

IUPAC Recommendations

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Glossary of terms used in developmental and reproductive toxicology (IUPAC Recommendations 2016)

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Abstract: The primary objective of this glossary is to give clear definitions for those who contribute to studies relevant to these disciplines, or who must interpret them, but are not themselves reproductive physiologists or physicians. This applies especially to chemists who need to understand the literature of reproductive and teratogenic effects of substances without recourse to a multiplicity of other glossaries or dictionaries. The glossary includes terms related to basic and clinical reproductive biology and teratogenesis, insofar as they are necessary for a self-contained document, particularly terms related to diagnosing, measuring, and understanding the effects of substances on the embryo, the fetus, and on the male and female reproductive systems. The glossary consists of about 1200 primary alphabetical entries and includes Annexes of common abbreviations and examples of chemicals with known effects on human reproduction and development. The authors hope that toxicologists, pharmacologists, medical practitioners, risk assessors, and regulatory authorities are among the groups who will find this glossary helpful, in addition to chemists. In particular, the glossary should facilitate the worldwide use of chemical terminology in relation to occupational and environmental risk assessment.

Keywords: birth defects; chemical toxicology; developmental biology; reproductive health; teratogenesis; terminology.

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Preface

A major goal of IUPAC is to promote “regulation, standardization, or codification” globally in relevant areas of chemistry. To this end, the Division of Chemistry and Human Health (Division VII), recognizing the

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importance of toxicology to chemists, produced the *Glossary of Terms Used in Toxicology*, 2nd ed., in 2007 [1]. That glossary was intended to provide clear and concise definitions for a range of terms in toxicology and toxicokinetics, primarily for chemists who find themselves working in toxicology or requiring a working knowledge of the subject. It was also recognized that other scientists, regulators, and managers must, from time to time, interpret toxicological information, and it was hoped that the glossary would also provide them with ready access to internationally accepted definitions of relevant terms. A number of subspecialties have broadened the scope of toxicology; the Division expanded the collection of available definitions in 2009 with the publication of a *Glossary of Terms Used in Ecotoxicology* [2] and again in 2012 with a *Glossary of Terms Used in Immunotoxicology* [3]. A *Glossary of Terms in Neurotoxicology* [4] has special significance with respect to the present compilation, insofar as the developing nervous system is particularly susceptible to toxic substances.

Scientific terminology continues to evolve and definitions need periodic refinement. A searchable, electronic database updating and combining entries from the previous glossaries is both desirable and achievable, and a project to realize this is underway, but at its inception we realized that some areas of toxicology have been under-represented. Addressing this deficit will enhance the usefulness of the database. One area that has been under-represented in previous IUPAC glossaries is reproductive and developmental toxicology. The present document is an attempt to address this deficit. Intended to stand alone as an IUPAC Recommendation in the narrower field, it is also destined for integration into the revised, online *Glossary of Terms Used in Toxicology*, currently under construction.

In order to minimize the reader's time in consulting additional texts, terms from the previously mentioned glossaries [1–4] are included in the present text when it is felt that they are used with particular frequency in reproductive and developmental toxicology. By the nature of the subject, it is necessary to include a number of clinical and anatomical terms. We have also exercised judgment in deciding which terms from basic developmental biology should be included for the reader's convenience. In the spirit of producing a document primarily useful for chemists and allied professionals, we have tried not to be over-inclusive in this regard, only including terms that may be encountered with reasonable frequency in the literature of reproductive and developmental toxicology. When a medical term is defined, we have tried to provide a brief, useful definition that is nevertheless accurate in terms of current medical understanding. A number of syndromes caused by gene mutations have been included, although the list is necessarily selective and by no means exhaustive. In many instances there is no evidence of these being the direct result of toxic or teratogenic effects, and the guiding principle has been to include more commonly mentioned syndromes (even when their actual occurrence may be rare) as examples of potentially teratogenic outcomes.

In general, commonly preferred or American spelling has been adopted for the main entry terms; thus, for example, disc (not disk), fiber (not fibre), masculinization (not masculinisation), and tumor (not tumour). Further, somewhat arbitrary decisions must be made in listing alternative forms of terms as the main entry (*e.g.*, haploid instead of monoploid, semen instead of seminal fluid, and undescended testis instead of cryptorchism). We have generally tried to use the form we find to be in most common usage and cross-reference the lesser-used term if it also seems common: if a desired entry is not found under one construction, it should be sought under another.

Some definitions have been compiled from earlier sources, with or without modification, as indicated in the citation. When no citation is given, the term is newly defined. When a citation is given, the definition is more or less a quotation from the original. With the qualification "After [ref.]", the general concept of the original has been retained with some rewording, often for consistency with IUPAC guidelines for glossaries. "Modified from" implies that a concept specific to the source is retained but given revised wording. When a citation is indented following a *Note*, it refers only to the *Note*.

This document has been put together with invaluable input from many colleagues and expert reviewers. Where flaws remain, they are the responsibility of the authors.

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Alphabetical entries

A/D ratio

Ratio of the *adult* toxic dose to the developmentally toxic dose.

abdominal cavity

Body cavity between the *diaphragm* and pelvis that contains the abdominal organs.

ablepharia (n)/ablepharous (adj)

Congenital absence of the eyelids.

abortion

Premature termination of *pregnancy* with the death of the *embryo* or *fetus*.

abortion, induced

Intentional termination of a *pregnancy* with death of the *embryo* or *fetus*.

abortion, spontaneous

miscarriage

Non-intentional termination of *pregnancy* before the *embryo* or *fetus* has developed to the stage of independent *viability*, or in humans before the 20th week of *gestation*.

accessory rib

Rib arising from a cervical *vertebra* (*cervical rib*), or *supernumerary* rib arising from a thoracic or lumbar *vertebra*.

accessory sex gland

Any gland, other than a *gonad*, associated with the genital tract, such as the *bulbourethral* gland and *prostate*.

accessory sex organ

secondary sex organ

Organ or structure other than the *gonads* that matures at *puberty* and assists indirectly in *sexual reproduction* by nurturing and transporting *gametes*.

Note 1: In the human female the accessory sex organs include the *Fallopian tubes*, *uterus*, *vagina*, and the external genitalia.

Note 2: In the human male, the accessory sex organs include the *epididymis*, *vas deferens*, ejaculatory duct, *urethra*, *seminal vesicles*, *bulbourethral glands*, *prostate*, and penis.

β -N-acetylhexosaminidase

Hydrolytic enzyme (EC 3.2.1.52) that acts on ganglioside G_{M2} , producing *N*-acetyl-D-galactosamine and ganglioside G_{M3} .

Note: Deficiency of this enzyme is associated with *Tay-Sachs disease*.

achondroplasia (n)/achondroplastic (adj)

Inherited disorder where *ossification* of cartilage is retarded, especially affecting growth of long bones, resulting in very short limbs and a comparatively large head. Type of dwarfism.

Note: Achondroplasia results from a *mutation* in the fibroblast growth factor receptor FGFR3 gene, increasing its activity in suppressing *endochondral ossification*.

acidosis

Opposite term: *alkalosis*

Abnormal increase in hydronium ion activity (decrease in pH below the reference interval measured in arterial blood) usually caused either by an accumulation of carbon dioxide or acidic metabolites, or by a depletion of alkaline reserve (*i.e.*, bicarbonate).

Note 1: In humans, the blood pH is tightly regulated within a range of 7.35 to 7.45.

Note 2: Acidosis may occur as a result of the accumulation of ketones in uncontrolled diabetes mellitus (diabetic acidosis) or after calorie deprivation (starvation acidosis), or with accumulation of ketoacids at the expense of bicarbonate (metabolic acidosis). Suppression of respiration can produce a respiratory acidosis.

Note 3: Some intoxications can produce metabolic and (or) respiratory acidosis.

acinus

1. Small sac-like cavity in a *gland*, surrounded by secretory cells.
2. Terminal region of the airways of the lung where gas exchange occurs.

acoustic meatus

Either of two passages in the ear, one leading to the *tympanic* membrane (external acoustic meatus), and one for passage of nerves and blood vessels (internal acoustic meatus).

[5]

acrania

Rare *congenital* disorder that occurs in the human *fetus*, in which the flat bones in the *cranium* are either completely or partially absent.

acrocephaly

acrocephalia

oxycephaly

Type of *cephalic* disorder where the top of the skull is pointed or conical due to premature closure of the coronal suture plus any other suture.

Note: Acrocephaly should be differentiated from *Crouzon syndrome*, which involves the maxilla and mandible.

acromegaly

acromegalia

Abnormal enlargement of the hands, feet, and face in adults, caused by overproduction of *growth hormone* by the *pituitary* gland.

Note: Overproduction of *growth hormone* by the *pituitary* gland in children causes *gigantism*.

acrosome

Organelle that develops over the anterior half of the head in the *spermatozoon*.

Note: The acrosome is a cap-like structure derived from the Golgi apparatus.

acrosome reaction

Process that occurs in the *acrosome* of the *sperm* as it contacts the *egg*, leading to structural changes that facilitate fusion.

activin

Growth factor of the transforming growth factor β (TGF- β) superfamily, originally identified as a gonadal factor that stimulated secretion of *follicle stimulating hormone*, also involved in many aspects of development including *mesodermal* induction (see *mesenchyme*), *hematopoiesis*, and *neuronal* differentiation.

acyclicity

Irregular or absent *estrous cycles*.
Compare *anestrus*.

Ad4BP

See *adrenal 4 binding protein*.

adactyly

adactylia
adactylism
Congenital absence of fingers or toes.

adenocarcinoma

Malignant *tumor* formed from glandular *epithelial* tissue or formed in a glandular pattern.

adermia

Congenital absence of skin.

adhesion factor

Substance contributing to selective cell-cell and cell-matrix binding.

aditus

Entrance or opening to some interior space or cavity.

adolescence (n)/adolescent (adj)

Stage of human development beginning with *puberty* and ending with *adulthood*.

adrenal 4 binding protein (Ad4BP)

Transcription factor that regulates the *expression* of the enzymes of *steroid* synthesis and is expressed primarily in steroidogenic cells.

adrenal gland

paranephric gland
suprarenal gland
Either of two small *endocrine glands*, one located above each kidney, consisting of a cortex, which secretes several *steroid hormones*, and a *medulla*, which secretes *adrenaline* and *noradrenaline*.

adrenaline

epinephrine
4-[(1R)-1-hydroxy-2-(methylamino)ethyl]benzene-1,2-diol
Catecholamine hormone secreted by the *adrenal glands* that increases heart rate, breathing rate, blood pressure, and carbohydrate metabolism.
See also *noradrenaline*.

adrenocorticotrophic hormone (ACTH)

Hormone secreted by the *pituitary gland* and stimulating the adrenal cortex (see *adrenal gland*).

adrenogenital syndrome

See *congenital adrenal hyperplasia*.

adult

Person or animal that is fully grown, developed and sexually mature.

adulthood

State of being *adult*.

adult stem cell

See *stem cell*.

aganglionic megacolon, congenital

See *Hirschsprung disease*.

agenesis

Absence or partial development of an organ or body part observed at *birth*.

age-specific birth rate

age-specific fecundity

age-specific fertility rate

Mean number of offspring born to a female in a specific age class in a given year, expressed per 1000 females in that age class.

[2]

aggregation chimera

Organism made by combining cells from two *embryos* of different *genotypes*.

After [6]

agnathia

Congenital absence or partial absence of the lower jaw.

See also *macrognathia*, *otocephaly*, *synotia*.

agonist

Opposite term: *antagonist*

Substance, naturally occurring or otherwise, that binds to cell *receptors* that normally respond to a naturally occurring substance, and producing an effect similar to the natural substance.

Note 1: A partial agonist activates a receptor but does not cause as much of a physiological change as does a full agonist.

Note 2: A co-agonist works together with other co-agonists to produce a desired effect.

After [1]

alar plate

Part of the *dorsal* side of *neural tube* in the *embryo*, involved in general *somatic* and *visceral* sensory communication.

albinism

achromasia

achromatosis

Congenital disorder characterized by the complete or partial absence of pigment in the skin, hair and eyes, due to an absence of or defect in tyrosinase, a copper-containing enzyme involved in the production of melanin.

Compare *leucism*.

alcohol-related neurodevelopmental disabilities (ARND)

Spectrum of functional neurologic (behavioral) defects resulting from exposure *in utero* to alcohol.
See also *fetal alcohol syndrome*.

alkalosis

Opposite term: *acidosis*

Abnormal decrease in hydronium ion activity (increase in pH above the reference interval of 7.35 to 7.45 in humans) measured in the arterial blood.

Note: Common causes of alkalosis include a decrease in CO₂, deficiency of chloride, and decreased bicarbonate.

allantois (n)/allantoic (adj)

Extra-embryonic membrane formed early in development as an outpouching of the *yolk sac* into the area of the future *umbilical cord*.

Note: Blood vessels of the allantois become the *umbilical artery* and *umbilical veins*.

allele

One of several alternate forms of a *gene* that occur at the same relative position (*locus*) on *homologous chromosomes*.

Note: Paired alleles become separated during *meiosis* and can be recombined following fusion of *gametes*.

[1]

alopecia

Hairlessness; absence or thinning of hair from areas of skin where it is usually present.

[1]

alopecia, neonatal

See *neonatal occipital alopecia*.

alpha-fetoprotein (AFP)

α-1-fetoprotein

Protein coded by the AFP gene and produced by *fetal* tissues, an abnormally high amount of which in the *amniotic fluid* or maternal serum may indicate a *neural tube defect*, or some other loss of structural integrity in the fetus.

alpha-reductase

See *5α-reductase*.

alveolar period

alveolar phase

Phase in lung development beginning *in utero* (about 32 to 36 weeks in the human fetus) and lasting until about 8 years of age.

Note: In this phase, the terminal alveolar saccules subdivide several more times, giving rise to the mature *alveoli*.

alveolus

Any of the many terminal air sacs of the airways in the lungs necessary for rapid gaseous exchange with the blood.

amastia

Congenital absence of one or both *mammary glands*.

ambisexual

bisexual

1. Pertaining to or characterized by *hermaphroditism*.
2. Denoting sexual characteristics common to both sexes, *e.g.*, *pubic* hair.

amelia

Lacking one or more limbs or having a shrunken or deformed limb as a *birth defect*.

See also *phocomelia*.

ameloblast

Epithelial cell that deposits enamel during tooth development.

amelogenesis imperfecta

hereditary yellow, brown, or grey tooth enamel

Developmental disorder of the teeth in which they are covered with thin, abnormal enamel resulting from defective structure or processing of enamel proteins.

amenorrhea

menostasis

Absence or abnormal stoppage of *menstruation*.

Ames test

Method for assessing *mutagenicity* performed *in vitro* using mutant (see *mutation*) strains of the bacterium *Salmonella typhimurium* that cannot grow in a given histidine-deficient medium

Note 1: Mutagens cause reverse mutations that enable the bacterium to grow on the deficient medium.

Note 2: The test can be carried out in the presence of differentially centrifuged liver homogenates, providing enzymes that catalyze the metabolic transformation of mutagen precursors to active derivatives.

[1]

amniocentesis

Transabdominal procedure in which *amniotic fluid* is sampled by means of a needle inserted into the *amniotic sac*.

Note: This procedure is used to screen for infections and abnormalities in the developing *fetus*.

amniochorionic membrane

Composite *membrane*, formed by fusion of the *amnion*, interiorly, with the outer *chorion* that surrounds the developing *fetus*.

amnion

Membrane that lines the *amniotic cavity* (*amniotic sac*) and encloses the *embryo* of a mammal, bird, or reptile.

amniote

Any *vertebrate* animal, such as a reptile, bird, or mammal, that possesses an *amnion*, *chorion*, and *allantois* during *embryonic* development.

Compare *anamniote*.

amniotic cavity

Fluid-filled space that surrounds the developing *embryo* of a mammal, bird, or reptile, bounded by the *amniotic sac*.

amniotic fluid

Fluid surrounding an *embryo* or *fetus* in the *amniotic cavity*.

amniotic sac

Membranous structure in *amniotes*, within which the *embryo* and *fetus* develop.

Note: It consists of a thin but tough, transparent pair of membranes, the *amnion* and *chorion*, that hold the developing *embryo* (and later *fetus*) until shortly before *birth*.

amphibian metamorphosis assay

Procedure in which a frog (often *Xenopus laevis*) is exposed to a substance starting at the tadpole stage, and the growth and development of the animals is studied.

See also *FETAX*.

ampulla

Flask-like dilatation of a *canal* or *duct*.

anal canal

Terminal part of the large intestine between the rectum and anus.

Note: The anal canal arises as the *dorsal* cavity of the *cloaca* after division of the cloaca by the urorectal septum, the *ventral* cavity becoming the *urogenital sinus*.

See also *anal membrane*.

anal membrane

In the *embryo*, dorsal part of the *cloacal membrane* after its division of the urorectal septum.

[5]

anal pit

See *proctodeum*.

anamniote

Any *vertebrate* animal, such as a fish or amphibian, that lacks an *amnion*, *chorion*, and *allantois* during *embryonic* development.

Compare *amniote*.

anaphase

Stage of *mitosis* and *meiosis* in which the *chromosomes* move from the equatorial plate toward opposite ends of the *nuclear spindle*.

anaphase lag

Slowing or stopping of normal migration of *chromosomes* during *anaphase*, resulting in chromosomes being excluded from one of the daughter cells causing *aneuploidy*.

anasarca

hydrosarca

dropsy

Generalized *edema* in the subcutaneous *connective tissue*.

Note: Anasarca may be *congenital* (whole body edema) caused by liver failure, renal failure, right-sided heart failure, or severe malnutrition with resultant protein deficiency.

anastomosis

Connection creating continuity between two tubular body structures, *e.g.* blood vessels or loops of bowel.

Note: An anastomosis may be a surgical construction (as when the two cut ends are joined following resection of a loop of bowel), may result from trauma, or may occur as a natural anatomic feature, typically involving blood vessels (as in an arteriovenous anastomosis bypassing a capillary bed; see *arteriovenous shunt*).

anatomic position, fetal

Usual positioning of the developing *fetus* with the back curved forward, head bent forward, and limbs drawn in towards the body.

Note: This position arises from the natural positioning of the *embryo* as the *germ layers* develop.

anchoring villus

Chorionic villus that is attached to the region of the *endometrium* (see also *decidua*) that interacts with the *trophoblast* during development of the *placenta*.

androblastoma

arrhenoblastoma

Sertoli cell tumor

Rare benign *tumor* of the *testis* histologically resembling the *fetal testis*: the *epithelium* contains *Sertoli cells* that may produce *estrogen* and cause feminization.

[5]

androgen

Substance, such as a naturally occurring *steroid hormone*, that binds to *androgen receptors* to activate the male *accessory sex organs* and induce male *secondary sexual characteristics*.

See also *androgenic*.

androgenic

Producing masculine characteristics.

See also *androgen*.

androgen receptor (AR)

Nuclear receptor that is activated by binding of *testosterone* or dihydrotestosterone.

See also *androgen*, *androgenic*.

androstenedione

Steroid hormone produced in the *adrenal glands* and *gonads* as a common precursor of male (*testosterone*) and female (*estrogen*) sex hormones.

anemia

Decrease in the number of erythrocytes or total hemoglobin in the blood that results in a decrease in the oxygen-carrying capacity of the blood, sometimes inducing pallor and fatigue.

anencephalus

1. *Fetus* lacking all or most of the neural tissues of brain.
2. *Anencephaly* (see below).

anencephaly (n)/anencephalic (adj)

anencephalia

Congenital absence of a major portion of the brain and its *meninges*, skull, and scalp that results from abnormal *embryonic* development.

anestrus

Interval of sexual inactivity between two periods of *estrus*.

aneugen (n)/aneugenic (adj)

Agent inducing *aneuploidy*.

aneuploid

Referring to a cell or organism with missing or extra *chromosomes* or parts of chromosomes, and thus an abnormal number of chromosomes that is not an exact multiple of the *haploid* number.

[1]

See also *euploid*, *ploidy*.

aneuploidy

State of being *aneuploid*.

aneurysm

Abnormal bulging of the wall of an artery or a chamber of the heart.

Note: An aneurysm may present a risk of hemorrhage if it ruptures.

angioblast

vasoformative cell

1. Cell taking part in blood vessel formation.
2. Primordial *mesenchymal* tissue from which *embryonic* blood cells and vascular *endothelium* are differentiated.

[7]

angiogenesis (n)/angiogenic (adj)

Development of new blood vessels in the *embryo* or from pre-existing vessels; formation of capillary networks. Compare *arteriogenesis*, *vasculogenesis*.

angiotensin converting enzyme (ACE)

Enzyme (EC 3.4.15.1) that converts angiotensin I to angiotensin II, causing blood vessels to constrict thus increasing blood pressure.

Note: ACE inhibitors are used clinically to lower blood pressure.

ankyloglossia

Congenital oral anomaly, in which the lingual frenulum (the membrane connecting the underside of the tongue to the floor of the mouth) is unusually short and thick.

Note: As a result of this, mobility of the tongue tip is decreased.

anodontia

Congenital absence of all primary or permanent teeth.

anogenital distance (AGD)

Distance along the *perineum* between the *anus* and the base of the *vagina* or penis, or in the *fetus* between the anus and the base of the *genital tubercle*.

Note 1: The distance is relatively longer in males than females. This in part relates to dihydrotestosterone levels, and abnormal distances may indicate birth defects, *feminization* in males, *etc.*

Note 2: In some species where gender is not obvious at birth, it can be used for a tentative determination of the sex of the *neonate*.

anomaly, developmental

congenital anomaly

Deviation in structure or function arising in the *embryo* or *fetus*, due to genetic or other causes.

See also *congenital malformation, variation*.

anonychia

Absence of nails.

Note: This rare disorder may be the result of a *congenital* defect of *ectoderm*, *ichthyosis*, severe infection, severe allergic contact dermatitis, self-inflicted trauma, Raynaud phenomenon, *lichen planus*, *epidermolysis bullosa*, or severe *exfoliative* diseases.

anophthalmia

Congenital absence of one or both eyeballs.

anorchism

Congenital absence of one or both testes.

anorectal

Relating to the *anus* and rectum.

anotia

Congenital absence of the (outer ear) *pinna*, often with narrowing or absence of the ear canal.

anovulation

Failure of the ovaries to produce, to facilitate maturation of, or to release ova.

anoxia

Total absence of dioxygen.

Note: Sometimes anoxia is incorrectly used instead of *hypoxia* to mean a decreased dioxygen supply to the tissues.

After [1]

antagonist (in toxicology)

Opposite term: *agonist*

1. Any substance that competes for effect with, or blocks the biological action of, another.
2. At a cell receptor, substance that binds to the receptor without activating it, and prevents a response to the natural ligand (the *agonist*).

antemortem

Opposite term: *postmortem*.

Before death.

antepartum

Before *birth*.

antidiuretic hormone

See *vasopressin*.

antimitotic

Referring to inhibition of cell division by *mitosis*.

anti-Müllerian hormone (AMH)

Müllerian inhibiting factor (MIF)

Müllerian-inhibiting hormone (MIH)

Müllerian-inhibiting substance (MIS).

Protein that inhibits the development of the *Müllerian ducts* (paramesonephric ducts) in the male *embryo*.

Note: The Müllerian ducts would otherwise differentiate into the *uterus* and *Fallopian tubes*.

antrum

Cavity or chamber, often in bone, with specific meanings in some hollow organs (e.g., the pyloric end or gastric antrum of the stomach).

anus (n)/anal (adj)

External opening of the rectum to the body surface, controlled by the anal *sphincter*.

See also *imperforate anus*.

aorta (n)/aortic (adj)

Great artery arising from the left ventricle, being the main trunk from which the systemic arterial system proceeds

[5]

aorta-gonad-mesonephros (AGM) region

Region of the *vertebrate embryonic mesoderm* that gives rise to the *genitourinary* tract and its blood supply.

Note: The AGM region is the first embryonic site for autonomous *hematopoiesis* and production of hematopoietic stem cells.

aortic arch

Curved portion of the *aorta* between its ascending portion exiting the heart and its descending portion that proceeds to the arteries of the *thoracic* and *abdominal cavities* and the lower body.

aortopulmonary septum

aorticopulmonary septum

Spiral *septum* that, during development, separates the *truncus arteriosus* into a *ventral pulmonary* trunk and the ascending *aorta dorsally*.

After [7]

aphakia

Absence of the lens of the eye, occurring as a *congenital* defect or as a result of trauma or surgery.

Note: Aphakia causes a loss of visual accommodation, far sightedness (hyperopia), and a deep anterior chamber of the eye.

apoptosis (n)/apoptotic (adj)

Active process of programmed cell death, characterized by cell shrinkage, nuclear condensation, and fragmentation and loss of individual cells; usually involving activation of *caspase* enzymes and requiring energy provided by hydrolysis of ATP.

Note 1: Other factors trigger cell death with characteristics of apoptosis but independent of caspase activation, an example being release of apoptosis-inducing factor (AIF) from the mitochondrion. Here the term caspase-independent apoptosis is used.

Note 2: While ATP is generally necessary to sustain the apoptotic program, depletion of ATP during the course of apoptosis may cause cells to default to death by *necrosis* (see *necrapoptosis*, *aponecrosis*), or proceed to apoptotic death with features common to necrosis, sometimes called “late apoptosis”. Alternatively, in some circumstances apoptosis may proceed without ATP (“ATP-independent apoptosis”).

See also *anoikis*, *autophagy*, *extrinsic pathway*, *intrinsic pathway*, *parthanatos*.

appendicular skeleton

Bones and *cartilage* that support the appendages, including the bones of the shoulders, upper limbs, pelvis, and lower limbs.

See also *axial skeleton*.

appendix (in anatomy)

3. Tube-shaped sac (“vermiform appendix”) attached to and opening into the upper end of the large intestine (*cecum*) in humans and some other mammals.

4. Appendage, blind sac, or diverticulum.

See also *epididymal appendix*.

arachnodactyly

Extreme length and slenderness of the fingers or toes.

arachnoid mater

See *arachnoid membrane*.

arachnoid membrane

Weblike *membrane* that lies between the outer (and much thicker) *dura mater* and the deeper *pia mater*, and which covers the brain.

Note: The arachnoid membrane is separated from the pia mater by the subarachnoid space, in which the *cerebrospinal fluid* flows and is absorbed by the arachnoid villi.

arachnoid villus

arachnoid granulation

Small projection of the *arachnoid membrane* into some of the venous sinuses of the *dura mater*.

areola (n)/areolar (adj)

1. A circular area of different color surrounding a central point, such as that surrounding the nipple of the breast, the part of the iris surrounding the pupil of the eye, or an area surrounding a *vesicle*.

2. Any minute space or interstice in a tissue.

After [5]

arm bud

See *limb bud*.

Arnold-Chiari malformation

Chiari malformation

Congenital herniation of the brainstem and lower cerebellum through the *foramen magnum* into the cervical *vertebral canal*.

Note: This malformation is often associated with *meningocele* and *spina bifida*.

[8]

See also *neural tube defect*.

aromatase

estrogen synthetase

Enzyme (EC 1.14.14.1) of the *cytochrome P450* superfamily that converts *testosterone* to 17 β -estradiol and androstenedione to estrone.

