blood pressure

Blood pressure is a measurement of the force applied to the walls of the arteries as the heart pumps blood through the body. Blood pressure readings are usually given as two numbers: for example, 110 over 70 (written as 110/70). The first number is the systolic blood pressure reading, and it represents the maximum pressure exerted when the heart contracts. The second number is the diastolic blood pressure reading, and it represents the pressure in the arteries when the heart is at rest.

Tesla (T)

International System unit of magnetic flux density. 1 tesla = 10000 gauss (G).

Time-weighted average (TWA)

A weighted average of exposure measurements taken over a period of time, with the weighting factor equal to the time interval between measurements. When the measurements are made with a monitor with a fixed sampling rate, the TWA is equal to the arithmetic mean of the measurements.

Transients

Brief bursts of high-frequency fields, usually resulting from mechanical switching of AC electricity.

Voxels

Cubic cells with sides of 1 - 10 mm used to represent animal and human tissues in dosimetry models.

Waveform

A single component of the field measured as a function of time by an instrument with a response time much faster than the field's frequency of oscillation. The term also refers to the shape of the wave as displayed on a graph or oscilloscope trace.

Wavelength

The distance between two successive points of a periodic wave in the direction of propagation, at which the oscillation has the same phase.

Workers

Those people who can be exposed to electric, magnetic or electromagnetic fields in the course of their professional duties, who have been informed about the possible risks associated with such exposure, and have been trained how to reduce these risks.

