IUPAC Recommendations

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IUPAC Glossary of terms used in neurotoxicology (IUPAC Recommendations 2015)

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Abstract: The primary objective of this Glossary of Terms Used in Neurotoxicology is to give clear definitions for those who contribute to studies relevant to neurotoxicology, or must interpret them, but are not themselves neurotoxicologists, neuroscientists or physicians. This applies especially to chemists who need to understand the literature of neurotoxic effects of substances without recourse to a multiplicity of other glossaries or dictionaries. The Glossary includes terms related to basic and clinical neurology insofar as they are necessary for a self-contained document, and particularly terms related to diagnosing, measuring, and understanding effects of substances on the central and peripheral nervous systems. The glossary consists of about 800 terms as primary alphabetical entries, and includes Annexes of common abbreviations, and examples of chemicals with known effects on the nervous system. The authors hope that among the groups who will find this glossary helpful, in addition to chemists, are toxicologists, pharmacologists, medical practitioners, risk assessors, and regulatory authorities. In particular, it should facilitate the worldwide use of chemistry in relation to occupational and environmental risk assessment.

Keywords: glossary; IUPAC chemistry and human health division; neurotoxicology; recommendations; terminology.

CONTENTS

PREFACE ........................................................................................................................................... 842
ACKNOWLEDGMENTS ................................................................. 842
ALPHABETICAL ENTRIES .......................................................... 843
MEMBERSHIP OF SPONSORING BODIES ...................................... 917
ANNEX I – ABBREVIATIONS ...................................................... 918
ANNEX II – REPRESENTATIVE LIST OF NEUROACTIVE SUBSTANCES ........................................... 920
REFERENCES FOR ALPHABETICAL ENTRIES ............................... 926

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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 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; in 2009 the Division expanded the collection of available definitions with publication of a Glossary of Terms Used in Ecotoxicology [2], and again in 2012 with a Glossary of Terms Used in Immunotoxicology [3].

In the years since publication of the 2nd edition of the general glossary, we have recognized that a number of the terms continue to evolve and definitions need periodic refinement. It is also apparent that now a searchable, electronic database updating and combining entries from the previous glossaries is desirable, and achievable. A project to achieve this is underway, but at its inception we realized that some areas of toxicology had been under-represented, and addressing this deficit would enhance the usefulness of the database. One area felt to be under-represented was neurotoxicology, and 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 [1] were included when it was felt that they were used with particular frequency in neurotoxicology. The authors have also exercised judgment in deciding which terms from basic neuroscience should be included for the reader’s convenience. Given the highly medical nature of the subject, it has been necessary to include a number of medical terms, both clinical and anatomic. 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, yet including terms that may be encountered with reasonable frequency in the literature of neurotoxicology of substances. 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.

In general, commonly preferred or American spelling has been adopted for the main entry terms; thus, for example, anesthetic (not anaesthetic), adrenalin (not adrenaline), neuron (not neurone), disc (not disk), and tumor (not tumour). Further, somewhat arbitrary decisions must be made in listing alternative forms of terms as the main entry (e.g., vasospasm instead of angiospasm, β-blocker instead of β-antagonist, and intervertebral disc rather than spinal disc). We have generally tried to use the form we find to be in most common usage, and cross-reference the least-used term if it seems also common, but if a desired entry is not found under one construction, it should be sought under the other.

Many 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,” the general concept of the original has been retained with some rewording, often for consistency with IUPAC guidelines for glossaries. “Modified from” implies a concept specific to the source is retained but put into original wording. When a citation is indented following a Note, it refers only to the Note.

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

Acknowledgments

Many reviewers contributed to the final content of this Glossary, some anonymously and some not, depending on the stage of the process. Among the latter, special thanks are due to Dr. Jean Harry, whose many suggestions...
and line-by-line commentary significantly shaped the final outcome. Very helpful guidance was also given by Prof. Aaron Bowman, Dr. William Boyes, Prof. Bernard Weiss and Dr. Steven Gilbert. A debt of gratitude is also owing to Prof. Philippe Grandjean, who suggested modifications to a later draft, and to Prof. Rita Cornelis for extensive editorial comment on the penultimate version.

Alphabetical entries

acclimation
acclimatization
Adjustment, physiologically and (or) behaviorally, of an organism to its environment or circumstances, e.g., thermoregulation, psychological adjustment.

Note: In biology, acclimation refers to allowing this adjustment prior to initiating experimental observations, whereas the term acclimatization refers to adaptation or selection of an organism or population in its natural environment.

acclimatization
See acclimation.

acetylcholine (ACh)
2-acetoxy-\(N,N,N\)-trimethylethanaminium
Substance that functions as a neurotransmitter between nerve cells and between nerves and muscles.

acetylcholinesterase (AChE)
acetylcholine hydrolase
Enzyme that hydrolyzes acetylcholine.

acetylcholine receptor
Integral membrane protein that allows the cell to respond to the binding of acetylcholine.

acoustic neuroma
acoustic neurinoma
vestibular Schwannoma
Non-malignant intracranial tumor of the eighth cranial nerve.

Note 1: This tumor arises from the Schwann cells.

Note 2: The eighth cranial (vestibulocochlear) nerve is involved in both hearing and balance.

acroparesthesia
Abnormal feeling of numbness, tingling, or burning of the skin, typically in the extremities.

action potential
Brief, spike-like depolarization associated with the passage of an impulse without decrement along the membrane of a muscle cell or nerve cell.

Note 1: It is used for rapid signaling over a distance.

Note 2: Action potentials also occur in many endocrine cells.

active avoidance test
Fear-motivated associative avoidance test based on presentation of an adverse stimulus (e.g., an electric current) as a source of discomfort, to create an environment from which the animal or subject would prefer to escape.
Note: In this test, a mouse or rat learns to associate the occurrence of an aversive event with the presentation of a specific stimulus, and to avoid the event by actively moving to a different location. The number of avoidances (moving to the other location during the stimulus signal), number of non-responses or errors (failing to move to the other location during the trial), and response latency (time between signal onset and response), are used as an index of learning.

Addiction
Compulsive, uncontrolled reward-seeking behavior, especially referring to substance use.

Note: An addiction may be psychological, referring to a craving or felt need for a behavior that produces a desired mental state without a known physiological basis, or it may be a physical (physiological) dependence in which discontinued use of a substance leads to symptoms of withdrawal.

See also habituation.

Adenoma
Benign tumor arising from epithelial cells in glandular tissue.

Adenosine receptor
Any of four types of purinergic receptors that respond to the nucleoside, adenosine, two of which are involved in release of the neurotransmitters, dopamine and glutamate.

Note: The stimulatory effects of caffeine are thought to be due to caffeine’s blockade of adenosine receptors.

Adrenalin
adrenaline
epinephrine
(R)-4-(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 noradrenalin.

Adrenergic
1. Relating to or denoting secretion of and (or) response to adrenalin, noradrenalin or related substances; in particular referring to sympathetic nerve fibers.
2. Relating to or denoting an agent that mimics the activity of adrenalin, noradrenalin or related substances.

Compare cholinergic.

See sympathomimetic.

β-adrenergic antagonist
See β-blocker.

β-adrenergic blocking agent
See β-blocker.

Adrenergic receptor
See α-adrenergic receptor, β-adrenergic receptor.

α-adrenergic receptor
Class of adrenergic receptor mainly functioning in vasoconstriction and modulation of glandular secretions.

β-adrenergic receptor
adrenergic receptor
adrenoceptor
β-receptor
Member of a class of G protein-coupled receptors that are targets of the catecholamines, especially adrenalin, noradrenalin, and related substances.

**β-adrenergic receptor antagonist**
See β-blocker

adrenoceptor
See β-adrenergic receptor.

**β-adrenoreceptor antagonist**
See β-blocker

afferent
Inflowing. Of nerves, those that conduct impulses toward the central nervous system.
Antonym efferent.

agnosia
Impaired ability to recognize or comprehend the meaning of various sensations, not attributable to faulty sensory input or general intellect.

After [5]
**Note:** Involvement of several senses are distinguished, such as auditory (acoustic), gustatory, olfactory, tactile, and visual agnosias.

agonist (in toxicology)
Substance that binds to cell receptors normally responding to a naturally occurring substance and produces an effect similar to that of 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.
[1]
Compare antagonist.

alpha-synuclein
Protein abundant in the human brain, thought to regulate the release of dopamine.

Alzheimer disease
Common and progressive neurodegenerative disease leading to loss of memory, orientation, and judgment.

γ-aminobutyric acid (GABA)
4-aminobutanoic acid
Major neurotransmitter at inhibitory synapses in the central nervous system of mammals.
**Note:** It is often referred to as an “inhibitory neurotransmitter.”

γ-aminobutyric acid (GABA) receptor
Transmembrane receptor protein that binds and responds to the inhibitory neurotransmitter γ-aminobutyric acid.

**Note 1:** GABA receptors are found in different parts of the central nervous system.

**Note 2:** There are two different receptor types with different signal transduction pathways:
GABA-A receptors are ion channels.
GABA-B receptors are \textit{G-protein-coupled} signal transducers.

\textbf{2-amino-3-(3-hydroxy-5-methyl-1,2-oxazol-4-yl)propanoic acid (AMPA) receptor}

Glutamate receptor in the \textit{central nervous system} activated by the synthetic glutamate analog, AMPA.
See also \textit{excitotoxicity}.

\textbf{amnesia}

Partial or total, transient or permanent loss of memory.

\textbf{amnesic shellfish poisoning (ASP)}

Human illness caused by consumption of the marine \textit{toxin domoic acid} that may lead to dizziness, confusion, motor weakness and seizures, with permanent cognitive impairment and short term memory loss.

\textit{Note 1:} Domoic acid is produced by marine diatoms belonging to the genus \textit{Pseudo-nitzschia} and the species \textit{Nitzschia navis-varingica}. Domoic acid is passed on to humans by consumption of bivalve shellfish (mollusks) such as mussels, oysters, and clams that have accumulated it during filter feeding.

\textit{Note 2:} Often characterized by \textit{excitotoxicity} and loss of \textit{hippocampal neurons}.

Modified from \cite{1}

\textbf{AMPA receptor}

See \textit{2-amino-3-(3-hydroxy-5-methyl-1,2-oxazol-4-yl)propanoic acid (AMPA) receptor}.

\textbf{amygdala}

Brain nucleus located in the median \textit{temporal lobe} that is part of the \textit{limbic system} and plays an important role in emotional responses.

\textbf{\textit{β}-amyloid}

\textit{amyloid}

Extracellular aggregate of \textit{misfolded} fibrous proteins, typically with cross-linked \textit{β}-sheet structure.

\textit{Note:} Amyloid occurs naturally with aging, but it is found in increased amounts in a number of tissue pathologies including \textit{Alzheimer disease}.

See also \textit{amyloid plaque}.

\textbf{amyloid plaque}

\textit{neuritic plaque}
\textit{senile plaque}

Structure representing extracellular deposition of \textit{β-amyloid} protein in the \textit{gray matter} of the \textit{brain} that occurs with aging and in increased amount in \textit{Alzheimer disease}.

\textbf{amyotrophic lateral sclerosis (ALS)}

Lou Gehrig's disease
\textit{motor neuron disease}

Debilitating degenerative disease of the \textit{motor neurons} characterized by progressive muscle weakness, muscle \textit{atrophy} and \textit{fasciculations}, muscle \textit{spasticity}, difficulty speaking (dysarthria), difficulty swallowing (dysphagia), and difficulty breathing (dyspnea).

\textbf{analgesic}

\textit{anodyne}
\textit{painkiller}

Substance that relieves \textit{pain} without causing loss of \textit{consciousness}. 
anaphrodisiac
Anything tending to reduce libido.

anesthetic
anaesthetic
Substance that reduces the experience of pain with or without loss of consciousness.

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

angiography
Radiography of blood or lymph vessels, following the introduction of a radio-opaque substance.

angiospasm
See vasospasm.

annulus (of intervertebral disc)
Tough outer ring of an intervertebral disc.

anodyne
See analgesic.

anorexia
Eating disorder characterized by self-imposed food restriction.
Compare anorexia nervosa.

anorexia nervosa
Eating disorder characterized by obsessive desire to lose weight by reducing food intake or by repeated vomiting.
Compare anorexia.

anosmi/a n., /c adj.
Loss of the sense of smell, either total or selective.

anoxia
Absence of inspired dioxygen in blood or tissues; to be distinguished from hypoxia.
After [5]

antagonist (in toxicology)
Antonym: agonist
Substance that binds to a cell receptor normally responding to a naturally occurring substance and prevents a response to the natural substance.
[1]

anticonvulsant
Substance used to prevent or reduce the severity of convulsions.

antidepressant
Substance used to alleviate depression.
antiemetic
Substance used to prevent nausea and vomiting (emesis).

antineuralgic
Substance used to alleviate the pain of neuralgia.

antinociception
Blockage of the perception of pain.
See also nociception.

antipsychotic
Psychoactive substance used to manage psychotic behavior or psychotic ideation.

antispasmodic
Substance used to prevent muscle spasms.

antrum
Cavity or chamber, often one with bony walls, and with specific meaning in some hollow organs (e.g., the pyloric end or gastric antrum of the stomach).

anxiolytic
Agent that reduces anxiety without causing excessive sedation (see sedative).
Note: Most, if not all, anxiolytics show at least some degree of sedation.
Compare sedative.

aphasia
Difficulty with, or loss of the use of language in reading, writing or speaking owing to specific lesions in the brain.
Compare aphony. See also dysphasia.

aphonia
Loss of the voice.

aphrodisiac
Anything that stimulates libido.

apneusis
apneustic respiration
Abnormal breathing pattern consisting of a pause at full inspiration.
Note: A prolonged inspiratory cramp is caused by a lesion in the brainstem.
After [5]

apneustic breathing
See apneusis

apraxia
Neurological condition characterized by loss of the ability to perform skilled or purposeful movement that a person is nevertheless physically able and willing to do.
**arachnoid mater**  
See arachnoid membrane.

**arachnoid membrane**  
arachnoid mater  
Middle layer of the meninges (see meninx), that is, the membranes that cover the brain and spinal cord.

**arachnoiditis**  
Inflammation of the arachnoid membrane, often characterized by perception of burning pain in the legs.

**arborization**  
Terminal branching of a neuron into a treelike structure of the dendrites.

**arrhythmia**  
Condition in which there is an irregular or abnormal heart beat.

**arteriography**  
See angiography.

**arteriolovenular anastomosis**  
Communication in which blood is shunted from arterioles to venules without passing through capillaries.  
See Note to arteriovenous anastomosis.

**arteriovenous (AV)**  
Relating to both arteries and veins.  
*Note:* Arteriovenous also refers to relations between arteries and veins, e.g., arteriovenous malformation, arteriovenous fistula, etc.

**arteriovenous anastomosis**  
Communication between an artery and a vein by collateral channels.  
*Note:* As the connection is generally between arterioles and venules, the term arteriolovenular anastomosis is preferred.  
After [5]

**arteriovenous fistula**  
Abnormal communication between an artery and a vein.

**arteriovenous malformation (AVM)**  
Web of blood vessels with one or more abnormal communications between arteries and veins that bypass the capillary system.  
*Note:* They may cause hemorrhage, seizures, headaches, paralysis or loss of speech, memory or vision.

**associative avoidance test**  
Avoidance test in which the test animal has learned to develop an association between the stimulus and the delivery of an aversive event.

**associative learning**  
Process in which a new behavior arises as a consequence of association with a particular stimulus, sometimes restricted to learning through classical conditioning.
astrocyte
*Glial cell* of ectodermal origin in the *central nervous system*, characterized by filamentous protoplasmic extensions.

astrocyte, reactive
*Astrocyte* that, after injury or excessive neural activity, undergoes morphological (including extension of pseudopodia) and biochemical (notably increased synthesis of *glial fibrillary acidic protein*) changes and participates in *astrocytic scar* formation.

astrocytic scar
glial scar
Clustering of *reactive astrocytes* separating a localized *brain* injury from surrounding uninjured tissue.

astrocytoma
*Tumor* within the substance of the *brain* or *spinal cord* made up of *astrocytes*.
*Note 1*: Astrocytomas are classified from Grade I (least aggressive) to Grade IV (most aggressive).
*Note 2*: This type of tumor does not usually spread outside the brain and spinal cord and it does not usually affect other organs.

astrogliosis
Localized site of *reactive astrocytes*, distinct from an *astrocytic scar*.
See *astrocyte, reactive*.

ataxia
Loss of muscular coordination (see *motor coordination*) resulting in abnormal clumsiness.

athetosis
Condition in which inappropriate muscle contraction causes involuntary writhing movements.

aton/y n., ic adj.
Lacking muscular tone.

atrophy
Pathological decrease in tissue, organ or body mass.
*Note*: This may be a consequence of decreased cell volume, cell number, or both.

attention deficit hyperactivity disorder (ADHD)
hyperkinetic disorder
Neuropsychiatric disorder of childhood characterized by decreased attention span, impulsiveness and hyperactivity.
*Note*: Both genetic and environmental factors (such as lead exposure) are implicated in increased risk.

aura
Constellation of symptoms experienced before a *migraine headache* or *seizure*.
*Note*: It may consist of flashing light, blurred vision, an odor, numbness, weakness, difficulty in speaking, or the feeling of a wind blowing.

autism
Neurodevelopmental disorder, present from early childhood, characterized by great difficulty in communicating and forming relationships with other people and in using abstract concepts.
Note: It is now considered part of a range of conditions (autism spectrum disorders) that includes Asperger syndrome, Rett syndrome, and childhood disintegrative disorder.

After [6]

**autonomic nervous system** (ANS)
Part of the *peripheral nervous system* controlling the bodily functions that are not consciously directed, e.g., breathing, heart rate, and digestive processes.

**avoidance test**
*Associative learning* pairing an adverse event with a non-specific stimulus such that the animal learns to respond in a manner to avoid the adverse event.