Note: Inhibiting its action is an approach to the management of breast *cancer*.

arrhenoblastoma

See *Sertoli-Leydig cell tumor*

arteriogenesis

Increase in the diameter of arterial vessels that leads to the formation of large conductance arteries from pre-existing arterioles.

arteriovenous (AV) anastomosis

See *anastomosis*.

arteriovenous (AV) shunt

Connection between the arterial and venous sides of the circulation that bypasses the capillary beds.

artificial insemination

Introduction of *semen* into the *cervix*, *uterus* or *Fallopian tubes* by means other than the natural one.

See also *insemination*.

aryl hydrocarbon receptor (AHR)

Ligand-activated *transcription factor* involved in the regulation of biological responses to planar aromatic hydrocarbons.

Note 1: This *receptor* has been shown to regulate *xenobiotic*-metabolizing enzymes such as various forms of *cytochrome P450* family 1 members.

Note 2: It also appears to play a role in cell proliferation and differentiation during vertebrate development, including hematopoiesis and development of the lymphoid and immune systems.

aryl hydrocarbon receptor nucleotide translocator protein (ARNT)

Protein coded for by a gene on *chromosome 1q21* that forms a complex with ligand-bound *aryl hydrocarbon receptor*, resulting in translocation of the ligand-binding subunit to the nucleus.

Note: A t(1;12)(q21;p13) *chromosomal translocation*, which results in a translocated ETS leukemia (TEL)-ARNT fusion protein, is associated with acute myeloblastic leukemia.

atelectasis

1. Total or partial collapse of the lung.
2. *Congenital* condition characterized by the incomplete expansion of the lungs at *birth*.

athelia

Congenital absence of one or both nipples.

athymia

1. *Congenital* absence of functioning thymus tissue.
2. Absence of affect; suppressed emotion.

atresia

clausura

Congenital absence or abnormal narrowing of a normal opening or normally patent lumen.

atresia, follicular

Degeneration of those *ovarian follicles* that do not *ovulate* during the *menstrual cycle*.

atrial-septal defect (ASD)

Defect in the septum between the atria of the heart, due to failure of normal closure of the *foramen ovale* in the *perinatal* period.

atrachia congenita

Congenital baldness caused by an abnormality of the hairless *gene*.

Note: It may include loss of hair in early childhood, which never regrows.

atrioventricular

Relating to the atrial and ventricular chambers of the heart.

atrioventricular bundle

See *bundle of His*

atrium

Each of the two upper chambers of the heart from which blood is passed to the ventricles.

Note: The right atrium receives deoxygenated blood from the veins of the body, the left atrium oxygenated blood from the *pulmonary vein*.

atrophy

Wasting away of the body or of an organ or tissue, involving a decrease in size and (or) numbers of cells.

[1]

auditory tube

Eustachian tube

Narrow channel connecting the middle ear and the *nasopharynx*.

[5]

auricle

1. See *pinna* of the ear.
2. An appendage to the *atrium* of the heart.

autopsy

Postmortem examination of the human organs and body tissue to determine cause of death or pathological condition.

autosite

Independent twin of a pair of *conjoined twins*; the other twin is a *parasitic twin*.

autosomal dominant mutation

Change in an *autosomal gene* capable of *expression* when carried by only one of a pair of *homologous chromosomes*.

autosomal recessive mutation

Change in an *autosomal gene* that produces an effect in the organism only when it is *homozygous*.

autosome (n)/autosomal (adj)

Any *chromosome* that is not a *sex chromosome*.

avascularity (n)/avascular (adj)

Absence of a blood supply.

axial skeleton

Bones of the body axis, including the skull, *spinal column*, ribs and sternum.

See also *appendicular skeleton*.

azoospermia

Absence of viable *spermatozoa* in the *semen*.

Barr body

See *sex chromatin*.

basal ganglia

basal nuclei

Complex structure at the base of the brain consisting of several groups of *neurons*, the caudate nucleus, the putamen, the globus pallidus, and the substantia nigra.

Note: These ganglia are involved in various functions, including voluntary motor movements and involuntary movements, such as tremors, bruxism (grinding the teeth), athetosis (involuntary writhing movements), and chorea (involuntary jerky movements).

basal lamina

See *basement membrane*.

basement membrane

basal lamina

Thin layer of *connective tissue* underlying an attached *epithelial* cell layer.

bell stage

Period in which the developing tooth takes on a bell shape in cross section, immediately preceding the “advanced bell stage”, in which the hard tissues (dentin and enamel) form the crown of the tooth.

bicornate uterus

Uterus that is divided into two lateral horns as a result of imperfect fusion of the paired *embryonic* tubes from which the uterus is formed.

Note: In humans it is a uterine malformation, but in some mammalian species, including rodents and pigs, it is normal.

bilaminar embryo

bilaminar blastoderm

Early *blastula* having only two of the three primary *germ layers* that it will ultimately have; the two layers present are the cells of the *epiblast* that will give rise to the *ectoderm* and those of the *hypoblast* that will become the *endoderm* during *gastrulation* – both attached to a basement membrane before the *mesoderm* has formed.

birth

Start of life as a physically separate being, *e.g.*, the emergence of a baby from the body of its mother, or the hatching of an egg.

birth defect

congenital defect

Physical or biochemical abnormality that is present at *birth*, and that may either be inherited or be the result of environmental influence.

Compare *congenital malformation*.

bisexual

See *ambisexual*.

blastema

Mass of cells from which an organ or a body part develops, either in normal development or in the regeneration of a lost body part.

After [7]

blastocoel

cleavage cavity

segmentation cavity

Fluid-filled cavity in the *blastula* of a developing *embryo*.

blastocyst

Modified *blastula* that is characteristic of *placental* mammals.

Note: It has an outer cell layer, known as the *trophoblast*, which participates in the development of the placenta, and an inner mass of cells in the *blastocoel*, which develops into the *embryo*.

blastomere

Any of the cells formed by *cleavage* of a *fertilized egg*.

blastula

blastocyst

blastodermic vesicle

Hollow mass of cells formed after a *zygote* has undergone approximately six cell divisions.

See also *blastocoel*, *blastocyst*.

blastulation

Process by which the early *embryo* transforms from the *morula* into the *blastula*.

See also *blastocyst*.

blood-testis barrier

blood-seminiferous tubule barrier

Sertoli cell barrier (SCB).

Occluding barrier, formed by the *Sertoli cells* of the *seminiferous tubules*, that separates the more mature cells of *spermatogenesis* from blood-borne products.

Note: The name “blood-testis barrier” is misleading in that it is not a blood-organ barrier in a strict sense, but is formed between Sertoli cells of the seminiferous tubule and, as such, isolates the further developed stages of *germ cells* from the blood. A more correct term is the “Sertoli cell barrier” (SCB).

After [7]

body cavity

See *coelom*.

bone age

Average age at which children reach a given stage of bone maturation, denoting the stage of skeletal development of an individual *fetus* or child.

Note: A child's current height and bone age can be used to predict *adult* height.

bone morphogenetic protein (BMP)

bone morphogenic protein

Any of a family of *growth factors* involved in bone and *cartilage* formation and, more generally, in orchestrating tissue architecture through *morphogenetic* signals.

Note: These proteins are also considered to be *metabologens*.

bone morphogenetic protein-4 (BMP4)

bone morphogenic protein-4 (BMP4)

Bone morphogenetic protein member of the transforming growth factor β (TGF- β) superfamily.

Note: Amongst the multiple functions of BMP4 is a role in early *embryonic* differentiation, where it is secreted from the *notochord* and acts with *sonic hedgehog* protein to establish a *dorsal-ventral* axis.

See also *Spemann organizer*.

brachydactyly

brachydactylia

Congenital abnormal shortness of fingers and toes.

branchial

Of, relating to, or resembling the gills of a fish or the *homologous embryonic* structures and their derivatives in higher animals.

branchial arch

gill arch

1. In *embryology*, one of several arches, resembling the gill arches of a fish, found in the *embryo* of a higher *vertebrate*; these arches develop into structures of the ear and neck.
2. In biology, one of several bony or *cartilaginous* arches located on either side of the *pharynx* and supporting the gills in fish and amphibians.

branchial cyst, congenital

branchiogenic cyst

Congenital cyst arising in the lateral aspect of the neck, from *epithelial* remnants of a *pharyngeal groove*.

brevicollis

Shortness of the neck.

bronchopulmonary segment

Largest subdivision of a lobe of the lung with its air supply from a major branch of the bronchus and having its own arterial blood supply.

buccopharyngeal membrane

oropharyngeal membrane

Membrane present in *fetal* life that separates the *nasal* cavities from the *pharynx*.

bud

Small protuberance resembling the bud of a plant and having the potential for growth and differentiation.

bulb, olfactory

Region of the frontal lobe of the brain, receiving input from *neurons* of the *nasal mucosa* and involved in the sense of smell.

bulbourethral gland

Cowper's gland

One of two small *glands* located on each side of, and inferior to, the *prostate*, draining to the *urethra*. Bulbourethral glands secrete a fluid component of the *seminal fluid*

bulbus cordis

Outflow tract of the *embryonic* heart between the primitive ventricle and the *aorta*.

[9]

bundle of His

atrioventricular bundle

Band of specialized cardiac muscle fibers connecting the atria with the ventricles of the heart.

Note: These muscle fibers conduct the electrical impulse that regulates the heartbeat from the right atrium to the ventricles.

After [5]

bursa

Padlike fluid-filled sac or sac-like cavity, especially one reducing friction at a joint.

Caesarian section

Caesarian delivery

Surgical operation for delivering a child by opening the mother's abdominal wall and *uterus*.

canal

In biology and medicine, a relatively narrow tubular passage or channel.

cancer

Disease resulting from the development of a *malignant tumor*.

[1]

capacitation (of sperm)

Sum of biochemical changes undergone by mammalian *spermatozoa* in the female *genital tract* that enables them to penetrate and fertilize (see *fertilization*) an *egg*.

[10]

caput epididymis

globus major

head of epididymis

Upper and larger extremity of the *epididymis*.

carcinogenesis (n)/carcinogen(et)ic (adj)

Induction, by chemical, physical, or biological agents, of *malignant neoplasms* and thus of *cancer*.

[1]

cardiac

Pertaining to the heart.

cardiac jelly

Gelatinous substance, present between the *endothelium* and *myocardium* of the heart in early *embryos*, that develops into the *connective tissue* of the *endocardium*.

cardiogenesis

Development of the heart in the *embryo*.

cardiogenic

1. Originating in the heart; describing anything caused by normal or abnormal function of the heart.
2. Pertaining to *cardiogenesis*.

cardiovascular

Pertaining to the heart and blood vessels.

cartilage (n)/cartilaginous (adj)

Specialized, fibrous *connective tissue* present in *adults*, forming the temporary skeleton in the *embryo*, providing a model in which the bones develop, and constituting a part of the organism's growth mechanism.

castration

Removal of the *testicles* or *ovaries*.

See also *sterilization*.

cataract

Partial or complete opacity (clouding) of the lens of the eye.

catecholamine

Any one of a group of bioactive molecules that contains a catechol (1,2-dihydroxyphenyl) moiety and usually affects the sympathetic nervous system.

Note: The common catecholamines are dopamine, *adrenaline*, and *noradrenaline*.

cauda epididymis

globus minor

Tail of the *epididymis* that opens into the ductus deferens; part of the reservoir of *spermatozoa*.

caudal

Situated more toward the cauda, or tail, than some specified reference point; toward the inferior (in humans) or posterior (in animals) end of the body.

[5]

cavitation (in biology)

Formation of a cavity, as in formation of the *amnion* in mammalian development.

cecum

Pouch connected to the junction of the small and large intestines.

See also *appendix*, *vermiform*.

central nervous system (CNS)

Part of an animal's nervous system that exerts control over the rest of the nervous system; in *vertebrates*, the brain and spinal cord protected within the *dorsal* body cavity (cranial and spinal cavities).

centromere

Constricted region of a *chromosome* that joins the two *chromatids* to each other and attaches to spindle fibers in *mitosis* and *meiosis*.

centromere, acrocentric

Having the *centromere* very close to one end.

cerebral hemisphere

Right or left half of the brain in *sagittal* section.

cerebral palsy

spastic paralysis

Condition marked by lack of muscle control, resulting from brain damage before, at, or shortly after *birth*.

cerebrospinal fluid (CSF)

Clear, colorless extracellular fluid that is found in the brain and spinal cord, filling the ventricles and subarachnoid spaces.

Note: The fluid acts as a cushion, providing mechanical and immunological protection to the brain, and plays an important role in the homeostasis and metabolism of the *central nervous system*.

cervical rib

costa cervicalis

Supernumerary rib arising from a cervical *vertebra*.

cervix

cervix uteri

uterine cervix

Narrow lower end of the *uterus* that opens into the *vagina*.

checkpoint pathway

Type of pathway used in intracellular signaling, activated in response to a cell's own internal imbalance or to errors in its synthetic activities.

Note: Activation of checkpoint pathways leads to a delay in certain synthetic processes until other processes are complete, thereby averting damage.

cheiloschisis

See *cleft lip*.

Chernoff-Kavlock assay

Group of testing methods for assessing *parturition*, *postnatal* growth, and *viability* of *prenatally* exposed *litters* of test animals.

Chiari malformation

See *Arnold-Chiari malformation*.

chimera (n)/chimeric (adj)

Animal consisting of genetically different cells derived from two (or more) different *zygotes*. Substance, such as an antibody, created from the proteins or *genes* of two different species.

chondrification

Formation of *cartilage*; transformation into cartilage.

chondroblast

Cartilage-producing *mesenchymal* progenitor cell, capable of proliferating and maturing into a *chondrocyte* or *osteoblast*.

chondrocyte (n)/chondrocytic (adj)

Any one of the cells embedded in the lacunae of the *cartilage* matrix.

After [5]

chordin

Secreted protein that *dorsalizes* early *vertebrate embryonic* tissues by binding to *ventralizing* transforming growth factor β (TGF- β)-like *bone morphogenetic proteins*, sequestering them in latent complexes.

chorioallantoic placenta

Placenta developed from the *allantois* and *chorion*, establishing a nutritive and excretory connection between the blood of the *fetus* and that of the mother.

chorion

1. In human *embryology*, the cellular, outermost extra-*embryonic membrane*, composed of *trophoblast* lined with *mesoderm*.

Note: The chorion develops *villi*, becomes vascularized by *allantoic* vessels, and forms the *fetal* part of the *placenta*.

2. In mammalian *embryology*, the cellular, outer extra embryonic membrane, not necessarily developing *villi*.

3. In biology, the noncellular membrane covering *eggs* of various animals, *e.g.*, fish and insects.

After [5]

chorionic gonadotropin

Hormone secreted by the *chorionic villi* of the *placenta* in mammals, especially *human chorionic gonadotropin*.

Note 1: Chorionic gonadotropin promotes the secretion of *progesterone* by the *corpus luteum*.

Note 2: Human chorionic gonadotropin is the hormone that is detected by *pregnancy tests*.

chorionic sac

Outermost *membranous* sac that encloses the *embryo* in higher *vertebrates* (reptiles, birds, and mammals), lined by *chorion*.

chorionic villus

Any of the tiny extensions from the *chorion* that contain *fetal* blood vessels and combine with the *uterine* tissue to form the *placenta*.

chorioretinitis

Inflammation of the choroid layer behind the *retina* of the eye.

choroid plexus

Infoldings of blood vessels of the *pia mater*, projecting into the cerebral ventricles, covered with ependymal cells, and secreting *cerebrospinal fluid*.

chromaffin cell

Cell of the *adrenal* medulla that secretes *epinephrine* and *norepinephrine*, and contains granules that are readily stained with chromate salts.

chromatid

One of a pair of *chromosomes* arising by duplication during *mitosis* or by pairing during *meiosis*, and joined together at the *centromere*.

Note: Sister chromatid refers to either one of the joined pair arising from the same chromosome by duplication, and non-sister chromatid refers to either of the joined homologous chromosomes of maternal or paternal origin arising during *meiosis*.

chromosomal abnormality

Abnormality in the number or structure of *chromosomes*.

chromosomal translocation

See *translocation*, *chromosomal*.

chromosome

1. Self-replicating structure consisting of DNA complexed with various proteins and involved in the storage and transmission of genetic information.
2. Physical structure that contains the *genes*.

After [1]

chromosome, acrocentric

See *centromere*, *acrocentric*.

chromosome deletion

Loss of a *chromosome* or part of a chromosome.

chromosome ring

Abnormal *chromosome* in which both ends have been lost and the two broken ends have reunited to form a ring-shaped structure.

See also *chromosome deletion*.

clastogen (n)/clastogenic (adj)

Agent causing *chromosome* breakage and (or) the consequent gain, loss, or rearrangement of pieces of chromosomes.

[1]

cleavage (in embryology)

First few divisions of a *fertilized egg*.

Note: There is little or no growth during these divisions and the cytoplasm is cleaved into smaller and smaller units with individual biochemistry that contributes to subsequent cell differentiation.

See also *blastocyst*, *blastomere*, *blastula*, *gastrulation*, *holoblastic*, *inner cell mass*, *meroblastic*, *trophoblast*, and *zygote*.

cleavage, meroblastic

Partial *cleavage* of the *egg*, occurring in some animals, such as reptiles and birds, whose eggs have a large amount of yolk, resulting in unequal *blastomeres* and only part of the egg progressing to further cell division; the yolk mass remains and has nutritive value.

cleavage, holoblastic

Cleavage producing separate, equal *blastomeres*.

cleft (n)

fissure

Gap in soft tissue, bone, or both.

cleft (adj)

Split, divided, or partly divided into two.

cleft lip

cheiloschisis

hare lip

Congenital malformation consisting of one or more *clefts* in the upper lip, the result of failed closure in the *embryo* of the *maxillary* and median *nasal* processes.

See also *cleft palate*.

[8]

cleft palate

Congenital fissure along the midline of the hard *palate*, that may extend into the *soft palate*.

cleft sternum

Rare *congenital malformation* resulting from defective fusion in the *embryo* of paired *mesodermal* bands in the *ventral* midline.

clitoral hood

See *prepuce*.

clitoris

Erectile body in the female genitalia, homologous with the penis in the male.

cloaca (in zoology)

Common cavity at the end of the digestive tract in *vertebrates* (apart from most mammals) into which are released both excretory and *genital* products.

cloacal membrane

Membrane that covers the *embryonic cloaca* during the development of urinary and reproductive organs in those *vertebrates* where the cloaca occurs.

clover disease

estrogenism

Condition caused by the continued ingestion of low but toxic levels of *estrogens*.

Note 1: The most important occurrence is in farm animals pastured on plants containing *phytoestrogens*. The signs are those related to *endometrial* hyperplasia and *vaginal* tumefaction (swelling and puffiness), including long-term *infertility* and *rectal prolapse*, especially in pigs; *uterine* prolapse, especially in ewes; and *feminization* of males that have undergone *castration*.

Note 2: Dogs are particularly susceptible to the *myelotoxic* effects of estrogens and high dose or prolonged administration causes severe bone marrow depression with *thrombocytopenia*, followed by *leukopenia* and *anemia*.

After [9]

clubfoot

talipes

Deformed foot that is twisted out of shape or position, usually *congenital* (congenital talipes equinovarus (CTEV)).

coarctation

Narrowing or constriction of a short section of a blood vessel, commonly of the *aorta*.

cochlea

Spiral cavity of the inner ear containing the *organ of Corti* that transduces sound into nerve impulses.

coelom

Body cavity, found in many animals, lined with *mesodermal epithelium* and containing the digestive tract and other *visceral organs*

Note: The principal cavities of the trunk arise from the *intraembryonic coelom*.

collagenous

Rich in the fibrous *connective tissue* protein, collagen.

collembolan reproduction test

Procedure in which collembolans (small soil-inhabiting insects) are exposed to soil that has been treated with a test substance, and *adult* mortality and reproductive output are studied.

coloboma

Any defect resulting from incomplete closure of the *retinal fissure*.

Note: The defect may be *congenital*, pathological, or artificial.

combined repeated dose toxicity study

Procedure to evaluate both general systemic toxicity, with an emphasis on neurological endpoints, and notably reproductive effects and developmental progression in rodents. Groups of males and females are administered a test substance in graded doses prior to mating, during the mating period, and subsequently (up to two weeks post-mating in males and four days post-delivery in females).

compaction

1. Complication of *labor* in *twin births* in which there is attempted simultaneous expulsion of both twins, so that the lower part of the mother's pelvis is filled and further descent through the birth canal is prevented.
2. In *embryology*, process during which *blastomeres* change their shape and align themselves tightly against each other to form the compact *morula*.

conal growth hypothesis

Hypothesis that explains *transposition of the great arteries* of the heart by failure of the *aortopulmonary septum* to follow a spiral course during partitioning of the *bulbus cordis* and *truncus arteriosus* in the process of forming the *aorta* and *pulmonary trunk*.

conception

Formation of a viable *zygote* by the union of a *spermatozoon* and an *ovum*.

See also *fertilization*.

conceptus

Embryo and associated membranes in the *uterus*, especially during the early stages of *pregnancy*.

congenital

Present from *birth*, as of a disease or physical abnormality.

congenital adrenal hyperplasia

adrenogenital syndrome

Group of disorders caused by *hyperplasia* of the *adrenal* cortex or by *malignant tumors*, resulting in excess secretion of adrenocortical *androgenic hormones*, and characterized by *masculinization* of women, *feminization* of men, or precocious *puberty* in the male.

Note: The condition is associated with a decrease in the blood level of cortisol and an increase in the level of *androgens* in both sexes, most commonly as a result of *21-hydroxylase* deficiency.

congenital malformation

Malformation existing at *birth*, or developing during the first month of life, regardless of the cause.

See also *birth defect*.

conjoined twin

One of a pair of *identical twins* fused together with varying degrees of union and of residual duplication of organs.

After [7]

See also *parasitic twin*.

connective tissue

Extracellular matrix of fibrous proteins and glycoproteins, with associated cells such as *fibroblasts*, that fills the spaces between and within organs and tissues.

Note 1: Connective tissue provides the organs and tissues with structural and metabolic support.

Note 2: Specialized connective tissues also include bone, *cartilage*, blood components, and adipose tissue.

contraceptive

Anything that prevents, or reduces the likelihood of *pregnancy*.

convulsion

Sudden, violent, irregular movement of the body caused by involuntary contraction of muscles and associated with brain disorders, such as *epilepsy*, fever in children, or with drug or alcohol abuse.

corpus cavernosum

Either of the two columns of erectile tissue forming the body of the clitoris (*corpus cavernosum clitoridis*) or penis (*corpus cavernosum penis*).

After [5]

corpus luteum

Glandular mass of yellowish tissue in the *ovary*, formed by a *Graffian ovarian follicle* that has matured and released its *oocyte*.

After [5]

Note: Observed in animal reproductive testing to calculate preimplantation loss.

cortex (in anatomy)

Outer layer of an organ such as the kidney, the cerebellum, or the *adrenal gland*.

See also *cortex, cerebral*.

cortex, cerebral

Outer layer of the cerebrum, composed of folded *grey matter*, playing an important role in consciousness.

Cowper's gland

See *bulbourethral gland*.

cranial placodes

Thickenings in the surface *ectoderm* of the *embryo* associated with future eye and ear regions.

cranial suture

Line where the bony plates of the skull are joined together by fibrous bands of tissue, easily felt in the newborn before closure by *ossification*.

See also *fontanelle*.

craniofacial

Pertaining to the *cranium* and the face.

craniorachischisis

Neural tube defect in which both the *cranium* and *vertebral* column remain open.

cranioschisis

Developmental failure of the *cranial sutures* to close completely, especially at the *occiput*, usually leading to grossly defective development of the brain.

craniosynostosis

Premature closure of the *cranial sutures*.

[5]

cranium (n)/cranial (adj)

Bony structure surrounding the brain, excluding the bones of the face.

Cre/loxP

Bacterial system in which the Cre protein mediates DNA recombination between specific DNA sequences known as lox-P sites.

Note: This system is used in mammalian cells to delete (or invert) a stretch of DNA by flanking it with lox-P sites and then exposing the cell to Cre protein at some predetermined time.

cretinism

Developmental disorder caused by deficiency of *thyroid hormone*, characterized by severe mental retardation and stunted physical growth, sometimes resulting from maternal iodine deficiency.

cri du chat syndrome

Lejeune syndrome

5p – syndrome

Hereditary *congenital syndrome* due to deletion of the short arm of *chromosome 5*.

Note: This syndrome is characterized by *hypertelorism*, *microcephaly*, severe mental deficiency, and a plaintive cat-like cry.

After [5]

crista

One of the inward projections or folds of the inner *membrane* of a mitochondrion.

critical period

Specific time in the development of a biological system when it is particularly vulnerable to injury or misdirection.

Crouzon syndrome

branchial arch syndrome

Group of autosomal dominant genetic diseases characterized by midfacial *hypoplasia*, *craniosynostosis*, *exophthalmos*, and a shortened head.

Note 1: This affects the first *branchial arch* (pharyngeal arch), which is the precursor of the maxilla and mandible.

Note 2: This syndrome is thought to be caused by a genetic *mutation* of the FGFR3 gene, located on *chromosome* 10.

crypt (in anatomy)

Small tubular *gland*, pit, or depression.

cryptophthalmos

Failure of the eyelids to develop with a fissure between them, usually with defective formation of the eyeballs.

cryptorchidism

See *undescended testis*.

cumulus oophorus

Mass of *follicular* cells surrounding the *oocyte* in the *Graafian follicle*.

cyanosis

Bluish discoloration of the skin and *mucous membranes* due to excessive concentration of deoxygenated haemoglobin, owing to poor circulation or inadequate oxygenation of the blood.

cycle, reproductive

Cycle of physiological changes in the female reproductive organs, from the time of *fertilization* of the *oocyte* through *gestation* and *parturition*.

[5]

cyclopia

cyclocephaly

synophthalmia

Rare form of *holoprosencephaly*, a *congenital* disorder characterized by a single orbital *fossa* due to the failure of the *embryonic prosencephalon* to divide the *orbits* of the eye correctly into two cavities.

cyst (n)/cystic (adj)

1. In an animal or plant, thin-walled hollow organ or cavity containing a liquid secretion.
2. Sac, *vesicle*, or bladder.

cytochrome P450 (CYP)

Member of a superfamily of heme-containing monooxygenases involved in *xenobiotic metabolism*, cholesterol biosynthesis, and steroidogenesis, in eukaryotic organisms found mainly in the *endoplasmic reticulum* and inner mitochondrial membrane of cells.

Note: “P450” refers to the observation that a solution of this enzyme exposed to carbon monoxide strongly absorbs light at a wavelength of 450 nm compared with the unexposed solution (a difference spectrum caused by a thiolate in the axial position of the heme opposite to the carbon monoxide ligand).

cytogenetics

Branch of genetics in which the structure and function of chromosomes and of other cell constituents concerned with heritable properties and their expression are studied.

cytomegalovirus

Type of *Herpes* virus that usually produces very mild symptoms in an infected person but may cause severe neurological damage in people with weakened immune systems and in the newborn.

cytotrophoblast

Inner cellular layer of the *trophectoderm* (*trophoblast*); part of the mammalian *placenta*.

Daphnia magna reproduction test

Procedure in which young female *Daphnia* are exposed to a substance added to the water and numbers of living offspring and surviving parent organisms are recorded.

decidua

Modified *endometrial* layer that lines the *uterus* during *pregnancy* and is shed with the afterbirth.

decidual cell

Enlarged, ovoid, *connective tissue* cell appearing in the *endometrium* during *pregnancy*.

decidual cell response technique

Biological test method in which *pseudopregnant* rats undergo a surgical treatment of the *uterus* to induce uterine differentiation and proliferation, resulting in massive tissue growth that mimics the response of the uterus during normal *blastocyst implantation*.

Note: Measurement of *decidual* growth during chemical treatment can be used to assess both *hormonal* status and uterine function. Uterine weight is a sensitive measure of the success of the *decidual cell* response.

decidualization

Changes in response to *progesterone* that include the *eosinophilic* proliferation around arterioles after *ovulation* or *progesterone* action on *endometrium*.

Note: Decidualization increases *glandular epithelial* secretion, stimulates glycogen accumulation in *stromal cell* cytoplasm, and promotes stromal vascularity (*spiral arterioles*) and *edema*.

decidium

Swelling of a *uterine crypt* produced by its reaction to an *implanted embryo*.

[6]

decussate (v)/decussation (n)

Pertaining to two or more things that cross or intersect each other to form an X.

See also *chiasma*.

defeminized gonadotropin secretion

Gonadotropin secretion without female sex *hormones*.

demasculinized

castrated

Describing a male animal from which the *testicles* have been removed.

dermis

Layer of the skin deep under the *epidermis*, consisting of a bed of vascularized *connective tissue* and containing the nerves and organs of sensation, the hair roots, and sebaceous and sweat *glands*.

After [5]

desynapsis

Failure of *synapsis* due to separation of *homologous chromosomes* after initial pairing in *meiosis*.

developmental biology

Study of biological development from *fertilization* to *adulthood*, usually with an emphasis on the *prenatal* period and regulation of *morphogenesis*, and neural development on through adolescence.

Note: Common model organisms include *Caenorhabditis elegans*, *Xenopus*, *Drosophila*, zebrafish (*Danio rerio*), chick, and mouse.

developmental neurotoxicity study

Procedure in which female rodents are exposed to a test substance from the time of *implantation* through all of *lactation*; offspring may be exposed during the preweaning period, either directly or through milk, and are studied with regard to neurologic and behavioral abnormalities during *postnatal* development and until *adulthood*.

developmental susceptibility gene

Any *gene* that encodes a *gene product* that can be altered by environmental agents to cause disturbance of normal development.

developmental toxicology

Study of adverse effects on the developing organism that result from exposure of either parent to an agent or substance prior to *conception*, of the mother and *fetus* during *prenatal* development, and of the child from birth until the time development is completed.

Note: Functional brain development continues past the time of *sexual maturation*.

dextrocardia

Congenital defect in which the apex of the heart is directed toward the right side of the thorax (isolated dextrocardia), or the heart is found in a mirror image position on the right side of the body (dextrocardia *situs inversus*).

dextroposition

Displacement to the right.

Di George syndrome (DGS)

congenital thymic aplasia

conotruncal anomaly face syndrome

DiGeorge anomaly

Shprintzen syndrome

Strong syndrome

thymic hypoplasia

velocardiofacial syndrome

Condition caused by the deletion of a small piece of *chromosome 22* near the middle of the chromosome at a location designated 22q11.2.

Note: Characteristic signs and symptoms may include *birth defects* such as *congenital* heart disease; defects in the *palate*, most commonly related to neuromuscular problems with closure (*velopharyngeal insufficiency*); learning disabilities; mild deviations in facial features; and recurrent infections.

diaphragm

Dome-shaped muscular *membranous* partition separating the thoracic cavity from the *abdominal cavity* in mammals.

Note: The diaphragm plays a major role in breathing, as its contraction increases the volume of the thorax and so inflates the lungs.

diathesis

Hereditary predisposition to a particular medical condition.

diencephalon

Posterior part of the forebrain (*prosencephalon*), containing the *hypothalamus* and other *thalamic* components and enclosing the third ventricle.

Compare *telencephalon*.

diethylstilbestrol (DES)

4,4'-[(3*E*)-hex-3-ene-3,4-diyl]diphenol

Synthetic *nonsteroidal* substance with *estrogenic* activity.

Note 1: DES was formerly given to reduce the risk of complications and loss of *pregnancy* but was shown to cause a rare *vaginal tumor* in female offspring who had been exposed to this drug *in utero*.

Note 2: DES also has effects on the reproductive organs of male progeny exposed *in utero*.

diploid

Cell or nucleus containing two complete sets of *chromosomes*, one from each parent, or an organism composed of such cells.

Compare *haploid*.

disc, embryonic

blastodisc

germinal disc

Bilayer plate of cells in the *blastocyst* from which the mammalian *embryo* develops.

dishevelled

See *Wnt*.

dispermy

Entrance of two *spermatozoa* into one *egg*.

Compare *monospermy*, *polyspermy*.

disruption

Disturbance that interrupts a process or disorganizes a structure.

distal (in anatomy)

Opposite term: *proximal*.

Situated away from the centre of the body or from the point of attachment.

diverticulum

Outpouching of a hollow structure in the body, that may be acquired (as in colonic diverticulitis) or be present at *birth* (e.g., Meckel diverticulum or Zenker diverticulum).

dominant

Of a *gene*, determining the *phenotype* even when present only in one copy or inherited from only one parent. Compare *recessive*.

dorsal

Opposite term: *ventral*.

On or relating to the upper side or back of an organism.

Down syndrome

See *trisomy 21*.

drug metabolizing enzyme (DME)

Any enzyme that *metabolizes xenobiotics*.

Note: Most if not all these enzymes also metabolize endogenous *substrates*.

duct

Vessel for transporting fluids such as *lymph*, or *glandular* secretions such as tears or bile.

duct, excurrent

See *excurrent*.

ductus arteriosus

Fetal blood vessel connecting the *pulmonary artery* to the *proximal* descending *aorta*.

Note: This vessel allows most of the blood from the right ventricle to bypass the fetus's fluid-filled non-functioning lungs. Upon closure at *birth*, it becomes the *ligamentum arteriosum*.

See also *patent ductus arteriosus*.

dung fly test

Dipterian dung fly test

Procedure using dung flies of the order *Diptera* where a test substance is mixed with bovine feces to which eggs of the fly are added; number, sex, and morphology are determined when the last *adult* has emerged.

duodenum

First portion of the small intestine, between the stomach and the *jejunum*, where bile and pancreatic digestive juices enter the intestinal tract.

dura mater

See *meninx*.

dysgenesis

Defective or abnormal development of an organ.

dysgonesis

Dysgenesis of the *gonads*.

dysmenorrhea

Difficult and painful *menstruation*.

[7]

dysmorphia (n)/dysmorphic (adj)

dysmorphism

Abnormality of shape of a body part or organ, often referring to a *birth defect*.

dysmorphogenesis

Production of *dysmorphia*.

dysplasia

Abnormal development of an organ or tissue identified by *morphological* examination.

[1]

dysostosis

Defect in the normal *ossification* of *fetal cartilage*.

early life stage (ELS) test

Toxicity test using an organism in an early life stage such as the *embryo* or larva, noting that this stage is often the most sensitive part of the species life cycle.

After [2]

earthworm reproduction test

Procedure in which *adult* worms (*Eisenia* sp.) are exposed to a test substance mixed into the soil; number, weight and behaviour of the adult worms are studied after four weeks and the number of juveniles hatched is counted after a further four weeks.

eclampsia

Acute, life-threatening complication of *pregnancy* characterized by tonic-clonic *seizures* (*convulsions*), usually in a woman who has developed *pre-eclampsia*.

ecogenetics

Study of the influence of hereditary factors on the response of individuals or *populations* to environmental factors.

ectoderm

In an *embryo*, outermost layer that develops into the *epidermis* of the skin and the nervous system.

See also *bilaminar embryo*, *epiblast*.

ectopia (n)/ectopic (adj)

ectopy

Abnormal location or malpositioning of an organ or body part, usually *congenital*.

ectopic expression

Expression of a *gene* in a tissue in which it is not normally expressed.

[11]

ectopic pregnancy

Complication of *pregnancy* in which the *embryo* implants (see *implantation*) and develops outside the cavity of the *uterus*.

ectrodactyly

Congenital absence or deficiency of one or more of the central digits of the hand or foot.

ectrosyndactyly

Congenital absence or deficiency of one or more of the central digits of the hand or foot with fusion of the existing ones.

edema

oedema

Presence of abnormally large amounts of fluid in body cavities and intercellular spaces of tissues.

[1]

efferent duct

efferent ductule

Seminal duct leading from the *testis* to the head of the *epididymis*.

egg

Female *gamete* after completion of the second *meiotic* division.

Note: The term is often loosely applied to secondary *oocytes* and early *embryos*.

See also *ovum*, *zygote*.

ejaculation

Expulsion of *semen* from the *genital ducts* and *urethra*, usually resulting from a reflex process during sexual stimulation

ejaculatory duct

Passage formed by the junction of the duct of the *seminal vesicles* and the *ductus deferens* through which *semen* enters the *urethra*.

[8]

electroporation

Means of introducing molecules into cells by transiently permeabilizing their *membranes* with brief electric field pulses.

[11]

embryo (n)/embryonic (adj)

Stage in the developing mammal at which the characteristic organs and organ systems are being formed:

for humans, this involves the stages of development from the second to the eighth week post-*conception* (inclusive), or to the end of organogenesis.

In birds, the stage of development from the *fertilization* of the *ovum* up to hatching.

In plants, the stage of development within the seed.

[1]

embryogenesis

Development and growth of an *embryo* in the period from formation of the *bilaminar embryo* to the beginning of the *fetal* period (in humans, the second through the eighth week after *conception*).

embryoid body

Structure resembling an *embryo* which is formed by *embryonic stem cells* or *teratocarcinoma* cells when they are removed from a growth-promoting medium.

embryonic induction

Process whereby the development of one group of cells, called the competent region, is altered by an inducing factor from another group, called a signaling center or organizer.

embryo transfer

Process of *implanting a fertilized ovum* into a *uterus*.

embryo transport rate analysis

Method to evaluate the potential for early *embryonic* loss in rodents caused by accelerated or retarded arrival of embryos into the *uterus*.

embryology

Science of the origin and development of the organism from *fertilization* of the *oocyte* to the beginning of *fetal* life (in humans, the end of the eighth week).

Note: In common usage this term includes all the stages of *prenatal* life.

After [7]

embryonic period

Period from *fertilization* to the end of major *organogenesis*.

See also *embryo*, *embryogenesis*.

[1]

embryonic stem (ES) cell

Undifferentiated, *pluripotent* cell from an early stage of the *pre-implantation embryo* (inner cell mass of the *blastocyst*).

Note: Embryonic stem cells have the potential to proliferate and differentiate into various cell types of the body.

encephalitis

Inflammation of the brain.

encephalocele

Congenital protrusion of brain tissue through a fissure or defect in the skull.

endocardial cushion

atrioventricular canal cushion

Subset of cells in the primordial tube-like heart that is essential to the development of the *ventricular septum* and the *atrioventricular* valves of the heart.

Note: Endocardial cushion defects may cause various types of heart *malformation*.

endocardium

Endothelial lining of the heart chambers, also containing small blood vessels and a few bundles of smooth muscle, continuous with the endothelium of the great blood vessels.

endochondral ossification

Formation and growth of bone tissue (especially of the long bones) during *fetal* development of the mammalian skeletal system, and in repair of bone fractures, that takes place in the presence of *cartilage*.

Note: Endochondral ossification is one of two mechanisms for bone formation, the other being *intramembrous ossification*.

endocrine

Pertaining to *hormones* or to *glands* that secrete hormones directly into the bloodstream.

[1]

endocrine disrupter

endocrine modifier

Exogenous substance that, at some dose, alters function(s) of the *endocrine* system and consequently causes adverse health effects in an intact organism, its progeny, or (sub)populations.

After [1]

endocytosis

Uptake of material into a cell by invagination of the plasma *membrane* and its internalization in a membrane-delimited vesicle.

After [1]

endoderm (n)/endodermal (adj)

Innermost of the three primary *germ layers* of an *embryo*, developing into the gastrointestinal tract, the lungs, and associated structures.

See also *bilaminar embryo*, *hypoblast*.

[10]

endometrium

Inner lining of the *uterus* that is shed during *menstruation*.

[12]

endothelium (n)/endothelial (adj)

Layer of flat cells that line the blood vessels, lymphatic vessels, and the chambers of the heart.

environmental factor

Physical, chemical, or biological agent or condition in the environment that has the potential to affect development and health of an organism, either in a positive or a negative manner.

epaxial

Located above or on the *dorsal* side of an axis.

epiblast

Primitive *ectoderm* of the early *embryo*.

[12]

epicardium

visceral pericardium

Inner layer of the *pericardium*, a sac of fibrous tissue that surrounds and lies upon the heart and the base of the great vessels.

epidemiology

Study of the distribution and determinants of health-related states or events in specified populations and the application of this study for the control of health problems.

[1]

epidermis

In *vertebrates*, protective outer stratified squamous layer of the skin consisting mainly of keratinocytes.

epididymis (n)/epididymal (adj)

Tightly-coiled, thin-walled tube that conducts *sperm* from the *testis* to the *vas deferens*.

[12]

epididymal appendix

appendix epididymidis

Cystic structure sometimes found on the head of the *epididymis*.

Note: The epididymal appendix represents a remnant of the *mesonephric duct*.

[8]

epigenesis (n)/epigenetic (adj)

Phenotypic change in an organism brought about by alteration in the *expression* of genetic information without any change in the *genomic* sequence itself.

Note: Common examples include changes in nucleotide base methylation and changes in histone acetylation. Changes of this type may become heritable.

[1]

epilepsy

Chronic neurological disorder marked by sudden recurrent episodes of sensory disturbance, loss of consciousness, or convulsions, associated with abnormal electrical activity in the brain.

epinephrine

See *adrenaline*.

epiphyseal plate

The disk of hyaline *cartilage* between the metaphysis and the epiphysis of an immature long bone that permits the bone to grow longer.

[7]

epispadias

Malformation in which the *urethra* does not develop to full length, opening typically on the dorsum of the penis (and rarely, in females, between the clitoris and labia); frequently associated with *exstrophy* of the bladder.

epistasis

Situation in which the *phenotypic expression* of one *gene* obscures the phenotypic effects of another *gene*.

[11]

epithelium (n)/epithelial (adj)

Sheet of one or more layers of cells covering the internal and external surfaces of the body and hollow organs.

[1]

epithelial-to-mesenchymal transition (EMT)

Sequence of events, where *epithelial* cells detach, migrate, and become *mesenchymal stem cells* that can differentiate.

Note: This transition plays a role in *embryogenesis*, wound healing, and *cancer*.

See also *mesenchymal-to-epithelial transition*.

epoxide hydrolase

epoxide hydratase

Detoxification enzyme (EC 3.3.2.9), located mainly in the endoplasmic reticulum, that hydrolyzes epoxides, converting them to metabolites that can be more rapidly excreted.

[12]

erectile dysfunction

Inability of a male to have or to maintain an erection.

erythroblastosis

See *hemolytic disease of the newborn*.

estradiol

17 β -estradiol

Steroid sex hormone, involved in many regulatory processes, but most prominently in the development of female sex organs, the *menstrual cycle*, and *pregnancy*.

estriol

Hormonally active metabolite of estradiol, eliminated in urine, especially during *pregnancy*.

estrogen

Any substance, natural or synthetic, that exerts the *hormonal* effects of the natural *estrogen*, *estradiol*, usually by interaction with the estrogen receptor.

Note: Phytoestrogens are substances that occur in plants and have estrogenic activity.

estrogen activity assay, in vitro

1. Procedure in which a *tumor* cell line is exposed to a test substance and activation of the *estrogen receptor* is studied by a reporter molecule in order to assess the estrogen-sensitivity of the tumor.
2. Test using estrogen-sensitive cells to evaluate estrogenic activity of a substance or environmental sample. Compare *uterotrophic assay*.

estrogen-mimetic

Behaving like an *estrogen*.

estrogenic

Exhibiting *hormonal* activity similar to that of *estrogens*.

estrogenism

See *clover disease*.

estrous cycle

Sequence of recurring physiological *uterine*, *ovarian*, and other changes, induced by reproductive *hormones* in higher female animals, resulting in readiness for *insemination*. This cycle starts in *adulthood* (at *menarche*), transiently discontinues during *pregnancy*, and disappears at the *menopause*.

estrus

oestrus

heat

Recurrent period of sexual receptivity and arousal in the female of most mammals except the higher primates, during which *conception* is possible.

estrus syndrome

Persistent *estrus* caused by elevated *estrogenic* activity, either due to endogenous estrogens (*e.g.*, in *polycystic ovary syndrome*) or due to exogenous substances.

Note: Estrus syndrome is associated with *infertility*.

euploid

Referring to a cell or organism with *chromosomes* present in an integral multiple of the *haploid* number.

Note: A human cell with the normal number of 46 chromosomes, an integral multiple of the monoploid number, 23, is thus euploid. However, a human with abnormal, but integral, multiples of this full set (*e.g.*, 69 chromosomes) would also be considered as euploid.

eutherian

Subclass of mammals having a *placenta* through which the *fetus* is nourished.

eventration

herniation of intestines

Protrusion of *omentum* and/or intestine through a defect or weakness in the abdominal wall while the skin remains intact.

After [1]

See also *omphalocele*.

evocation

Specific *induction* of a tissue within a developing *embryo* that results from the action of a single *hormone* or other chemical (the evocator).

excurrent

Pertaining to a vessel (or opening) conveying fluid outwards.

Note: The male excurrent *ducts* are those involved in the transport, enrichment and *ejaculation* of *semen*.

exencephaly

exencephalus

Exposed brain resulting from failure of the neural tube to close and absence of the top of the skull.

Note: In humans this is followed by degeneration of the brain, resulting in *anencephaly*.

[12]

exfoliation (n)/exfoliative (adj)

desquamation

Detachment and shedding of superficial cells of an *epithelium* or tissue surface, especially of the horny layer of the *epidermis*.

[10]

exocrine

Relating to or denoting *glands* that secrete through *ducts* opening on to superficial *epithelium* (*e.g.*, the intestinal tract) rather than into the blood.

exomphalos

omphalocele

Hernia in which bowel or *omentum* protrudes through the abdominal wall under the skin at the *umbilicus*.

After [7]

exophthalmia

exophthalmos

Marked protrusion of the eyeballs, usually resulting from an increased volume of the *orbital* contents.

After [8]

expressed sequence tag (EST)

Partial or full complementary DNA sequence that can serve as a marker for a region of the *genome* that encodes an expressed product.

[1]

expression, gene

Translation of a *gene* into a *gene product*.

extrophy

Congenital malformation in which a hollow organ has its interior exposed through eversion; most commonly observed in the urinary bladder (ectopia vesicae).

external genitalia

Genitalia visible outside the body.

extracellular matrix (ECM)

Mesh of molecules, secreted by cells into the surrounding extracellular space.

Note: Cells may adhere to the matrix and this can provide them with structural and biochemical support.

extraembryonic membrane

One of the *membranes* that surrounds the *embryo*, which include the *yolk sac*, *allantois*, *amnion*, and *chorion*.

After [5]

extraembryonic mesoderm

Cells outside the *embryo* that, although derived from the *zygote*, are not part of the embryo proper and contribute to the *fetal* membranes (*yolk sac*, *allantois*, *amnion*, and *chorion*).

extrinsic pathway

Apoptotic pathway of cell death initiated upon occupancy of so-called death receptors at the cell surface with their ligands, such as Fas/CD95 and tumor necrosis factor- α , and involving activation of caspase 8.

Note: This pathway converges with the *intrinsic pathway* at the level of cleavage of procaspase 3 by either caspase 8 (extrinsic pathway) or caspase 9 (intrinsic pathway).

F1 generation

Indicating 'first filial' generation, denoting offspring from genotypically (see *genotype*) distinct parents.

Note: F2 denotes offspring resulting from mating (inbreeding) of individuals from F1. The term may be extended to F3 and beyond.

F2 generation

See *F1 generation*.

facial cleft

Congenital anomaly resulting from the failure of facial structures in the *embryo* to fuse properly.

See also *orofacial cleft*.

facies

In medicine, facial expression of an individual that is typical of a particular *syndrome*, disease, or condition.

Fallopian tube

oviduct

uterine tube

salpinx

One of a pair of tubes, on either side of the upper or outer extremity of the *ovary*, that provides a path by which an *ovum* travels from the ovary to the *fundus* of the *uterus*.

Note: Each tube is largely enveloped by its expanded *infundibulum*, where, if the ovum is fertilized in the tube, it will implant (see *implantation*) as a *zygote*.

Modified from [7]

fecundation

impregnation

Process of *fertilization*.

[2]

fecundity

Ability to produce offspring within a given period of time.

Quantity of reproductive output.

Note 1: The potential reproductive capacity of an organism or population may be measured by the number of *gametes*.

Note 2: Fecundity is controlled by both genetic and environmental factors, and is a major determinant of *fitness*.

After [1]

feminization

Development of female characteristics as part of normal female maturation, or, in a male, pathologically as a result of endocrine imbalance.

fertility, female

Ability to conceive (see *conception*).

Production of live offspring.

fertility, male

Ability to induce *conception*.

Note: *Sperm* count and *motility* are important contributing factors.

Fertility Assessment by Continuous Breeding (FACB)

Reproductive Assessment by Continuous Breeding (RACB)

Reproductive toxicity test in rodents in which female animals are repeatedly mated and frequency and size of *litter* and other parameters are measured; second or later generation fertility is also studied.

fertilization

In reproductive biology, union of male and female *gametes* to form a *zygote* from which an *embryo* can develop.

See also *conception*.

fetal alcohol syndrome (FAS)

Condition developing in the *fetus* and resulting in *congenital* abnormalities, caused by alcohol intake by the mother during pregnancy, typically characterized by decreased cognitive development, stunted growth and a characteristic *facies*.

Note: FAS is the most serious form of fetal alcohol spectrum disorder (FASD), a range of milder forms that may show reduced skills in learning, social development, memory, and control of emotions.

fetal period

See *fetus*.

fetal pole

Thickening on the margin of the *yolk sac* of a *fetus* during *pregnancy*.

Note: Appearance of the fetal pole is used as the earliest sign of a baby in *ultrasound* examination.

FETAX

Assay for *teratogenicity* using *embryos* of the frog, *Xenopus laevis*.

Note: The term is derived from the first letters of “frog embryo teratogenesis assay *Xenopus*”.

After [2]

fetoscopy

Procedure in which a *fetus* may be directly observed *in utero*, using a fiber-optic endoscope (fetoscope) introduced through a small incision in the abdomen under local anesthesia.

Note: Photographs may be taken, and *amniotic fluid*, fetal cells, or blood may be sampled for prenatal diagnosis of many *congenital* anomalies or genetic defects.

After [8]

fetus (n)/fetal (adj)

Young mammal within the *uterus* of the mother, from the visible completion of characteristic *organogenesis* until *birth*.

Note: In humans, this period is usually defined as from the third month after *fertilization* until birth; prior to this the young mammal is referred to as an *embryo*.

[1]

fibroblast

fibrocyte

desmocyte

Flat fibrous tissue cell, with stellate or spindle shape, associated with the formation of collagen fibers and intercellular *extracellular matrix*.

Note: This cell may develop into a number of precursor cells, such as collagenoblasts, *osteoblasts*, and chondroblasts.

fibroblast growth factor (FGF)

Any member of a family of more than twenty protein *growth factors* involved in *angiogenesis*, wound healing, and, in early *embryonic* development, induction of *mesoderm*, patterning and *morphogenesis*, and development of the limbs and brain.

See also *sonic hedgehog*.

fish embryo test (FET)

Fish embryo acute toxicity test

Procedure in which fish (often zebrafish, *Danio rerio*) eggs and embryos are exposed to a test chemical and subsequent development or death of the animals is studied.

fish reproduction assay

Procedure in which sexually mature male and spawning female fish are exposed to a test substance and multiple endpoints, including egg production, endocrine activity, vitellogenin, and gonadal histopathology are measured.

fish sexual development test

Procedure in which fish are exposed from the time of fertilization of the egg until sexual differentiation is completed and markers of possible endocrine disruptor activity are studied, including vitellogenin concentration, gonadal histopathology, sex ratios, and the occurrence of intersex.

fistula

Permanent abnormal passage from an internal organ to the body surface or between two internal organs or structures.

fitness

Ability to survive and reproduce.

flexure, hepatic

flexure, right colic

Bend between the ascending colon and the transverse colon.

foetus

Alternative spelling of fetus found in British English usage.

fold

plica

1. Ridge or margin apparently formed by the doubling back of a lamina.

Note: In anatomy, used as a common identifier, as, for example, in nail f., neural f., tail f., transverse f., and urogenital f.

2. In the embryo, a transient elevation or reduplication of tissue in the form of a lamina.

After [7]

folic acid

Water-soluble B vitamin involved in breakdown of carbohydrates, releasing energy and promoting biosynthesis.

Note: Folic acid deficiency may lead to a range of serious abnormalities of the developing fetus, including neural tube defects.

follicle (n)/follicular (adj)

Small, secretory sac, such as the dental follicles that enclose the teeth before eruption or the hair follicles within the epidermis.

Fluid- or colloid-filled ball of cells in some glands such as the thyroid gland and the ovaries.

[13]

follicle-stimulating hormone (FSH)

Hormone secreted by the anterior pituitary that stimulates the Graafian follicles of the ovary and subsequent follicular maturation, and in the male contributes to inducing spermatogenesis.

After [7]

follicle-stimulating hormone releasing hormone (FSH-RH)

gonadoliberin

Hormone, released by the *hypothalamus*, inducing the secretion of *follicle-stimulating hormone* and *luteinizing hormone* by the *pituitary gland*.

follicular

See *follicle*.

follicular atresia

Degeneration and resorption of an *ovarian follicle* before it reaches maturity and ruptures.

follicular phase

First half of the human *menstrual cycle*, during which one or more *follicles* in the *ovary* may mature, culminating in *ovulation*.

fontanelle

Any of several soft spots in specific locations on the skull of the newborn where the bones have not yet fused and the brain is covered by skin and a tough *membrane*.

See also *cranial suture*.

foramen (pl. foramina)

Opening, hole.

Note 1: The skull has several such openings that act as passageways for structures, notably *nerves* and blood vessels.

Note 2: The *vertebral column* is perforated by the vertebral foramina through which nerves from the *spinal cord* exit to the periphery.

foramen magnum

Large *foramen* in the base of the skull, through which the *spinal cord* passes.

foramen ovale

In the *fetal* heart, opening that allows shunting of blood between the right and left *atria* and normally closes at birth.

One of the larger *foramina* in the base of the skull.

forebrain

See *prosencephalon*.

foreskin

See *prepuce*.

forward genetics

Approach to genetic investigation in which the aim is to identify the *gene* that governs a particular function.

Note: Mutant *phenotypes* indicate the responsible gene and co-inherited genetic markers indicate the region of the *genome* where it occurs.

See also *reverse genetics*.

fossa

In anatomy, a depression or hollow, often in a bone.

fossa ovalis

Oval depression in the heart, on the lower part of the *septum* of the right *atrium*.

Note: The fossa ovalis is a remnant of the *foramen ovale*.

After [7]

frontonasal dysplasia (FND)

frontonasal dysostosis

frontonasal malformation

median cleft face syndrome

Tessier cleft numbers 0/14 (See *Tessier classification*)

Congenital malformation of the midface in which the nose has a flat, wide appearance, the eyes may be wide-set, and there is a groove of varying size, running down the middle of the face across the nose.

functional genomics

Development and implementation of technologies to characterize the mechanisms through which *genes* and their products function and interact with each other and with the environment.