**axon** n., /ˈæxən/ adj.
Long thread-like process of a *neuron* along which impulses are conducted from the cell body to the nerve ending.
Compare *dendrite*.

**axonal degeneration**
Progressive loss of structure and function of an *axon*, typically in a peripheral-to-central direction.

**axonal transport**
*Axoplasmic transport* Movement of organelles and biomolecules to (retrograde) and from (anterograde) a *neuron*'s cell body, within the cytoplasm of its *axon* (the axoplasm).

**axonopathy**
Damage (*peripheral neuropathy*) to multiple nerves in roughly the same areas on both sides of the body, causing weakness, numbness, and *paresthesia.*

Note: This often occurs as a symmetrical polyneuropathy involving nerves in roughly the same areas on both sides of the body.

See also *polyneuropathy*.

**bar test**
Test for *catalepsy* in which a mouse is placed on a bar oriented parallel to and approximately 2.5 cm off the ground. Typically, if the mouse remains immobile on the bar for more than 20 seconds, it is considered to be cataleptic.

Note: The test can also be used for evaluating motor coordination.

See also *tetrad test*.

**Barnes maze**
Circular platform equipped with some 20 equidistant holes near the outer rim, one of which is marked by visual *cues* and is an escape hole for a rodent that is placed near the middle of the platform and subjected to an adverse stimulus, e.g., bright light.

Note 1: Measured parameters include latency to escape, path length, number of errors, and velocity.

Note 2: The test is used to evaluate cognitive deficits.

See also *maze*.

**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: They are involved in various functions including voluntary motor movements and involuntary movements such as tremors, bruxism, athetosis, and chorea.

Bayley scale
Bayley scales of infant development (BSID)
Range of scores on play tasks performed by infants age 0–3 years, intended to assess development of motor, cognitive, and language skills against norms for age-matched normal child development.

beading (in neurites)
neuritic beading
Focal bead-like swellings in dendrites and axons.
Note: These swellings can be an early neuropathological sign in neuronal injury, e.g., in epilepsy, trauma, ischemia, aging, and neurodegenerative diseases.

beam walking test
Assessment of the ability of an animal to remain upright and to walk on an elevated and relatively narrow beam.
Note: Unilateral brain injury tends to induce a hemiparesis-like effect which can cause the animal to slip to one side, usually that which is contralateral to the injury site.

Benton test
Benton visual memory test
Procedure in which patterns on cards are memorized by a test subject who then attempts to recognize them on other cards presented subsequently.
Note 1: The test measures short-term visual memory.
Note 2: Test conditions have repeatedly been modified, and variations such as asking the subject to redraw the pattern are in use.
See also neurobehavior core test battery.

Biel water maze
A water labyrinth, described by Biel (1940), where rodents are forced to swim until they find a small underwater platform that allows them to escape.
Note 1: Used to study possible neurotoxic effects on spatial learning, memory and others.
Note 2: The Cincinnati water maze is related to the Biel water maze.
See also maze.

bipolar disorder
manic-depressive disorder
Psychiatric illness characterized by mood shifts with periods of severe depressive illness and one or more episodes of exaggerated activity levels (manic behavior).

β-blocker
β-adrenergic antagonist
β-adrenergic blocking agent
β-adrenergic receptor antagonist
β-adrenoreceptor antagonist
β-antagonist
Any of a class of drugs that targets the β-adrenergic receptor, interferes with binding of adrenalin and other related substances to the receptor, and weakens their effects.
blood–brain barrier
Selectively permeable structure that restricts the exit of blood cells and many substances from the brain capillaries into the extracellular space of the brain.
*Note:* It consists of a layer of tightly packed cells (chiefly endothelial cells and astrocytes) and basement membrane, continuous along the brain capillaries.

blood–cerebrospinal fluid barrier
Functional restriction by cells of the choroid plexus of transit of substances from the cerebrospinal fluid into the extracellular space of the brain.

blood–retinal barrier
Functional restriction of transit of substances from the blood to the retina by non-fenestrated endothelial cells with tight junctions.

Boston naming test (BNT)
Procedure in which 60 pictures are shown to a subject who has to name them quickly.
*Note:* The BNT is a neuropsychological test and is used to study brain function and learning disabilities in children.

brachial plexus
Bundle of nerve fibers that begins in the spine at the base of the neck, travels through the axilla (armpit region), and into the arm.
*Note:* Damage to these motor and sensory nerves affects muscle function and sensation in the arm and chest.

bradycardia
Abnormally slow heart rate.

bradykinesia/hypokinesia
Abnormally slow body movement.

brain
That part of the central nervous system contained within the cranium.

brain-derived neurotrophic factor (BDNF)
Protein secreted by the brain that acts on neurons in the central and peripheral nervous systems; a member of the neurotrophin family of growth factors, related to the nerve growth factor (NGF).
*Note:* It is also secreted by contracting skeletal muscle and can be classified as a myokine.

brain herniation
Movement of part of the brain across structures within the skull such as a shift across such structures as the falx cerebri, the tentorium cerebelli, and even sometimes through the foramen magnum in the base of the skull (through which the spinal cord connects with the brain).
*Note:* This is caused by high intracranial pressure and may have fatal results.

brain slice
Slice of brain tissue immersed in artificial cerebrospinal fluid, used in electrophysiology experiments to allow study of a synapse or neural circuit in isolation from the rest of the brain, and in metabolic studies, under controlled physiological conditions.
brainstem
Unpaired subdivision of the brain, continuous with the spinal cord, that includes the thalamus, hypothalamus, pons, medulla oblongata, and the mesencephalon.

Broca area
Broca speech area
Region in the frontal lobe of one of the hemispheres (the speech-dominant hemisphere, usually the left) of the hominid brain that is involved in motor functions of speech production.
Note: Destruction of the Broca area results in a characteristic type of aphasia.

bruxism
Involuntary habitual grinding of the teeth, frequently during sleep.

burr hole surgery
trepanning
trephination
trephining
Medical intervention in which a hole is drilled or scraped into the human skull, exposing the dura mater, to gain access during surgery, to relieve intracranial pressure, to evacuate a subdural hematoma, etc.

butyrylcholinesterase
plasma cholinesterase
pseudocholinesterase
Enzyme, found mainly in the liver, that hydrolyzes choline esters; it is non-specific and distinct from acetylcholinesterase.
Note: Measurement of plasma cholinesterase activity mainly reflects butyrylcholinesterase activity, although the inhibitory action of many neurotoxic substances on the two enzymes acetyl- and butyrylcholinesterase, is correlated.

CA1-pyramidal cell
Pyramidal neuron located in the cornu ammonis area 1, in the hippocampus.
Note: CA1-pyramidal cells provide an output pathway from the hippocampus involved in long-term learning and memory.
Note 2: They are more susceptible to ischemia and hypoxia than the neighbouring CA3-pyramidal cells.

CA3-pyramidal cell
Pyramidal neuron located in the cornu ammonis area 3, in the hippocampus.
Note: It receives information from neurons of the dentate gyrus and sends information to the CA1-pyramidal cells.

Caenorhabditis elegans
Nematode with a well defined small neural network and homologues of human neurotransmitters, used as a model organism for studying normal development as well as neurotoxicity.
Note: Neurotoxic endpoints studied in Caenorhabditis elegans include locomotion, reaction to touch and temperature-sensitivity.

California verbal learning test
Procedure in which some common words are read aloud and the test subject is asked to recall as many of these as possible.
Note: This neuropsychological test is used to assess the verbal memory.
canceroma
Malignant tumor of an epithelial cell.
[1]

carotid artery
One of two paired large arteries on either side of the neck that supplies most of the cerebral hemisphere.

carpel tunnel syndrome (CTS)
Median nerve entrapment neuropathy that causes paresthesia, pain, and numbness due to compression of the nerve at the wrist in the carpal tunnel.

cassava toxin
See cassavism.

cassavism
konzo
mantakassa
Epidemic paralytic disease, mainly affecting women and children, occurring in remote rural areas of African and Latin American countries, where cassava root is an important food.
*Note:* It is associated with many weeks of consumption of “bitter” (high cyanide) cassava that has not been adequately treated to remove the cyanide.

cauda equina
Bundle of long spinal nerve roots arising from the end of the spinal cord and filling the lower part of the spinal canal (from approximately the thoraco-lumbar junction downwards).
*Note:* These nerves contribute to the innervation of the pelvic organs and lower limbs to include motor innervation of the hips, knees, ankles, feet, and internal and external anal sphincter. In addition, the cauda equina extends to sensory innervation of the perineum and, partially, parasympathetic innervation of the bladder.

caudate nucleus
caudatum
Crescent-shaped mass of gray matter forming part of the corpus striatum and part of the basal ganglia.

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 cavity (cranial and spinal cavities).

cerebellar tonsillar herniation
Abnormal protrusion of a portion of the cerebellum through the foramen magnum of the skull.
cerebellum
Lower part of the brain that is beneath the posterior portion of the cerebrum, regulating the unconscious coordination of movement.
See also inferior cerebellar peduncle.

cerebral cortex
Outer layer of the cerebrum, composed of folded gray matter, playing an important role in consciousness.
*Note:* In humans, this is a 2–3 mm thick covering with gyri and sulci, whereas in rodents, it is smooth.

cerebral herniation
See brain herniation.

cerebroside
Member of a group of glycosphingolipids called monoglycosylceramides which are important components in animal nerve and muscle cell membranes and the myelin sheath.

cerebrospinal fluid (CSF)
Clear colorless extracellular fluid found in the brain and spinal cord filling the ventricles and subarachnoid spaces.
*Note 1:* It is produced in the choroid plexus of the brain from arterial blood by a combined process of diffusion, pinocytosis and active transfer.
*Note 2:* It acts as a cushion or buffer for the cortex, providing mechanical and immunological protection to the brain, is involved in autoregulation of blood flow in the cerebrum, and plays an important role in the homeostasis and metabolism of the central nervous system.

cerebr/um n., /al adj.
Principal part of the brain in vertebrates, located frontwards in the skull, consisting of the two hemispheres of the cerebral cortex separated by a fissure, and certain subcortical structures such as the hippocampus, basal ganglia, and the olfactory bulb.

cervical spine
Part of the spine immediately inferior to the skull and connecting to the thoracic spine, made up of seven vertebrae.

cervical vertebra
Any of seven vertebrae that provide strength and structure to the cervical spine and support the head, allowing for its rotation and flexion.

cholinergic
1. Relating to or denoting a nerve that liberates acetylcholine at a synapse upon receiving an appropriate nerve impulse; in particular referring to parasympathetic nerve fibers.
2. Relating to or denoting an agent that mimics or enhances the activity of acetylcholine.
Compare adrenergic.

cholinesterase
See acetylcholinesterase, butyrylcholinesterase.

cholinesterase inhibitor
See acetylcholinesterase inhibitor.
cholinomimetic
Having an action similar to acetylcholine.
See also parasympathomimetic.

chorea
choreia
Neurological disorder characterized by rapid, jerky involuntary movements affecting especially the limbs or facial muscles.

choreoathetosis
Occurrence of involuntary movements in a combination of chorea and athetosis.

choroid plexus
Branching network of blood vessels in the cerebral ventricles that serves to regulate intraventricular pressure by secretion or absorption of cerebrospinal fluid.

chromatolysis
1. Disintegration of nuclear chromatin.
2. Disintegration of Nissl bodies following neuronal injury.

chronic solvent-induced encephalopathy (CSE)
organic solvent syndrome
toxic solvent syndrome
Constellation of neurological symptoms that may include polyneuropathies, encephalopathy, memory loss, attention deficit and dementia following long-term exposure, often occupational, to organic solvents found in paints, glues, and other industrial products.

ciguatera poisoning
Food-borne illness caused by ingesting fish containing ciguatera toxins.

Note 1: Ciguatera toxins tend to accumulate in predator fish, such as the barracuda and other carnivorous reef fish, after eating other fish that consume toxin-producing algae (dinoflagellates) living in coral reef waters. Ciguatera toxins are harmless to fish but poisonous to humans.

Note 2: The toxins are heat-resistant, and cooking does not destroy them.

ciliary muscle
Intrinsic smooth muscle of the eye that contracts to cause the lens to thicken, allowing accommodation to near vision.

ciliary neurotrophic factor
Polypeptide hormone and nerve growth factor that promotes neurotransmitter synthesis and neurite outgrowth in certain neural populations including astrocytes.

clonus n., /ic adj.
1. Alternate involuntary muscular contraction and relaxation in rapid succession.
2. Continuous rhythmic reflex tremor initiated by the spinal cord below an area of spinal cord injury, set in motion by reflex testing.

[7]

cognition n., /ive adj.
Sum of the mental processes by which sensory input is stored, recovered, and used by the conscious brain, including attention, memory, language usage, learning, reasoning, problem solving, and decision making.
Note: It usually refers to human information processing, but is sometimes used to describe learning and memory in rodents.

cognitive function
See cognition.

coma
State of profound unconsciousness lasting more than several hours in which one cannot respond to stimuli and from which one cannot be roused.

computed tomography (CT)
X-ray computed tomography (X-ray CT)
computerized axial tomography (CAT)
Tomographic technique that rapidly images the body in cross-sections, or slices: thereafter, a computer algorithm reconstructs a map from the slices to create a three-dimensional image of soft tissue or bone.

conditioned avoidance response (CAR) test
Experimental procedure in which an adverse effect (e.g., foot shock, drug withdrawal) is delivered to rats or mice after presentation of a cue (e.g., light or sound); the rodents are trained to avoid rather than escape the shock after the start of its delivery.

conditioning, classical
Pavlovian conditioning
respondent conditioning
Learning in which a behavior comes to be elicited as a reflex response by association with a neutral antecedent stimulus through repetition of the stimulus-response pairing.
Note: The neutral antecedent stimulus (see conditioned stimulus) such as the ringing of a bell is repetitively paired with an unconditioned stimulus such as food to elicit a response such as salivation.

conditioning, operant
instrumental conditioning
Learning in which appropriate behavior is rewarded, or inappropriate behavior is punished; behavior is modified by learned association with antecedents and consequences.
See also reinforcement.

cone cell
See photoreceptor cell.

confusion
Mental state of bewilderment or disorientation in which reactions to environmental stimuli may be inappropriate.

conscious adj., /ness n.
Aware of and responding to one's surroundings.

continuous performance test (CPT)
Any of several available neuropsychological procedures that measure a person's sustained attention.
Note 1: An example of a CPT is the computer-administered Conners' test, where, in one version, the test subject is asked to click the spacebar when presented any letter except the letter “X” with 360 presentations over a 14-minute period.
Note 2: Continuous performance tests are often used in evaluating children with suspected attention deficit hyperactivity disorder.

**contracture**
Contraction
Persistent shortening and tightening of muscle, tendon, or other tissue.

**contrast medium**
Any material (usually opaque to X-rays) employed to delineate or define a structure during a radiologic procedure.

**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 drug or alcohol abuse.

**cornu ammonis**
Part of the hippocampus.

**coronal**
Vertical (longitudinal) plane dividing the body into ventral and dorsal (front and back) sections.

**coronal suture**
Transverse junction in the skull separating the frontal bone from the parietal bones.

**corpus callosum**
Bundle of myelin-enriched neural fibers beneath the cortex connecting the two hemispheres of the brain.

**corpus striatum**
Striatum together with the globus pallidus.

**cramp**
Painful muscle spasm caused by prolonged tetanic contraction.
After [5]

**cranial nerve**
Each of 12 pairs of nerves that arise directly from the brain, not from the spinal cord, and pass through separate apertures in the skull.

**cranial suture**
Line where the bony plates of the skull join together, consisting of fibrous bands of tissue, easily felt in the newborn until closure by ossification.

**craniopharyngioma**
Congenital tumor arising from the pituitary gland in the embryonic tissue between the brain and pharynx.
*Note:* As the specific cells from which the tumor arises also contribute to tooth formation, the tumor will often show calcium deposits visible on x-rays.

**crani/um** n., /al adj.
Boney structure surrounding the brain, excluding the bones of the face.
cranial bifidum
See encephalocele.

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.

cue
Stimulus or associated feature of a stimulus that evokes a response or alerts the subject to a particular behavior.

cycad toxin
See Western Pacific amyotrophic lateral sclerosis and parkinsonism–dementia complex.

delirium
State of severe confusion, characterized by restlessness, hallucinations and hyperactivity, during which the person affected may be isolated from normal communication.
Note: Delirium can result from drug or alcohol toxicity or withdrawal, infection, brain tumor, head injury, metabolic disturbances, etc.

dementia
Serious loss of brain function in a previously unimpaired person, affecting memory, thinking, and behavior.
Note: It may be static as a result of brain injury, or progressive with long-term decline due to damage of disease.

dementia, presenile
Dementia, often of the Alzheimer type (see Alzheimer disease) developing at or before age 65.
After [5]

dementia, senile
Dementia, often of the Alzheimer type (see Alzheimer disease) developing after the age of 65.
After [5]

demyelination
demyelination
Destruction of the protective myelin sheath that surrounds nerve fibers, resulting in diminished function and decreased action potential in those nerves.

dendrite
Short branched extension of a nerve cell, along which impulses received from other cells at synapses are transmitted to the cell body.
Compare axon.

dentate gyrus
Narrow strip of cerebral cortex associated with the hippocampus that continues forward to the uncus.
Note: It is thought to contribute to the formation of new episodic memories, the spontaneous exploration of novel environments, and other functions.
dependence, physical
See addiction.

dependence, psychological
See addiction.

dependency, chemical
drug addiction
Craving for or addiction to a substance.

depolarization
Relative reduction in the resting membrane potential of an excitable cell, generally making the inside less negative, or even positive with respect to the outside.

depression (of the central nervous system)
1. Reduction in the activity of the central nervous system.
2. Mental state or disorder characterized by feelings of sadness and despair.

After [5]

despair test
behavioral despair test
See swimming test, tail suspension test.

developmental neurotoxicity
Adverse effects of toxic substances on the development of the nervous system.

developmental neurotoxicity testing (DNT)
Any examination that allows detection of substance-induced changes in the structural or functional integrity of the nervous system of a developing organism, fetus or child.

diaphoretic
1. n. Substance inducing perspiration.
2. adj. Of a human, sweating heavily.

diarrheal shellfish poisoning (DSP)
diarrhetic shellfish poisoning (DSP)

After [1]
diencephalon
Posterior part of the forebrain (prosencephalon), containing the hypothalamus and other thalamic components, and enclosing the third ventricle.

differentiation (in biology)
Process by which a cell is committed to a lineage and becomes more specialized in structure and function.

digit span test
digit span task
Test of memory in which numbers (series of digits) are presented orally or on a computer screen to a test subject who is asked to repeat each number from memory; the numbers increase in length until mistakes are made.
Note: In the backward digit span task the presented numbers must be recalled in reverse order.
See also neurobehavior core test battery.

digit symbol substitution test (DSST)
digit symbol test
Neuropsychological assessment in which the top two rows of a test sheet function as a key, displaying numbers 1–9 (upper row) matched to “non-sense” symbols (lower row). There follow pairs of rows where the numbers 1–9 appear in irregular sequence and the test subject must match the correct symbol from the key to each number, as quickly as possible.
Note 1: The test is used to assess brain damage, dementia and depression.
Note 2: It is a subtest of some intelligence tests.
See intelligence quotient.
See also neurobehavior core test battery.

diplopia
double vision
Simultaneous perception of two images of a single object.

disc, intervertebral
spinal disc
Flat circular structure, consisting of a tough, fibrous exterior and a gelatinous core, interposed between adjacent vertebrae.

disorientation
1. Loss of sense of direction.
2. In clinical assessment, lack of awareness of one’s identity, present location, or the current day and time.

domoic acid
(2S,3S,4S)-4-[(2Z,4E,6R)-6-carboxy-6-methylhexa-2,4-dien-2-yl]-3-(carboxymethyl)pyrrolidine-2-carboxylic acid
Neurotoxic kainic acid analog produced by some algal blooms that causes amnesic shellfish poisoning.
Note 1: Filter-feeding shellfish become contaminated from trapping and eating these algae.
Note 2: Domoic acid is produced by the red alga called doumoi in Japan (Chondria armatasome), diatoms of the genus Pseudo-nitzschia, and by some strains of the diatom species Nitzschia navis-varingica.

dopamine
4-(2-aminomethyl)benzene-1,2-diol
Naturally occurring substance functioning as a neurotransmitter in the sympathetic nervous system, and a metabolic precursor of other substances including adrenalin.
Note: It has an inhibitory effect on movement and its depletion in the brain produces the symptoms of rigidity, tremors, and bradykinesia that are characteristic of Parkinson disease.

dopaminergic
Relating to a nerve that releases or responds to dopamine as a neurotransmitter.

dorsal root
posterior root of spinal nerve
Outgrowth of a spinal nerve that carries sensory signals to an appropriate integration center in the brain.

dorsal root ganglion
Nodule on a dorsal root of the spine that consists of afferent sensory neuronal cell bodies.
See also ganglion.

dura mater
Outermost and most fibrous of the three membranes of the meninges (see meninx) covering the brain and the spinal cord.

dynein
Protein associated with motile structures that exhibits adenosine triphosphatase activity; it forms “arms” on the outer microtubules of cilia and flagella and functions as a molecular motor.
Note: Dyneins are involved in axonal transport and are targets of various neurotoxic substances.

dynorphin
Member of a class of opioid peptides that arise from the precursor protein prodynorphin.
Note 1: When prodynorphin is cleaved during processing by proprotein convertase 2 (PC2), multiple active peptides are released: dynorphin A, dynorphin B, and α/β-neo-endorphin.
Note 2: Depolarization of a neuron containing prodynorphin stimulates PC2 processing, which occurs within synaptic vesicles in the presynaptic terminal.

dysaphia
Impairment of the sense of touch.

dysarthria
Difficulty in speech owing to disturbances of muscular control resulting from central or peripheral nervous system damage or emotional stress.

dysesthesia
1. Condition in which a disagreeable sensation, especially of touch, is produced following damage to peripheral or central sensory pathways.
2. Abnormal sensation experienced in the absence of stimulation.
[5]

dysgraphia
Difficulty in writing.

dyskinesia
Difficulty or abnormality in voluntary movement.
dyskinesia, tardive
Involuntary, repetitive body movement of slow onset.
*Note:* May be induced by drugs such as chlorpromazine.

dyslexia
Impairment in appreciation of spatial relations, often leading to difficulty in reading.

dysphagia
Difficulty in swallowing.

dysphasia
Difficulty in the use of language owing to a brain lesion, without mental impairment.
See also aphasia.

dyspnea
Difficulty in breathing; shortness of breath.

**dysreflexia, autonomic (AD)**
Over-activity of the autonomic nervous system causing an abrupt onset of excessively high blood pressure, tachycardia, and constriction of peripheral blood vessels.
Compare hyperreflexia.

dystonia
State of abnormal (either hypo- or hypertonic) muscle tone resulting in impairment of voluntary movement.
After [5]

edema
oedema
dropsy
Presence of abnormally large amounts of fluid in intercellular spaces of body tissues.
[1]

efferent
Carrying outward; of nerves, those that conduct impulses outward from the central nervous system.
Antonym afferent.

electroconvulsive therapy (ECT)
electroshock therapy
Therapeutic intervention in which seizures are electrically induced in patients with the aim of providing relief from a specific mental illness.

electroencephalogram
Test or record of brain electrical activity detected by electroencephalography.

electroencephalography (EEG)
Recording of electrical activity from different parts of the brain.

electromyography (EMG)
Recording of the electrical activity of muscle, or its representation as a visual display or audible signal, using electrodes attached to the skin or inserted into a muscle.
electroneurography
Non-invasive method used to examine the integrity and conductivity of a *peripheral nerve*, in which a brief electrical stimulation is given to the nerve at one point, while at the same time the induced electrical activity (compound action potentials) is recorded at another point of the nerve’s distribution and the interval is displayed on a video monitor.

electrophysiology
Study of the electrical properties of cells and tissues.

electroretinogram (ERG)
Recording, with electrodes placed on the cornea or nearby skin, of the electrical activity of *photoreceptors* and other retinal cells in response to standardized, patterned stimuli with light and colour.

elevated plus maze
Stage with four orthogonal side arms elevated above the floor, where two opposite arms have sidewalls and the other two arms have no walls; used as research tool for anxiety.
*Note:* Rodents normally preferentially avoid the arms without walls, but during *anxiolytic* treatment they tend to spend more time on them, or enter them more often.

emesis
Vomiting.

emetic
1. n. Substance that produces vomiting.
2. adj. Producing vomiting.

encephalitis
Inflammation of the *brain*.

encephalopathy
Any disorder of the *brain* that affects its functioning.
*Note:* Common causes include trauma, infection, liver failure, anoxia, kidney failure, or exposure to a *neurotoxin*.

endocrine disruptor
endocrine modifier
Exogenous chemical that alters function(s) of the endocrine system and consequently causes adverse health effects in an intact organism, its progeny, or (sub)populations.
*Note:* Adverse effects include those on neurodevelopment.

endorphin
One of several peptides (including the *enkephalins*) that activates the body’s *opiate receptors*, causing an *analgesic* effect; literally, *endogenous morphine*-like substance.
See also *enkephalin*.

enkephalin
Either of two endogenous pentapeptides with *opiate*-like effects that are especially involved in modulating pain responses in the *central nervous system*.
See also *endorphin*. 
ependymal tissue
Glial cells that line the cavities within the brain’s ventricles.

ependymoma
Growth in the brain or spinal cord arising from ependymal tissue.
*Note:* Because cerebrospinal fluid normally flows through the ependymal tissue-lined ventricles, blockage due to an ependymoma can cause build up of fluid, increased intracranial pressure, and hydrocephalus.

epidural
extradural
Immediately outside the dura mater.

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 adrenalin.

epithalamus
Dorsal part of the diencephalon, including the pineal gland and adjacent structures in the roof of the third ventricle.

ergotism
St Anthony’s fire
ignis infernalis
ignis sacer
*Poisoning* produced by eating food affected by ergot (ergotamine alkaloids), substances produced by the fungus *Claviceps purpurea* that contaminate rye and wheat.
*Note:* Ergotism typically results in hallucinations, headache, vomiting, diarrhea, a painful burning sensation in the limbs and extremities, and gangrene of the fingers and toes.

euphoria
n. /c adj.
Characterized by or feeling intense excitement and happiness.

evoked potential
Electrical potential that is triggered by presentation of a stimulus (somatosensory, auditory, visual) and measured with electrodes near the nerve or near the brain region in which the signal is processed.
*Note:* Speed, amplitude and location of the evoked potential provide information about the intactness of the response.

evoked response
evoked potential
Electrical potential recorded from the nervous system following exposure to a stimulus, as distinct from spontaneous potentials detected by *electroencephalography*, *electromyography*, or other *electrophysiological* recording methods.

excitable cell
Cell that can be stimulated to create an electric current; muscle fibers and nerve cells are excitable (see excitation).
excitation
State of enhanced activity of a cell, organism, or tissue that results from stimulation.
See also excitable cell.

excitatory post-synaptic potential (EPSP)
Referring to a more positive membrane potential at the postsynaptic side of the synaptic cleft that renders the postsynaptic neuron more likely to generate an action potential.
Note 1: EPSP’s are commonly produced by excitatory neurotransmitters such as glutamate.
Note 2: Postsynaptic electrical activity is in part a function of the balance of EPSP’s and inhibitory post-synaptic potentials.

excitotoxicity
Pathological process by which neurons are damaged and killed by the overactivation of receptors for the excitatory neurotransmitter glutamate, such as the N-methyl-D-aspartic acid (NMDA) receptor and the 2-amino-3-(3-hydroxy-5-methyl-1,2-oxazol-4-yl)propanoic acid (AMPA) receptor.
Note: Excitotoxins like NMDA and kainic acid bind to glutamate receptors, and can cause excitotoxicity by allowing high levels of calcium ions to enter cells, activating enzymes such as phospholipases, endonucleases, and proteases such as calpain, which damage cell structures, including the cytoskeleton, membranes, and DNA.

extrapyramidal system
See motor system.

facilitation
1. Neural facilitation: Increase in postsynaptic excitation as a result of very rapid firing of action potentials by a presynaptic neuron.
2. Presynaptic facilitation: Increase of prepsynaptic excitation when an excited neuron receives additional excitatory impulses from other neurons.

falx (cerebri)
Continuation of dura mater between the right and left hemispheres of the brain.

Farnsworth dichotomous test
See Lanthony D-15 color test.

fasciculation
Involuntary contractions, or twitchings, of groups (fasciculi) of muscle fibers
Note: This is a coarser form of repetitive muscular contraction than fibrillation.
After [5]

fatigue
Mental state characterized by weakness, sleepiness and reduced performance, often a consequence of physical exhaustion, disease, or chemotherapy.
Note: “Chronic fatigue syndrome” is a poorly defined term for a long lasting state of perceived fatigue without an identifiable cause of exhaustion or a defined underlying disease.

fetal alcohol syndrome
Condition developing in the fetus and resulting in a congenital abnormality, caused by excessive alcohol intake by the mother during pregnancy, typically characterized by delayed cognitive development, stunted growth and a characteristic facies.
fibrillation
Rapid contractions or twitching of muscle fibrils, but not of the muscle as a whole.
Note: The term is commonly used for atrial fibrillation, where the muscles of the cardiac atrium show the phenomenon, leading to loss of normal rhythmic contraction, and also for loss of synchronized contraction of the ventricles, i.e., ventricular fibrillation.
Compare fasciculation.

finger tapping test
Procedure in which a test subject is asked to tap a finger at maximal rate on a surface, a higher rate of tapping indicating better neuromuscular function.

flaccid
Relaxed, flabby, or without tone.
[5]
Note 1: Flaccid paralysis is a condition where one or more muscles are without tone. It is often caused by the lack of motor nerve impulses due to nerve trauma, disease or specific pharmaceuticals.
Note 2: Curare causes flaccid paralysis by binding to acetylcholine receptors and inhibiting their action.

foramen
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
1. One of the larger foramina in the base of the skull.
2. In the fetal heart, opening that allows shunting of blood between the right and left atria that should close at birth.

forebrain
See prosencephalon.

frontal lobe
Most anterior of the four major lobes of each cerebral hemisphere, containing the primary motor cortex.

frontotemporal dementia (FTD)
frontotemporal lobular degeneration (FTLD)
Neurodegenerative disease characterized by progressive neuronal defects in the frontal and temporal lobes of the brain, leading to dementia

functional domain
In the brain, referring to the concept that discrete regions are involved in specific aspects of cognitive function, thus giving rise to modularity.
Note: A competing theory, distributive processing, holds that cognition involves more interaction of brain regions.
**functional observational battery**
Structured set of tests to examine changes in neuromuscular, arousal, autonomic and sensory functions that assesses the presence, absence or severity of specific neurological signs.

*Note:* Usually performed in rodents after exposing them to potentially *neurotoxic* substances.

**FUS (fused in sarcoma) transcription factor**
Nuclear DNA- and RNA-binding protein involved in transcription, splicing, and RNA-transport.

*Note:* Mutation in the FUS gene is believed to have a role in several *neurodegenerative diseases*.

**GABA**
See $\gamma$-aminobutyric acid.

**GABA receptor**
See $\gamma$-amino butyric acid receptor.

**GABAergic**
Pertaining to the action of $\gamma$-aminobutyric acid or to neural or metabolic pathways in which it functions as a neurotransmitter.

[5]

**ganglion**
1. Cluster of nerve cell bodies located outside the brain and spinal cord, i.e., in the peripheral nervous system

*Note:* Ganglia interconnect to form a complex network known as a *plexus* and serve as relay stations where different neurons can modulate the signals of each other.

Compare basal ganglion.

2. Fibrous cyst usually attached to a tendon sheath.

**ganglion cell**
*Neuron* located in a *ganglion*.

*Note:* Included are cells in the ganglion cell layer of the retina, cells of the sympathetic nervous system in the adrenal medulla, cells in sympathetic and parasympathetic ganglia, and cells in the spiral (cochlear) ganglion involved in hearing.

**ganglioside**
Glycosphingolipid chemically similar to cerebrosides but containing one or more sialic (N-acetylneuraminic or N-glycolyneuraminic) acid residues, found principally in nerve tissue, spleen, and thymus.

*Note:* Accumulation can be associated with disease. Ganglioside GM1 accumulates in generalized gangliosidosis; GM2 accumulates in Tay-Sachs disease.

After [5]

**giant axon**
squid giant axon

Very large *axon* (typically 0.5 mm in diameter) that functions in the propulsion system of the squid.

*Note:* The large size of the axon has facilitated studies on the mechanism of the *action potential*.

**giant axonal neuropathy**
Rare human genetic neurological disorder in which the neurofilaments become disordered, resulting in abnormal size and shape of neurons.
**glia** n., /ˈɡleɪə/ adj.
neuroglia
Non-neuronal cellular elements of the central and peripheral nervous system having metabolic and support functions.

*Note:* In the central nervous system, the glia include oligodendroglia, astrocytes, ependymal cells, and microglia cells. In the peripheral nervous system they include ganglion satellite cells and Schwann cells.

**glial cell**
Cellular component of the glia, including oligodendroglial cells, astrocytes, ependymal cells and microglial cells.

**glial-derived neurotrophic factor** (GDNF)
Protein that promotes and guides the growth of neurons and facilitates the survival of mature neurons by suppressing cell death.

**glial fibrillary acidic protein** (GFAP)
Cytoskeletal intermediate filament protein found in mature fibrillary astrocytes and in neural progenitor cells.

*Note 1:* Stains for GFAP are frequently used in the differential diagnosis of neurologic lesions.

*After [5]*

*Note 2:* GFAP staining does not reveal the full distal arborization of the cell.

**glioblastoma**
glioblastoma multiforme
Glioma consisting chiefly of undifferentiated anaplastic cells of astrocytic origin.

*Note:* These neoplasms grow rapidly, invade extensively, and occur most frequently in the cerebrum of adults.

*After [5]*

**glioma**
Neoplasm originating from any of the glia cells in the brain and spinal cord.

*Note:* It is the predominant form of malignant brain tumor.

**gliosis, reactive**
Damage-induced proliferation, enlargement and overgrowth of glial cells, often astrocytes in the central nervous system, resulting in an astrocytic scar.

**globoside**
Glycosphingolipid, specifically a ceramide tetrasaccharide (tetracylgosylceramide), isolated from kidney and erythrocytes.

*Note:* It accumulates in people with Sandhoff disease.

*After [5]*

**glutamate**
Salt of glutamic acid (2-aminopentanedioic acid).

*Note 1:* Glutamate is a major excitatory neurotransmitter in the vertebrate nervous system.

*Note 2:* Monosodium glutamate (MSG) is commonly used in the food industry as a flavor enhancer, and at high doses has given rise to reported feelings of headache and discomfort.
glutamate-induced excitotoxicity
Form of excitotoxicity where excess glutamate release in synapses (glutamatergic storm) leads to overstimulation, followed by excess cellular calcium uptake, cytotoxicity and apoptosis.

*Note 1:* N-methyl-D-aspartic acid, kainic acid, and other ligands of the glutamate receptor induce this effect.

*Note 2:* Excitotoxicity may occur after acute neuronal ischemia and damage. It is believed to be a factor in chronic diseases of the nervous system, and in some withdrawal phenomena.

glutamatergic storm
See glutamate-induced excitotoxicity.

glycosphingolipid
Any representative of a group of glycolipids where a carbohydrate is connected with sphingosine (see also sphingolipid).

*Note 1:* Important glycosphingolipids are cerebrosides, gangliosides and globosides.

*Note 2:* Glycosphingolipids are components of cell membranes, notably nerve cell membranes.