[7]

fundus

Part of a hollow organ (*e.g.*, the *uterus*) that is furthest from its opening.

gall bladder

Pear-shaped muscular sac underneath the liver that stores bile secreted by the liver before its release into the *duodenum*.

gamete

Reproductive cell (*e.g.*, *sperm* or *egg*) containing a *haploid* set of *chromosomes*.

[7]

gamete intrafallopian transfer (GIFT)

Technique of assisted reproduction by placing *eggs* and *sperm* into a woman's *Fallopian tubes* in order that *fertilization* may occur there.

Note: The *embryo* is expected to travel through the Fallopian tube and *implant* in the *uterus* as it would have done had natural fertilization occurred.

gametogenesis

Development of male or female *gametes* to maturity.

gastroschisis

Congenital defect characterized by a fissure in the anterior abdominal wall through which the small and (or) large intestine protrude.

gastrula

Embryonic stage that develops from two to three *germ layers* during *gastrulation*.

gastrulation

Stage of *embryo* development in which the two-layered *blastula* transforms into the *gastrula* by developing *ectoderm* and *endoderm*, as well as a third layer (*mesoderm*), through the movement of specific cells.

gene

Length of DNA or RNA (in viruses) that encodes a functional product, which may be a polypeptide or a ribonucleic acid.

Note: A gene is the fundamental unit of heredity.

[1]

gene product

Both the messenger RNA resulting from transcription of a *gene* and the proteins and peptides translated from that mRNA.

gene silencing

Prevention of the expression of a specific *gene*.

Note: Gene silencing may occur by natural genetic or *epigenetic* processes, or by experimental intervention, as in *gene targeting knockout mutation*, or by *RNA interference*.

gene targeting

Use of *homologous recombination* to change a *gene*, *e.g.*, to delete a gene, remove exons, add a gene, or introduce point *mutations*.

genital

Of or relating to human or animal reproduction.

Of or relating to the *genital organs*.

Of or relating to the final stage of psychosexual maturation.

Genital organ.

genitalia

Plural of *genital*.

Externally visible sex organs.

genital fold

genital ridge

genitourinary ridge

labioscrotal swelling

urogenital ridge

Embryonic structure that will develop into the penis and *scrotum* in males or the labia in females.

genital organ

Organ of reproduction or generation, both external and internal to the body.

genital tract

reproductive tract

genital duct

Genital passages of the *urogenital* apparatus.

Note: In females, the tract runs from the *ovaries* to the *vulva*, in males from the *testicles* to the external *urethral* orifice of the penis.

genital tubercle

Primordium of the penis or *clitoris*.

genitourinary

See *urogenital*.

genome

Complete set of *chromosomal* and extrachromosomal *genes* of an organism, a cell, an organelle (e.g., mitochondria or chloroplasts), or a virus, *i.e.*, the complete DNA component of an organism (or the complete RNA component of an RNA virus).

After [1]

genomics

1. Science of using DNA-and RNA-based technologies to demonstrate alterations in *gene expression*.
2. In toxicology, method providing information on the consequences for gene expression of interactions of the organism with environmental stress, *xenobiotics*, *etc.*

[1]

genotoxic

Capable of causing a change to the structure of the *genome*.

[1]

genotype

Genetic constitution of an organism as revealed by genetic or molecular analysis; the complete set of *genes* possessed by a particular organism, cell, organelle, or virus.

[1]

germ cell

See *germ line cell*.

germ cell gene mutation assay

Procedure in which *mutations* induced by an agent are studied in *germ line cells* or *somatic stem cells* from a *transgenic* animal (rodent), containing reporter *genes* for detection of various *mutations*.

germ line cell

germ cell

Gamete or an *embryonic* cell that can develop into a gamete.

germ layer

Any of three distinct layers of cells (*endoderm*, *ectoderm*, and *mesoderm*) that become recognizable as the *embryo* develops.

gestation

pregnancy

Period between *conception* and *birth* during which an *embryo* or *fetus* is carried in the *uterus* of a female mammal.

gestation period

Time from *conception* to *birth*, during which a *fetus* develops.

gigantism

Condition of abnormal size or overgrowth of the entire body or of any of its parts.

Note: Often caused by increased levels of *growth hormone*.

See also *acromegaly*.

gland

Organized aggregation of cells functioning as a secretory or excretory organ.

[7]

glans

Any small rounded mass or *gland*-like body.

glans clitoridis

Rounded mass of sensitive erectile tissue that forms the head of the *clitoris*.

glans penis

Rounded mass of sensitive erectile tissue at the distal end (head) of the *penis*, analogous to the *glans clitoridis*.

glaucoma

Disease of the eye characterized by increased intraocular pressure, resulting in *atrophy* of the optic nerve.

After [7].

glomerulus

Tuft or a cluster, as of a plexus of capillary blood vessels or nerve fibers (*e.g.*, capillaries of the filtration apparatus of the kidney).

[1]

glucocorticoid

Any of a group of *steroid hormones*, such as cortisone, produced by the *adrenal cortex*, inhibiting inflammation, and mediating a response to stress that alters protein, fat, and carbohydrate metabolism.

glycolysis

Biochemical breakdown of glucose into pyruvic acid with the production of ATP.

Note: If the resulting pyruvate is not used efficiently in aerobic metabolism, it may then be converted to ethanol (fermentation) or lactic acid (anaerobic glycolysis).

gonad (n)/gonadal (adj)

Organ in animals that produces *gametes*, *i.e.*, the *testis* or the *ovary*.

gonadotropin

gonadotrophin

Glycopeptide hormone, produced by the *fetal placenta*, that maintains the function of the *corpus luteum* during the first few weeks of *pregnancy*.

gonadotropin-releasing hormone (GnRH, GRH)

gonadoliberin

luteinizing hormone-releasing hormone (LHRH)

Any factor from the *hypothalamus* that stimulates the anterior *pituitary* to release both *follicle-stimulating hormone* and *luteinizing hormone*.

Modified from [7]

Graafian follicle

vesicular ovarian follicle

Mature *ovarian follicle* within which an *oocyte* attains full size and which ruptures during *ovulation* to release the *ovum*.

granulocyte

White blood cell, distinct from a lymphocyte, containing cytoplasmic granules.

granulosa

Pertaining to cells of the *cumulus oophorus*.

[5]

grey matter

Regions of the brain and *spinal cord* that are made up primarily of cell bodies and dendrites of nerve cells rather than of *myelinated* axons.

After [7]

Compare *white matter*.

growth factor

Naturally occurring or genetically engineered protein or *steroid hormone* that binds to a *receptor* to regulate cell growth, proliferation, or differentiation.

growth hormone (GH)

somatotropin

somatotropic hormone (STH)

Peptide *hormone* secreted by the anterior *pituitary* that stimulates growth, energy metabolism, and cell proliferation.

Note: Human growth hormone (hGH) isolated from cadavers or produced by recombinant technology is used clinically to treat deficiency of the hormone and other growth disorders, and inappropriately to enhance athletic performance.

growth hormone releasing factor (GHRF)

Substance produced in the *hypothalamus* that regulates release of *growth hormone* by the anterior *pituitary*.

gubernaculum

Fetal mesenchyme ligament that passes through the anterior abdominal wall and connects the lower pole of each developing *gonad* with the developing *scrotum* in men, and with the developing labia majora in women.

Note: In men, it guides descent of the *testes* into the scrotum.

haploid

monoploid

State in which a cell contains only one set of *chromosomes*.

[1]

harelip

See *cleft lip*.

hemal

Pertaining to blood or blood vessels.

Situated, in common with the heart and major blood vessels, on the *ventral* side of the body with respect to the *vertebral* column or its *embryonic* precursors.

hemangioma

Benign *tumor* formed by a vascular *malformation* present at birth or developing during life, in which proliferation of blood vessels leads to a vascular tangle.

Note 1: Hemangiomas can occur anywhere in the body but are most frequently noticed in the skin and subcutaneous tissues; most hemangiomas present at birth undergo spontaneous regression.

Note 2: Hemangioma in the brain (central nervous system cavernous hemangioma) can be accompanied with multiple neurological symptoms, ranging from headache to seizures.

hematopoiesis

hemopoiesis

Development of each of the types of blood cell from common precursor cells, located mainly in the bone marrow.

hemimelia

Congenital partial absence of all or part of the *distal* half of a limb.

hemivertebra

Congenital defect of the *vertebral* column in which one side of a vertebra fails to develop completely due to failure of the *chondrification* center to form on that side.

Note: The resulting wedge-shaped vertebra can cause an angle in the spine leading to *kyphosis*, *scoliosis*, or *lordosis*.

After [7]

hemolytic disease of the newborn

erythroblastosis fetalis

erythroblastosis

Severe form of *anemia* in a *fetus* or newborn infant caused by incompatibility with the mother's blood type, typically when the mother is *rhesus factor* negative (Rh -ve) and produces antibodies which attack (Rh +ve) fetal blood through the *placenta*.

hepatosplenomegaly

Enlargement of the liver and spleen.

hermaphrodite

Having the reproductive organs and many of the *secondary sex characteristics* of both sexes.

Note: Pseudohermaphroditism is a state in which the person is of an unambiguous *gonadal sex* (possessing either *testes* or *ovaries*) but has ambiguous external *genitalia*.

hermaphroditism

State of being *hermaphrodite*.

See also *pseudohermaphrodite*.

hernia

Protrusion of an organ or structure through an abnormal opening in *connective tissue* or in the muscle wall of the cavity in which it is normally enclosed.

hernia, hiatal

hernia, hiatus

Hernia of a part of the stomach through a rupture of the *diaphragm* at the esophageal opening.

Herpes

Family of viruses including herpes simplex types 1 and 2, and herpes zoster (also called varicella zoster).

Note: Herpes viruses cause several infections, all characterized by blisters and ulcers, including chickenpox, shingles, genital herpes, and cold sores or fever blisters.

[14]

Hershberger bioassay

Short-term *in vivo* procedure in which the *androgenic* or antiandrogenic effects of a test substance are studied in castrated, peripubertal male rodents, as indicated by changes in the weights of androgen-dependent tissues.

hexosaminidase A

See β -*N*-acetylhexosaminidase.

hippocampus

Structural component of the limbic system of the *vertebrate* brain involved in short-term and long-term memory and spatial navigation.

Hirschsprung syndrome

aganglionic megacolon

Absence of nerve ganglia throughout all or part of the gastrointestinal tract, causing dysregulation of intestinal motility.

hirsutism

Presence of excessive bodily and facial hair.

After [7]

holoprosencephaly

(formerly arhinencephaly)

Birth defect in which the *embryonic forebrain* fails to divide completely to form the *cerebral hemispheres*.

Note: This results in varying degrees of mental impairment and abnormal development of eye, nose, and lip.

homeobox

Any of a class of closely similar DNA sequences occurring in various *genes* and involved in regulating pattern formation, segmentation, and *morphogenesis* during *embryonic* development in many species.

See also *homeosis*.

homeobox gene

Gene containing a *homeobox* sequence.

homeosis (n)/homeotic (adj)

Replacement of part of one segment of an insect or other segmented animal by a structure characteristic of a different segment, especially through *mutation*.

homologous

1. Having the same relationship, relative position, or structure.
2. (Of organs) Similar in position, structure, and evolutionary origin but not necessarily in function.
3. (Of *chromosomes*) Pairing at *meiosis* and having the same structural features and pattern of *genes*.
4. (Of a series of chemical compounds) Having the same functional group(s) but differing in structure by a fixed group of atoms.

homologous recombination

Crossing over between two similar or identical strands of DNA, resulting in exchange of corresponding stretches of DNA between two sister *chromosomes*.

honey bee larval toxicity test

Procedure in which larvae of the honey bee (*Apis mellifera*) are exposed to a test chemical in the diet and subsequent mortality is recorded daily up to the 72-h LD50.

hormone (n)/hormonal (adj)

Substance formed in one organ or part of the body and carried in the blood to another organ or part where it selectively alters functional activity.

[1]

human chorionic gonadotropin (HCG)

See *chorionic gonadotropin*.

Human Genome Project (HGP)

International research project that started in 1990 with the goal of determining the base-pair sequence of the human *genome*. The project was declared complete in 2003.

Note: HGP also involved studying the genome of a number of organisms other than humans, including insects, fish, plants, and other mammals.

hydatidiform mole

Vesicular or *polycystic* mass resulting from the proliferation of the *trophoblast*, with *hydropic* degeneration and *avascularity* of the *chorionic villi*.

Note: The abnormal tissue typically results from *gene expression* from paternally derived *chromosomes* and a loss of maternal chromosomes.

[7]

hydranencephaly

Rare condition in which the brain's *cerebral hemispheres* are replaced by sacs filled with *cerebrospinal fluid*.

[12]

hydrocele

Accumulation of *serous* fluid in a sacculated cavity; specifically, such an accumulation in the space of the *tunica vaginalis testis*, or in a separate pocket along the *spermatic cord*.

After [7]

hydrocephalus

Accumulation of excess *cerebrospinal fluid* within the *ventricles* of the brain; head enlargement and brain damage may occur.

[12]

hydromicrocephaly

Microcephaly with excess *cerebrospinal fluid*.

hydronephrosis

Swelling of the funnel-shaped part of the kidney, where urine is collected to enter the ureter.

Note: Hydronephrosis may be a *congenital* deformity or the consequence of an obstruction in the ureter.

hydrops (n)/hydropic (adj)

Gross *edema* of the entire body, with severe *anemia*, occurring in *hemolytic disease of the newborn*.

[5]

hydroureter

ureterectasia

Dilation of a ureter with fluid.

21-hydroxylase

See *steroid 21-monooxygenase*.

hygroma (n)/hygromous (adj)

hydroma

Accumulation of fluid in a sac, *cyst*, or *bursa*.

[5]

hymen

Thin, *membranous* fold of highly variable appearance that, before its rupture, partly occludes the opening of the *vagina*.

hyoid arch

Second *pharyngeal* or *branchial* arch of the developing *embryo*, from which different tissues around the neck, ear, and face will develop.

hypaxial

Ventral to the long axis of the body.

hyperextension

Extension of a limb or part of a limb beyond the normal limit.

hyperflexion

Flexion of a limb or part of a limb beyond the normal limit.

hyperplasia

Abnormal multiplication or increase in the number of normal cells in a tissue or organ.

[1]

hypertelorism

Abnormally wide space between two organs, especially referring to the eyes.

hypertrichosis

See *hirsutism*.

hypertrophy

Enlargement of an organ or tissue as a result of the increase in the size of its cells.

hypoblast

Innermost of the three primary *germ layers*, adjacent to the *blastocyst* cavity, that develops into the *endoderm*.

[12]

hypogonadism

Inadequate functioning of the *testes* or *ovaries* as manifested by deficiencies in *gametogenesis* or in secretion of *gonadal hormones*.

Note: Primary hypogonadism refers to a defect that is inherent in the gonad while secondary hypogonadism refers to a defect lying outside the gonad, often an *endocrine* effect.

hypophysis

See *pituitary*.

hypoplasia

Underdevelopment or *atrophy* of a tissue or organ.

hypospadias

Birth defect in which the *urethra* opens on the underside of the penis, or into the *vagina*.

hypothalamus

Region at the base of the brain containing specialized nerve cells that help activate, control, and integrate peripheral autonomic mechanisms, endocrine activities, and some *somatic* functions such as body temperature, sleep, and appetite.

hypoxia

Abnormally low dioxygen content or tension.

Deficiency of dioxygen in the inspired air, in blood, or in tissues, short of anoxia.

[1]

ichthyosis (n)/ichthyotic (adj)

fish-skin disease

fish-scale disease

xeroderma

Congenital disorder of *keratinization*, characterized by dryness and scaling of the skin, often associated with other defects and with abnormalities of lipid metabolism.

After [7]

identical twins

monozygotic twins

Twins resulting from one *zygote* that, at an early stage of *embryonic* development, separated into two independently growing cell aggregations giving rise to two individuals of the same sex and identical genetic constitution.

[7]

ileocecal

Relating to the *ileum* and the *cecum*.

ileum

Third portion of the small intestine, between the *jejunum* and the *cecum*.

iliac artery

hypogastric artery

Main artery of the pelvis.

imperforate anus

anal atresia

Congenital absence of an *anal* opening due to the persistence of *epithelial* plug (persistence of the anal membrane) or to complete absence of the *anal canal*.

[7]

implantation

nidation

Embedding of the early *embryo* in the lining of the *uterus*.

[12]

imposex

Pseudohermaphroditic condition in female gastropods (snails) manifested by the development (imposition) of male characteristics such as a penis or *vas deferens*.

Note: Quantitation of imposex in the dog whelk (*Nucella lapillus*) has been used to monitor pollution by the antifouling agent tributyltin oxide (TBTO) in marine environments.

[2]

imposition

See *imposex*.

imprinting (in genetics)

Differential *expression* of a *gene*, depending on whether it was transmitted through the *sperm* or the *egg*.

After [12]

Note: Imprinting is an *epigenetic* modulation of gene expression, thought to be regulated by attachment of methyl groups to the DNA, and by chromatin structure.

inbred strain

Strain of an animal that has been inbred by brother-sister matings for more than 20 generations, and consequently all the individuals of the strain are more than 98% genetically identical.

After [11]

index, female fertility

In rodents, number of *pregnant* females divided by the number of females mated, multiplied by 100.

Note: This index measures the female's ability to become pregnant and may be used as a general indicator of *fertility*.

index, gestation

In rodents, number of females with live born *offspring* divided by number of females with evidence of *pregnancy*, multiplied by 100.

index, male fertility

In rodents, number of males impregnating females divided by number of males mated, multiplied by 100.

Note: This index measures the male's ability to produce *sperm* that are capable of impregnating a female, assuming all mated females are *fertile*.

index, tubular fertility

Percentage of *seminiferous tubules* containing identifiable *spermatogonia*.

induced pluripotent stem (iPS) cell

Pluripotent stem cell that is generated from an *adult* cell by genetic reprogramming.

induction

1. Process of stimulating and determining *morphogenetic* differentiation in a developing *embryo* through the action of chemical substances transmitted from one *embryonic* part to another.

See also *evocation*.

2. Increased expression of a protein or set of proteins triggered by an endogenous mediator or a *xenobiotic*.

infecundity

See *infertility*.

infertility

barrenness

infecundity

sterility

Persistent inability of either a male or a female to achieve *conception* or to produce offspring.

infundibulum

Anatomical funnel-shaped opening, often referring to the hollow stalk that connects the *hypothalamus* and the posterior *pituitary* gland, or to the portion of the *Fallopian tube* that receives the *ovum*.

inguinal canal

Passage in the lower anterior abdominal wall, which in men conveys the *spermatic cord* and in women the round ligament of the *uterus*.

inhibin

Any of a group of peptide *hormones* secreted by the *follicular granulosa cells* of the *ovary* and the *Sertoli cells* of the *testis*, inhibiting *follicle stimulating hormone* secretion by the anterior *pituitary*.

iniencephaly

Malformation producing a cranial defect at the *occiput*, with the brain exposed, often combined with a cervical *rachischisis* and retroflexion.

After [7]

iniopagus

Twins conjoined at the *occiput*.

insemination

Delivery of *sperm* into the female reproductive system for the purpose or with the result of causing *pregnancy*.

integrin

Any of a family of cell membrane glycoproteins that mediate cell-to-cell and cell-to-*extracellular matrix* interactions.

intermediate filament (IF)

Any of a group of fibrous proteins (including *keratin* fibres, neurofilaments, desmin, and vimentin) that make up part of the cytoskeleton of most eukaryotic cells; so named because, at about 10 nm diameter, they are intermediate in thickness between actin filaments and microtubules.

Note: Most types of intermediate filaments are cytoplasmic, but one type, the lamins, is nuclear.

intersexuality

intersex

Condition of having both male and female characteristics: thus, the state of being intermediate between the sexes.

[7]

intracytoplasmic sperm injection (ICSI)

Infertility treatment in which the *sperm* is injected through the *membrane* of the *egg* into its cytoplasm.
[12]

intramembrous ossification

Creation of bone tissue during *fetal* development of jawed *vertebrates*, as well as during the healing of bone fractures; the tissue forms from *mesenchymal stem cells* residing in an *extracellular matrix* devoid of collagen.
Note: Intramembrous ossification is one of two mechanisms of bone formation, the other being *endochondral ossification*.

intrauterine

Within the *uterus*.

intrauterine growth restriction (IUGR)

intrauterine growth retardation

Subnormal, poor growth of the *fetus*.

Note: Growth restriction can be due to maternal or fetal causes, as well as to malnutrition and toxic exposures.

intrinsic pathway

Apoptotic pathway of cell death initiated from within the cell by signals initiated by mitochondrial damage and (or) DNA damage, a defective cell cycle, detachment from the *extracellular matrix*, hypoxia, loss of cell survival factors, or other types of severe cell stress; characterized by the activation of caspase 9.

Note 1: This pathway involves the release of pro-apoptotic proteins from the mitochondria.

Note 2: The intrinsic and *extrinsic pathways* converge with cleavage of procaspase 3 by either caspase 8 (extrinsic pathway) or caspase 9 (intrinsic pathway).

introitus

See *ostium*.

in utero

See *intrauterine*.

inversion, chromosomal

Rearrangement of a *chromosome* in which, after breakage at two points, a segment is reversed, resulting in a change in sequence of nucleotides.

in vitro fertilization (IVF)

Fertilization outside the body, used as a treatment for *infertility*.

[12]

ischemia

Local deficiency of blood supply, and hence of dioxygen, to an organ or tissue, caused by constriction or obstruction of the blood vessels.

After [1]

isotretinoin

Vitamin A-like medication (13-*cis* retinoic acid) used, among other things, for acne treatment.

Note: Intake during *pregnancy* has a high *teratogenic* risk.

jejunum

Second part of the small intestine between the *duodenum* and *ileum*.

karyolysis

Dissolution of a cell nucleus, especially during *mitosis* and *meiosis* but also following *necrosis*.

See also *karyorrhexis*.

karyorrhexis

Irreversible fragmentation of the nucleus of a dying cell following *karyolysis*, whereby its chromatin is distributed irregularly throughout the cytoplasm.

karyotype

1. Characterization of the number, form, and size of the *chromosomes* of an individual or a species.
2. Photomicrograph of an individual's chromosomes, arranged according to a standard classification for the species.

keratin

Fibrous protein forming the main structural constituent of hair, feathers, hoofs, claws, horns, *etc.*

keratinization

cornification

Replacement of the outer *epithelial* layer of cells, especially in skin, with *keratin*-rich structures.

ketoacidosis

Acidosis, as in diabetes, *pregnancy*, or starvation, accompanied by the accumulation of *ketone bodies* in body tissues and fluids.

ketone body

Ketone that is an intermediate product of the breakdown of fats in the body; any of three compounds, acetoacetic acid, acetone, and (or) β -hydroxybutanoic acid, found in excess in blood and urine of persons with metabolic disorders.

Note: Ketone bodies tend to accumulate in the blood and urine of individuals affected by starvation or uncontrolled diabetes mellitus.

Klinefelter syndrome

Syndrome in males resulting from a genetic defect in which an extra female *X chromosome* (thus an *XXY genotype*) is present in a male, characterized by small *testes*, long legs, enlarged breasts, reduced *sperm* production, and mental retardation.

knockout mutation

null mutation

Mutation that leads to the loss of function of a particular *gene*.

[11]

kyphosis

hunchback

Rearward curvature or convexity of the spine in excess of normal, resulting in a protuberant upper back.

labor

Physical efforts of expulsion of the *fetus* and the *placenta* from the *uterus* during *birth*.

lactation

Secretion of milk from the *mammary gland*, usually to feed the infant during the *neonatal* period.

lactation period

Time following *pregnancy* during which the *mammary glands* secrete milk.

lamina propria

Layer of *connective tissue*, underlying the *epithelium* of a *mucus membrane*, containing capillaries and *lymphatic* vessels, as well as *fibroblasts* and cells of the immune system.

larynx

Part of the respiratory tract between the *pharynx* and the *trachea*, having walls of *cartilage* and muscle and containing the vocal cords.

leprosy

Disease caused by infection with the bacterium *Mycobacterium leprae*, often affecting the skin and nerves and causing body parts to become deformed.

Note: *Thalidomide* is used as a therapeutic drug and thalidomide-associated *embryopathy* occurs in regions where leprosy is endemic.

leptocephaly

Malformation characterized by an abnormally tall, narrow *cranium*.

[7]

leptodactyly

Abnormally slender digits.

leucism

Lack of pigmentation in the skin, hair, or feathers as a result of a failure of pigment cells to develop, or to migrate to those locations from their origin in the *neural crest*, in the *embryo*.

Note: Unlike *albinism*, where the defect is in the production of melanin pigment only, animals with leucism usually have pigment in the eye, as *retinal* pigment cells do not derive from the neural crest.

leukopenia

Abnormally low concentration of white cells (leukocytes) in the blood.

levocardia

Normal position of the heart in the left hemithorax with the apex pointed to the left, and transposition of other viscera.

See also *dextrocardia*, *situs inversus*.

Leydig cell

Cell in the *testis* that produces *androgens*, mainly *testosterone*, in the presence of *luteinizing hormone*.

ligamentum arteriosum

Fibrous remnant of the *ductus arteriosus* linking the *aortic arch* and the top of the left *pulmonary artery*.

limb bud

Embryonic outgrowth of *mesoderm* covered in *ectoderm* that will give rise to one of the forelimbs or hindlimbs.

limit test

Acute toxicity test in which, if no ill effects occur at a preselected maximum dose, no further testing at greater exposure levels is required.

[2]

linkage analysis

Technique that studies patterns of heredity in high-risk families, in order to locate a disease-causing *gene mutation* by identifying co-inherited traits, usually by producing a *LOD score*.

linkage disequilibrium

Occurrence in members of a population of combinations of linked *genes* in non-random proportions, implying that the genes are close enough together on a *chromosome* to make it unlikely that they will be separated by recombination (see *homologous recombination*) during *meiosis*.

lipidosis

Disorder of fat metabolism characterized by the accumulation of abnormal levels of certain lipids in the body.

litter

Multiple offspring produced by a mammal from one *pregnancy*.

lobster-claw deformity

split hand

cleft hand

See *ectrodactyly*.

locus (in genetics); (pl. loci)

Specific location of a *gene* or DNA sequence on a *chromosome*.

LOD score

logarithm (base 10) of odds

Ratio of the likelihood of two or more *loci* remaining together when chromosomes recombine (true linkage) to the likelihood of this occurring by chance alone.

Note: An LOD score of 3 or greater is considered indicative of genetic linkage with odds greater than 1000:1.

See also *linkage analysis*.

lordosis

Forward (*ventral*) curvature of the spine in the lumbar and cervical regions.

Note 1: Some degree of lumbar curvature is normal. Excessive curvature (lumbar hyperlordosis) is sometimes called swayback.

Note 2: This posture is also associated with a rodent being in heat.

lumbar puncture

spinal tap

Piercing into the subarachnoid space of the lumbar region in order to obtain spinal fluid for diagnostic purposes or to inject a drug.

luteal phase (menstrual cycle)

Phase of the human *menstrual cycle*, usually lasting 14 days, beginning with formation of the *corpus luteum* and ending, in the absence of *fertilization*, with the onset of *menstruation*.

Modified from [5]

luteinizing hormone (LH)

Hormone made by the *pituitary* gland that acts on the *ovary* to control *egg* maturation and to trigger *ovulation*. The same hormone acts in the *testes* to trigger production of *testosterone*.

luteinizing hormone-releasing hormone (LHRH)

See *gonadotropin-releasing hormone*.

lymph

Transparent fluid, containing chiefly lymphocytes, that bathes the tissues and drains through a system of vessels (the *lymphatic* system) into the venous bloodstream through the *thoracic duct*.

lymphatic

Relating to *lymph* or its secretion.

lymphoid

Relating to or denoting tissue responsible for producing lymphocytes and antibodies.