Golgi staining
Golgi’s method
Method of silver staining of histological sections of tissue from the nervous system, in which a limited number of neurons stain in their entirety upon formation of microcrystals of silver chromate, thus allowing visualization in the light microscope of some individual neurons in densely packed tissue.

G-protein-coupled receptor (GPCR)
Seven-transmembrane-domain receptor that interacts with guanosine triphosphate/diphosphate (GTP/GDP) binding proteins to initiate signal transduction.

granule cell
One of several types of neurons with small cell bodies, involved in neural networks in several regions of the brain, including the cerebellum, hippocampus, and cerebral cortex.

*Note 1:* They give rise to the name granular layer within these regions.

*Note 2:* Not to be confused with granular cells of the kidney.

grass pea poisoning
See lathyrism.

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

After [5]
Compare white matter.

Guillain-Barré syndrome (GBS)
Type of idiopathic polynyuritis in which autoimmunity to peripheral nerve myelin leads to a condition characterized by chronic demyelination of the spinal roots (see spinal cord), peripheral nerves, and cranial nerves.

*Note:* Guillain-Barré syndrome is often preceded by a respiratory or gastrointestinal infection and shows gradual but complete recovery in most cases.

After [3]

habituation
Decrease or cessation of a response to a stimulus after its repeated presentation.
hallucination n., vb.
The apparent, often strong, subjective perception of an external object or event when no such stimulus or situation is present.

Note: Hallucinations may be visual, auditory, olfactory, gustatory, or tactile.

headache
Pain in one or more parts of the cranium, not confined to the area of distribution of any nerve.

headache, rebound
Headache caused by stopping analgesics following their overuse to relieve headaches.

headache, tension
Headache associated with anxiety or other states of distress, associated with chronic contraction of the scalp muscles.

hemangioma
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.

hematoma
Region of bleeding into a tissue or organ.

Note 1: Often a result of trauma, defective blood clotting or drugs that suppress blood clotting.

Note 2: Hematoma of the brain is a common cause of stroke and is accompanied by potentially lethal increase of intracranial pressure and neuronal damage.

hemiplegia
Paralysis of one side of the body, including the arm, trunk and leg.

hemisphere, cerebral
Right or left half of the brain in sagittal section.

hemisphere, dominant
Cerebral hemisphere containing the representation of speech and controlling arm and leg preference in skilled movements.

Note: Usually the left hemisphere.

hemorrhage
Copious escape of blood from a disrupted blood vessel.

Note: When occurring in the brain, this is a hemorrhagic stroke.

hen test
Procedure using birds to study acute and delayed neurotoxicity, notably of organophosphates.
Note: After exposure to the substance, the birds are closely observed with regard to motor activity, gait changes, motor coordination, and related parameters.

**hippocampal slice culture**

Maintenance in vitro of fresh prepared slices of the hippocampus

*Note 1:* Vital cultures can be kept for weeks and maintain structure and neuronal functions (“organotypic”).

*Note 2:* Useful for many types of brain research including electrophysiological, biochemical and morphological measurements in studies of neurotoxicity.

See also *brain slice.*

**hippocampus**

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

See also CA pyramidal cell, dentate gyrus, granule cell.

**histamine**

2-(1H-imidazol-4-yl)ethanamine

Bioactive metabolite produced in living organisms by deamination of the amino acid histidine.

*Note:* Histamine acts as a neurotransmitter in the brain. It also serves as a mediator in the regulation of various body functions such as gastric secretion, bronchial constriction, vasorelaxation, and local inflammation.

See also *Scombroid poisoning.*

**histaminergic**

Pertaining to the action of histamine or to neural pathways in which it functions as a neurotransmitter.

**hormone** n., *al* 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]

**Huntington disease**

Genetic autosomal dominant neurodegenerative disease resulting from a mutation in the Huntingtin gene and resulting notably in decline of cognitive function and a characteristic chorea.

**hydrocephalus**

Excessive accumulation of cerebrospinal fluid in the cerebral ventricles, often in the developing embryo.

*Note:* It is associated with raised intracranial pressure that may damage the brain and lead to an enlargement of the skull.

**hydrocephalus, communicating**

Hydrocephalus where flow of cerebrospinal fluid is not blocked but there is failure of its reabsorption.

**hydrocephalus, obstructive**

Hydrocephalus where flow of the cerebrospinal fluid is blocked.

**hydromyelia**

Pathological dilation of the spinal cord due to expansion of the cerebrospinal fluid-filled central canal of the cord.
5-hydroxytryptamine (5-HT)  
serotonin  
3-(2-aminoethyl)-1H-indol-5-ol  
Neurotransmitter found in the digestive tract, platelets and central nervous system.  
Note: In the central nervous system, it influences mood, appetite and sleep.

hypercapnia  
Abnormally increased carbon dioxide concentration in the blood resulting in a increased rate and depth of breathing.  
Note: Hypercapnia may result either from insufficient pulmonary respiration or from increased levels of carbon dioxide in the ambient air.

hyperesthesia  
Excessive sensitivity to touch, pain, or other sensory stimuli.

hyperpolarization  
Transient increase in membrane polarization of nerve cells or muscle cells; the opposite of depolarization.

hyperreflexia  
Increased or exaggerated reflex response.

hypertonia  
Extreme tension of the muscles or arteries.  
[5]  
Note: This is often a result of an upper motor neuron lesion in the brain, which is accompanied by decreased synaptic inhibition and increased excitability of muscle.

hypnotic  
Agent that may reduce anxiety and induces sleep.  
See also soporific.

hypocapnia  
Abnormally decreased carbon dioxide concentration in the blood.  
Note: An increased respiratory rate during normal metabolic activity may cause hypocapnia that may be associated with spasms.

hypophysectomy  
Surgical removal of the pituitary gland (hypophysis).

hyporeflexia  
Diminished reflex response.

hypotension  
1. Subnormal arterial blood pressure.  
Note: Hypotension can be a cause of dizziness, weakness and fainting.  
2. Lower than normal pressure or tension of any kind (used less commonly).  
[5]
hypothalamus
A region at the base of the brain containing specialized nerve cells that helps activate, control, and integrate peripheral autonomic mechanisms, endocrine activities, and some somatic functions such as body temperature, sleep, and appetite.

hypotonia
1. Condition in which there is a diminution or loss of muscle tone.
2. Relaxation of the arteries.
3. Lower than normal tension in any part, as in intraocular pressure of the eyeball.
After [5]

hypoxia
Suboptimal concentration of dioxygen in the inspired air, in the circulating blood, or in a tissue.
Note 1: The healthy organism attempts to counteract hypoxia in the ambient air or blood by increasing the rate and volume of pulmonary respiration.
Note 2: Even short periods of hypoxia may result in irreversible brain damage.

ictus
Sudden attack, stroke or seizure.

inclusion body
Particle in a cell, detectable under the light microscope.
Note: Inclusion bodies often consist of aggregates of misfolded proteins and are often found in neurodegenerative diseases, such as the β-amyloid plaques in Alzheimer disease.

inferior cerebellar peduncle
Part of the cerebellum that is important for a number of motor functions, including balance, position sensing and coordination of movement (see motor coordination).

inflammation
Reaction of the body to injury or to infectious, allergic, or chemical irritation; characterized by redness, swelling, heat, and pain resulting from dilation of the blood vessels accompanied by loss of plasma and leukocytes into the tissues.
[3]
Note: This process differs in the brain (see neuroinflammation), where lymphocytic invasion requires compromise of the blood–brain barrier, although T-cells can enter the brain for surveillance.

infratentorial
Below the tentorium.

infundibulum
Neural stalk extending from the base of the brain to the pituitary gland.

inhibitory post-synaptic potential (IPSP)
Referring to a more negative membrane potential at the postsynaptic side of the synaptic cleft that renders the postsynaptic neuron less likely to generate an action potential.
Note 1: IPSPs are commonly produced by inhibitory neurotransmitters such as γ-amino butyric acid (GABA) and glycine.
Note 2: Postsynaptic electrical activity is in part a function of the balance of IPSPs and excitatory post-synaptic potentials (EPSPs).
insecticide
Substance intended to kill insects. [1]
Note: Insecticides commonly target the nervous system of insects.

insomnia
Inability to sleep during the period when sleep should normally occur. After [5]

intelligence quotient (IQ)
Numeric measure of a person’s cognitive function based on one of several standardized tests of a problem-solving nature.
Note 1: The quotient is expressed as a ratio of the individual’s score to the median raw score of a sufficiently large reference population, the latter score taken as 100.
Note 2: The tests and numeric value are age-specific.
Note 3: Historically, test results have been prone to misuse in drawing invalid conclusions about differences in intelligence based on genetic background, gender or race, ignoring potentially confounding factors such as education, socioeconomic status and other environmental influences on test performance.

intention tremor
See tremor.

intracranial pressure (ICP)
Pressure within the cranial cavity.
Note 1: Increased ICP may result from increased volume of the cerebrospinal fluid.
Note 2: Even minor increases in ICP, e.g., due to intracranial bleeding, may cause serious damage to the brain.

intrathecal
Within a sheath, as within either the subarachnoid or the subdural space. After [5]

ion channel
Pore-forming transmembrane protein that can gate the transmembrane flux of small ions.
Note 1: Ion channels are generally involved in regulation of the electrical membrane potential and cell volume.
Note 2: Both voltage-gated and ligand-gated channels promote electrical signals in neurons and muscle cells.
Note 3: Many of the known channels are susceptible to inhibition by specific neurotoxins.

ion channelopathy
Neuromuscular disease resulting from a genetic defect in an ion channel.
Note: Documented ion channelopathies include those arising from mutations in channels for Na⁺, K⁺, Cl⁻, and Ca²⁺.

ionized calcium-binding adapter molecule 1 (Iba-1)
allograft inflammatory factor 1 (AIF-1)
Protein that is expressed in several tissues, but in brain is a specific immunomarker for microglia.
Note: Expression of Iba-1 is up-regulated upon activation of microglia, thus allowing identification of areas of brain injury or inflammation.
ischemia
Local deficiency of blood supply and hence oxygen to an organ or tissue owing to constriction of the blood vessels or to obstruction.

*Note:* Ischemic cerebrovascular insult is due to decreased cerebral blood flow or dioxygen supply, without bleeding.

IQ test
See *intelligence quotient*.

Irwin battery
Set of neurobehavioral tests, including observations of behavior in novel environments, of reactions, and of motor functions; used in various modifications and resembling the *functional observational battery*.

kainic acid
\((2S,3S,4S)-3-(\text{carboxymethyl})-4-(\text{prop-1-en-2-yl})\text{pyrrolidine-2-carboxylic acid}\)
Natural amino acid produced by some seaweeds that activates a subclass of *glutamate receptors* ("kainate receptors") to produce *excitotoxicity*.

*Note:* Kainic acid is used experimentally to induce focal *seizures* and model *epilepsy*.

kindling
Increase of epileptogenic (see *epilepsy*) activities as a result of repeated, longer-lasting subthreshold brain stimulation, e.g., with electrical stimuli.

*Note:* Kindling is used in models to study the development of *seizures* and epilepsy, and also for studying withdrawal phenomena.

lacrimation
Secretion and discharge of tears.

[1]

Lanthony D-15 color test
Lanthony D-15 desaturated hue panel
Test of color vision using 15 distinct color chips with low color saturation that have to be arranged in a correct order.

*Note:* The low color saturation makes this test more difficult than the Farnsworth dichotomous test (D-15) and thus it can detect more subtle color vision deficiencies.

latent
Not yet manifest; dormant but potentially discernible.

After [5]

latent period
1. Delay between exposure to a harmful substance and the manifestations of a disease or other adverse effect.
2. Period from disease initiation to disease detection.

[1]

lathyri sm n., /tic adj.
grass pea poisoning
Disease characterised by *spastic paralysis* of the legs and lower part of the body, pain, *hyperesthesia*, and *paresthesia*. 
Note: Lathyrism is due to excessive ingestion of seeds of plants of the genus *Lathyrus*, which includes many kinds of pea, including *Lathyrus sativa* (grass pea). These seeds contain the glutamate analog and neurotoxicant oxalylidiaminopropionic acid (3-[(carboxycarbonyl)amino]alanine)).

**lethargy**
Relatively mild impairment of consciousness resulting in reduced alertness and awareness.
*Note:* Lethargy has many causes but reflects a generalized suppression of brain activity.

**levarterenol**
S-noradrenaline
4-[(1S)-2-amino-1-hydroxyethyl]benzene-1,2-diol
Levorotatory isomer of norepinephrine, having greater pressor activity than the natural dextrorotatory isomer.

**libido**
Conscious or unconscious sexual desire; passionate interest in life force.
After [5]

**ligand-gated ion channel**
*Ion channel* that opens upon binding an activating ligand.
Compare voltage-gated ion channel.

**limbic system**
Collection of interconnected neurons lying underneath the cerebrum on either side of the thalamus, related more by anatomical location than as a single functional entity.
*Note 1:* Various structures of the limbic system, including the cingulate gyrus, the isthmus, the hippocampus, the uncus, and the amygdala are associated with various emotions and feelings such as anger, fear, sexual arousal, pleasure, and sadness.
*Note 2:* Often termed the paleobrain, and considered to consist of primitive structures.

**lipoma**
Benign tumor of the adipose tissue, often visible under the skin.
*Note:* Lipoma of the corpus callosum is a rare congenital condition that can be asymptomatic or can present with headache, hemiplegia, dementia and epilepsy.

**lobe** (of cerebral cortex)
One of the four main regions of the cerebral cortex.
See frontal lobe, occipital lobe, parietal lobe, temporal lobe.

**lower motor neuron**
*Neuron* that receives impulses from an upper motor neuron and whose axons innervate the skeletal muscles.

**lumbar puncture**
Procedure for sampling the cerebrospinal fluid through a needle positioned in the subarachnoid space of the spinal cord, between vertebrae of the lumbar spine.
*Note:* It is used to analyze the composition of the cerebrospinal fluid for diagnostic purposes, for therapeutic reasons, and also to study drug concentrations in the cerebrospinal fluid.

**lumbar spine**
Portion of the vertebral column of the lower back between the thoracic spine and sacrum, in humans consisting of five vertebrae designated L1 to L5.
magnetic resonance imaging (MRI)
nuclear magnetic resonance imaging (NMRI)
magnetic resonance tomography (MRT)
Diagnostic imaging technique that produces three-dimensional images of body structures based on the ability to detect changes in nuclear spin alignment of nuclei held in a strong magnetic field and subjected to radiofrequency pulses.

Note: The basic MRI technique is based on the nuclear spin of protons in water, but MRI signals vary depending on the elements and chemical bonds in a tissue and therefore can be used to visualize other aspects of the chemical composition of organs.

magnetic resonance spectroscopy (in neurotoxicology)
Noninvasive method based on nuclear spin alignment that allows localization of levels and measurement of kinetics of an injected labeled substances in living tissue.

Note: In neurology, the method is used to localize the brain areas where increased metabolic activity occurs upon stimulation; it is also used to study activity and location of neurotransmitters.

manganism
Condition of manganese poisoning, usually after chronic inhalation exposure to manganese fumes.

Note 1: Manganism is characterized by neurological and psychiatric disorders including reduced reaction time, lethargy, tremors, and a mask-like face. Impotence and loss of libido have also been reported.

Note 2: Low environmental exposures are reported to impair brain development and to reduce performance on neuropsychological tests.

maze
Labyrinthine system, in which the ability of an animal (usually a rodent) to find a direct route from a starting point to a specific location is observed.

Note: Different mazes are available for psychological and neurotoxicity testing. Maze tests suitable for studying spatial navigation, learning, memory, cognition, anxiety and other behaviours have been developed.

See also Barnes maze, Biel water maze, radial arm maze, T-maze, water maze test.

medulla
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.

medulloblastoma
Highly malignant, invasive brain tumor of embryonal origin, arising in the posterior fossa, usually from the cerebellum.

Note: It is the most common malignant brain tumor in children.

membrane polarization
Occurrence of a potential difference across a biological membrane.

Note: A cell at its resting potential is said to be polarized. See membrane potential.

membrane potential
Difference in electric potential between the inside and the outside of a cell.

Note 1: Typical cell membrane potentials are around –70 to –80 mV.

Note 2: The ion disequilibria that give rise to the potential difference are produced by the combined action of ATP-consuming ion pumps, gated ion channels, and ion leakage.
Note 3: During neuronal excitation, the membrane potential becomes transiently positive during the action potential before returning to the resting potential. See also depolarization, ion channel.

meninges
Plural of meninx.

meningioma
Firm, often vascular, tumor arising from the meninges of the brain or spinal cord.

Note: Meningiomas are slowly growing benign tumors and quite common.

meningitis
Inflammation or infection of the meninges.

Note 1: Although bacterial and viral infections are the most common causes, there are also non-infectious causes including cancers, autoimmune disease and head injury.

Note 2: Several common drugs may cause aseptic meningitis.

meningocele
Protrusion of the meninges of the spinal cord through a defect in the spinal column.

meningoencephalitis
cerebromeningitis
encephalomeningitis

Inflammation of the brain and meninges.

meningoencephalocele
Protrusion of both the meninges and brain tissue through a defect in the skull.

Note: Often due to a congenital defect.

meninx
Any membrane; specifically, usually referring to one of the membranous coverings of the brain and spinal cord.

[5]

Note: The brain and the spinal cord are covered by three membranes termed (from outermost to innermost) dura mater, arachnoid and pia mater that together are called the meninges.

mental retardation
Formerly used term to describe intellectual disability.

mentation
Mental activity, conscious or unconscious, but especially referring to thinking and reasoning.

mesencephalon
midbrain
Rostral part of the brainstem that contains nuclei of cranial nerves controlling shape and movement of the eye.

N-methyl-D-aspartate (NMDA).
Excitotoxic non-essential amino acid used experimentally to identify a specific subset of glutamate receptors.
**N-methyl-D-aspartate (NMDA)-type glutamate receptor**
One of the various types of receptors of the neurotransmitter glutamate.