Note: Lymphoid tissue occurs throughout the body in *lymph* nodes, *thymus*, *tonsils*, and spleen.

Lyon hypothesis

Lyon law

X-inactivation

lyonization

Hypothesis (named after Mary Lyon) that random inactivation of all but one *X chromosome* occurs in each female mammalian cell in early development, thus explaining why the effect of the X chromosome on *phenotype* is the same in males with one copy as in females with two copies.

Note 1: The *Barr body*, visible in some female cells, is an inactivated X chromosome.

Note 2: This phenomenon leads to *mosaicism* for *X-linked genes* in the female, since the paternal X chromosome is inactivated in some cells and the maternal one in others.

Note 3: The Lyon hypothesis was designated the Lyon law by the European Molecular Biology Organization (EMBO) in 2011.

lysosomal storage disease

One of a group of rare inherited metabolic disorders resulting from a defect in lysosomal function, commonly a deficiency of enzymes required for the metabolism of lipids, glycoproteins, or mucopolysaccharides, resulting in their accumulation in the cell.

macrocephaly

megacephaly

megalocephaly

Congenital disorder characterized by an abnormally large head and (or) brain.

macroglossia

Congenital disorder characterized by an abnormally enlarged tongue.

Note: This is often seen in *Down syndrome*.

macrogathia

megathia

Congenital disorder characterized by enlargement or elongation of the jaw.**macromelia**

megalomelia

Congenital disorder characterized by an abnormally large limb or limbs.**macrosomia***Congenital* disorder characterized by an abnormally large body or body part.**macrostomia***Congenital* disorder characterized by an abnormally large size of the mouth.**male efferent duct**See *efferent duct*.**malformation**

Structural defect as a result of abnormal development.

malignantOpposite term: *benign*.

1. Occurring in a severe form, tending to become progressively worse, resistant to treatment, and likely to result in death.
 2. In *cancer*, cells showing both uncontrolled growth and a tendency to invade and destroy other tissues.
- After [1]

mammary gland

Milk-producing organ in female mammals.

Marfan syndrome*Congenital connective tissue* disorder associated with *mutation* of the fibrillin-1 gene FBN1.**masculinization**Development of male characteristics, such as facial hair, either as part of normal male maturation, or, pathologically, by people of either sex as a result of *hormonal* imbalance.**maternal serum alpha-fetoprotein (MSAFP)**Protein made in the *fetus* that normally leaks, in small amounts, into the mother's circulation.

[12]

Note: If there is an abnormal opening in the fetus, such as a *neural tube defect*, larger amounts appear in the mother's serum, providing a screening test for such fetal anomalies.**maxillary**

Relating to the maxilla (upper jaw).

Meckel diverticulum

ileal diverticulum

Congenital pouch in the *ileum* resulting from incomplete closure of the *yolk sac*.

meconium

First intestinal discharges of the newborn infant, greenish in color and consisting of *epithelial* cells, *mucus*, and bile.

[7]

median teratogenic concentration (TC)

Median concentration resulting in developmental *malformations* for 50% of exposed test animals within a predetermined time, *e.g.*, 96 h.

[2]

mediastinum

Region in the middle of the thorax between the two lungs, containing the regional vessels, *trachea*, esophagus, bronchi, *lymph* nodes, and heart.

medulla

1. medulla oblongata

Lower part of the brain stem continuous with the *spinal cord*, containing neural centers regulating the autonomic functions of breathing, heart rate, and blood pressure.

2. Middle (central) part of an organ, as in *adrenal* medulla, renal medulla, or the medulla of a lymph node.

megacolon

Condition of extreme dilation of the colon that can be *congenital* (as in *Hirschsprung* disease) or acquired (as when children refuse to defecate).

Note: Aganglionic megacolon is a condition, where parts of the colon have abnormal motor activity, resulting in spasms and massive distention of the colon *proximal* to the spasm.

megadactyly

macroductyilia

Disorder characterized by an abnormally large fingers and (or) toes.

meiosis

Process of “reductive” cell division, occurring during the production of *gametes*, by means of which each daughter nucleus receives half the number of *chromosomes* characteristic of the *somatic* cells of the species.

[7]

Note: Not to be confused with *mitosis*.

membrane

1. In anatomy, thin layer of tissue separating or connecting structures or organs.
2. In cell biology, phospholipid-based bilayer structure, surrounding and isolating cells and organelles.

menarche

First *menstrual cycle* of a woman.

Mendelian gene

Gene located in a *chromosome* that obeys the laws of *Mendelian inheritance*.

[11]

Mendelian inheritance

Inheritance in which stable and indivisible characteristics are controlled entirely or overwhelmingly by a single genetic *locus* and transmitted over many generations.

[7]

Mendelian trait

Phenotype that shows a pattern of *Mendelian inheritance*.

meninx (s)/meninges (pl)

Any of the three membranes (the *dura mater*, *arachnoid*, and *pia mater*) that line the skull and *vertebral canal* and enclose the brain and *spinal cord*.

meningocele

Herniation of the *membranes* of the brain or *spinal cord* (see *meninx*) through a defect in the *cranium* or *spinal column*.

After [7]

meningomyelocele

meningoencephalocele

Birth defect following failure of the *neural tube* to close, resulting in protrusion of a sac of nerve tissue and its covering *membranes*.

[12]

menopause

Cessation of reproductive capability in a woman, marked by declining *ovarian* function and an end to *menses*.

menstrual cycle

The period, normally lasting 28 days in the human female, during which an *ovum* matures, is *ovulated*, and enters the *uterus* through the *Fallopian tubes*. If *fertilization* occurs, the cycle is interrupted by *pregnancy*; otherwise, the cycle ends with *menstruation*.

menstruation

menses

Cyclic *endometrial* shedding and discharge of a bloody fluid from the uterus during the *menstrual cycle*.

[7]

meromelia

Congenital absence of a part of a limb, resulting in a shrunken and deformed extremity.

See also *amelia*, *hemimelia*, *phocomelia*.

After [7]

mesectoderm

ectomesenchyme

Embryonic migratory cells derived from the *neural crest* of the head that contribute to the formation of the meninges (see *meninx*) and become pigment cells.

[5]

mesencephalon

midbrain

Part of the *vertebrate* brain that develops from the middle section of the *embryonic neural tube*.

mesenchymal-to-epithelial transition (MET)

Process in which motile *mesenchymal* cells undergo a development to planar, polarized fixed cells, forming *epithelia*.

Note: This transition occurs in both normal development and *tumor metastasis*.

See also *epithelial-to-mesenchymal transition*.

mesenchyme (n)/mesenchymal (adj)

Meshwork of *embryonic connective tissue* in the *mesoderm*, from which are formed the bone, muscular, and connective tissues of the body and also the *urogenital* system, blood vessels, and *lymph* vessels.

[9]

mesentery

Membranous sheet attaching various organs to the body wall, especially the *peritoneal* fold attaching the intestine to the *dorsal* body wall.

[9]

mesoderm (n)/mesodermal (adj)

embryonic mesoderm

Middle layer of cells in the *embryo*, lying between the *ectoderm* and the *endoderm*. It includes the following tissues:

- a. Lateral mesoderm: peripheral portion of intraembryonic mesoderm.
- b. Intermediate mesoderm: origin of the nephrogenic cord.
- c. *Parietal (somatic)* mesoderm: cell source for the formation of the lateral and *ventral* body wall.
- d. *Visceral (branchial, pharyngeal, splanchnic)* mesoderm: inner layer of lateral mesoderm that, with the *endoderm*, provides the cells from which the gut and lungs and their coverings arise.

See also *mesenchyme*.

mesogastrium

Part of the *embryonic mesentery* that is attached to the early stomach.

mesonephric duct

Wolffian duct

Embryonic duct of the *mesonephros*, which in the male becomes the *vas deferens* and in the female becomes *vestigial*.

mesonephros

Middle part of the *embryonic* kidney in *vertebrates*, becoming the *adult* kidney in fishes and amphibians and the *epididymis* in reptiles, birds, and mammals.

See also *pronephros*, *metanephros*

mesothelium

Single layer of flattened cells forming an *epithelium* that lines *serous* cavities such as the *peritoneum*, *pleura*, and *pericardium*.

After [7]

messenger RNA (mRNA)

RNA that results from transcription of *genes* coding for polypeptides.

metabologen

Morphogen, including *bone morphogenetic protein*, that affects metabolism and homeostasis.

metallothionein

One of a family of low-molecular mass proteins that binds metals such as zinc, copper, cadmium and mercury.

metanephros

Primordium of the permanent kidney, developing later than, and *caudal* to, the *mesonephros*.

[5]

metaphase

Stage of *mitosis* or *meiosis* in which the *chromosomes* become aligned on the equatorial plate of the cell, separating the *centromeres*.

metaplasia

Abnormal transformation of an *adult*, fully differentiated tissue of one kind into a differentiated tissue of another kind.

[7]

methylation

Attachment of a methyl group to a molecule.

Note: Methylation of DNA on cytosine bases is an *epigenetic* event that alters *gene expression*.

microcephaly

Congenital occurrence of an abnormally small head.

microcheiria

Congenital occurrence of abnormally small hands.

microglossia

Congenital occurrence of an abnormally small tongue.

micrognathia

Congenital occurrence of abnormally small jaws, especially effecting the mandible.

micromass culture

Laboratory technique in which dispersed cells from an *embryonic* organ or tissue, such as the brain, *limb bud*, or *cartilage*, are allowed to reaggregate in culture.

After [12]

micronucleus test

1. Test for *mutagenicity* in which animals are treated with a test agent, after which time the frequency of micronucleated cells is determined.

Note: If a test group shows significantly increased levels of micronucleated cells compared to a control group, the chemical is considered capable of inducing *chromosomal* damage.

[1]

2. Procedure to detect *clastogenic* or *aneugenic* agents by microscopic examination of chromosomes.

Note: The test can be performed *in vivo* in rodents, or in cell culture (*in vitro* mammalian cell micronucleus test).

microphallus

Abnormally small penis.

microphthalmia

Congenital occurrence of abnormally small eyeballs.

microsatellite (in genetics)

short tandem repeat (STR)

Non-coding segment of DNA consisting of short nucleotide sequences (2–6 base pairs), typically occurring in 10–100 consecutive (tandem) repeats.

Note 1: The number of repeats varies between members of any given species.

Note 2: Microsatellites are used as markers in determining genetic diversity, in identifying important genetic traits, in forensic science, in population studies, and in determining paternity.

microsome

Spherical vesicle, prepared by tissue fractionation methods, that is rich in membranes of the endoplasmatic reticulum

Note: The microsomal fraction obtained in this way is often used as a source of monooxygenase enzymes in drug metabolism studies.

After [1]

microstomia

Congenital occurrence of an abnormally small opening of the mouth.

midgut

mesenteron

Middle section of the digestive tract in a *vertebrate embryo*, from which the *ileum*, *jejunum*, and portions of the *duodenum* and colon develop.

Minamata disease

Neurological disease caused by methylmercury, first seen in subjects ingesting contaminated fish from Minamata Bay in Japan.

[1]

minisatellite

variable number tandem repeat (VNTR)

Non-coding segment of DNA, found throughout the *genome*, usually near the ends of *chromosomes*, that consists of tandem repeats of sequences of about 10–100 base pairs.

Note: These VNTRs are useful for genetic research and analysis.

Compare *microsatellites*.

miscarriage

Lay term for *spontaneous abortion*.

mitosis (n)/mitotic (adj)

Process by which a cell nucleus divides into two daughter nuclei, each normally having the same genetic complement as the parent cell: nuclear division is usually followed by cell division.

[1]

molecular epidemiology

Use in *epidemiological* studies of techniques of molecular biology, such as DNA profiling and genetic analysis, with the aim of detecting genetic patterns characteristic of susceptible populations or of groups at risk of disease.

monophthalmos

Congenital absence of one eye.

monosomy

Disorder in which body cells have only one pair instead of the normal two pairs of a particular *chromosome*.

monozygotic twin

See *identical twin*.

morphogen (n)/morphogenetic (adj)

Any of various signalling factors in *embryonic* tissue that influences the movement and organization of cells during *morphogenesis* by forming a concentration gradient.

morphogenesis

Shaping of an organism during *embryological* development by differentiation of cells, tissues, organs, and organ systems, according to the genetic program of the organism, and influenced by *morphogens* and environmental conditions.

After [15]

morphological

Pertaining to structure or form.

morula

Early multi-celled stage of the *embryo* from which the *blastocyst* is formed.

[12]

mosaicism

Condition in which an individual or an organism that develops from a single *zygote* has two or more cell populations that differ in genetic constitution.

Note: Mosaicism is seen in humans in *Down syndrome*, *Turner syndrome* and *Klinefelter syndrome*.

After [8]

motility, sperm

Energy-dependent forward movement of the *sperm*, allowing it to reach and penetrate the *egg*.

Note: Decreased sperm motility is an indicator of reduced *fertility*.

mucosa

See *mucous membrane*.

mucous membrane

Layer of *epithelial* tissue with a thin underlying layer of *connective tissue* (the *lamina propria*) that lines many body cavities, including the gut, respiratory passages, and tubular organs; it secretes, and is covered in, *mucus*.

mucus (n)/mucous (adj)

Slippery viscous fluid, consisting largely of water and glycoproteins, secreted by *mucous membranes*.

Müllerian duct

See *paramesonephric duct*.

Müllerian inhibiting factor (MIF)

See *anti-Müllerian hormone*.

Müllerian-inhibiting hormone (MIH)

See *anti-Müllerian hormone*.

Müllerian inhibiting substance (MIS)

See *anti-Müllerian hormone*.

multicotyledonary placentation

Formation of a *placenta* with many lobes.

[12]

multifactorial inheritance

Transmission from parents to offspring of a trait that is determined by multiple genetic and environmental factors, each with a small effect.

[12]

multigenerational study

1. Animal test of reproductive toxicity in which two to three generations of the test organism are exposed to the substance being assessed.
2. Animal test of reproductive toxicity in which only one generation is exposed and effects on subsequent generations are assessed.

After [1]

mutagen (n)/mutagenic (adj)

Agent that can induce heritable changes (*mutations*) in the *genotype* of a cell, as a consequence of alterations in, or loss of, genetic material.

[1]

mutation

Any relatively stable heritable change in genetic material that may be a chemical transformation of an individual *gene* (gene or point mutation), altering its function; or a rearrangement, gain, or loss of part of a *chromosome*, which may be microscopically visible (chromosomal mutation).

Note: A mutation can be either germinal and inherited by subsequent generations, or *somatic* and passed through cell lineage by cell division.

[1]

mutation (in immunology)

See *somatic hypermutation*.

mycoplasma

Very small infectious microorganism, related to bacteria, but without a cell wall.

Note: *Genital* mycoplasmas may lead to spontaneous preterm *labor* or *perinatal* morbidity and mortality.

myelencephalon

Part of the brain in the *embryo* that gives rise to the *medulla oblongata*.

myelination (n)/myelinated (adj)

The acquisition, development, or formation of a myelin sheath around a nerve fiber.

myeloblast (n)/myeloblastic (adj)

Immature bone marrow cell that is a precursor of the *granulocyte* series.

myelotoxic

Harming bone marrow or any of its components.

myoblast

Mononucleate cell that is committed to differentiate into muscle.

[12]

myocarditis

Inflammation of the heart muscle.

myocardium

Muscle of the heart.

myometrium

Muscular wall of the *uterus*.

myositis

Inflammation of muscle.

myotome

In the *embryo*, that part of a *somite* that develops into skeletal muscle.

nasal

Relating to the nose.

natality

Rate of *birth*, the number of newborn individuals per unit time.

Note: Natality and mortality graphs together form a life table.

[2]

navel

See *umbilicus*.

necropsy

Postmortem examination of the organs and body tissue of a non-human animal to determine cause of death or pathological condition.

Compare *autopsy*.

necrosis (n)/necrotic (adj)

Sum of morphological changes resulting from cell death by lysis and (or) enzymatic degradation, usually accompanied by inflammation and affecting groups of cells in a tissue.

Note: Distinct from *apoptosis*, *autophagy*, and other modes of cell death.

[1]

neonate (n)/neonatal (adj)

Newborn animal or human infant during the first four weeks of *postnatal* life.

Note: For statistical purposes, some scientists have defined the period as the first seven days of human postnatal life. The precise definition varies from species to species.

After [1]

neoplasm

New and abnormal formation of tissue as a consequence of growth by cell proliferation, which may continue after the initial stimulus that initiated the proliferation has ceased, and which may develop into a *tumor*.

neural

1. Pertaining to a nerve or to the nervous system.
2. Pertaining to the *dorsal* side of the *vertebral* bodies or to their precursors.

Compare *hemal*.

After [7]

neural arch

1. *Dorsal* bony covering of the spinal cord.

Syn. *vertebral* arch.

2. *Cartilaginous* structures surrounding the *embryonic spinal cord*.

neural crest

Band of cells on either side of the *neural tube*.

Note: Cells from the region of the neural crest migrate to form parts of the nervous system, face, skin, and heart.

After [12]

neural plate

Area in the middle of the early *embryo* that rolls up to form the *neural tube*.

After [12]

neural tube

Embryonic tubular structure that becomes the brain and *spinal cord*.

After [12]

neural tube defect

Failure of the *neural tube* to close properly during *gastrulation*.

See also *anencephaly*, *spina bifida*.

neurobehavioral

Pertaining to the function of the nervous system as it relates to behavior.

[12]

neuroblast

Cell derived from *neural stem cell* that will differentiate into a *neuron*.

See also *neuroblastoma*.

neuroblastoma

Malignant neoplasm consisting of poorly differentiated *embryonic* nerve cells (*neuroblasts*).

neuroectoderm

Central region of the early *embryonic ectoderm* that will give rise to the brain and *spinal cord*, together with the *neural crest* cells that will form the peripheral nervous system.

neuroendocrine (system)

Combined cooperating network of the nervous system and *hormonal* systems.

neuroendocrine

Pertaining to the nervous and *endocrine* systems in anatomical or functional relationship.

neurohypophysis

Posterior lobe of the *pituitary gland*, involved in the storage and secretion of *oxytocin* and *vasopressin*.

neuron (n)/neuronal (adj)

Nerve cell.

neuropore

Opening at either the *cranial* (*caudal*) or anterior (*rostral*) end of the *neural tube* before it completes closure in the early *embryonic stage*.

neurotrophin

One of several protein *growth factors* that regulates development, maintenance, and function of the *vertebrate* nervous system.

neurulation

Formation of the *embryonic neural plate* and its rolling up into the *neural tube*.

nipple

Projection on the apex of the breast through which the *ducts* of the milk-producing glands open.

After [7]

nodal (protein)

Growth factor of the transforming growth factor β (TGF- β) superfamily, coded by a *gene* designated NODAL, that plays crucial roles in *embryogenesis*, particularly in signalling from the *primitive streak* to the *mesoderm* to establish left-right asymmetry as well as aspects of *stem cell* differentiation.

Note: The name derives from *expression* of the gene in the *primitive node*.

noggin (NOG)

Signaling protein released by the *notochord*, important in *somite* patterning and nervous system development.

See also *Spemann organizer*.

nondisjunction

Failure of *chromosomes* to separate during *meiosis*, resulting in an uneven distribution of chromosomes in the two *gametes* (24 and 22 in humans).

noradrenaline

norepinephrine

4-[(1S)-2-amino-1-hydroxyethyl]benzene-1,2-diol

Catecholamine hormone acting as a postganglionic adrenergic mediator at α - and β -adrenergic receptors.

Note 1: Noradrenaline is also stored in, and released from, *chromaffin* granules in the adrenal medulla (see *adrenal gland*).

Note 2: Noradrenaline has strong vasoconstrictive effects.

norepinephrine

See *noradrenaline*.

notochord

Rod-shaped structure of cells derived from *mesoderm*, lying *ventral* to the *neural tube* and defining the *primitive axis* of the *embryo*.

nuclear spindle

mitotic spindle

Structure, formed from microtubules, that draws the newly duplicated *chromosomes* apart during *mitosis* and *meiosis*.

nuclear type I receptor

Steroid hormone receptor, found in the cytosol, that upon ligand binding translocates into the nucleus and interacts with DNA as a homodimer to drive specific *gene* transcription.

Compare *nuclear type II receptor*.

nuclear type II receptor

Steroid hormone receptor, found in the nucleus, that upon ligand binding interacts with DNA as a heterodimer (usually with the *retinoid X receptor*, RXR) to drive specific *gene* transcription.

Compare *nuclear type I receptor*.

nulligravida

Never having been *pregnant*.

Compare *nulliparous*.

nulliparous

Never having given *birth* to a live infant.

Compare *nulligravida*.

occiput (n)/occipital (adj)

Back part of the head or skull.

odontoblast

Dentin-forming cell of the pulp cavity of a tooth, arising from the *mesenchyme* of the *neural crest*.

offspring

Child or children of a person, or the young of an animal, in relation to the parent(s).

oligodactyly

Congenital occurrence of fewer than the usual number of digits, resulting in humans having fewer than five fingers or toes on a hand or foot.

oligodontia

Congenital absence of some of the teeth.

oligomenorrhea

Infrequent or scanty *menstruation*.

oligospermia

oligospermatism

oligozoospermia

Subnormal concentration of *sperm* in the male ejaculate (see *ejaculation*).

omentum

Fold of *peritoneal membrane* passing between the stomach and another abdominal organ.

After [7]

See also *omentum, greater*; *omentum, lesser*.

omentum, greater

Omentum passing from the greater curvature of the stomach in front of the small intestine, folding back on itself to fuse into four layers of *peritoneal membrane*, and ascending to the transverse colon.

Note: The greater omentum functions in fat deposition, contains islands of macrophages that contribute to immune function, and can delimit areas of traumatic tissue damage or infection.

omentum, lesser

Double-layer of *peritoneal membrane (omentum)* passing between the lesser curvature of the stomach and the duodenum.

omphalocele

exomphalos

Congenital herniation of *abdominal viscera* into the base of the *umbilical cord*.

Compare *gastroschisis*.

omphalosite

Lesser developed of two *monozygotic twins* that failed to separate completely during *embryogenesis*.

Note: The omphalosite is joined to the other twin (the *autosite*) by the *umbilical* vessels, receives its blood supply from the *placenta*, and is incapable of survival after separation from the placenta.

one-generation reprotox study

Procedure in which male rodents are dosed with a test substance for at least one *spermatogenic* cycle, and females for two *estrous* cycles, and then further exposed during mating, *pregnancy*, and nursing; adverse effects on reproduction, *parturition*, *lactation* and *postnatal* growth are studied.

Compare *extended one-generation reprotox study*.

See also *two-generation reprotox study*.

oocyte

ovocyte

Immature precursor of the *ovum* resident in the *ovary*.

oocyte, primary

Oocyte during growth phase before completion of the first *meiotic* division.

Note: The primary oocyte is *diploid* and becomes a *secondary oocyte* before birth.

oocyte, secondary

Oocyte in which the first meiotic division to a *haploid* cell has been completed.

Compare *oocyte, primary*.

oogenesis

Process of formation and development of an *ovum*.

[7]

See also *oocyte*; *oocyte, primary*; *oocyte, secondary*; *oogonium*.

oogonium

Primitive *germ cell* that proliferates by *mitosis* and develops into a *primary oocyte* prior to *birth*.

After [7]

open reading frame (ORF)

DNA sequence that begins with an initiation codon and ends with a termination codon that codes for and is potentially translatable into polypeptide.

optic

Relating to the eye or vision.

orbit (in anatomy)

eye socket

Cavity in the skull of a *vertebrate* that contains the eye.

organ of Corti

spiral organ

Specialized collection of *epithelial* hair cells in the inner ear, involved in hearing.

organogenesis

Formation and development of organs.

orofacial cleft

Failure of the lip or *palate* to fuse properly.

See also *facial cleft*.

oropharyngeal membrane

See *buccopharyngeal membrane*.

ossification

See *osteogenesis*.

osteoblast

Fibroblast-derived bone-forming cell that produces a collagen type-I-rich matrix; this matrix calcifies to become bone.

osteoclast

Large multinucleate cell that resorbs bone, allowing for the deposition of new bone.

Note: Osteoclasts secrete enzymes and acids that dissolve the calcium phosphate matrix of old bone tissue.

osteogenesis

Laying down of new bone tissue.

ostium

Opening into a vessel or cavity of the body.

otic

auricular

Pertaining to, or located near the ear.

otocephaly

Congenital anomaly characterized by the absence or extreme underdevelopment of the lower jaw, producing closeness of the ears below the face.

See also *agnathia*, *synotia*.

ovarian cycle

Sequence of events occurring in the *ovary* involved in *ovulation*.

Note 1: It consists of the *follicular phase* with maturation of the *ovarian follicle* under control of *follicle stimulating hormone* (FSH), *ovulation* with release of the *secondary oocyte*, and the *luteal phase* in which FSH and *luteinizing hormone* drive formation of the *progesterone*-producing *corpus luteum*.

Note 2: Together with the *uterine cycle*, it comprises the *menstrual cycle*.

ovarian follicle

Cavity in the *ovary* containing a maturing *ovum*, at any stage of development, surrounded by its encasing cells.

After [5]

ovary (n)/ovarian (adj)

One of the paired female reproductive *glands* containing the *ova* (see *ovum*).

[7]

ovotestis

Abnormal *gonad* in which both *ovarian* and *testicular* tissues are present, and thus a form of *hermaphroditism*.

After [7]

ovulation

Release of a mature *ovum* from the *ovary* into the *Fallopian tube*.

ovum

Mature female sex cell, capable of undergoing *fertilization*.

See also *egg*, *gamete*, *oocyte*.

oxytocin

Peptide *hormone* secreted by the *neurohypophysis* that stimulates contraction of the *myometrium* during *labor* and secretion of milk during *lactation*.

Note: Oxytocin is used clinically in the induction of labor and in the management of *postpartum* hemorrhage.

palate (n)/palatine (adj)

Roof of the mouth, separating the oral and *nasal* cavities.

Note 1: In *embryonic* development an anterior, primary palate is distinguished from a posterior, secondary palate.

Note 2: The embryonic primary palate gives rise to an anterior bony part called the hard palate, and a posterior muscular part called the soft palate.

See also *orofacial cleft*.

palatine raphe

Medial central ridge of the *palate*.

palatoschisis

See *cleft palate*.

Papanicolaou smear

Papanicolaou stain

Pap smear

Pap test

cervical smear

Examination by light microscopy of a sample of cells scraped from the *uterine cervix*, used to screen for cervical cancer.

paracrine

Type of signaling in which a cell secretes into the intercellular space a molecular messenger that diffuses and binds to receptors on nearby target cells, producing a signal in those cells.

After [3]

parafollicular cell

C cell

Neuroendocrine cell that migrates into the *thyroid gland* during *embryonic* development and secretes the *hormone* calcitonin.

paramesonephric duct

Müllerian duct

One of two paired *embryonic ducts* of *mesodermal* origin that will become the *Fallopian tubes*, *uterus*, *cervix* and upper part of the *vagina* in the female, and will regress in the male.

parametrium

Connective tissue of the floor of the female pelvis that lies in front of the *uterine cervix* and separates it from the bladder.

parasitic twin

Smaller of unequal *conjoined twins*.

[7]

See also *autosite*.

paraxial mesoderm

somatic mesoderm

Area of *mesoderm* in the *embryo* that forms during *neurulation*, lies along both sides of the *neural tube*, and gives rise to the *somites*.

parenchymal cell

Distinguishing or specific type of cell of an organ or *gland*, contained in, or supported by, the *connective tissue* framework provided by the *stromal cells*.

After [7]

parietal

Relating to or denoting the wall of the body or of a body cavity or hollow structure.

parietal cell, gastric

Acid-producing cell in the stomach.

parthenogenesis

apogamia

Type of *nonsexual reproduction* in which an *unfertilized ovum* develops into an *embryo*.

parturition

Process of giving *birth* by a maternal organism.

patent ductus arteriosus

Congenital disorder wherein the *ductus arteriosus* fails to close after birth.

Note: This may lead to failure to thrive and increased breathing in early life.

pelvic kidney

ectopic kidney

Congenital abnormality in which a kidney develops and remains in the pelvic area.

Note: Pelvic kidney is generally asymptomatic but may produce complications.

pericardium

Serous membranous sac that surrounds the heart, consisting of an inner *visceral* layer (the *epicardium*), and an outer *parietal* pericardium that is attached to the sternum and *diaphragm*.

perinatal

Relating to the period from shortly before to shortly after *birth*, in humans usually from the 20th to the 29th week of *gestation* to 1 to 4 weeks after birth.

After [1]

perineum

Muscular structure of the lower pelvis, between the legs and extending from the anus to the *pubic symphysis*, or alternatively including the *anus* and *vagina* in the female and the region from the anus to the base of the *scrotum* in the male.

peritoneal cavity

Potential space between the two layers (*visceral* and *parietal*) of the *peritoneum*.

peritoneal membrane

See *peritoneum*.

peritoneum (n)/peritoneal (adj)

Thin double layer of *mesothelium* and irregular *connective tissue* that lines the *abdominal cavity* and covers most of the abdominal organs.

Note: The two layers of the peritoneum consist of the *parietal* peritoneum that lines the abdominal wall and the *visceral* peritoneum that covers the abdominal organs.

See also *peritoneal cavity*.

phage display

Method that enables the presentation of large peptide libraries on the surface of phage particles, from which proteins with desired functional properties can be selected rapidly.

After [11]

pharyngeal groove

One of several paired grooves in the *embryonic endoderm*, lateral to the corresponding *pharyngeal pouch* in the *ectoderm*.

pharyngeal pouch

branchial pouch

One of several paired evaginations in the *embryonic endoderm* that develop into *epithelial* tissues and organs such as the *thymus* and *thyroid gland*.

After [7]

pharynx (n)/pharyngeal (adj)

Part of the digestive tube lying between the esophagus (below) and the mouth and *nasal* cavity (above and anterior).

Note: The pharynx is subdivided into the nasopharynx lying at the base of the nasal cavity, the oropharynx behind the mouth, and the laryngopharynx posterior to the larynx.

phenotype (n)/phenotypic (adj)

Observable characteristics or traits of an organism, including those at a biochemical level, resulting from interaction of its *genotype* with *epigenetic* and environmental factors.

phenylketonuria (PKU)

Autosomal recessive disorder resulting from *mutations* that impair the function of the enzyme phenylalanine 4-monooxygenase (EC 1.14.16.1).

Note 1: The resulting failure of phenylalanine metabolism in the liver leads to its accumulation, causing mental retardation, seizures, and other neurological disorders in untreated individuals.

Note 2: The excess phenylalanine is metabolized to phenyl pyruvate (“phenylketone”) that is detected in the urine and is used for screening newborns.

philtrum

Groove in the midline of the upper lip below the nose.

phocomelia

Congenital abnormality in which one or more of the hands or feet is attached to an underdeveloped limb, and therefore too close to the body.

Note: This very rare disorder is associated with prenatal exposure to *thalidomide*.

phytoestrogen

Non-steroidal natural product from a plant that, because of a structural similarity to 17β -*estradiol* can exert mild *estrogenic* effects, or antagonize them.

Note 1: Examples include isoflavones and coumestans.

Note 2: While foods containing phyto-estrogens are often promoted as beneficial, medical benefits are not well established.

pia mater

See *meninx*.

piebaldism (n)/piebald (adj)

Patchy absence of pigmentation of the hair or skin or, depending on the species, of feathers, scales, or other body surfaces.

pineal gland

epiphysis

Pea-sized conical mass of tissue behind the third ventricle of the brain, secreting the *hormone*-like substance melatonin in some mammals.

pinna

1. Externally visible portion of the ear.

See also *auricle*.

2. Feather or fin.

pituitary

hypophysis

pituitary gland

Small *endocrine gland* sitting in a bony cavity (the *sella turcica*) at the base of the brain and connected to the *hypothalamus*.

Note: The pituitary is structurally and functionally divided into anterior and posterior lobes. The anterior lobe secretes *growth hormone (somatotropin)*, *thyroid-stimulating hormone (TSH)*, *adrenocorticotrophic hormone (ACTH)*, *prolactin (PRL)*, *luteinizing hormone (LH)*, and *follicle-stimulating hormone (FSH)*. The posterior lobe develops from the hypothalamus and secretes *oxytocin* and *antidiuretic hormone (ADH)* (also called *arginine vasopressin (AVP)*). An intermediate lobe (indistinct in humans) secretes *melanocyte-stimulating hormone (MSH)*.

placenta

Organ of exchange of nutrients and waste products between mother and *fetus*, having parts derived from both. See also *placental barrier*.

placental barrier

placental membrane

Multilayered *membrane* of *fetal* tissue within the *placenta* that separates the maternal blood from the fetal blood and allows selective passage of substances between the two.

Note: This membrane blocks only a few *xenobiotics*.

placental circulation

Circulation of blood through the *placenta* during *intrauterine* life, serving the needs of the *fetus* for oxygenation, nutrition, and elimination of waste.

After [7]

placental insufficiency

Inadequate blood flow through the *placenta* to maintain the needs of the *fetus* for oxygenation and metabolic balance.

See also *placental circulation*.

placental membrane

See *placental barrier*.

placental transfer

Delivery of substances from the maternal circulation to the *fetus*, across the *placental barrier*.

pleiotropism (n)/pleiotropic (adj)

1. Having more than one effect.
2. Relating to a *gene*, *expression* of which gives rise to multiple *phenotypic* traits.

pleura (n)/pleural (adj)

Each of a pair of *serous membranes* lining the *thorax* and enveloping the lungs in humans and other mammals.

Note: The pleural membrane covering the lungs and extending into the fissures of the lobes is called the *visceral* pleura and lacks a nerve supply. That lining the chest cavity, *mediastinum*, and *diaphragm* is called the *parietal* pleura; it is innervated and sensitive to pain.

pleural cavity

Potential space between the *pleural* membranes lining the chest cavity (*parietal* pleura) and covering the lungs (*visceral* pleura).

Note: In pathological conditions, fluid may accumulate in the pleural cavity, between the visceral and parietal pleura.

ploidy

Number of *haploid* sets of *chromosomes* in a cell.

pluripotent

Able to differentiate into a variety of cell types.

Note: Examples are the *ovum* and *embryonic stem cells*.

polycystic

Composed of many *cysts*.

polydactyly

Congenital occurrence of *supernumerary* fingers or toes.

polymorphism (n)/polymorphic (adj)

1. Occurrence of a *gene* in more than one distinct nucleotide sequence in a population, resulting from *mutation(s)* and potentially producing *gene products* with different levels of function.

Note: It is sometimes considered that the least frequent of polymorphic gene sequences should be present in at least 1% of the population; otherwise the variant is a mutation rather than a polymorphism.

2. Occurrence of different *phenotypes* of a single trait.

polyploidy

Occurrence of more than two complete sets of *chromosomes*.

See also *ploidy*.

porencephaly

Occurrence of a *cyst* in the substance of the brain that usually communicates with one of the lateral ventricles.

Note: These abnormal cavities may result from brain tissue destruction or maldevelopment.

post-implantation

Occurring after the early *embryo* embeds in the lining of the *uterus*.

postmortem

Opposite term: *antemortem*.

After death.

postnatal

Referring to events in the life of the mother or *fetus* following *birth*.

postpartum

Period following the *birth* of an infant, often considered to be about six weeks in the human.

predatory mite test

Procedure in which *adult* females of the predatory mite (*Hypoaspis (Geolaelaps) aculeifer*, considered representative of soil fauna) are exposed to a test substance in artificial soil and the number of surviving females and of juveniles is determined.

pre-eclampsia

Pathological condition in *pregnancy* with symptoms of high blood pressure, kidney dysfunction and *edema*.

See also *eclampsia*.

pre-embryo

Fertilized *ovum* up to 14 days of age and before *implantation*.

pregnancy (n)/pregnant (adj)

State of a female between *conception* and the termination of *gestation*.

pre-implantation

Occurring before the early *embryo* embeds in the lining of the *uterus*.

premature birth

Delivery before the expected length of *gestation* for the species; in humans taken as *birth* before a gestational age of 37 weeks.

prenatal

antenatal

Referring to events in the life of the mother or *fetus* preceding *birth*.

prenatal development study

Procedure in which a substance is administered to *pregnant* animals (usually rodents or rabbits) from the time of *implantation* until closure of the hard palate. The animals are killed one to two days before a scheduled delivery, whereupon *uterine* contents and the *fetuses* are evaluated for abnormalities.

preoptic area

preoptic region

Region of the anterior *hypothalamus* primarily involved in regulating body temperature.

prepubertal

Stage of human development before the onset of *puberty*.

Compare *prepubescence*.

prepubescence

Period before *pubescence*.

Note: Whereas *prepubertal* refers to any time before *puberty*, *prepubescence* refers less specifically to a time closely preceding early *puberty*.

See also *pubescent*.

prepuce

Skin protecting the *glans penis* in the male (foreskin) or the *clitoris* in the female (clitoral hood).

preputial separation

Separation of the *prepuce* from the *glans penis*.

prethalamus

See *subthalamus*.

primary sex organ

Gonads, which form *gametes*; *ovaries* in the female and *testes* in the male.

See also *accessory sex organ*.

primitive axis

Thickening of the *embryonic* tissue extending forward from the *primitive streak*.

primitive groove

Shallow depression in the *primitive streak* that extends anteriorly to communicate with the *yolk sac*.

primitive node

primitive knot

Group of cells at the anterior end of the *primitive streak*, involved in secreting chemical signals that regulate differentiation of the *germ layers* during *gastrulation*.

primitive pit

Depression in the *primitive node* contiguous with the *notochord*.

primitive streak

Structure forming in the *blastula* during early *embryogenesis* that establishes bilateral symmetry and determines the site of *gastrulation* and *germ layer* formation.

primordial follicle

Early stage of the *oocyte* in which it is surrounded by a single layer of *follicular cells*.

See also *follicle*.

primordial germ cell

Germ cell in the earliest stages of development.

primordium

Organ or tissue at its earliest recognizable stage of development.

proctodeum

anal pit

Ectodermal depression of the *caudal* end of the *embryo*, where later the *anus* is formed.

[5]

progesterone

pregn-4-ene-3,20-dione

Steroid hormone produced in the *ovary* by the *corpus luteum*.

Note: Progesterone is involved in sexual development and the *ovarian cycle*, and essential for maintenance of *pregnancy*.

progestin

Synthetic variant of *progesterone*, often used in oral *contraceptive pills* or to suppress *hyperplasia* of the *endometrium*.

progestogen

gestagen

Member of a family of *hormones*, based on the 21-carbon *pregnane skeleton*, involved in maintaining *gestation* and regulating the *ovarian cycle*.

See also *progesterone*, *progestin*.

prolactin

Hormone released from the anterior *pituitary gland* that stimulates milk production after childbirth.

prolapse

Falling or slipping out of place of an organ or other body part.

Note: Uterine prolapse occurs when the ligaments holding the uterus weaken and the uterus slips down into, or even protrudes from, the *vagina*.

pronephros

Collection of cells in the *vertebrate embryo* that represent the earliest stage of development of the kidney.

pronucleus

Haploid nucleus formed by either the head of the *sperm* or the nucleus of the *oocyte* after *fertilization* but before their nuclei fuse to form the *diploid zygotic* nucleus.

propharynx

See *pharynx*.

prophase

First phase of *meiosis* or *mitosis* in which thickening and orientation of the *chromosomes* occurs.

prosencephalon

forebrain

Most forward part of the brain that includes most of the cerebral cortex, the *thalamus* and *hypothalamus*, and the *basal ganglia*.

prostate

Male *exocrine gland* whose secretion contributes alkaline fluid to the ejaculate (see *ejaculation*).

Note: The alkaline environment facilitates *sperm* transport and prolongs the survival of sperm in the acidic environment of the *vagina*.

protamine

Small, basic (arginine-rich) protein involved in *sperm* maturation and DNA packaging during *spermatogenesis*.

protein kinase

Any enzyme catalyzing protein phosphorylation, often for the purpose of *signal transduction*.

proteomics

Global analysis of *gene expression* using a variety of techniques to identify and characterize proteins.

Note: In toxicology, proteomics can be used to study changes caused by exposure to substances and to determine if changes in mRNA expression correlate with changes in protein expression: the analysis may also show changes in post-translational modification, which cannot be distinguished by mRNA analysis alone.

[1]

proximal (in anatomy)

Nearer to an anatomical point of origin or attachment, or the midline of the body.

Opposite term: *distal*.

pseudocyesis

See *pseudopregnancy*.

pseudohermaphrodite

Organism possessing either male (*testes*) or female (*ovaries*) *gonads*, but with ambiguous *external genitalia*. Compare *hermaphrodite*.

pseudopregnancy

pseudocyesis

false pregnancy

Development of signs of pregnancy in the absence of an *embryo*.

Note: This is commonly called pseudocyesis in humans and pseudopregnancy in other mammals.

psychomotor retardation

Delayed development of both cognitive and motor function.

puberty

Process in which an individual undergoes sexual development, including the onset of *gametogenesis*, changes in *hormonal* secretions, *secondary sexual characteristics*, and reproductive competence.

pubescent

Being in the early stage of *puberty*.

pubic

Relating to the region of the most *ventral* bone of the pelvis (the pubic bone), and thus the region around the genital area, normally showing hair growth (pubic hair) in the *adult*.

pubic symphysis

Cartilaginous joint between the *pubic* bones forming the front of the pelvis.

pulmonary

Pertaining to the lungs.

pulmonary artery

Large vessel that transports blood from the heart to the lungs.

pulmonary valve stenosis

Condition in which the flow of blood from the heart to the lungs is slowed by a deformity on or near the *pulmonary* valve that controls the blood flow from the right heart to the lungs.

pup

1. (n) Young or newborn dog, rat or seal.
2. (v) Give birth to a pup.

pyloric stenosis

Narrowing of the *sphincter* (the pylorus) between the stomach and *duodenum*.

quickenings

Initial awareness of *fetal* movement by the *pregnant* mother, usually occurring early in the second *trimester*.

rachischisis

Failure of the *neural tube* to close *in utero*, resulting in a *birth defect* that leaves a fissure in the *vertebral* column with part of the *spinal cord* exposed.

receptor

Molecular component in or on a cell that is specifically recognized by and binds a molecular structure (ligand), leading to physiological signal transduction or the mediation of an effect.

receptor, nuclear

Receptor that encounters its ligand in the cytosol and translocates to the nucleus, where it binds DNA and acts as a factor regulating *gene* transcription.

recessive

In genetics, relating to or denoting heritable characteristics controlled by *genes* which are expressed in offspring only when inherited from both parents.

Compare *dominant*.

reciprocal mesenchymal-epithelial interaction

Process in tissue or organ development in which *epithelium* induces changes in the *mesenchyme* and the mesenchyme also induces changes in the epithelium, through *paracrine signaling*.

Note: An example occurs during development of the *prostate*, in which mesenchyme of the *urogenital sinus* influences differentiation and patterning of the prostatic epithelium, and the developing epithelium induces prostatic mesenchymal cells to differentiate into smooth muscle and other prostatic *stromal cells*.

See also *epithelial-to-mesenchymal transition*, *mesenchymal-to-epithelial transition*.

reciprocal translocation

Chromosomal translocation in which crossing over between two non-*homologous* chromosomes leads to each carrying genetic material from the other.

Note: If the exchange is equal (*i.e.*, no genetic material is missing) it is called a balanced translocation, and may be without severe consequences for the developing *embryo*. If extra or missing genetic material results from the process, it is called an unbalanced translocation, and the consequences are often more harmful.

recombination, genetic

1. Referring to new *gene* sequences, and thus to new heritable information, caused by gene crossovers, occurring naturally in either *meiosis* or *mitosis*, or constructed artificially for the purpose of introducing a new trait into an organism or cell line.
2. In immunology, random scrambling of specific gene sequences to produce the vast array of possible immunoglobulin and T cell receptor sequences required to recognize, potentially, all possible antigens.

rectum (n)/rectal (adj)

Terminal part of the large intestine, ending at the anus.

5 α -reductase

Enzyme (EC 1.3.99.5) that converts *testosterone* to 5 α -dihydrotestosterone in peripheral tissues.

5 α -reductase deficiency

Condition caused by a *mutation* of the 5 α -reductase type II gene, with *autosomal recessive* inheritance.

renal

Pertaining to the kidneys.

reproductive senescence

Progressive decline in reproductive capacity with age, marked by *menopause* in females.

reproductive toxicant

Agent that interferes with reproductive function, including sexual performance, *fertility*, and development of the *fetus* and *embryo*.

Note 1: Effects on fertility may include effects on *sperm* count and *sperm viability*, *oogenesis* and *ovulation*, placental function, lactation, male erectile function, genetic intactness, *etc.*

Note 2: Effects on development may include effects on embryo viability, fetal growth, *morphogenesis*, functional integrity, *etc.*

Note 3: Reproductive toxicants may show long-term effects not detectable before the second or later generations.

See also *developmental toxicology*.

reproductive toxicity test

Procedure based on specific guidelines in which adverse effects of a substance on reproduction and development are studied either in animals or by use of *in vitro* assays.

resorption

1. Removal of mineralized tissue by natural processes, as in the breakdown of bone by *osteoclasts* or the disappearance of a tooth.
2. Disintegration and assimilation of an *embryo* or *fetus* through a natural process involving lysis and removal of all the products of *conception* by cells of the maternal immune system.
3. In *multigestational* pregnancies, death of one fetus followed by absorption of its tissue by another, sometimes referred to as a “vanishing twin”.

restriction fragment length polymorphism (RFLP)

Variations in the DNA nucleotide sequence that are indicated by the presence or absence of particular *restriction sites* in the DNA.

Note: RFLP analysis is a common method used for DNA profiling.

restriction site

Short DNA nucleotide sequence that is recognized by a sequence-specific enzyme (restriction enzyme) that cleaves the double stranded DNA.

rete

Fibrous mesh or network.

rete testis

Rete in the *testis* that carries *sperm* from the *seminiferous tubules*.

retina

Multicell-layer *membrane* in the back of the eye that is sensitive to light and transduces incoming optical information into signals that are necessary for vision.

retinoic acid

(2*E*,4*E*,6*E*,8*E*)-3,7-dimethyl-9-(2,6,6-trimethylcyclohex-1-en-1-yl)nona-2,4,6,8-tetraenoic acid

Acidic metabolite of Vitamin A.

Note 1: Retinoic acid binds to the retinoic acid *receptor* (RAR), which then acts as a *transcription factor*.

Note 2: The role of RAR in development (*e.g.*, in regulating *homeobox genes*) accounts for the *teratogenicity* of related pharmaceuticals.

retinoid

Member of a class of substances structurally related to vitamin A.

Note: Retinoids play roles in cell growth and differentiation, *tumor* suppression, immune function, and vision. At higher concentrations they cause multiple toxicities, including effects on the long bones, spleen and *lymph* nodes, and *retina*.

retinopathy

Noninflammatory degenerative disease of the *retina*.

[7]

Note: Retinopathy of prematurity (see *premature birth*) is a risk for preterm infants, possibly induced by oxygen therapy and related to disorganized *retinal* blood vessels.

retinoschisis, congenital

juvenile retinoschisis

X-linked retinoschisis

Congenital splitting of the retina into two layers.

retroperitoneal

Outside of and posterior to the *peritoneum*.

reverse genetics

Approach to elucidating the function of a *gene* by studying the effects on *phenotype* of expressed variations in a known DNA sequence.

Note: The term is intended to indicate the reverse of the approach (starting from a phenotype and working back to identify the gene) of *forward genetics*.

rhesus (Rh) factor

Antigen that occurs on the red blood cells of about 85 per cent of humans and can cause *hemolytic disease of the newborn* (erythroblastosis fetalis) and hemolytic transfusion reactions.

Note: The Rh factor was first identified in the blood of a rhesus monkey.

rhombencephalon

hindbrain

Posterior portion of the brain that includes the *cerebellum*, *pons*, and *medulla*.

RNA interference (RNAi)

Effect of small, often double-stranded RNA targeting a specific messenger RNA (mRNA), blocking its translation, and thereby silencing *expression* of the corresponding *gene*.

Note 1: Cells produce two types of small RNA, microRNA (miRNA) and small interfering RNA (siRNA), that are both involved in the regulation of gene expression.

Note 2: As an experimental technique, RNAi uses designed sequences to silence a gene of interest.

Note 3: Short hairpin RNAs (shRNA) are sequences, designed for improved effect in RNAi experiments, that have a base-paired stem representing the double-stranded portion and an intervening unpaired loop.

Robertsonian translocation

Chromosomal translocation in which *chromosomes* with *acrocentric centromeres* break the centromere to fuse the long arms into a new large chromosome and the short arms into another small one that may be lost, leaving a *karyotype* in the human of 45 chromosomes.

rostral

1. Pertaining to, resembling, or having a rostrum or beak.
2. Situated toward the beak (thus, oral and nasal region), which may mean superior (in relationships of areas of the *spinal cord*) or anterior or *ventral* (in relationships of brain areas).

After [5]

3. Closer to the head.

Compare *caudal*.

runt

Smallest and weakest animal of a *litter*.

Note: A runt may be disadvantaged in competing with its siblings for resources and its mother's attention.

sacral agenesis

caudal regression syndrome

Absence or significant underdevelopment of the lower part of the spine and the lower limbs.

Note: Sacral agenesis is associated with maternal diabetes.

After [12]

sagittal

Vertical (longitudinal) plane dividing the body into right and left sections.

Salmonella test

See *Ames test*.

salpingectomy

Surgical removal of the *Fallopian tubes*.

saturation mutagenesis

Mutagenesis screening in which a large number of *mutations* are introduced in a target area of the *genome* with the aim of identifying all the *genes* or their functions that are associated with that area.

scaphocephaly (n)/scaphocephalic (adj)

Elongated and narrow head with decrease of the *parietal* regions and conspicuous frontal and *occipital* protrusions; a type of *craniosynostosis*.

Note: Scaphocephaly is a result of the premature closure of the sagittal suture and is usually accompanied by mental retardation.

scoliosis

Abnormal lateral and rotational curvature of the *vertebral spinal column*.

[7]

scrotum

Pouch of skin containing the *testicles* and their accessory tissues.

secondary sexual characteristic

Feature of the *adult* animal, appearing during *puberty* in humans and distinct between the sexes, although not part of the reproductive system.

Note: Examples include enlargement of the female breasts and sex-specific patterns of body hair, such as facial hair in the male and the male or female *pubic* escutcheon.

secondary spermatocyte

See *spermatocyte*.

seizure

Sudden change in neural activity, leading to *convulsions* and (or) changes in consciousness of varying degrees of severity.

See also *epilepsy*.

selector gene

Member of a group of *genes* that codes factors driving differentiation and regional patterning during development.

sella turcica

Depression on the upper surface of the *sphenoid bone*, accommodating the *pituitary gland*.

semen (n)/seminal (adj)

ejaculate (n)

seminal fluid

Fluid, containing *spermatozoa*, that is expelled from the penis during *ejaculation*.

seminal fluid

See *semen*.

seminal vesicle

One of a pair of *glands* of the male reproductive system that together produce a significant portion of the *semen*.

Note: Seminal vesicle secretion does not contain *spermatozoa*, but provides nutrients and an alkaline environment that prolongs their survival.

seminiferous tubule

One of numerous coiled tubes, found in the *testis*, in the walls of which *spermatogenesis* occurs.

sensitized strain

Model organism containing a *mutation* in a pathway (*e.g.*, metabolic or signal transducing) that does not itself cause a change in *phenotype*, but makes the organism more sensitive to another change elsewhere in the pathway.

After [11]

septum (n)/septal (adj)

In anatomy, thin wall dividing two cavities or masses of softer tissue.

serous

Containing, resembling, or secreting serum.

Sertoli cell

Somatic cell in the *seminiferous tubule* that supports *spermatogenesis*.

Note: Tight junctions between Sertoli cells contribute to the *blood-testis barrier*.

Sertoli-Leydig cell tumor

Ovarian tumor composed of both *Sertoli* and *Leydig cells*.

Note: The tumor may secrete *androgens*, thus causing *masculinization*.

sex chromatin

Barr body

Condensed mass of one inactivated *X chromosome* seen inside the nuclear *membrane* of an interphase cell.

Note: The Barr body is not seen in normal male cells (XY), but one body may be seen in normal female cells (XX). In *chromosomal* abnormalities, the number seen is one less than the number of X chromosomes.

See also *Lyon hypothesis*.

sex chromosome

One of the pair of *chromosomes* determining sex; in humans designated an *X chromosome* and a *Y chromosome*, with females having an XX *genotype* and males an XY *genotype*.

sex-determining region Y (SRY) protein

testis-determining factor (TDF)

Transcription factor coded by a gene on the *Y chromosome* that initiates development of the male sex organs (*i.e.*, *testicular* differentiation) in the *embryo*.

sexual dimorphism

Phenotypic difference between the sexes of a species.

sexually dimorphic nucleus (SDN)

Compact area of large cells in the anterior *hypothalamus*, larger in men than women, and believed to influence sexual behaviour.

See also *sexual dimorphism*.

sexual maturation

Process of reaching the age or stage when an organism can reproduce sexually.

sexual maturity

Age or stage when an organism can reproduce sexually.

sexual reproduction

Creation of a new organism requiring combination of the genetic material from two different sexes.

Siamese twin

See *conjoined twin*.

sibling

sib

One of two or more individuals with a common pair of parents.

signal transduction

Process whereby a signal arising outside the cell is converted through a series of intermediate chemical reactions inside the cell to produce a functional change in the cell.

[3]

single-nucleotide polymorphism (SNP)

Single base variation at a *chromosomal locus*, which exists stably within populations (typically defined as each variant form being present in at least 1 to 2 % of individuals).

[1]

sinoatrial node

sinuatrial node

Mass of specialized *cardiac* muscle cells (“pacemaker cells”) that spontaneously depolarize to initiate rhythmic contraction of the heart.

sinus

1. Hollow or cavity.
2. Channel for the passage of fluid, lacking the usual lining of a blood or *lymphatic* vessel; especially a dilatation for the passage of venous blood.

sinus venosus

venous sinus

Cavity at the *caudal* end of the developing *embryonic* heart where intra- and extra-*embryonic* veins meet.

Note: The sinus venosus develops into the portion of the right *atrium* in the *adult* heart that receives blood from the *vena cava*.

siRNA

See *RNA interference*.

sister chromatid

See *chromatid*.

sister chromatid exchange (SCE)

Reciprocal exchange of chromatin between two replicated *chromosomes* that remain attached to each other until *anaphase* of *mitosis*.