*Note 1:* It is both a ligand-gated and voltage-gated cation channel.

*Note 2:* It is believed to be involved in memory and learning.

See also α-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid (AMPA) receptor, N-methyl-D-aspartate (NMDA).

**1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine** (MPTP)
Synthetic substance causing parkinsonism.

*Note:* Originally a toxic by-product in the illicit manufacture of the synthetic opioid meperidine, thus with neurotoxicity first detected in drug abusers, it is used as a model substance for studying the pathogenesis of parkinsonism.

**microglial cell**
Small glial cell; resident macrophage derived as a mononuclear phagocyte that populates the brain in early development.

*Note:* Microglia represent about 15% of all cells in the brain parenchyma and spinal cord and function in areas of neural damage or inflammation. They clear debris and misfolded proteins, assist in synaptic stripping, and contribute to immune surveillance.

**microgliosis**
Morphological response of microglia to injury, characterized by hypertrophy and amoeboid morphology.

*Note:* Microgliosis can arise from resident microglia or from infiltrating blood-borne macrophages.

**midbrain**
See mesencephalon.

**migraine**
Recurrent syndrome usually characterized by unilateral head pain accompanied by symptoms including nausea and vomiting, vertigo, photophobia and other visual phenomena.

*Note:* Migraine can be classified as classic migraine, common migraine, cluster headache, hemiplegic migraine, and ophthalmoplegic migraine.

After [5]

See also aura, prodromal stage.

**migrainous infarction**
Stroke that occurs in connection with a migraine attack.

**Minamata disease**
methylmercury poisoning
Neurological disorder caused by methylmercury intoxication, characterized by tremors, dysarthria, ataxia, and loss of peripheral sensation, hearing and vision.

*Note:* First described in residents of Minamata Bay, Japan, who consumed fish that had accumulated methylmercury derived from industrial waste.

After [5]

**Minnesota multiphasic personality inventory** (MMPI)
MMPI-2-RF
Questionnaire type of psychological test for ages 18 and older. The RF version has 338 true–false statements with seven validity and ten personality scales that may be used in either an individual or group format.
Note: This test has been used outside clinical psychology in legal cases, to screen applicants for certain jobs, and to evaluate treatments for substance abuse.

misosis
Abnormal contraction of the pupil of the eye to less than 2 mm.

Note: Miosis may indicate organophosphate poisoning or opiate intake.

misfolded protein
Protein that has the same amino acid sequence as the normal, functional protein but exhibits a deviant tertiary structure and lacks normal function.

Note: Common neurodegenerative diseases (e.g., Alzheimer disease) are associated with the formation, aggregation and deposition of misfolded proteins in neurons.

See also inclusion body.

mitochondrial membrane potential ($\Delta \psi_m$)
Membrane potential across the inner membrane of the mitochondrion generated by the electron transport chain.

Note: Changes in this potential are associated with exposure to some neurotoxicants.

mixed neuropathy
Dysfunction or degeneration of both motor and sensory nerves.

Monro-Kellie hypothesis
Monro-Kellie doctrine
Monro doctrine
Hypothesis that the intracranial volume is unchangeable and therefore a constant intracranial pressure requires that the sum of the volumes of the three compartments blood, brain tissue and cerebrospinal fluid remains constant.

Moro reflex
See startle reflex.

morphine
$(5\alpha,6\alpha)$-7,8-didehydro-4,5-epoxy-17-methylmorphinan-3,6-diol
The major phenanthrene alkaloid of opium, used as an analgesic, sedative, and anxiolytic.

Note 1: Morphine and its analogues exert their action by binding to morphine receptors in the brain and nervous tissues. The natural ligands of these receptors are peptide neurotransmitters such as endorphin.

Note 2: While chronic consumption of morphine leads to the development of tolerance and physical dependence, the artificial morphine derivative heroin can cause severe addiction after only few doses.

Morris water maze
See water maze test.

motor activity
Physical activity and performance of an animal.

Note: In performance tests, locomotor or ambulatory activity refers to the linear movement of an animal, whereas ambulatory and rearing movements together are referred to as total activity.
motor coordination
Cooperation of the motor neurons and the involved muscles to perform a body movement precisely according to spatiotemporal requirements.

Note 1: Motor coordination involves signals from the organ of equilibrium, the visual system and the cerebellum as well as other neural inputs.

Note 2: Impaired coordination results in ataxia.

motor cortex
Region of the cerebral cortex, located primarily in the frontal lobe, involved in coordinating motor activity.

motor endplate
Complex structure by which the axon of a motor neuron establishes synaptic contact with a skeletal muscle fiber.

motor neuron
Nerve cell in the spinal cord having an axon that leaves the central nervous system to establish a functional connection with an effector (muscle or glandular) tissue. After [5]

motor neuron disease (MND)
Generic term for a heterogenous group of disorders, all affecting motor neurons in the brain, spinal cord, or both.

Note: Examples include spinal muscle atrophy, amyotrophic lateral sclerosis, progressive bulbar paralysis, and primary lateral sclerosis. After [5]

motor system
Part of the central nervous system responsible for control of movement, consisting of the pyramidal system controlling voluntary movement and the extrapyramidal system coordinating involuntary movement.

multiple chemical sensitivity (MCS)
environmental illness
idiopathic environmental intolerance
Intolerance condition attributed to extreme sensitivity of individuals to various environmental chemicals, found in air, food, water, building materials, or fabrics.

Note 1: This syndrome is characterized by the patient's belief that his or her symptoms are caused by very low-level exposure to environmental chemicals. The term "chemical" is used to refer broadly to many natural and man-made substances, some of which have several chemical constituents.

Note 2: Several theories have been advanced to explain the cause of multiple chemical sensitivity, including allergy, toxic effects, and neurobiological sensitization. There is insufficient scientific evidence to confirm a relationship between any of these possible causes and symptoms.

[1]

multiple sclerosis (MS)
Common demyelinating (see demyelination) disorder of the central nervous system, causing patches of sclerosis (plaques) in the brain and spinal cord.

Note: Autoantibodies targeting myelin basic protein are believed to play an important role.
muscarinic
Referring to agents that stimulate the postganglionic parasympathetic receptor, named after the prototypical mushroom alkaloid, muscarine [2,5-anhydro-1,4,6-trideoxy-6-(trimethylammonio)-D-ribo-hexitol].

Note 1: The muscarinic receptor has a recognition site for acetylcholine.
Note 2: Muscarinic receptors are distinguished from nicotinic receptors, thus allowing classification of cholinergic receptors as muscarinic and nicotinic.
Note 3: Drugs that bind with muscarinic cholinergic receptors but do not activate them, thus preventing access to acetylcholine, include atropine and scopolamine.

muscarinic receptor
One of the two main classes of acetylcholine receptors (see also nicotinic receptor) that responds to muscarinic agents.

muscle spindle
neuromuscular spindle
Sensory organ in the body of a striated muscle containing afferent and efferent nerve fibers that detect passive muscle stretch and convey information to the central nervous system to cause reflex resistance to this stretch.

mydriasis
Dilation of the pupil.
Note: Mydriasis can be a physiological response to light, a sign of brain trauma, or caused by drugs such as atropine.
See also miosis.

myelin
Electrically insulating lipoprotein layers that are produced by glial cells and surround the axons of the neurons.
Note: It is produced by oligodendrocytes in the central nervous system and by Schwann cells in the peripheral nervous system.
See also myelin sheath.

myelin basic protein
Major component of myelin, that helps organizing the correct assembly of the lipids and proteins in myelin sheets.

Note 1: Absence of myelin basic protein in animals results in seizures.
Note 2: Myelin basic protein levels in the cerebrospinal fluid are elevated in various demyelinating disorders, including multiple sclerosis where autoantibodies against myelin basic protein are believed to play a role.

myelin-associated glycoprotein
Transmembrane glycoprotein that plays an important role in the interaction between axons and myelin and affects myelination during nerve regeneration.

myelination
The acquisition, development, or formation of a myelin sheath around a nerve fiber.
See also demyelination.

myelin sheath
Concentric layers of myelin surrounding the axons of some neurons.
Note: The myelin sheath increases the conduction velocity of electrical impulses.
myelogram
X-ray of the spinal canal following injection of a contrast material into the surrounding cerebrospinal fluid spaces.

myelomeningocele
Protrusion of the spinal cord and its coverings through a defect in the vertebral column.

myelopathy
1. Any functional or pathologic disturbance in the spinal cord.
2. Disorder of the myelopoietic tissues of the bone marrow.

myopathy
Any disease of muscle.

myotonia
Prolonged contraction or delayed relaxation of a muscle after mechanical or brief electrical stimulation.
After [5]
Note: Myotonia is indicative of an abnormality of ion channels of the muscle membrane, and is often an example of an ion channelopathy.

NG2 cell
polydendrocyte
Glial cell of the central nervous system, distinct from an oligodendrocyte or astrocyte, that may serve as a precursor of oligodendrocytes, and that takes its name from expression of proteoglycan NG2.

narcosis
Nonspecific, reversible depression of central nervous system function, marked by stupor or unconsciousness.
After [8]

narcotic
1. Nonspecific usage – an agent that produces insensibility or stupor.
2. Specific usage – any natural or synthetic substance that has morphine-like actions.
See also opioid.
After [1]

neocortex
Outer layer of the cerebral cortex that supports higher brain functions, especially cognitive function and language in humans.
Note: It includes most of the cerebral cortex except for the hippocampus.

neoplasm
New and abnormal formation of tissue as a consequence of growth by cell proliferation that may continue after the initial stimulus that initiated the proliferation has ceased, and may develop into a tumor.
After [1]

nerve
Ensheathed bundle of nerve fibers that conveys information between the central nervous system and other regions of the body.
See also cranial nerve, peripheral nervous system.
nerve cell
See neuron.

nerve conduction study
Measure of the functional integrity of a nerve with a stimulating electrode, placed on the skin over the nerve, and a more distal recording electrode, to determine the velocity of the impulse that passes along the nerve between the electrodes.

nerve conduction velocity
Rate of progression of a nerve impulse in a peripheral nerve or in its largest component nerve fibers.
Note: It is measured to provide information on the intactness of the nerve.

nerve fiber
Axon with its surrounding myelin sheath.

nerve gas
nerve agent
Volatile chemical with neurotoxic features intended for use in warfare to disable or kill the organism rapidly after inhalation or skin contact, and classified as a prohibited weapon of mass destruction by The Chemical Weapons Convention (CWC).
Note: Some organophosphates are characteristic representatives of nerve gas, including the G series (e.g., sarin [(RS)-propan-2-yl methylphosphonofluoridate], tabun [(RS)-ethyl N,N-dimethylphosphorimidocyanidate]), the V series (e.g., VX [ethyl {2-[bis(propan-2-yl)amino]ethyl}sulfanyl}(methyl) phosphinate], VG [O,O-diethyl S-[2-(diethylamino)ethyl] phosphorothioate]), and some insecticides.

nerve growth factor (NGF)
One of a family of proteins known as neurotropins that function as signaling molecules to induce axon growth, branching, elongation and survival of neurons.

nerve root
Proximal end of a spinal nerve nearest its attachment to the spinal cord.

nervous system
The entire neuronal apparatus, composed of both the central nervous system and the peripheral nervous system.
After [5]

neural activity
Metabolic and electrical activity of neurons.
Note: Brain regions active during task performance can be studied with implanted electrodes or with non-invasive methods such as electroencephalography and functional magnetic resonance imaging.

neuralgia
Paroxysmal pain extending along the course of one or more nerves.

neural network
neronal network
A functionally interconnected set of neurons, generally in the central nervous system.
Note: In computer science, the term refers to an interconnected set of electronic components designed to mimic or exploit functional aspects of the human brain.
neural stem cell
Multipotent cell, with mitotic potential, that may serve as a precursor for neuroprogenitor cells.
Note: Adult neural stem cell refers to a cell localized in specific niches of the adult central nervous system, capable of generating new neurons.

neurectomy
Excision of a nerve or part of a nerve.

neurite
Outgrowth or projection of either an axon or a dendrite from the neuron cell body that is the structural basis of the neural network.

neurite outgrowth
Phenomenon in which neurons tend to send out neurites to make contact with other nerve cells.
Note: These outgrowths can be induced by electrical stimulation, neurotropic factors, and other stimuli.

neuritic plaque
See amyloid plaque.

neuritis
Inflammation of a nerve.
Note: Neuritis may also be used to denote non-inflammatory nerve lesions of the peripheral nervous system.

neurobehavior core test battery (NCTB)
A set of seven tests, recommended by the World Health Organization (WHO) in 1983, to detect neurotoxicity in human populations.
Note: The battery consists of digit symbol, digit span, pursuit aiming, Benton visual memory, simple reaction time, Santa Ana dexterity, and profile of mood states tests.

neuroblastoma
Tumor originating from the sympathetic nervous system.
Note: It is found mostly in infants and children.

neurodegenerative disease
Disease of the brain and (or) peripheral nervous system with progressive loss of neuronal function, accompanied by changes in morphology and subcellular organization of the nervous system.

neurodevelopmental toxicity
1. Adverse effect of a substance that disrupts developmental processes of the nervous system.
2. Toxicity in which the developing nervous system shows heightened sensitivity compared with the adult nervous system.

neuroendocrine (system)
Cooperating network of the nervous system and hormonal system.
Note: An example is the action of the pituitary gland, which responds to neuronal signals from the hypothalamus by secreting hormones into the circulation.

neurofibril
Part of a filamentous structure found in the cell body, axons, dendrites, and sometimes synaptic endings of neurons, consisting of bundles of neurofilaments and neurotubules.
neurofibrillary tangle
Intracellular accumulation of aggregates of hyperphosphorylated tau protein or paired helical filaments consisting of the tau protein, a microtubule-associated protein that normally stabilizes the cytoskeleton.

Note: Neurofibrillary tangles are characteristically found in neurons of the cerebral cortex of patients with Alzheimer disease.

neurofibroma
Tumor of the peripheral nervous system representing an abnormal collection of Schwann cells and connective tissue.

neurofilament
Class of intermediate filament of the neuronal cytoskeleton, providing support for the axon and dendrites. See also neurofibril.

neurogenesis
Formation of nerve cells or of the nervous system.

neurogenic
1. Originating in, starting from, or caused by, the nervous system or nerve impulses.
2. Relating to neurogenesis.

[5]

neurogenic shock
Condition of decreased blood pressure, slow heart rate and insufficient perfusion of the body with blood, caused by loss of autonomic control (see autonomic nervous system) following acute trauma to the brain or spinal cord.

neurohypophysis
Posterior lobe of the pituitary gland.

neuroimaging
Process of producing images of the structure or activity of the brain or other parts of the nervous system.

Note: Current neuroimaging techniques include magnetic resonance imaging and computerized tomography.

neuroinflammation
Complex series of local immune responses within the nervous system to deal with a threat to the neural environment from infection, injury, or trauma.

Note: In the brain, the process is initiated by microglial release of cytokines, often leading to increased blood–brain barrier permeability and a secondary lymphocyte-mediated inflammation.

neuroleptic
Any of a class of psychotropic drugs used to treat psychosis, particularly schizophrenia.

Note: Neuroleptics include the phenothiazines, thioxanthene, and butyrophenone derivatives and the dihydroindolones.

After [5]

neurolysis
1. Breakdown of nervous tissue from disease or injury.
2. Therapeutic destruction of a nerve or nerves to treat intractable pain.
3. Surgical freeing of a nerve from adhesions of the neural sheath.
neuroma
Tumor made up largely of nerve cells.

neuromuscular junction (NMJ)
See motor endplate.

neuron n., /ən/ adj.
nerve cell
Electrically excitable cell type consisting of a cell body, axon, and dendrites that is the basis of brain function and of peripheral sensory and motor activity.
Note: Neurons cooperate in neural networks via chemical neurotransmitters at the synapses.

neuropathic
Disorder involving destruction of the cell bodies of neurons.

neuron-specific enolase
Enzyme of glucose metabolism, normally found in nervous tissue, that catalyzes the dehydration of 2-phosphoglycerate.
Note: Elevated concentrations in the blood are associated with various disease, including neuroblastoma and non-neuronal tumors.

neuropathological examination
Application of gross and histopathologic methods to study toxic changes in the morphology and histology of the nervous tissues and the brain.
Note: This can be a very detailed part of neurotoxicity evaluation that may reveal mechanisms of action.

neuropathy n., /əp/ adj.
Pathological change in the peripheral nervous system.
Note: It may occur as a localized lesion, or secondary to systemic toxicity (e.g., from alcohol consumption) or a generalized medical condition (e.g., diabetes).

neuropathy target esterase (NTE)
neurotoxic esterase
Enzyme that is phosphorylated by organophosphate compounds and is believed to be involved in the delayed neuropathy of organophosphates.

neuropeptide
One of a group of small proteins (peptides) that serve as neurotransmitters in the brain, autonomic nervous system and neuroendocrine system.
See also endorphin, enkephalin.

neuroprogenitor cell
Precursor cell that is capable of differentiating into specific cell types of the nervous system.
Note 1: The term typically refers to a cell that has further committed beyond an early neural stem cell, either by being located in a particular region of the nervous system or destined for a particular type of neuron.
Note 2: The renewal potential of neuroprogenitor cells is typically reduced relative to neural stem cells.

neuroprotective
Agent or property of an agent that protects neurons from damage and (or) from the process of aging or degeneration of the brain.
neuropsychological testing
Assessment, under standardized conditions, of an individual’s brain function as it impacts upon cognitive function, thought processes, behavior and personality.

Note 1: Such tests are designed to measure a psychological function known to be linked to a particular brain structure or pathway and often measure reaction times, motor performance or cognitive association (see motor activity).