Note: SCE is used as a measure of *mutagenicity* of substances that produce this effect.

[1]

situs inversus

Developmental anomaly in which major *visceral* organs are found in a mirrored position to their normal location.

See also *dextrocardia*.

small interfering RNA (siRNA) molecule

short interfering RNA

See *RNA interference*.

somatic

Pertaining to the body or describing cells that form the body other than *germ line cells* or undifferentiated *stem cells*.

somatic hypermutation (SHM)

Programmed process of *mutation* affecting the variable (*V*) regions of immunoglobulin (*Ig*) genes. SHM affects only individual immune cells, and the mutations are not transmitted to offspring.

Note 1: This process is part of the way the *immune system* adapts to new antigens.

Note 2: Mistargeted SMH is a likely mechanism in the development of B-cell lymphoma.

[3]

somatomammotropin, human chorionic

human placental lactogen (hPL)

Placental hormone that affects maternal metabolism and supports *fetal* growth by making more glucose and fatty acids available to the fetus.

somatomedin

Any of a group of peptide *growth factors* produced by the liver following stimulation by *somatotropin*.

Note: Somatomedin acts directly on *cartilage* cells to stimulate skeletal growth.

somatotropin

growth hormone

Hormone produced in the *pituitary gland* that stimulates the liver to produce *somatomedin*.

somite

One of bilaterally paired, segmented masses of *mesodermal* tissue lying along the *notochord* that gives rise to the *vertebrae* and associated muscle and *connective tissue*.

sonic hedgehog

Protein *morphogen* produced in the *notochord* that plays a critical role in early development, including *vertebrate organogenesis*, brain development and limb formation.

Note: Production in the *embryo* is dependent upon secretion of *fibroblast growth factors*.

See also *bone morphogenetic protein 4*.

spawn

1. (v) Release *gametes*. (Of mature adult fish, frogs, molluscs, crustacea, *etc.*).
2. (n) Fertilized *eggs* of mature adult fish, *etc.*

spawning

1. (n) Release of *gametes* (*eggs* or *sperm*) from mature adult fish, frogs, molluscs, crustacea, *etc.*
2. (adj) Describing behavior related to the readiness of mature adult fish, *etc.* to release gametes.

Spemann organizer

Group of cells in the amphibian *embryo* that is important in orientation of surrounding cells and facilitates development of the *central nervous system*.

Note: Cells on the *ventral* side of the *Xenopus blastula* secrete factors such as *bone morphogenic protein-4* (BMP-4) to signal the overlying *ectoderm* to become skin. The Spemann organizer blocks the action of BMP-4 by secreting *chordin* and *noggin*, allowing the *ectoderm* to develop into the brain and *spinal cord* by default.

sperm

See *spermatozoon*.

sperm banking

Storage of frozen donor *sperm* for use in *artificial insemination*.

spermatid

Haploid cell in the late stage of developing into a *spermatozoon*, derived from the *secondary spermatocyte*.

spermatocide

spermicide

Agent that kills *spermatozoa*.

spermatocyte

Parent cell of a *spermatid*, derived by *mitotic* division from a *spermatogonium*.

[7]

Note: The primary spermatocyte gives rise to a pair of *haploid* secondary spermatocytes by *meiosis*.

spermatogenesis

Entire process by which *spermatogonial stem cells* divide and differentiate into *spermatozoa*.

[7]

spermatogonial chromosome aberration test

Procedure in which rodents are exposed to a test substance and *chromosome* aberrations are then studied microscopically in *germ cells*.

spermatogonium

Primitive cell derived from *mitosis* of the *germ cell* that becomes the *diploid* primary *spermatocyte*.

spermatozoon

sperm cell

Mature male *gamete*.

spermiation

Release of mature *spermatozoa* from the *Sertoli cells*.

spermicide

See *spermatocide*.

spermiogenesis

Maturation of an immature *spermatid* into a *spermatozoon*.

sphenoid bone

sphenoid

Irregular wing-shaped bone at the anterior base of the skull, forming part of the *orbit*, serving as an attachment site for muscles of mastication, and containing *foramina* for nerves and vessels of the head and neck.

Note: The complex structure, function, and development of the sphenoid bone have been linked with developmental disorders such as sphenoid *dysplasia* and *cystic* degeneration of the sphenoid.

sphincter

Ringlike muscle that maintains closure of a body passage or orifice by contracting, and opens it by relaxing.

spina bifida

Failure of the *neural tube* to close, resulting in the absence of part of the *vertebral* arch at the midline of the *spinal column* and exposure of the *spinal cord* and its covering membranes.

spinal column

spine

vertebral column

Backbone.

spinal cord

Portion of the *central nervous system* outside the brain and inside the *vertebral* column.

spiral arteriole

spiral artery

spiral endometrial artery

corkscrew-like artery

coiled artery of the uterus

One of the corkscrew-like arterioles in *premenstrual* or *progestational endometrium*.

[5]

splanchnic

Relating to the *visceral* organs, especially those of the abdomen.

spongioblast

Embryonic epithelial cell that develops into a neuroglial cell.

stalk

In anatomy, narrow connection with an organ or other structure.

After [7]

stalk, allantoic

Narrow connecting tube between the intra- and extra-*embryonic* parts of the *allantois*.

After [7]

stem cell

Multipotent cell, with *mitotic* potential, that may serve as a precursor for many kinds of differentiated cells.

[1]

Note: *Embryonic* stem cells give rise to the embryonic *germ layers*, whereas adult stem cells are involved in tissue regeneration, repair processes and possibly in *carcinogenesis*.

See also *induced pluripotent stem cell*.

stenosis

Abnormal narrowing of a passage or opening in the body.

sterility (n)/sterile (adj)

1. Infertility
2. Asepsis.

sterilization

1. Process that makes an organism incapable of *fertilization* or reproduction, *e.g.*, *castration*, *vasectomy*, or *salpingectomy*.
2. Process that makes an object aseptic.

steroid (n)/steroidal (adj)

Naturally occurring compounds and synthetic analogues, based on the cyclopenta[*a*]phenanthrene carbon skeleton, partially or completely hydrogenated; there are usually methyl groups at C-10 and C-13, and often an alkyl group at C-17. By extension, one or more bond scissions, ring expansions, and/or ring contractions of the skeleton may have occurred.

After [16]

Note: Natural steroids are derived in biogenesis from triterpenoids; they play important roles as *hormones* (sex hormones), *membrane* components (cholesterol) and emulsifying agents (bile acids).

steroid 21-monooxygenase

Member (EC 1.14.14.16) of the *cytochrome P450* family of enzymes required for the synthesis of some *steroid hormones* including aldosterone and cortisol.

steroidogenesis assay

Procedure in which the effect of a test substance on *steroid* synthesis is studied, usually in a human adrenocortical carcinoma cell line.

Note: This assay is part of the OECD framework for the “Testing and Assessment of Endocrine Disrupting Chemicals”.

stillbirth

Birth of a baby without any signs of life, at a time variously taken as 20–28 weeks of *pregnancy*.

Note: The baby may have died during pregnancy (called *intrauterine* death), labor, or birth.

Compare *miscarriage*.

stress-response pathway

Signaling events induced when normal cell function or development is disrupted by environmental (physical or chemical) factors.

Note: Induction of stress pathways may lead to cellular repair and counteraction of stress effects, or to adverse effects.

stromal cell

Cell producing the *connective tissue* framework of an organ or other anatomical structure.

See also *parenchymal cell*.

subthalamus

Part of the *diencephalon*, of which the major part is the *subthalamic nucleus*, and which connects to the globus pallidus, part of the *telencephalon*.

sulcus

Any long, narrow groove, furrow or shallow depression, specifically referring to one of the fissures on the surface of the brain.

After [7]

superfecundation

Fertilization of two or more *ova* released in the same period of *ovulation*, either by different males or by the same male in separate acts of intercourse.

Note: If there are two or more different fathers, the state may be called heteropaternal superfecundation. Rare in humans, heteropaternal superfecundation is common in some species, such as cats and dogs.

superfetation

Presence of two *fetuses* in the *uterus* at different stages of development, resulting from *fertilization* of *ova* released in two successive periods of *ovulation*.

After [7]

supernumerary

Exceeding the usual number; thus, in anatomy, anomalies such as a sixth finger on one hand or a third nipple (in a human).

surfactant, pulmonary

Surface-active layer of phospholipids and proteins coating the *pulmonary alveoli* that increases lung compliance, facilitates lung expansion, and stabilizes alveolar volume.

Note: Lack of pulmonary surfactant is more common following *premature birth* and is a cause of infant respiratory distress *syndrome*.

synapsis

syndesis

Point-wise pairing of *homologous chromosomes* during the *prophase* of *meiosis*.

synaptonemal complex

Structure of filamentous proteins that forms between *homologous chromosomes* when they pair during *meiosis*; it may contribute to *synapsis* and genetic recombination.

syncephalus

monocephalus

Conjoined twins with two bodies and a fused head.

syncytiotrophoblast

Outer *syncytial* layer of *trophoblast* cells that invades the *endometrium* during *implantation*.

Note: The syncytiotrophoblast is the site of synthesis of *human chorionic gonadotropin* and is involved in *implantation*.

syncytium (n)/syncytial (adj)

Referring to a large multinucleated mass of cellular contents that arises from the fusion of originally individual cells.

syndactyly

Congenital occurrence of fusion or webbing of the fingers or toes.

syndrome

Group of signs and symptoms occurring together, having a common cause and defining a disease.

synophthalmia

cyclopia

monophthalmos

Congenital fusion of the *orbits* in the midline, which then contains one eyeball.

synotia

Congenital malformation characterized by the union or approximation of the ears in front of the neck, often accompanied by the absence or defective development of the lower jaw.

[13]

See also *agnathia*, *megagnathia*, *otocephaly*.

tail bud

In the *vertebrate embryo*, mass of proliferating cells at the *caudal* end that arises from the *primitive node*.

talipes

See *clubfoot*.

Tay-Sachs disease

infantile GM2 gangliosidosis

Autosomal recessive inheritance of *hexosaminidase A* deficiency leading to a *lysosomal storage disease* characterized by central and peripheral *neuronal* involvement and early death.

tegmentum

Floor of the midbrain.

Note 1: In the *embryo* this term refers more generally to the anterior portion of the *neural tube*.

Note 2: The tegmentum is the site of the nuclei of several cranial nerves.

telencephalon

Embryonic structure that develops into the *cerebrum*.

telophase

Final phase of both *meiosis* and *mitosis* in which distinct nuclei form in each daughter cell.

teratocarcinoma

Malignant teratoma, occurring most often in the *testis*.

teratogen (n)/teratogenic (adj)

Chemical, physical, or biological agent that, when administered to a parent either prior to conception or before *birth* of the child, induces permanent structural *malformations* or *birth defects* in the offspring.

Modified from [1]

Note 1: Teratogens may act at vulnerable points in the development of *gametes* in parents or of organ development in the *embryo* and *fetus*.

Note 2: Their modes of action include mimicry of *morphogens* (thus interference with morphogenesis), modulation of *genes* and *gene expression*, and direct alterations in protein function.

teratogenesis

Process of development of *malformations* or *birth defects*.

See also *teratogen*.

teratogenetics

Study of how *genes* and *teratogens* interact to cause *birth defects*.

teratogenic index (TI)

Mortality of *eggs* expressed as a lethal concentration divided by the threshold concentration for production of abnormal *embryos* with nonheritable permanent structural *malformations* or defects following exposure to a *teratogen*.

Note: The TI is thought to reflect the developmental hazard of a contaminant.

teratogenicity

Inherent ability to act as a *teratogen*.

teratology

Study of the causes, mechanisms, and manifestations of developmental deviation of either structure or function.

teratoma

dermoid cyst

Benign *germ cell*-derived *tumor* containing *embryonic* elements of the three primary *germ layers*, such as skin, hair, and muscle, occurring most frequently in the *ovary*.
See also *teratocarcinoma*.

Tessier classification

Classification of bony and soft tissue *facial clefts* based on their anatomic location.

Note: They are numbered from 0–14, with 0 and 14 being in the midline.

testicular feminization

Type of male *pseudohermaphroditism* in which the individual has a male *karyotype* and *testes* present within the *abdominal cavity*, but develops external female *genitalia* and female *secondary sexual characteristics*.

Note 1: Testicular feminization is due to an *androgen receptor mutation*, causing the target tissues to be insensitive to the *masculinizing* effects of *androgens*.

Note 2: Clinical presentation is usually as a *phenotypic* female with primary *amenorrhea*.

testis (n)/testicular (adj)

testicle

Gonad of a male animal, involved in the secretion of *androgens* and the site of *sperm* production.

testosterone

Androgenic steroid hormone produced primarily in the *testis*, responsible for the development of the male sexual organs and male *secondary sexual characteristics*.

Note: The *ovary* also secretes testosterone, but circulating levels in the female are much lower than in the male.

tetracycline

(4*S*,4*aS*,5*aS*,6*S*,12*aR*)-4-(dimethylamino)-3,6,10,12,12*a*-pentahydroxy-6-methyl-1,11-dioxo-1,4,4*a*,5,5*a*,6,11,12*a*-octahydro-tetracene-2-carboxamide

Broad-spectrum antibiotic of polycyclic polyketide structure.

Note: Tetracyclines are considered to be *teratogens* because they can deposit in, and cause discoloration of, the developing teeth, while also inhibiting the tooth development process.

tetralogy of Fallot

Set of four *congenital cardiac* defects involving an opening in the wall that should separate the right and left ventricles (*ventricular septal defect*), allowing the aorta to receive venous as well as arterial blood: including *stenosis* of the *pulmonary artery*, *hypertrophy* of the right ventricle, and displacement of the *aorta*. Right ventricular *hypertrophy* is the fourth part of the tetralogy, although it may also be a consequence of the other defects.

Note 1: The constellation of anatomical defects is understandable in terms of a flaw in the ordered sequence of events in the normal development of the heart and associated vessels.

Note 2: These anatomical defects are the most common cardiac cause of *cyanosis* in infants.

thalamus

Either of two masses of *grey matter*, the largest part of the *diencephalon*, lying between the *cerebral hemispheres* on either side of the third ventricle, relaying sensory information and acting as a centre for pain perception.

thalidomide

Teratogenic indole-based drug with sedative and anti-*angiogenic* properties.

Note 1: The introduction of thalidomide for alleviating nausea in *pregnancy* in some countries in 1957 was soon linked to severe *birth defects* in the infant, with *phocomelia* being highly characteristic.

Note 2: Currently, it is used successfully to treat and prevent the moderate to severe skin lesions caused by leprosy, and is used together with dexamethasone to treat multiple myeloma.

theca

Bilayer covering of the *ovarian follicle* (thus theca interna and externa), of which the theca interna is involved in production of *androstenedione*.

thoracic duct

Largest of the *lymphatic* vessels; it conducts *lymph* from its origin in the *abdomen* to the venous circulation at the junction of the left subclavian and jugular veins.

thrombocytopenia

Abnormally low concentration of platelets (thrombocytes) in the blood.

Note: Thrombocytopenia is an unwanted effect of some drugs and carries an increased risk of spontaneous bleeding.

thymus

Pyramid-shaped organ in the thoracic or cervical region of mammals, composed of *lymphatic tissue* in which minute concentric bodies (thymic corpuscles, the remnants of *epithelial* structures) are found.

Note 1: *Stem cells* in the outer cortex of thymus develop into different kinds of *T cells*. Some migrate to the inner *medulla* and enter the bloodstream; those that do not may be destroyed to prevent *autoimmune* reactions.

Note 2: This organ is necessary for the development of thymus-derived lymphocytes (T cells) and is the source of several hormones involved in T-cell maturation, for example, thymosin, thymopoietin, thymulin, and thymocyte humoral factor.

Note 3: If a newborn's thymus is removed, not enough T cells are produced, the spleen and *lymph* nodes have little tissue, and the immune system fails, causing a gradual, fatal wasting disease. Thymus removal in adults has little effect.

[3]

thyroglossal duct

Connection in the *embryo* between the site of initiation of development of the *thyroid gland* and its final location in the neck.

thyroid gland

Bilobar *endocrine gland*, located below the prominence of *cartilage* surrounding the *larynx* (the Adam's apple), that produces and secretes the *hormones* triiodothyronine (T3), thyroxine (T4), and calcitonin.

thyroid tissue, accessory

Ectopic thyroid tissue arising from remnants of the *thyroglossal duct*.

thyroid stimulating hormone (TSH)

Pituitary hormone that stimulates the *thyroid gland* to produce thyroxine (T4), and then triiodothyronine (T3).

tonsil

Small, rounded mass of tissue, especially of *lymphoid* tissue; generally used to designate one of the paired *palatine* tonsils.

[3]

toxicity

1. Capacity to cause injury to a living organism, defined with reference to the quantity of substance administered or absorbed, the way in which the substance is administered and distributed in time (single or repeated doses), the type and severity of injury, the time needed to produce the injury, the nature of the organism(s) affected, and other relevant conditions.
2. Adverse effects of a substance on a living organism, defined as in 1.
3. Measure of incompatibility of a substance with life that may be expressed as the reciprocal of the absolute value of median lethal dose (1/LD50) or concentration (1/LC50).

[1]

toxoplasmosis

Infection with the parasite *Toxoplasma gondii* that, when acquired by the *fetus*, can lead to a variety of *congenital* abnormalities that may include *hydrocephalus* or *microcephaly*, mental retardation, and problems with vision and hearing.

Note: Infection of the fetus is from the mother who may acquire it from contact with feces of the domestic cat or from undercooked meat.

trachea

Thin-walled, *cartilaginous* tube descending from the *larynx* to the bronchi and carrying air to the lungs.

transcription factor

DNA-binding protein that is involved in regulating *gene expression*.

transgenic

Describing an organism that is genetically changed by the addition or deletion of genetic material or whose existing *genes* are altered by *gene targeting*.

translocation, chromosomal

Rearrangement involving transfer or exchange of genetic material between non-*homologous chromosomes* that may occur during *gametogenesis* or in *somatic* cells, potentially leading to *birth defects*.

See also *reciprocal translocation*, *Robertsonian translocation*.

transplacental carcinogen

Substance that crosses the *placenta* and subsequently causes *cancer* in the child or young *adult*.

After [17]

transposition of the great arteries

transposition of the great vessels

Congenital cardiovascular malformation in which the position of the chief blood vessels of the heart (*aorta* and *pulmonary artery*) is reversed.

Note: Survival then depends on a crossflow of blood between the right and left sides of the heart, as through a *ventricular septal defect*.

After [5]

See also *conal growth hypothesis*.

Treacher Collins syndrome

Treacher Collins–Franceschetti syndrome

mandibulofacial dysostosis

Congenital deformity characterized by structural abnormalities of the head and face.

See also *craniofacial*.

Note: *Autosomal dominant mutations* have been identified in several *genes* involved in early development of bone and the tissues of the face, the most frequently implicated being TCOF1.

trilaminar embryo

trilaminar blastoderm

Disc-like *embryonic* stage in which differentiation into three layers (*endoderm*, *mesoderm*, and *ectoderm*) has occurred.

Note: In the human embryo this occurs in the third week, following the onset of *gastrulation*.

trimester

In *pregnancy*, one of three equal timed divisions of the normal human *gestation period*, each lasting approximately three months.

triple screen

triple test

Measurement of maternal serum levels of *alpha-fetoprotein*, *human chorionic gonadotropin*, and *estriol*, usually in the second *trimester* of *pregnancy*, that can serve as an indicator of risk for certain *fetal chromosomal abnormalities* and *neural tube defects*.

triploidy

Presence of three *haploid* sets of *chromosomes* in the cell.

Note: The condition is fatal in *fetal* or early *neonatal* life.

See also *diploid*, *euploid*, *ploidy*.

trisomy

Condition of having three *homologous chromosomes* in each *somatic* cell instead of the normal pair.

trisomy 8

Warkany syndrome 2

Presence of an extra *chromosome 8*.

Note: Complete *trisomy 8* is lethal, but most affected individuals show *mosaicism* with *craniofacial* abnormalities, a short wide neck, multiple joint defects, and deep creases in the palms and soles.

trisomy 13

Patau syndrome

trisomy D

Presence of part or all of an extra *chromosome 13* from nondisjunction during meiosis.

Note 1: This leads to multiple *congenital abnormalities* and mental retardation, and is usually fatal in early childhood.

Note 2: Patau syndrome can also occur with an extra partial chromosome 13 resulting from a *Robertsonian translocation*.

trisomy 18

Edwards syndrome

Presence of part or all of an extra *chromosome 18* from nondisjunction during meiosis.

Note: This leads to multiple *congenital abnormalities* and mental retardation, and is usually fatal in early childhood.

trisomy 21

Down syndrome

Presence of an extra *chromosome 21*.

Note 1: This produces a characteristic constellation of physical abnormalities with delayed growth and mental development, but is compatible with life into *adulthood*.

Note 2: The formerly used terms *mongoloid* and *mongolism* are now considered offensive.

trophectoderm

Outer layer of the *blastocyst* that contacts the *endometrium*, establishes nutrition for the *embryo*, and differentiates into the *trophoblast*.

trophoblast

Outer layer of the *blastocyst* that invades the *endometrium* and establishes nutrition for the *embryo*.

Note: Trophoblast cells do not form part of the *embryo*, but contribute to the development of the *placenta*.

truncus arteriosus

Arterial trunk, opening from the *fetal* heart and developing into the *aorta* and *pulmonary artery*.

tuberoinfundibular pathway

Group of dopaminergic neurons in the *hypothalamus* involved in regulating *prolactin* secretion from the anterior *pituitary gland*.

tumor

tumour

Any abnormal swelling or growth of tissue, whether *benign* or *malignant*.

Compare *neoplasm*.

tunica albuginea

Dense, *collagenous* fibrous coat surrounding an anatomical structure, and in particular surrounding the *ovaries*, *testicles*, and *corpora cavernosa* of the penis.

tunica vaginalis

Membranous sheath, derived from the *peritoneum*, surrounding the *testis* and *epididymis*.

Turner syndrome

Ullrich–Turner syndrome

Phenotypic female lacking one *X chromosome*, the *genotype* being designated XO.

Note: This results in a number of developmental abnormalities including short stature, *webbed* neck, sexual immaturity, and *sterility*.

two-generation reprotox study

Procedure in rodents wherein parents (P0 generation) and their offspring (*F1 generation*) are both exposed to a test substance and the second generation (F2) is examined for possible toxic effects.

See also *one-generation reprotox study*.

tympanic

In anatomy, relating to the resonant cavity and *membrane* of the inner ear.

ultrasonography

Imaging technique that creates a picture of internal body structures from differentially reflected *ultrasound* waves.

Note: By using this technique, the human *embryo* can be observed *in utero* as early as 5 1/2 weeks of *gestation*: *fetal* monitoring by this technique (obstetric ultrasound) is standard.

ultrasound

1. Sound waves of frequency higher than the range audible to the human ear.
2. Imaging technique that uses such sound waves to create a picture of internal body structures.

See also *ultrasonography*.

umbilical

omphalic

Relating to the *umbilicus*.

umbilical artery

Paired artery that, in the *fetus*, returns deoxygenated blood from each half of the *fetal* body to the *placenta*, via the *umbilical cord*.

Note: In the *adult*, part of the umbilical artery remains open as a branch of the internal *iliac artery*, and part ceases to be an artery and becomes the *medial umbilical ligament*.

umbilical cord

Cord-like structure connecting the *fetus* with the *placenta* and housing the *umbilical artery* and *umbilical vein* that carry nutrients from the mother and remove wastes from the fetus.

umbilical hernia

Protrusion of bowel or *omentum* through the abdominal wall at the *umbilicus*.

umbilical vein

left umbilical vein

Vessel within the *umbilical cord*, entering the *fetus* at the *umbilicus* and carrying oxygenated blood from the *placenta*.

umbilicus (n)/umbilical (adj)

navel

belly button

Feature marking the point in the abdominal wall where the *umbilical cord* entered the *fetus*.

undescended testis

cryptorchid testis

cryptorchidism

Testis that has failed to descend completely from its developmental origin in the lower *abdominal cavity* into the *scrotum*.

urethra

Duct by which urine is conveyed out of the body from the bladder, and which in male *vertebrates* also conveys *semen*.

urogenital

genitourinary

Concerning the urinary and *genital organs*.

urogenital sinus

Embryonic structure that forms in the *ventral* part of the *cloaca* when it separates from the *anal canal* to give rise to the *genitourinary* organs.

Note: A rare urogenital sinus anomaly occurs as a birth defect in the female when the *urethra* and *vagina* open into a common channel.

uterine crypt

Chamber on the interior surface of the *uterus* that serves as a site of *embryo* homing and *implantation*.

uterine cycle

Regular, periodic changes that occur in the *uterus* and, together with the *ovarian cycle* constitute the *menstrual cycle* necessary for female *fertility*.

Note 1: The uterine cycle consists of three phases: i) *menstruation*, ii) a proliferative phase in which the uterine wall thickens under the influence of *estrogen*, and iii) a secretory phase in which the *corpus luteum* is producing *progesterone* and the *endometrium* becomes receptive to *implantation* of the *blastocyst*.

Note 2: The three phases of the uterine cycle correspond to the three phases of the *ovarian cycle*.

uterotrophic

uterotropic

Having an effect on the *uterus*.

Note: This usually refers to *estrogen*-like effects of uterine cell proliferation caused by some drugs and other substances with weak *estrogen*-mimetic properties.

uterotrophic assay

Procedure in which immature female rodents are treated for three days with a test substance. A resultant increase in *uterine* wet weight suggests an *estrogenic* activity of the substance.

uterus (n)/uterine (adj)

womb

Hollow muscular organ of the female reproductive system that receives the *fertilized ovum* (see *implantation*) and supports the subsequent development of the *fetus*.

uvula

palatine uvula

Muscular projection from the posterior edge of the soft *palate*.

Note: The uvula contributes to the gag reflex and is involved in shaping some sounds of human speech.

vagina (n)/vaginal (adj)

Fibromuscular canal passing between the *uterine cervix* and the opening to the *vulva*.

Note: The vagina permits sexual intercourse and delivery of babies.

vaginal cornification

Conversion of the normal *epithelium* of the *vagina* to a *keratinized* squamous (flattened) *epithelium*.

Note: The appearance of keratinized (“cornified”) epithelial cells in a vaginal smear is an indication of increased *estrogen* levels.

vaginal patency

Referring to the opening of the *vagina* that usually occurs at *sexual maturity* and is maintained by hormonal influences pre-*menopausally*.

vaginal smear

Examination by light microscopy of a sample of a *vaginal* discharge, used in the diagnosis of a vaginal infection.

Note: Not to be confused with a *Papanicolaou smear*.

variation, developmental

Anatomical deviation that is not life-threatening.

vasculogenesis

De novo development of blood vessel *endothelium* in absence of preexisting vessels, *e.g.*, during *fetal* development or in connection with tissue repair, initiated by migration of *mesodermal* precursor cells.

Compare *angiogenesis*, *arteriogenesis*.

vas deferens

ductus deferens

spermatic duct

Secretory *duct* of the *testis* running between the *epididymis* and the *ejaculatory duct*.

vasectomy

Surgical removal of all or part of each *vas deferens*, typically as a means of *sterilization*.

vasopressin

Pituitary hormone that acts to promote the retention of water by the kidneys and to increase blood pressure.

velopharyngeal insufficiency

velopharyngeal incompetence

Inability to achieve closure of the velopharyngeal *sphincter* (closure of the muscle of the *soft palate*) during speech, owing to muscular dysfunction, *cleft palate*, or other disorders.