Note 2: An initial training period may be required so that each individual starts the testing at an optimized performance level, although most neuropsychological assessments compare an individual’s raw score to a normative sample score of the population.

neurotoxic
Poisonous to structures and (or) functions of the brain and nerves.

neurotoxicant
Substance that can produce functional or structural damage to the nervous system.

neurotoxic esterase (NTE) assay
Test in which delayed neuropathy resulting from hydrolytic cleavage of organophosphate esters is studied with measurement of the responsible enzyme activity,
See also hen test, neuropathy target esterase.

neurotoxicology
Discipline applying principles of both neuroscience and toxicology to study the ability of certain substances to alter nervous system structure or function.

neurotoxic shellfish poisoning (NSP)
Toxic shellfish poisoning characterized by nausea, vomiting, and mild neurological symptoms such as dysarthria, paresthesia, ataxia, and vertigo caused by ingestion of shellfish (specifically, bivalve molluscs) contaminated with the polyether brevetoxin and its derivatives produced by the dinoflagellate Karenia brevis.

neurotoxin
Any substance that has the potential to damage the nervous system.

Note: In the narrower sense, neurotoxins are of biological origin, like toxins in general. However, the term neurotoxin is also in general use for non-biological substances.

neurotransmission
Process by which a presynaptic cell, upon excitation, releases a specific agent (a neurotransmitter) that crosses the synapse to stimulate or inhibit the postsynaptic cell.

After [5]
See also neurotransmission, retrograde.

neurotransmission, retrograde
Neurotransmission wherein a neurotransmitter is sent from the postsynaptic to the presynaptic membrane in order to modify a signal.

neurotransmitter
Biochemical that is released upon excitation from a presynaptic membrane, crosses the synaptic space and binds to a receptor on the postsynaptic membrane, where it induces a signal that may be either stimulatory or inhibitory.
neurotropic
neurotrophic
Having an affinity for nerve cells or tissues of the nervous system.

neurotropin
neurotrophin
Family of secreted proteins that promote the survival, differentiation, and function of neurons. See also nerve growth factor.

neurotubule
Microtubule found in neurons. See also neurofibril.

neurovascular
1. Relating to both the nervous system and the vascular system.
2. Relating to the vasomotor nerves that supply the walls of the blood vessels. After [5]

nicotinic
Referring to a substance or effect that mimics acetylcholine at the neuromuscular junction, at autonomic ganglia and at other locations in the brain.

Note 1: These substances bind to a specific class of cholinergic receptors denoted nicotinic acetylcholine receptors.

Note 2: The prototype substance is the parasympathomimetic alkaloid, nicotine [(S)-3-[1-methylpyrrolidin-2-yl]pyridine].

See also muscarinic.

nicotinic receptor
One of the two main classes of acetylcholine receptors (see also muscarinic receptor), ligand-gated ion channels that open upon binding nicotine as well as acetylcholine.

nine-hole box test
5–9 hole attention box test
Behavioral test based on the five-choice serial reaction time task, which allows the study of attention based on a test animal learning from which hole (typically one of five open holes in an arc of nine) a visual (light) cue was given, with a food pellet reward for nose-poking the correct hole. See also nose-poke test.

Nissl body
Nissl granule
Nissl substance
Granular structure consisting of rough endoplasmic reticulum, found in neurons. See also chromatolysis.

nociception
Physiological response to harmful stimuli by specialized nerve endings that transmit a signal perceived as pain by the brain. See also antinociception.
node of Ranvier
Short interval in the myelin sheath of a nerve fiber where the axon is invested only by scant cytoplasmic processes of the neighboring Schwann cells or, in the central nervous system, of oligodendroglia cells.
Note: At the nodes the axonal membrane is not insulated and contains a high density of voltage-gated Na⁺ channels (see voltage-gated ion channel) that generate action potentials.

noradrenaline
4-[(1R)-2-amino-1-hydroxyethyl]benzene-1,2-diol
Catecholamine hormone acting as a postganglionic adrenergic mediator at α- and β-adrenergic receptors.
Note 1: It is also stored in and released from chromaffin granules in the adrenal medulla.
Note 2: It has strong vasoconstrictive (see vasopressor) effects.

norepinephrine
See noradrenaline.

nose-poke test
Test allowing study of attention deficit based on noting the success of a test animal in gaining a food pellet reward for nosing the correct hole in a box. A specific example is the nine-hole box test.

numbness
Imprecise term for absent or reduced touch perception, as well as paresthesia.

nystagmus
Involuntary rhythmic oscillation of the eyeballs.
After [5]

occipital lobe
One of the four major lobes of each cerebral hemisphere, situated within the occiput, containing most of the neural apparatus of visual processing.

occiput
Posterior part of the head or skull.

olfaction
Detection of odors.

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

oligodendrocyte
oligodendroglial cell
Type of glial cell that produces the myelin sheath in the central nervous system.
Note: Schwann cells perform a comparable function in the peripheral nervous system.

oligodendroglial cell
See oligodendrocyte.

oligodendroglioma
Glioma arising from the oligodendrocytes.
Note: Usually a slow-growing, well-circumscribed tumor.
open field test
Procedure to observe changes in motor activity and rearing, in which a rodent is placed on a surface and distance and patterns of movement are recorded.
Note 1: Typically the animal is placed within a circular enclosed arena with grid lines marking the floor and the number of line crossing and rearing events are counted within a defined period of time.
Note 2: Automated procedures include video capture methods using photocell devices to measure activity as photocell beam breaks.

operant behavior, schedule-controlled
See schedule-controlled operant behavior.

opiate receptor
One of a group of G-protein-coupled receptors that bind morphine and endogenous substances that have morphine-like effects.
Note: Such endogenous substances include endorphins and enkephalins.

opiod
Synthetic narcotic having properties consistent with binding to opiate receptors, but not derived from opium.

opium
Extract of the opium poppy, Papaver somniferum, containing morphine as a major psychoactive component.

organoleptic
1. Relating to perception by a sensory organ.
2. Involving the use of sensory organs, e.g., organoleptic tests.

organometallic compound
Compound having covalent bonds between one or more metal atoms and one or more carbon atoms of an organyl group.
Note: Organification of metals such as Mn, Pb, Sn and Hg often enhances their neurotoxicity.

organophosphate
Organic ester of phosphoric acid.
Note: These are often acetylcholinesterase inhibitors used as pesticides or prohibited agents in chemical warfare.

organophosphate-induced delayed neuropathy (OPIDN)
Disorder, typically with symptoms of pain and weakness in the extremities, resulting from neuronal death associated with organophosphate poisoning (either chronic or a late effect of acute poisoning).

osmophobia
olfactophobia
Morbid fear of odors.
[5]

oxidative stress
Adverse effects occurring when the generation of reactive oxygen species (ROS) in a system exceeds the system's ability to neutralize and eliminate them; excess ROS can damage a cell's lipids, protein, and DNA.
[1]
pain
1. Conscious awareness of an unpleasant sensation mediated by nerve conduction of a stimulus from a site of tissue injury to the brain.
   
   Note 1: Chemical mediators of pain include histamine, bradykinins, and prostaglandins.
   
   Note 2: The sensation may occur or persist when the injured tissue is no longer present, as in phantom pain.

2. Sensation one feels when hurt in body or mind.
   
   After [9]

pain, neuropathic
Pain initiated by nerve injury, not mediated by nociception.

pain, nociceptive
See nociception.

pain, phantom
phantom limb pain
Sensation that an amputated limb is still present, often associated with pain.

pain receptor
See nociception.

paired helical filament (PHF)
Describing the aggregation of hyperphosphorylated tau protein into neurofibrillary tangles.

palpitation
1. Unduly rapid or throbbing heartbeat that is noted by a patient; it may be regular or irregular.
2. Undue awareness by a patient of a heartbeat that is otherwise normal.

papilledema
Edema of the region of the head of the optic nerve in the retina (the optic disc).

Note: Often caused by increased intracranial pressure.

paralysis
Total or partial loss of motor function.

Note: Paralysis may occur as a consequence of disease or injury to the muscle, or impairment of its nerve supply.

paralytic shellfish poisoning (PSP)
Illness that is a consequence of consumption of bivalve molluscs such as mussels, oysters, and clams that have ingested large quantities of microalgae containing saxitoxin or its derivatives.

Note: Initially there is tingling, numbness, and burning of the tongue and lips, which spreads to the face, neck, arms, fingertips, legs, and toes; this is followed by weakness of the upper and lower limbs, loss of motor coordination, and, in severe cases, paralysis.

paraoxonase
Any of several related enzymes that hydrolyze aryl esters and lactones, notably organophosphate pesticides including the acetylcholinesterase inhibitor, paraoxon.
Note: The most studied, PON1, is associated with high density lipoprotein and is considered to have beneficial antioxidant, including antiatherosclerotic, properties.

paraplegia
Paralysis of both lower limbs.

parasympathetic nervous system
Division of the autonomic nervous system involved in stimulating digestive secretions, slowing heart rate, constricting the pupils of the eyes, and dilating blood vessels.
Compare sympathetic nervous system.
After [1]

parasympathomimetic
cholinomimetic
1. n., Substance that produces effects resembling those of impulses transmitted by the postganglionic fibers of the parasympathetic nervous system.
2. adj., Producing effects resembling those of impulses transmitted by the postganglionic fibers of the parasympathetic nervous system.

paresis
Slight or incomplete paralysis.
[1]

paresthesia
paraesthesia
Abnormal or unexplained tingling, pricking, or burning sensation on the skin.
[1]

parietal lobe
One of the four major lobes of each cerebral hemisphere situated between the frontal and occipital lobes, above the temporal lobe.

Parkinson disease
idiopathic parkinsonism
primary parkinsonism
Degenerative disorder of the central nervous system resulting from decreased production of the neurotransmitter dopamine in the basal ganglia (notably the substantia nigra).
Note 1: Characterized by rhythmic muscle tremor, rigidity of movement, and a mask-like face.
Note 2: Usually idiopathic, although inherited cases occur.

parkinsonism, secondary
Neurological syndrome resembling Parkinson disease and often resulting from decreased dopamine production as a consequence of neurodegenerative changes in the substantia nigra.
Note: There are a number of known causes for secondary parkinsonism, including exposure to a number of neurotoxic substances.

passive avoidance test
Fear-motivated test in which rodents learn to avoid an otherwise preferred environment in which they are exposed to an aversive stimulus.
Note: The latency to avoid the aversive stimulus indicates changes of learning and (or) memory.
paw-reaching test
Test used to reveal motor deficits, usually of central origin, exhibited on the contralateral side by reduced ability of a test animal to extend the forelimb.

Note 1: Typically performed with rodents in an apparatus resembling a staircase on which reward food pellets are placed on steps of increasing distance, or with larger animals reaching under a barrier for a reward.

Note 2: Often used to assess traumatic brain injury deficits or recovery.

PC-12 cell
Cell of an established line originally derived from a pheochromocytoma of the rat adrenal medulla.

Note: PC-12 cells dividing in culture will terminally differentiate into neuron-like cells under an appropriate stimulus (e.g., nerve growth factor), making them a common model for studying neuronal differentiation and properties in culture.

Peripheral nervous system (PNS)
One of the two major divisions of the nervous system, made up of the nerves and ganglia lying outside the brain and spinal cord that transmit sensory and motor signals to and from the central nervous system.

Peripheral neuropathy
Neuropathy affecting nerves of the peripheral nervous system.

Peristalsis
Progression of a wave of smooth muscle contraction followed by relaxation along the length of a muscular tube.

Note: Typically occurring in the gastrointestinal tract and ureter.

Pesticide
Substance intended to kill pests.

Note: In common usage, any substance used for controlling, preventing, or destroying animal, microbial, or plant pests.

[1]

Phenylketonuria (PKU)
Autosomal recessive disorder resulting from mutations that impair the function of the enzyme phenylalanine hydroxylase.

Note 1: The resulting failure of phenylalanine metabolism in the liver leads to accumulation of phenylalanine that causes mental retardation, seizures, and other neurological disorders in untreated individuals.

Note 2: The excess phenylalanine is metabolized to phenyl pyruvate (2-oxo-3-phenylpropanoic acid) (“phenylketone”) that is detected in the urine.

Pheochromocytoma
Tumor of the chromaffin cells of the adrenal medulla that results in excessive secretion of norepinephrine and other catecholamines.

Pheromone
Substance used in olfactory communication between organisms of the same species to elicit a change in sexual or social behavior.

[1]
phonophobia
Abnormal fear of loud sound, or occasionally of voices.

photophobia
Abnormal visual intolerance of light.

Note: The two main types of photoreceptor cells are rod cells, responsible for vision at low light intensities, and cone cells, responsible for colour and high acuity vision at higher light intensities.

photoreceptor cell
Specialized neuron found in the retina, involved in detecting light and transducing the signals of vision.

Note: The two main types of photoreceptor cells are rod cells, responsible for vision at low light intensities, and cone cells, responsible for colour and high acuity vision at higher light intensities.

pia
pia mater
Innermost of three membranous layers, together composing the meninges (see meninx), that surrounds and adheres to the brain and spinal cord.

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.

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: It is structurally and functionally divided into anterior and posterior lobes. The anterior lobe secretes growth hormone (somatotropin), thyroid-stimulating hormone (TSH), adrenocortocotropic 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).

plexus
Network of interconnecting nerves, blood vessels or lymphatic vessels.
See also ganglion.

pneumotaxic center
pontine respiratory group
Neural network in the brainstem involved in regulating respiration.

poison n., /ous adj.
Substance that, taken into or formed within the organism, impairs the health of the organism and may kill it.

polarization
See membrane polarization.

polydendrocyte
See NG2 cell.
polyneuritis
Inflammation of several peripheral nerves simultaneously.

polyneuropathy
Neuropathy (distal axonopathy) of the peripheral nervous system, often affecting the extremities in a bilateral distribution, and characterized by numbness, tingling, and paresthesia.

Note: It may be caused by infections or toxic substances (notably alcohol abuse), may be associated with chronic diseases such as diabetes, or may be idiopathic.

pontine respiratory group
See pneumotaxic center.

PorSolt test
See swimming test.

posterior fossa
Pocket in the back of the skull that accommodates the cerebellum and the midbrain.

postsynaptic
Event or structure at the distal side of a synaptic cleft.

potentiation (in neurology)
post-tetanic potentiation
Increase in strength of synaptic transmission between two neurons after repetitive stimulation of the presynaptic partner.

Note 1: Typical duration of the effect is minutes.

Note 2: Attributed to various mechanisms including presynaptic biochemical changes, e.g., kinase activation or increased Ca^{2+} availability.

potentiation, long-term
Potentiation lasting up to several months.

Note: Considered to be a major mechanism involved in learning and memory.

presynaptic
Event or structure at the proximal (transmitting) side of a synaptic cleft.

prodromal stage
Phase before the onset of full-blown disease.

Note: Often referring to visual disturbances and (or) mood changes before the further development of a migraine headache or epileptic seizure.

See also prodrome.

prodrome
Symptom(s) heralding impending onset of a disease.

See also prodromal stage.

profile of mood state (POMS) test
Procedure in which a test subject is asked to indicate his/her mood during the past week, by quickly marking specified emotional words on a scale between “not at all” and “extremely.”

Note: Tested moods typically include tension, anxiety, depression, hostility, vigor, fatigue and confusion.
proprioeption
Sense of the movement or position of the body independent of vision.
*Note:* Often gained from input from *nerve* terminals in the muscles, tendons, and joint capsules.
See also *proprioceptor*.
After [5]

proprioceptor
Sensory organ in a muscle, tendon or joint capsule that senses position or state of contraction.
After [5]

prosencephalon
forebrain
*Anterior* part of the brain, including the *cerebral hemispheres*, the *thalamus*, and the *hypothalamus*.

proximal
Nearest the point of origin or closest to the medial plane of the body.
After [5]

**pseudobulbar affect (PBA)**
Involuntary emotional outburst (typically crying or laughing).
*Note:* PBA is a result of neurological injury or disease, but the precise mechanism is unknown.

pseudocholinesterase
*See* butyrylcholinesterase.

pseudomeningocele
Part of the *cerebrospinal fluid* that, in contrast to a *meningocele*, is not surrounded by *dura*.

pseudotumor cerebri
idiopathic intracranial hypertension
Disorder with increased *intracranial pressure*, *cerebral* edema, and frequently *papilledema*, symptoms that resemble the effects of a *tumor* but without the occurrence of one.

psychoactive
Having the ability to alter mood, behavior, *cognitive function* or mental state.
*Note:* Usually referring to a pharmacologic agent.
After [5]
Compare *psychotropic*.

psychoneuroimmunology (PNI)
Study of links between the *brain* and the immune system, recognizing an interaction between psychological states and the outcome of immune responses to disease.

psycho/sis n., /tic adj.
Disordered thought processes that may include changes in *cognitive function*, perception, belief, behavior and personality; altered awareness of reality.

psychosis, organic
organic brain syndrome
*Psychosis* with a known physical (anatomic, disease-related or toxic) cause.
psychotropic
Capable of affecting the mind, emotions and behavior.
*Note:* Often referring to drugs used to treat mental illness.
After [5]
Compare psychoactive.

**puffer fish**
Marine fish of the order Tetraodontiformes and family Tetraodontidae.
See also tetrodotoxin.

**Purkinje cell**
Large neuron forming part of a layer of cells in the cerebellum.
*Note:* By releasing γ-aminobutyric acid, these inhibitory gabaergic neurons regulate and coordinate motor activity.

**pursuit aiming test**
Procedure in which a subject is instructed to place a dot in defined sites (such as a number of circles), as quickly as possible.
*Note:* The test provides information about eye-to-hand coordination.
See also neurobehavior core test battery.

**putamen**
Part of the basal ganglia that plays a role in coordinating movement and learning.
*Note:* It is involved in neurodegenerative diseases such as Parkinson disease.

**pyknosis**
Clumping of nuclear chromatin and shrinkage of the cell nucleus during cell degeneration.

**pyramidal cell**
Large neuron of the cerebral cortex having a triangular cell body in histological section with several dendrites at the base and one large apical axon.
*Note 1:* Pyramidal cells are also found in other brain areas such as the hippocampus.
*Note 2:* They are thought to play a role in cognitive function.

**pyramidal system**
See motor system.

**pyrethrin**
See pyrethroid.

**pyrethroid**
Synthetic molecule with structural similarity to the natural pyrethrins found in plants of the genus Chrysanthemum.
*Note:* They are a major class of insecticide and cause paralysis by blocking closure of axonal sodium ion channels, thus depolarizing (see depolarization) neurons.

**quadriplegia**
Paralysis of both upper and both lower limbs.
radial arm maze
Apparatus with a central platform and equidistant arms (usually eight), at the end of which is a reward (e.g., a food pellet).
Note: A rodent placed in the center is observed seeking the shortest way to the reward, as an indicator of spatial learning and memory.
See also maze, water maze test.

radiculitis
Inflammation of the spinal nerve roots leading to pain and hyperesthesia radiating along the nerve.

reaction time
Time between an inducing sensory stimulus and a measured physiological response.
See also simple reaction time test.

rearing (in toxicity testing)
Of a rodent or other animal raising itself on its hind legs.

rebound
Reappearance of original symptom(s), often exacerbated, following cessation of treatment.
See also headache, rebound.

receptor
Molecule that binds to a ligand, thus leading to biochemical signaling inside the cell.
Note: Receptors are usually transmembrane molecules that bind ligands at the extracellular surface (e.g., growth factor receptors) or soluble intracellular molecules (e.g., steroid hormone receptors).
[3]

β-receptor
See β-adrenergic receptor.

reflex
Involuntary reaction in response to a stimulus applied to the periphery following its transmission to the nervous centers in the brain or spinal cord.
Note: Often contraction of a muscle due to a stimulus applied to its proprioceptors.
After [5]

reflex sympathetic dystrophy (RSD)
Diffuse persistent pain usually in an extremity.
Note: Often associated with vasomotor disturbances, interruption of the nerve supply, and limitation of joint movement, frequently following local injury.
After [5]

reinforcement (in psychology)
Use of a stimulus in operant conditioning to increase the likelihood that a particular behavior will occur.
Note 1: Reinforcement may be positive (using a desirable stimulus) or negative (removing or withholding an adverse stimulus).
Note 2: In contrast to reinforcement, use of stimuli to decrease a behavior is called punishment.

relaxant
Agent that reduces muscle tension.
See also relaxation.
relaxation
Reduction in or release of tension, as in reversal of muscle contraction, relief of anxiety, etc.

reperfusion
Restoration of the blood supply to an organ or tissue following a period of ischemia.
*Note:* Reperfusion itself may cause further injury to the tissue (ischemia-reperfusion injury), for instance due to production of reactive oxygen species or excessive Ca\(^{2+}\) influx.

repolarization
Returning of a cell’s membrane potential to its resting potential following depolarization.

resolution phase
Return to a sexually unexcited state following orgasm.

resting potential
Baseline membrane potential.

resting tremor
See tremor.

retina
Multilayered structure lining the inner surface of the eye, containing photoreceptor cells and the neural components for transmission of signals to the optic nerve.

retrograde axonal transport
Transport of material from the nerve ending back to the cell body.
See also axonal transport.

reuptake
Transporter-dependent resequestration of a neurotransmitter by a presynaptic neuron, terminating synaptic transmission.

Rey–Osterrieth complex figure (ROCF) test
Procedure in which the test subject first copies a complicated drawing and then is asked to draw it from memory.
*Note:* This tests several aspects of cognitive ability, including visuospatial perception and memory.

righting reflex
Reflex that restores the correct orientation of the body when taken out of the upright position.

righting test
righting test, aerial
Experimental measurement of an animal’s (usually a rodent’s) ability to land in an upright position at the end of a fall.
*Note:* Imprecise measure of proprioception and motor coordination.
See also righting reflex.

righting test, elevated
See rotarod test.
righting test, surface
Test animal is placed on its back and the time to retain an upright position with four paws in contact with the surface is measured.
Note: This may be used to study development.

rod cell
See photoreceptor cell.

rotarod test
Experimental observation of an animal’s (usually a rodent’s) ability to stay on a rotating rod without falling off.
Note 1: The length of time the animal stays on the rod is a relative measure of motor coordination, balance and resistance to fatigue.
Note 2: Maintaining an upright position on the rod involves the righting reflex.

saccadic eye movement
Rapid or jerky movement of the eyes from one line of sight to another, as in reading or correction of a jerky nystagmus.
After [5]

sagittal
Vertical (longitudinal) plane dividing the body into right and left sections.

Saint Anthony fire
1. See ergotism.
2. Referring to inflammatory conditions of the skin such as erysipelas.

Santa Ana dexterity test
Procedure in which a test subject stands in front of a plate with 48 square holes and an equal number of fitted pegs, each having a cylindrical upper part and square base, and is asked to fit the pegs into the holes as quickly as possible by turning them 180 degrees, first with one hand and in a subsequent trial with the other hand.
Note: The test measures eye-to-hand coordination and gives information about right/left-handedness.
See also neurobehavior core test battery.

schedule-controlled operant behavior (SCOB)
Experimental procedure in which operant behavior (see conditioning, operant) is assessed following a conditioning stimulus delivered at a pre-determined duration and frequency ('schedule of reinforcement'), thus allowing comparison of the effects of magnitude, frequency and duration of the stimulus.

schedule of reinforcement
Frequency, duration, dose, and (or) intensity of a conditioning stimulus (see stimulus, conditioned).
See also schedule-controlled operant behavior.

Schwann cell
Glial cell in the peripheral nervous system that produces myelin for the axons of the peripheral nerves.

sclerosis
Hardening of an organ or tissue, especially that due to excessive growth of fibrous tissue.
[1]
Scombroid poisoning
Constellation of symptoms resembling an allergic reaction, caused by eating the meat of decaying fish that has high levels of histamine (in this context sometimes referred to as scombrotoxin).
*Note:* Typically but not exclusively caused by fish of the *Scombridae* family, such as tuna, albacore and mackerel.

sedative
Substance that exerts a soothing or tranquillizing effect, or describing the effect itself.
After [1]
Compare tranquilizer.

seizure
Sudden change in neural activity, leading to convulsions and (or) changes in consciousness of varying degrees of severity.
See also epilepsy.

selective serotonin reuptake inhibitor (SSRI)
Drug in a subclass of substances that interfere with the resequestration of serotonin by the presynaptic membrane.
*Note:* This particular subclass is used in the treatment of clinical depression.

senile plaque
See amyloid plaque.

dementia n., /e adj.
Characteristics typically associated with old age, especially relating to memory loss and other mental impairment.
See also dementia.

sensory neuron
Nerve cell specialized for detecting and transducing signals from external or somatic stimuli.

serotonin
See 5-hydroxytryptamine.

serotonergic
Relating to a nerve that releases or responds to serotonin as a neurotransmitter.

shellfish poisoning
Illness associated with consumption of seafood contaminated with toxins.
*Note 1:* These are primarily associated with consumption of bivalve molluscs such as mussels, clams, oysters and scallops that accumulate toxins produced by microscopic algae such as dinoflagellates and diatoms, and cyanobacteria.

*Note 2:* Four syndromes with overlapping features are recognized. These are amnesic shellfish poisoning, diarrheal shellfish poisoning, neurotoxic shellfish poisoning, and paralytic shellfish poisoning.

shunt
n. Fistula or prosthetic device that diverts fluid from one system to another.
vb. To bypass or divert.
After [5]
sick building syndrome
Health effects or loss of a sense of well-being associated, by those who experience it, with time spent in a certain building or room.

Note 1: Neurological symptoms include headache, irritability, and fatigue.
Note 2: Potential causes include poor ventilation and indoor air quality, outgassing of volatile substances from building materials, molds, and ozone build-up from office machines. Psychological factors may play a role.

silver staining
Method for visualization of macromolecules such as nucleic acids and proteins, typically in electrophoretic gels or formalin-fixed histological sections, based on the reduction of silver salts to metallic silver or formation of crystalline silver compounds.

See also Golgi staining.

simple reaction time test
Procedure to assess psychomotor speed in which a test subject is presented at irregular intervals with a visual stimulus, such as a coloured dot on a screen, and is asked to press a button immediately after noticing the stimulus.

Note 1: Premature or untimely late reactions should be minimized during an initial practise phase.
Note 2: Many variations of the test exist.

See also neurobehavior core test battery.

SLUDDE
SLUDGE
Acronym for the constellation of signs salivation, lacrymation, urination, defecation, dyspnea/gastrointestinal upset, and emesis.

Note 1: These are consequences of stimulation of the parasympathetic nervous system by some poisons such as mushroom toxins, nerve gases, or organophosphate insecticides.
Note 2: Sometimes used as an acronym to remember functions of the parasympathetic nervous system.

social interaction test
Behavioral test wherein a rodent stranger is placed in the cage of a domestic rodent and intensities and duration of interactions (e.g., sniffing, aggression, avoidance) between the socially unacquainted animals are observed.

soporific
Substance producing sleep.
[1]

spasm
Sudden involuntary contraction of one or more muscles; includes cramps and contractures.
[5]

spasmolytic
Agent that relieves smooth muscle spasms.
After [5]

spastic
Relating to spasticity.
spasticity
Increased muscle tone at rest, characterized by resistance to passive stretch.
*Note:* Increased deep tendon reflexes and clonus are additional manifestations.
After [5]

sphingolipid
Member of a class of lipids containing the aliphatic amino alcohol sphingosine, or related structures, thus including ceramide.
*Note:* Abnormal sphingolipid metabolism is associated with lipid storage diseases such as Tay–Sachs and Niemann–Pick diseases.

sphingomyelin
One of a family of phospholipids found especially in the central nervous system, containing 1-phosphocholine bound to a ceramide.

sphingosine
2-aminooctadec-4-ene-1,3-diol
Major lipid component of cell membranes.
See also sphingolipid, sphingomyelin.

spina bifida
Failure of the neural tube to close, resulting in the absence of part of the arch of the spinal column and exposure of the spinal cord and its covering membranes.

spinal cord
Portion of the central nervous system outside the brain and inside the vertebral column.

spinal tap
See lumbar puncture.

spine
See vertebral column.

staircase test
See paw-reaching test.

startle reaction
startle response
startle part
Rapid physiological and psychological response to a sudden, unexpected stimulus that includes muscle contraction (see contracture) and avoidance posturing, with an increase in heart rate, respiration, skin conductance, and a negative affect.
*Note:* In the startle response test, types and intensities of reactions (e.g., motor activity) are evaluated.

startle reflex
The earliest brainstem-mediated part of the reflex reaction to a stimulus perceived as threatening.
*Note:* The Moro reflex in the newborn is a distinct but related response to a fear of falling, usually characterized by spreading of the arms and crying.

startle response test
See startle reaction.
startle response test, acoustic
Neurophysiological examination in which an animal is exposed to a brief (e.g., 40 ms) acoustic stimulus, followed by measurement of the animal’s motor reaction.
See also startle reaction.

status epilepticus
Repeated or prolonged seizure lasting more than 30 min.

stenosis
Narrowing or stricture of a channel, as of a blood vessel or muscular tube.

stereology
Three dimensional interpretation of two dimensional cross sections of tissue and other materials.
Note 1: Often used for estimating the number of neurons or neuronal cell bodies in a volume of tissue.
Note 2: Stereology is different from tomography; the latter requires a complete set of planes to reconstruct the internal structure whereas stereology uses statistical methods to reconstruct the image from representative plane sections.

stereology, unbiased
Stereological method that uses systematic analysis of defined spatial fractions of a sample to estimate numbers of neuronal nuclei independent of changes in size and shape that may occur during tissue processing.

stimulant
Agent that rouses or increases mental or physical activity.

stimulus
1. Anything that produces a reaction in an organism.
2. That which causes a response in an excitable tissue (see excitation) such as a nerve, muscle or gland.

stimulus, conditioned
Stimulus that comes to evoke a response after repetitive pairing with another stimulus that automatically elicits that response.
Compare stimulus, unconditioned. See also classical conditioning.

stimulus, unconditioned
Stimulus that automatically elicits a paired response, such as food eliciting salivation in a hungry animal.
Compare stimulus, conditioned.

striatum
Subcortical structure of striations of gray matter and white matter in the forebrain that serves as the major input to the basal ganglia, specifically the caudate nucleus, the putamen and the striated structure linking them.
See also corpus striatum.

stroke (in neuroscience)
Acute impairment of circulation to a part of the brain, lasting more than 24 h.
After [5]

stupor
State of impaired consciousness showing diminution in response to environmental stimulation.
After [5]
subarachnoid
Underneath the arachnoid membrane.

subarachnoid hemorrhage
Loss of blood into the space between the arachnoid membrane and the pia mater.

subdural
Between the dura mater and the arachnoid membrane.

substantia nigra
Component of the basal ganglia involved in production of the neurotransmitter dopamine. See also parkinsonism.

sudorific
See diaphoretic.

supratentorial
Intracranial contents located above the tentorium of the cerebellum, notably the white matter of the cerebral hemispheres, often describing functional symptoms of diseases of the white matter that lead to physical and mental disability.

supratentorial herniation
Abnormal protrusion of brain structures into compartments above the tentorium, or over the edge of the tentorium, due to increased intracranial pressure.

swimming test
forced swimming test
Porsolt forced swimming test
behavioral despair test
Procedure in which a test animal (rodent) is forced to swim to avoid drowning.
Note 1: Most often used to test antidepressants, which increase the time the animal spends in escape-directed swimming behavior.
Note 2: Interpretation is controversial, as cessation of swimming could be a learned response to hasten removal by the investigator.
Compare tail suspension test.

sympathetic nervous system
Part of the autonomic nervous system originating in the thoracic and lumbar regions of the spinal cord that tends to inhibit or oppose the physiological effects of the parasympathetic nervous system, as in tending to reduce digestive secretions, increase the heart rate, and contract blood vessels.
[1]

eysopathomimetic
adrenergic
1. n., Substance that produces effects resembling those of impulses transmitted by the postganglionic fibers of the sympathetic nervous system.
2. adj., Having the property of producing such effects.
After [1]
synapse n., /tic adj.
Functional junction between two neurons, where a nerve impulse is transmitted from one neuron to another, by neurotransmitters.
After [1]

synaptic cleft
Narrow gap between the presynaptic and postsynaptic regions of two communicating neurons, into which neurotransmitters are secreted.
See also synapse.

synaptic inhibition
Suppression of synaptic transmission.
Note: This may occur presynaptically or postsynaptically, result from electrical or chemical effects, and be deliberately produced or part of a physiological process.
See also inhibitory post-synaptic potential.

synaptic plasticity
1. Ability of synapses to form and reform continually, including to allow learning.
2. Malleability of signal strength arising at the level of synaptic transmission.
See also augmentation, facilitation, long-term potentiation, potentiation.

synaptic stripping
Removal of dysfunctional synapses.
See also microglial cell.

synaptic transmission
Neurotransmitter release, diffusion, and receptor binding, propagating an impulse across a synapse.

syringomyelia
syrinx
Cyst occurring within the spinal cord as a result of accumulation of cerebrospinal fluid.

T-maze
Simple type of test apparatus with three arms shaped like the letter “T.” After placing a rodent in the middle, it is recorded how often the animal enters each arm.
Note 1: Rewards can be used for motivation, or the inborn trend for alternation can be tested.
Note 2: The Y-maze is a variation of the T-maze where the apparatus is “Y”-shaped.
See also maze.

tachycardia
Antonym: bradycardia
Abnormally fast heartbeat.
[1]

tail flick test
Procedure in which the tail of a rodent is heated and the time taken for the animal to flick its tail (latency) is taken as a measure of the relative degree of antinociception.
See also tail immersion test.
tail immersion test
Procedure in which the tail of a rodent is placed in a hot water bath (typically between 54 °C and 58 °C) and the time it takes the animal to remove the tail from the water is interpreted as a measurement of the relative degree of antinociception.
See also tail flick test.

tail suspension test
Procedure in which a mouse is suspended by its tail and the time spent attempting to right itself is observed.
Note 1: Most often used to test antidepressants, which usually increase the time the animal spends in escape-directed righting behavior.
Note 2: Both the tail suspension test and the swimming test are sometimes referred to as behavioral despair tests.

tapping test
See finger tapping test.

tauopathy
One of a class of neurodegenerative diseases, including Alzheimer disease, associated with abnormal aggregation of tau proteins.
See also paired helical filament, Western Pacific amyotrophic lateral sclerosis and parkinsonism–dementia complex.

tau protein
One of a class of proteins that stabilizes microtubules, particularly in neurons, astrocytes, and oligodendrocytes of the central nervous system.
Note 1: The various tau proteins are splice variants of the single gene microtubule-associated protein tau (MAPT).
Note 2: Defective tau proteins are associated with dementias such as Alzheimer disease.

TDP-43 transcription factor
Cleavage product (43 kDa) of the transactive response (TAR) DNA binding protein (TARDBP) that targets TAR DNA and transcriptionally represses HIV-1.
Note: Pathological accumulation of the misfolded protein cleavage product has been associated with frontotemporal dementia and amyotrophic lateral sclerosis.

Teleky’s sign
See wrist drop.

temperature sensitivity
1. Adverse responsiveness to heat or cold.
Note: It is associated with a number of medical conditions, some physiologically well-defined (as in cold intolerance in hypothyroidism) and others less so (as in reported chronic fatigue syndrome).
2. Phenotype arising from engineered or selected gene mutations in experimental organisms characterized by an altered temperature permissive for optimal growth or survival.

temporal lobe
One of the four major lobes of each cerebral hemisphere, situated at the base of the brain.
Note: It is involved in memory, language comprehension, emotion, and processing sensory input.
tentorium
tentorium cerebelli
Fold of the dura mater separating the cerebrum from the cerebellum.

tetanic
Pertaining to tetanus, characterized by tonic muscle spasm.