Note: This insufficiency often causes speech problems by allowing air to escape through the nose instead of the mouth.

vena cava

Large vein returning deoxygenated blood to the right heart.

Note: The vena cava has two branches in humans, the inferior vena cava (carrying blood from the lower body) and the superior vena cava (carrying blood from the head, arms, and upper body).

venous shunt

See *arteriovenous shunt*.

ventral

Situated to the anterior side of the trunk; in humans, to the front of the body.

Opposite term: *dorsal*.

ventral thalamus

See *subthalamus*.

ventricular septum

Dividing wall between the two lower chambers (*ventricles*) of the heart.

ventricular septal defect (VSD)

Congenital defect with an opening in the wall separating the right and left *ventricles* of the heart (see *ventricular septum*).

Note: This cardiac anomaly allows reflux of blood back to the right ventricle during left ventricular contraction, producing varying degrees of cyanosis.

vertebra (n)/vertebral (adj)

One of the bony segments that together make up the bony column surrounding the *spinal cord*.

vertebral arch

See *neural arch*.

vvertebrate

Denoting an animal that has as part of its nervous system a *spinal cord* that is surrounded by a bony *vertebral* column.

vesicle (n)/vesicular (adj)

Small fluid-filled sac, bladder-like structure, or blister.

Note: This term may refer to an anatomic structure, a subcellular organelle, or a liposome-related particle.

vestigial

In anatomy, pertaining to a remnant of an *embryonic* or *fetal* structure persisting in the *adult*.

viability

Ability to continue living.

Note: Fetal viability refers to the ability of the *fetus* to survive outside the *uterus*.

villus

1. Projection from the surface, typically of a *mucous membrane*.
2. Elongated projection of the dermis into an epidermal space.

After [7]

vimentin

Intermediate filament protein that is expressed in *mesenchymal* cells, *e.g.*, fibroblasts, leukocytes, and blood vessel *endothelial* cells.

Note: Vimentin filaments support cell *membranes*, keep some organelles in a fixed place within the cytoplasm, and transmit *membrane receptor* signals to the nucleus.

virilization

Possession or acquisition of characteristics of a male body, especially by a female or *prepubescent* male.

After [7]

viscera (n)/visceral (adj)

Soft and hollow organs of the body, in *vertebrates* particularly those found in the thoracic and *abdominal cavities*.

Note: This gives rise to the distinction of the visceral and *parietal serous membranes*, located closest to the organ or to the body wall, respectively. For examples, see *pericardium*, *peritoneal cavity* and *pleura*.

vitellogenin (VTG)

Protein that forms part of the yolk of egg-laying *vertebrates*.

Note: Its expression in male fish is used in ecotoxicology as an indicator of exposure to environmental *estrogenic endocrine disruptors*.

vulva

External genitalia of the female.

wean

Accustomize a young mammal to independence from its mother's milk as a source of nutrition.

web (in anatomy)

webbing

Tissue or *membrane* present between adjacent structures where it is not usually found, *e.g.*, between fingers or toes, or between the neck and shoulder, representing a *congenital abnormality*.

Wharton's jelly

Gelatinous substance that embeds the vessels of the *umbilical cord*.

Note: The jelly consists mainly of hydrated glycosaminoglycans such as hyaluronic acid and chondroitin sulfate.

white matter

substantia alba

Portion of the brain and *spinal cord* consisting mainly of myelinated axons (see *myelination*) and glial cells.

Note: Neurons of the white matter transmit signals between areas of *grey matter* within the cerebrum, to lower brain centers, and up and down the superficial aspect of the spinal cord.

whole embryo culture

Technique, used prior to *embryo* transfer during *in vitro fertilization*, in which *embryos* undergoing *organogenesis* are maintained in formulated medium outside the body.

Note: Whole embryo culture is a useful procedure for testing the *teratogenic* effects of a substance on organogenesis in rodent or chick embryos.

wild type

Of an *allele* or *phenotype*, the naturally occurring, unaltered, or most frequent; if several alleles occur, the most frequent one is considered to be the wild type.

Williams syndrome

elfin facies syndrome

Congenital disorder with characteristic *facies* (described as elf-like), short stature, outgoing personality and mild mental retardation; associated with contiguous *gene deletions* on *chromosome 7*.

Wnt

Family of *genes* important in development, the proteins they encode, or the *signal transduction* pathways they determine.

Note 1: Wnt pathways are involved throughout *embryonic* development, regulating such processes as cytoskeletal dynamics, cell polarity, proliferation, migration, and body axis patterning.

Note 2: The proteins signal by binding to cell-surface G-protein coupled receptors of the Frizzled family that signal to members of the Dishevelled (Dsh) family of cytoplasmic phosphoproteins.

Note 3: Wnt is derived from Wingless-related integration site, originally identified in *Drosophila*.

Wolffian duct

See *mesonephric duct*.

womb

See *uterus*.

X chromosome

Chromosome determining female sex in the absence of a *Y chromosome*.
See also *sex chromosome*.

X-linked

Carried by a *gene* located on the *X chromosome*.

xenobiotic

Compound with a chemical structure foreign to a given organism.
Note: Frequently restricted to man-made compounds.

Y chromosome

Chromosome determining male sex.
See also *sex chromosome*.

yolk

vitellus

Nutritive material stored in the *ovum* for the nourishment of the *embryo*.

yolk sac

Fluid-filled, *membrane*-bound pouch on the *ventral* side of the early *embryo* that provides nourishment until the circulatory system develops.

yolk stalk

Narrow *tubular* support that connects the *yolk sac* to the middle of the digestive tract of an *embryo*.

zinc finger

Small tertiary protein structure in which parts of the protein, typically with cysteine and histidine residues, link to a divalent zinc ion, forming a loop or “finger” that attaches proteins to DNA.

Note: A zinc finger is present in many proteins, such as nucleases or *transcription factors* that regulate expression of eukaryotic *genes*.

zona pellucida

Acellular glycoprotein-rich *membrane* surrounding the mature *ovum*.

zygosis

Sexual union of two cells with fusion of their nuclei.

zygote (n)/zygotic (adj)

1. Cell such as a fertilized *egg* (*ovum* after *fertilization*) resulting from the fusion of two *gametes*.
2. Cell obtained as a result of complete or partial fusion of cells produced by *meiosis*.

[1]

zygote intrafallopian transfer (ZIFT)

tubal embryo transfer

Introduction of a *zygote* fertilized *in vitro* into one of the *Fallopian tubes*.

See also *in vitro fertilization*.

Compare *gamete intrafallopian transfer*.

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Annex I – Abbreviations

ACE – angiotensin converting enzyme
ACTH – adrenocorticotrophic hormone
Ad4BP – adrenal 4 binding protein
AFP – alpha-fetoprotein
AGD – anogenital distance
AGM region – aorta-gonad-mesonephros region
AHR – aryl hydrocarbon receptor
AIF – apoptosis-inducing factor
AMH – anti-Müllerian hormone
AR – androgen receptor
ARND – alcohol-related neurodevelopmental disabilities
ARNT – aryl hydrocarbon receptor nucleotide translocator protein
ASD – atrial-septal defect
AV – arteriovenous
BMP – bone morphogenetic protein
CNS – central nervous system
CSF – cerebrospinal fluid
CTEV – congenital talipes equinovarus
DES – diethylstilbestrol
DGS – Di George syndrome
DME – drug metabolizing enzyme
ECM – extracellular matrix
ELS test – early life stage test
EMT – epithelial-to-mesenchymal transition
ES cell – embryonic stem cell
EST – expressed sequence tag
FACB – Fertility Assessment by Continuous Breeding
FAS – fetal alcohol syndrome
FASD – fetal alcohol spectrum disorder
FET – fish embryo test
FETAX – frog embryo teratogenesis assay *Xenopus*
FND – frontonasal dysplasia
FSH – follicle-stimulating hormone
FSH-RH – follicle-stimulating hormone releasing hormone
FGF – fibroblast growth factor

GH – growth hormone
GHRF – growth hormone releasing factor
GIFT – gamete intrafallopian transfer
GnRH – gonadotropin-releasing hormone
GRH – gonadotropin-releasing hormone
HCG – human chorionic gonadotropin
hGH – human growth hormone
hPL – human placental lactogen
HGP – Human Genome Project
ICSI – intracytoplasmic sperm injection
IF – intermediate filament
IUGR – intrauterine growth restriction (retardation)
IVF – *in vitro* fertilization
iPS – induced pluripotent stem cell
LC50 – median lethal concentration
LD50 – median lethal dose
LH – luteinizing hormone
LHRH – luteinizing hormone-releasing hormone
LOD score – logarithm (base 10) of odds score
MET – mesenchymal-to-epithelial transition
MIF – Müllerian inhibiting factor
MIH – Müllerian-inhibiting hormone
MIS – Müllerian-inhibiting substance
mRNA – messenger RNA
miRNA – microRNA
MSAFP – maternal serum alpha-fetoprotein
NOG – noggin
ORF – open reading frame
PKU – phenylketonuria
RACB – Reproductive Assessment by Continuous Breeding
RAR – retinoic acid receptor
RFLP – restriction fragment length polymorphism
Rh factor – rhesus factor
RNAi – RNA interference
RXR – retinoid X receptor
SCE – sister chromatid exchange
SDN – sexually dimorphic nucleus
SHM – somatic hypermutation
shRNA – short hairpin RNA
siRNA – small interfering RNA
SNP – single-nucleotide polymorphism
SRY protein – sex-determining region Y protein
STH – somatotrophic hormone
STR – short tandem repeat
T3 – triiodothyronine
T4 – thyroxin
TBTO – tributyltin oxide
TC – median teratogenic concentration
TDF – testis-determining factor

TEL-ARNT – translocated ETS leukemia-ARNT fusion protein (where ARNT is defined above and ETS refers to the E twenty-six transformation-specific family of transcription factors)

TGF- β – transforming growth factor β

TI – teratogenic index

VNTR – variable number tandem repeat

VSD – ventricular septal defect

VTG – vitellogenin

ZIFT – zygote intrafallopian transfer

Annex II – List of some chemicals with important adverse effects on the reproductive system, embryo, and fetus.

Substance	Occurrence, use	Reprotoxic and fetotoxic effects
<i>N</i> -Acetoxy-2-acetylaminofluorene (2-AAF)	DNA-adduct forming agent	Teratogenic in various laboratory studies.
Acrylamide	Industrial monomer and cooking byproduct	Affects male and female fertility in experimental animals. Fetotoxic but not teratogenic in experimental animals.
Alcohol (see Ethanol)		
Aldrin	Organochlorine pesticide (widely banned)	Fetotoxic and teratogenic in experimental animals. Affects fertility in multiple experimental animal species.
{1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-dimethanonaphthalene}		
Aminoglycosides	Antibiotic drugs	Deafness
Aminopterin (4-aminopteroic acid)	Folic acid analog and antagonist	Abortion, CNS- and craniofacial defects, growth retardation, and immunosuppressive effects.
{2-[[4-{{(2,4-diaminopteridin-6-yl)methyl} amino}benzoyl]amino}pentanedioic acid}		
Angiotensin converting enzyme (ACE) inhibitors	Hypotensive drugs	Various fetal organ failures associated with hypotensive effect.
Aniline	Solvent and intermediate	May induce methemoglobinemia in the fetus.
Anti-androgens	Drugs, endocrine disrupters	Disruption of sexual differentiation in various species.
Anticonvulsants	Antiepileptic drugs	Agents belonging to different chemical groups, associated with risks of mental retardation and other growth abnormalities.
Anti-HIV drugs	Therapeutic drugs	Interaction with cell cycle; effects ill-defined.
Antineoplastics	Anticancer and antitumor drugs	Agents interfering with DNA and the cell cycle, possibly producing various reprotoxic effects.
Arsenic (inorganic ions)	Semimetallic chemical species contaminating water	Spontaneous abortion, stillbirth.
Busulfan	Alkylating chemotherapeutic drug	Teratogenic, embryotoxic and fetotoxic.
{butane-1,4-diyl dimethanesulfonate}		
Cadmium (elemental and compounds)	Industrially in dust and fumes, contaminating food and water	Placental necrosis, zinc antagonist, calcium mimic.
Caffeine	Consumer products	Non-human teratogen only.
{1,3,7-trimethylpurine-2,6-dione}		

Substance	Occurrence, use	Reprotoxic and fetotoxic effects
Carbamazepine {5 <i>H</i> -dibenzo[<i>b,f</i>]azepine-5-carboxamide}	Antiepileptic drug	Associated with developmental disorders and risk of spina bifida.
Carbimazole {1-ethoxycarbonyl-3-methyl-2-thio-4-imidazoline}	Thyroxin antagonistic drug	Associated with risk of fetal hypothyroidism.
Carbon dioxide	Gas from fermentations and burning fossil fuels	Malformations in the offspring of experimental animals. Male reproductive effects in experimental animals.
Carbon disulfide	Industrial organic solvent	Spontaneous abortion, premature birth.
Carbon monoxide	Gas from incomplete combustion of fossil fuels	Possible neuropathological effects in offspring.
Carbon tetrachloride	Organic solvent	Embryotoxic and fetotoxic.
Chlorambucil {4-[4-(bis(2-chlorethyl)amino)phenyl]butanoic acid}	Alkylating chemotherapeutic drug	Various types of malformation and birth defects.
Chloroform	Organic solvent	Placental necrosis in experimental animals.
α -Chlorohydrin {3-chloropropane-1,2-diol}	Industrial intermediate, food contaminant	Adverse effects on male sperm production, potential chemosterilizant. May be genotoxic.
Choline acetyltransferase inhibitor	Pesticide	Deterioration of male reproductive organs.
Chromium [chromous(II)chloride, chromic(III)chloride, chromic(VI)trioxide]	Inorganic compounds, industrial exposures and environmental pollutants	Birth defects and fertility problems in experimental animals.
Cocaine {methyl(1 <i>R</i> ,2 <i>R</i> ,3 <i>S</i> ,5 <i>S</i>)-3-(benzoyloxy)-8-methyl-8-azabicyclo[3.2.1]octane-2-carboxylate}	Drug of abuse	Cerebral infarcts, mental retardation, withdrawal symptoms after birth.
Colchicine { <i>N</i> -[(7 <i>S</i>)-1,2,3,10-tetramethoxy-9-oxo-5,6,7,9-tetrahydrobenzo[<i>a</i>]heptalen-7-yl]acetamide}	Anti-gout drug	Teratogenic in mice. Modulation of fertility.
Corticoids	Hormones and therapeutic drugs	Support for maturation of lungs in fetus.
Coumarin derivatives (see Warfarin)		
Cyclophosphamide {(RS)-2-[bis(2-chloroethyl)amino]tetrahydro-2 <i>H</i> -1,3,2-oxazaphosphorine 2-oxide}	Alkylating anticancer drug	Malformations and birth defects, experimental teratogen.
Deoxycoformycin (Pentostatin) {(8 <i>R</i>)-3-(2-deoxy-D-erythro-pentofuranosyl)-3,4,7,8-tetrahydroimidazo[4,5- <i>d</i>][1,3]diazepin-8-ol}	adenosine deaminase-inhibiting drug	Reproductive and teratogenic effects.
Diazepam (Valium) {7-chloro-1-methyl-5-phenyl-3 <i>H</i> -1,4-benzodiazepin-2-one}	Sedative drug	Cleft lip and (or) cleft palate.
Dibromochloropropane {1,2-dibromo-3-chloropropane}	Soil fumigant	Testicular toxicant.
Dichlorodiphenyltrichloroethane (DDT) {1,1'-(2,2,2-trichloro-1,1-ethanediyl)bis(4-chlorobenzene)}	Insecticide (widely banned)	Thinning of eggshells of predator birds along with altered behavior, leading to reproductive failure. Found in human milk.
Dichlorvos {2,2-dichlorovinyl dimethyl phosphate}	Organophosphorus insecticide	Teratogenic in swine.

Substance	Occurrence, use	Reprotoxic and fetotoxic effects
Dieldrin {(1 <i>R</i> ,2 <i>S</i> ,3 <i>S</i> ,6 <i>R</i> ,7 <i>R</i> ,8 <i>S</i> ,9 <i>S</i> ,11 <i>R</i>)- 3,4,5,6,13,13-hyexachloro-10-oxapentac yclo[6.3.1.1 ^{3,6} .0 ^{2,7} .0 ^{9,11}]tridec-4-ene}	Organochlorine insecticide	Reproductive and developmental effects in experimental animals.
Diethylstilbestrol (DES) {4,4'-[(3 <i>E</i>)-hex-3-ene-3,4-diyl]diphenol}	Synthetic estrogen	Clear cell adenocarcinoma of the vagina associated with treatment of the patient's mother during first trimester.
Dinitrotoluene	Organic chemical	Methemoglobinemia in the fetus, male reproductive effects
Dinoseb {(RS)-2- <i>sec</i> -butyl-4,6-dinitrophenol}	Herbicide	Embryotoxic, may induce methemoglobinemia in experimental animals.
Diphenylhydantoin (see phenytoin) Drugs of abuse	Addictive drugs	Multiple effects on sexual behaviour and reproduction.
Enalapril (see Angiotensin converting enzyme inhibitors)		
Endosulfan {1,9,10,11,12,12-hexachloro-4,6-dioxa- 5-thiatriacyclo[7.2.1.0 ^{2,8}]dodec-10-ene 5-oxide}	Organochlorine pesticide	Effects on the reproductive systems of experimental animals.
Epichlorohydrin {2-(chloromethyl)oxirane}	Industrial chemical	Male reproductive toxicity seen in experimental animals.
Ethanol	Drug of addiction	Fetal alcohol syndrome associated with birth defects and cognitive deficits by oral consumption.
Ethylene thiourea {1,3-ethylene-2-thiourea}	Industrial chemical	Teratogenic in rats.
di(2-Ethyhexyl)phthalate (see Phthalates)		
Ethylnitrosourea {1-ethyl-1-nitrosourea}	Alkylating mutagen	Fetotoxic, teratogenic effects.
Etretinate {ethyl 9-(4-methoxy-2,3,6-trimethyl- phenyl)-3,7-dimethyl-nona-2,4,6,8- tetraenoate}	Anti-psoriasis drug	Teratogenic (see also Vitamin A).
5-Fluorouracil	Chemotherapeutic drug, experimental teratogen	Embryotoxic, teratogenic.
Folic acid (see also Aminopterin)	Essential nutrient	Deficiency leads to various types of malformations, neural tube defects. Possible effects on sperm.
Halothane {2-bromo-2-chloro-1,1,1-trifluoroethane}	Inhalation anaesthetic	Developmental delay and behavioral abnormalities in offspring.
Hydralazine {(1 <i>E</i>)-1-hydrazono-1,2- dihydrophthalazine}	Antihypertensive drug	Teratogenic in mice.
Indomethacin {2-[1-[(4-chlorophenyl)carbonyl]-5- methoxy-2-methyl-1 <i>H</i> -indol-3-yl]acetic acid}	Nonsteroidal anti- inflammatory drug (NSAID)	Risk of premature closure of ductus arteriosus, malformations and neonatal complications.
Iodide	Essential nutrient	Deficiency leads to goiter and cretinism.
Isotretinoin (13- <i>cis</i> -retinoic acid)	Drug used in treating acne	Craniofacial, ear and cardiovascular malformations, intellectual deficits.
Kepone (chlordecone) {decachloropentacyclo[5.3.0.0 ^{2,6} .0 ^{3,9} .0 ^{4,8}] decan-5-one}	Organochlorine insecticide (widely banned)	Depressed sperm count and motility, found in milk.

Substance	Occurrence, use	Reprotoxic and fetotoxic effects
Lead (ions and organic lead)	Industrial and environmental contaminants of air, water and food	Abortion, growth retardation, and neurobehavioral deficits.
Lithium salts	Antidepressant drugs	Associated with risk of malformations notably of the heart (Epstein anomaly)
Malathion {diethyl 2-[(dimethoxyphosphorothioyl) sulfanyl]succinate}	Organophosphate pesticide	Effects on development and reproduction in several species of experimental animals
Mercury (elemental, inorganic mercury compounds, and organomercury)	Element used in gold refining, industrial and environmental pollutants	Teratogenic, embryotoxic and a disruptor of brain development, especially in the form of methylmercury.
Methimazole {1-methyl-3 <i>H</i> -imidazole-2-thione}	Antithyroid drugs	Prematurity, intrauterine growth retardation, craniostenosis, cardiac failure, fetal hydrops, and intrauterine death.
Methotrexate {4-amino- <i>N</i> 10-methylfolic acid}	Antineoplastic drug, abortifacient	Teratogen, also adversely affects male and female fertility.
Methoxychlor {1,1'-(2,2,2-trichloro-1,1-ethanediyl) bis(4-methoxybenzene)}	Organochlorine insecticide	Male and female reproductive toxicity and developmental toxicity demonstrated in experimental animals.
Methoxyethanol	Organic solvent	Low sperm count (oligospermia), teratogenic.
Methylene blue {3,7-bis(dimethylamino)-phenothiazin-5-ium chloride}	Dye, various applications	Teratogenic.
Methylene chloride	Organic solvent	Spontaneous abortion, low birth weight.
Methylformamide	Chemical intermediate	Teratogenic in several animal species.
Methylmercury	see mercury	
Methylpyrrolidone { <i>N</i> -methyl-2-pyrrolidone}	Solvent	Fetotoxic and teratogenic in mice and rats at high doses.
Misoprostol {methyl (11 α ,13 <i>E</i>)-11,16-dihydroxy-16-methyl-9-oxoprost-13-en-1-oate}	Synthetic prostaglandin	Abortifacient, limb and neural tube defects.
Narcotics	Sedative and anaesthetic drugs	Substance-dependent effects on fetal brain. Potential withdrawal symptoms in the neonate.
Nickel compounds	Industrial and environmental pollutants from extraction and refining of nickel	Species-dependent embryotoxicity and teratogenicity.
Oral contraceptives	Contraceptive drugs	Decreased fertility in female. <i>Note:</i> Possible association with developmental deficits of fetus is a matter of debate.
Parathion { <i>O,O</i> -diethyl <i>O</i> -(4-nitrophenyl) phosphorothioate}	Organophosphate insecticide	May reduce fertility in experimental animals. Embryotoxic and fetotoxic.
Penicillamine {(2 <i>S</i>)-2-amino-3-methyl-3-sulfanylbutanoic acid}	Metal-chelating and antirheumatic drug	Connective tissue defects.
Phenol	Industrial chemical	Embryotoxic and fetotoxic in experimental animals.
Phenylalanine in maternal hyperphenylalaninemia (PKU)	Phenylalanine substitution in PKU-patients	Possible mental retardation if maternal phenylalanine substitution is too high.

Substance	Occurrence, use	Reprotoxic and fetotoxic effects
Phenytoin (diphenylhydantoin) {5,5-diphenylimidazolidine-2,4-dione}	Anticonvulsant drug	Craniofacial, limb, and cerebrovascular defects, growth and mental retardation, fetal loss.
Phorbol {1,1a,1b,4,4a,7a,7b,8,9,9a-decahydro-4a,7b,9,9a-tetrahydroxy-3-(hydroxymethyl)-1,1,6,8-tetramethyl-5H-cyclopropa[3,4]benz[1,2-e]azulen-5-one}	Cellular research agent, kinase activator	Various teratogenic effects.
Phthalates	Plasticiser	Teratogenic, fetotoxic, testicular toxicant in several animal species.
Polychlorinated biphenyls (PCB)	Environmental pollutants (widely banned)	Growth retardation, hyperpigmentation and neurobehavioral deficit.
Polycyclic aromatic hydrocarbons (PAH)	Incomplete combustion	Associated with reproductive disturbances, birth defects and cancer in laboratory animals.
Progesterone	Female hormone	Possible masculinization of female fetus.
Psychoactive drugs	Therapeutic and addictive drugs	Various substance-dependent effects on fetal neurological function. Possible withdrawal phenomena in the newborn.
Retinoids	Natural and synthetic (therapeutic) derivatives of Vitamin A	Substance-dependent teratogenic effects.
13- <i>cis</i> -Retinoic acid (see Isotretinoin)		
Sucrose	Nutrient	Potentially diabetogenic in predisposed women, increasing risk of birth defects and prenatal imprinting.
Suramin {8,8'-{carbonylbis[imino-3,1-phenylenecarbonylimino(4-methyl-3,1-phenylene)carbonylimino]}di(1,3,5-naphthalenetrisulfonic acid)}	Anti-protozoal drug	Reduced placental blood flow, fetal growth retardation.
Tetracycline {(4S,4aS,5aS,6S,12aS)-4-(dimethylamino)-3,6,10,12,12a-pentahydroxy-6-methyl-1,11-dioxo-1,4,4a,5,5a,6,11,12a-octahydro-2-tetracenecarboxamide}	Antibiotic drug	Discoloured (yellow, brownish or grey), defective teeth. May affect bone growth.
Thalidomide {(RS)-2-(2,6-dioxopiperidin-3-yl)-1H-isoindole-1,3(2H)-dione}	Treatment of certain cancers (multiple myeloma) and of leprosy	Teratogenic, particularly reduction defects of the limbs (phocomelia) and ears when mothers are treated on days 21–26 of pregnancy.
Tobacco smoke	Nicotine, addictive agent	Intrauterine growth retardation, low birth weight, prematurity.
Toluene	Industrial chemical	Toluene sniffing results in "Toluene embryopathy" with mainly neurological anomalies in the fetus.
Toxaphene (chlorinated camphene) {1,2,2,3,3,4,7,7-octachloro-5,5-dimethyl-6-methylenebicyclo[2.2.1]heptane}	Organochlorine insecticide	Multiple reproductive and developmental effects in laboratory animals.
Trifluoperazine {10-[3-(4-methylpiperazin-1-yl)propyl]-2-(trifluoromethyl)-10H-phenothiazine}	Antipsychotic drug	Teratogenic.
Trimethadione {3,5,5-trimethyl-1,3-oxazolidine-2,4-dione}	Anticonvulsant drug	Craniofacial and cardiovascular defects, mental retardation.

Substance	Occurrence, use	Reprotoxic and fetotoxic effects
Trypan blue	Dye	Experimental teratogen when injected in frogs.
Valproic acid {2-propylpentanoic acid}	Anticonvulsant drug	Neural tube closure defects, mental retardation.
Vinclozolin {(RS)-3-(3,5-dichlorophenyl)-5-methyl-5-vinylloxazolidine-2,4-dione}	Fungicide, endocrine disruptor	Multigenerational epigenetic effects on the male reproductive system.
Vismodegib {2-chloro-N-(4-chloro-3-pyridin-2-ylphenyl)-4-methylsulfonylbenzamide}	Basal cell carcinoma therapy	Teratogenic, enters the semen.
Vitamin A	Essential human nutrient, including retinol, retinoic acid and β -carotene	Excessive supplementation with liver-derived retinoids (not carotenes) is teratogenic.
Vitamin E	Essential human nutrient	Deficiency associated with infertility.
Warfarin, coumadin {(RS)-4-hydroxy-3-(3-oxo-1-phenylbutyl)-2H-chromen-2-one}	Anti-clotting drug, rodenticide	Craniofacial defects, intrauterine growth retardation, central nervous system malformation, and stillbirth.
Zinc ions	Metallic elemental species in food and water, essential human nutrient	Deficiency may cause birth defects.

IUPAC names of substances are included in {brackets}.

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