[tetanus]
1. Sustained muscle contraction.
2. Disease caused by tetanus toxin and characterized by painful, sustained muscle contraction with spasticity and paralysis.

tetanus toxin
tetanospasmin
Neurotoxin produced by the bacterium Clostridium tetani growing in anaerobic conditions, producing the disease tetanus.
Note: Its action is in major part due to suppression of release of the inhibitory neurotransmitter, \( \gamma \)-aminobutyric acid.

tetanus toxin-binding ganglioside
Ganglioside that binds tetanus toxin, facilitating its internalization at the presynaptic neuronal membrane.

tetany
Neurological syndrome characterized by muscle twitches, cramps, and spasms; and in severe forms, by spasm of the muscles of the larynx (laryngospasm) and seizures.
Note: Often reflecting irritability of the central and peripheral nervous systems resulting from a low concentration of ionized calcium in the serum.

tetrad test
Battery of tests typically for the effects of cannabinoids in rodents that includes hypomotility assessed by an open field test, catalepsy assessed by the bar test, hypothermia measured by rectal temperature, and analgesia measured by avoidance of heat, e.g., in the tail immersion test.

tetrodotoxin (TTX)
\(4R,4aR,5R,6S,7S,8S,8aR,10S,12S\)-2-azaniumylidene-4,6,8,12-tetrahydroxy-6-(hydroximethyl)-2,3,4,4a,5,6,7,8-octahydro-1H-8a,10-methano-5,7-(epoxymethanoxy)quinazolin-10-olate
Neurotoxin that inhibits action potentials by blocking sodium ion channels.
Note: It is produced by bacteria living in symbiosis with fish of the order Tetraodontiformes, including trigger fish and puffer fish.

tetrodotoxin (TTX)-insensitive
Denoting a class of sodium ion channels, found mainly in the heart, that is not blocked by tetrodotoxin.
Note: Their significance lies in experimental characterization of channel subtypes in neuromuscular physiology, development, and drug design.

thalamus
Paired midline structure of the vertebrate brain that surrounds the third ventricle, relays information on sensation, movement and spatial sense to the cerebral cortex, and plays a role in the regulation of wakefulness.
thigmotaxis
Movement of an organism toward or away from a mechanical stimulus, physical contact, or spatial discontinuity, as in movement away from touch by a physical stimulus or exploring close to a wall.

thoracic spine
Portion of the vertebral column of the upper back, between the cervical spine and lumbar spine, in humans consisting of 12 vertebrae designated T1 to T12.

threshold potential
Level of depolarization that must be reached to trigger an action potential in an excitable cell. See also excitation, hyperpolarization.

thrombus
Clot in the cardiovascular formed from components of the blood, which may be attached to the vessel wall and/or occlusive.

tic douloureux
See trigeminal neuralgia.

tingling
Pricking type of paresthesia.
[5]

tinnitus
Continual noise in an ear, such as ringing, buzzing, roaring, or clicking.
[1]

tolerance n., /t adj.
1. Becoming less responsive to a stimulus, especially following continued exposure.
2. Resisting the action of a poison or drug taken repeatedly or in large doses. After [5]

tomography
Construction of an image of a three-dimensional structure from a series of planar sections obtained with penetrating waves. 
Note: Wave sources include light (optical tomography), X-rays, an electron beam producing X-rays (electron beam tomography; EBT), and γ-rays (positron emission tomography; PET),

torticollis
wry neck
Spasmodic contraction of neck muscles drawing the head to one side with the chin pointing to the other side.

toxicant
See toxic substance.

toxic shellfish poisoning
See shellfish poisoning.

toxic substance
Substance causing injury to living organisms as a result of physicochemical interactions.
[1]
toxin
Poison produced by a biological organism such as a microbe, animal, plant, or fungus.

*Note:* Examples are botulinum toxin, *tetrodotoxin*, pyrrolizidine alkaloids, and α-amanitin \[(\text{cyclic}(\text{L}-\text{asparaginyl-4-hydroxy-L-proly-(R)-4,5-dihydroxy-L-isoleucyl-6-hydroxy-2-mercapto-L-tryptophylglycyl-L-isoleucylglycyl-L-cysteinyl})\text{ cyclic (4 → 8)}-\text{sulfide(R)-S-oxide}\]. [1]

tranquilizer
Drug that calms and pacifies with minimal *sedating* or *depressant* effects.

*Note 1:* A tranquilizer decreases anxiety (i.e., has *anxiolytic* properties) or agitation without necessarily decreasing awareness or wakefulness. Tranquilizers at higher dose may induce sleep.

*Note 2:* Minor tranquilizers are *sedatives*, examples of which include benzodiazepines, antihistamines, alcohol, cannabis, and chloral hydrate. Major tranquilizers include *antipsychotic* drugs and *neuroleptics*.

transcutaneous electronic nerve stimulation (TENS)
Electrical *stimulus* applied across the skin to excite *nerves* for therapeutic purposes.

*Note:* Most often used to control *pain*.

transsynaptic
Referring to an event, such as transmission of a nerve impulse, across a *synapse*.

transtentorial herniation
Bulging of *brain* tissue from the *cerebrum* through the notch of the *tentorium*, caused by increased *intracranial pressure*.

treadmill test
Procedure used to assess limb function and strength, often to evaluate models of peripheral neuropathy, in which a rodent is placed in an enclosed lane upon a surface that can be made to move at variable speed in a retrograde manner, thus allowing observation of the animal’s gait dimension during sustained attempt at forward motion.

*Note 1:* The test can be modified to provide a test of endurance in the animal, or to test *motor coordination* and gait.

*Note 2:* A treadmill test with humans is commonly used in a medical setting for assessment of cardiac performance and pulmonary function.

tremor
Repetitive, often regular and usually involuntary oscillatory movement caused by alternating contractions of opposing muscle groups.

After [5]

*Note 1:* There are many causes of tremor, some of them benign.

*Note 2:* A characteristic tremor originating in *cerebellar* pathways upon intentional fine movement (“intention tremor”) can occur during alcohol *withdrawal*.

*Note 3:* A coarse rhythmic (3–5 Hz) tremor of the hands and forearms that appears when the muscles are relaxed (“resting tremor”) is characteristic of *Parkinson disease*.

trigeminal nerve
Fifth cranial nerve, supplying sensation to the face and controlling motor activity of mastication.
trigeminal neuralgia
tic douloureux
Severe, paroxysmal bursts of pain in one or more branches of the trigeminal nerve, often induced by touching trigger points in or about the mouth.

[5]

triptan
Member of a class of drugs based on tryptamine that act as serotonin receptor agonists.
Note: Used for pain relief in the treatment of migraine headache.

tumor
tumour
Any abnormal swelling or growth of tissue, whether benign or malignant.
Compare neoplasm.
[1]

unconscious
1. Not in a conscious state.
2. In psychoanalytic theory, describing feelings and motivations of which one is unaware that nevertheless shape behavior.

uncus
Anterior projection of the gray matter surrounding the hippocampus, covered by a region of the temporal lobe, involved in olfaction.
Note 1: Often a source of seizures accompanied by hallucinations and a sense of unpleasant odors.
Note 2: The uncus may herniate over the notch of the tentorium and compress the third cranial nerve.

upper motor neuron
Neuron whose cell body lies in the cerebral cortex or brainstem and whose axon carries impulses to a lower motor neuron.

vagus nerve
Tenth cranial nerve, arising from the medulla oblongata.
Note: It carries parasympathetic and motor impulses to the larynx and pharynx, thoracic organs and abdominal viscera, as well as containing afferent fibers that supply information about the state of the organs to the central nervous system.

vasoconstriction
Decrease in the diameter of the lumen of a blood vessel (especially in the arteries and arterioles) as a result of contraction of smooth muscles in the vessel walls.
Note: This results in an increase in vascular resistance followed by an increase in blood pressure.
Antonym vasorelaxation.

vasodilator
Agent that induces vasorelaxation.

vasopressor
vasoconstrictor
pressor
Agent that induces vasoconstriction.
vasorelaxation
vasodilatation
Increase in the diameter of the lumen of the blood vessels as a result of relaxation of smooth muscles in the
vessel walls.
Note: This results in a decrease in vascular resistance followed by a decrease of blood pressure.
Antonym vasoconstriction.

vasospasm
angiospasm
Contraction of the muscular wall of blood vessels with sustained vasoconstriction possibly leading to tissue
ischemia.

venom
Animal toxin generally used for self-defense or predation and usually delivered by a bite or sting.
[1]

ventricle
Normal cavity within an organ, as in the brain or heart.
Note 1: In the brain there are two lateral ventricles and two midline (called the third and fourth) ventricles.
Note 2: The ventricles in the brain are filled with, and produce most of, the cerebrospinal fluid, and play a
critical role in its circulation.

ventriculo-atrial shunt
Surgical shunt draining cerebrospinal fluid into a cardiac atrium, to relieve pressure in hydrocephalus.

ventriculogram
Radiographic image of the cerebral ventricles.

ventriculomegaly
Enlargement of the cerebral ventricles.
See also hydrocephalus.

ventriculo-peritoneal shunt
Surgical shunt draining cerebrospinal fluid into the peritoneum of the abdominal cavity, to relieve pressure in
hydrocephalus.

vermis (in neuroanatomy)
vermis cerebelli
Narrow central part of the cerebellum between the two cerebellar hemispheres.

vertebra
One of the bony segments that together make up the bony column surrounding the spinal cord.
Note: Inclusive of the vertebrae of the cervical, thoracic and lumbar spine and the fused sacral and coc-
cygeal bones.

vertebral column
spine
Bony structure consisting of the vertebrae and enclosing the spinal cord.
vertigo
Dizziness; an illusion of movement as if the external world were revolving around one’s self or as if one’s self were revolving in space.
[1]

vigilance
Ability to maintain concentration or sustain attention over prolonged periods of time.

vigilance decrement
Decreased vigilance measured as a decline in the ability to maintain an accurate voluntary response to signals with time.

visual cortex
Part of the cerebral cortex located in the occipital lobe, responsible for processing the images of sight.

voltage-gated ion channel
Ion channel that opens and closes in response to changes in membrane potential.
Compare ligand-gated ion channel.

water maze test
Morris water maze test
water navigation test
Procedure in which a rat or mouse is placed in a pool of water and observed to swim, using visual environmental clues, to an invisible submerged platform that allows escape from the water.
Note: It is intended to test spatial memory and learning.
See also Biel water maze, maze, water maze test.

Wernicke aphasia
fluent aphasia
receptive aphasia
sensory aphasia
Type of aphasia associated with damage to Wernicke’s area or alternatively the medial temporal lobe of the brain, characterized by preservation of speech but with loss of meaningful language and language comprehension.

Wernicke’s area
Region of the brain in superior temporal gyrus of the dominant hemisphere, associated with comprehension of written and spoken language.

Wernicke-Korsakoff syndrome
alcoholic encephalopathy
Co-existence of Wernicke encephalopathy (with gait, ocular and mental disturbances) and Korsakoff psychosis (severe memory loss, often with aphasia, apraxia or agnosia) caused by vitamin B1 deficiency in the context of chronic alcohol abuse.

Western Pacific amyotrophic lateral sclerosis and parkinsonism–dementia complex (ALS-PDC)
Neurodegenerative disease observed in the islands of Guam, Indonesia, Japan and Papua New Guinea, showing combinations of characteristics of amyotrophic lateral sclerosis, atypical parkinsonism with dementia, or dementia alone that may present sequentially during life.
Note 1: Neurotoxins of the cycad plant, such as β-N-methylamino-L-alanine (L-BMAA) produced by symbiotic cyanobacteria, and methylazoxymethanol (MAM), are suspected causative agents.

Note 2: Polyproteinopathy, notably tauopathy, is a common causative feature underlying the different clinical manifestations.

white matter
substransia alba
Portion of the brain and spinal cord consisting mainly of myelinated axons and glial cells.

Note: Neurons of the white matter transmit signals between areas of gray matter within the cerebrum, to lower brain centers, and up and down the superficial aspect of the spinal cord.

Wisconsin card sorting test (WCST)
Procedure in which cards, depicting different arrangements, numbers, and colors of symbols, are presented to the test subject, who is asked to make the most appropriate match of a test card without further instructions.

Note: Performance requires integration of higher level cognitive functions and the procedure is sometimes referred to as a frontal lobe test.

withdrawal
Cessation of exposure to a substance, being characterized by adverse symptoms.

Note: The symptoms may be physiological or psychological in origin. See also addiction.

withdrawal effect
Adverse event following withdrawal from a person or animal of a drug to which they have been chronically exposed or on which they have become dependent.

Wolfgram protein
Acidic proteolipid protein component of central nervous system myelin.

wrist drop
radial nerve palsy
Inability to extend the wrist as a result of peripheral nerve damage, causing drooping of the hand.

Note: When associated with the effects of lead poisoning on the radial nerve, it is called Teleky’s sign.

Y-maze
See T-maze.

zebrafish
Tropical fish (Danio rerio) about 4 cm long, commonly used as a model organism in developmental biology.

Note 1: The zebrafish has been used in studies of neurodevelopment, neuronal networks and the blood–brain barrier.

Note 2: The zebrafish is also used for alternative toxicity testing; multiple endpoints for developmental neurotoxicity are known.

Membership of sponsoring bodies

Membership of the Committee of the Chemistry and Human Health Division during the preparation of this report (2014-2015) was as follows:

Annex I – Abbreviations

ACh – acetylcholine
AChE – acetylcholinesterase
ACTH – adrenocorticotrophic hormone
AD – autonomic dysreflexia
ADH – antidiuretic hormone
ADHD – attention deficit hyperactivity disorder
AIF - 1 – allograft inflammatory factor 1
ALS – amyotrophic lateral sclerosis
ALS - PDC – amyotrophic lateral sclerosis and parkinsonism–dementia complex
AMPA - 2 – amino-3-(3-hydroxy-5-methyl-1,2-oxazol-4-yl)propanoic acid
ANS – autonomic nervous system
ASP – amnesic shellfish poisoning
AV – arteriovenous
AVM – arteriovenous malformation
AVP – arginine vasopressin
BDNF – brain-derived neurotrophic factor
BMMA – β-N-methylamino-L-alanine
BNT – Boston naming test
BSID – Bayley scales of infant development
CAR – conditioned avoidance response
CAT – computerized axial tomography
CNS – central nervous system
CPT – continuous performance test
CSE – chronic solvent-induced encephalopathy
CSF – cerebrospinal fluid
CT – computed tomography
CTS – carpel tunnel syndrome
CWC – Chemical Weapons Convention
DNT – developmental neurotoxicity testing
DSP – diarrheal (diarrhetic) shellfish poisoning
DSST – digit symbol substitution test
EBT – electron beam tomography
ECT – electroconvulsive therapy
EEG – electroencephalography
EMG – electromyography
EPSP – excitatory post-synaptic potential
ERG – electroretinogram
FSH – follicle-stimulating hormone
FTD – frontotemporal dementia
FTLD – frontotemporal lobular degeneration
FUS – fused in sarcoma (transcription factor)
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AChE</td>
<td>Acetylcholinesterase</td>
</tr>
<tr>
<td>ACTH</td>
<td>Adrenocorticotropic hormone</td>
</tr>
<tr>
<td>AD</td>
<td>Alzheimer's disease</td>
</tr>
<tr>
<td>ADH</td>
<td>Alcohol dehydrogenase</td>
</tr>
<tr>
<td>ADMA</td>
<td>Asymmetric dimethylarginine</td>
</tr>
<tr>
<td>ADP</td>
<td>Adenosine diphosphate</td>
</tr>
<tr>
<td>AED</td>
<td>Antiepileptic drug</td>
</tr>
<tr>
<td>AFR</td>
<td>Axon fasciculation rate</td>
</tr>
<tr>
<td>AMRA</td>
<td>Acetylcholinesterase</td>
</tr>
</tbody>
</table>
Annex II—Representative List of Neuroactive Substances

Note 1: The table shows a selection of substances which are important in neurotoxicology, not only as poisons, but also as experimental tools to study toxic mechanisms.

Note 2: Many assays today are done in cell cultures, where no blood–brain barrier exists. However, substances which do not cross this barrier in the living organism, but act in cell cultures, were included, e.g., many endogenous neurotransmitters.

Note 3: Many neurotoxic substances have more than a single biochemical endpoint. Only the major mechanism is noted here. Likewise, when a substance has several toxicological endpoints, only very characteristic endpoints are listed.

Note 4: For several metallic elements included in the Table, multiple chemical species show speciation-dependent toxicities and mechanisms, e.g., inorganic and methylated species of mercury. This is indicated as “speciation-dependent” under the heading Mechanism, but individual species are not listed.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Mechanism</th>
<th>Neurological effect</th>
<th>Occurrence / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetylcholine (2-acetoxy-N,N,N-trimethylethanaminium)</td>
<td>neurotransmission</td>
<td>cholinergic</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>acrylamide (prop-2-enamide)</td>
<td>nerve-terminal damage</td>
<td>peripheral and central neuropathy</td>
<td>potential food contaminant, industrial monomer</td>
</tr>
<tr>
<td>acetylsalicylic acid (2-(acetoxy)benzoic acid)</td>
<td>prostaglandin synthesis inhibitor</td>
<td>pain relief</td>
<td>analgesic drug</td>
</tr>
<tr>
<td>aluminium</td>
<td>complex, speciation-dependent</td>
<td>encephalopathy</td>
<td>chemical element</td>
</tr>
<tr>
<td>γ-amino butyric acid (GABA) (4-aminobutanoic acid)</td>
<td>neurotransmitter</td>
<td>gabaergic</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>aminoglycosides</td>
<td>accumulation in inner ear, hair cell damage</td>
<td>possible loss of hearing (ototoxicity)</td>
<td>antibiotics</td>
</tr>
<tr>
<td>2-amino-3-(3-hydroxy-5-methyl-1,2-oxazol-4-yl)propanoic acid (AMPA)</td>
<td>glutamate receptor (AMPA type) agonist</td>
<td>excitotoxic damage</td>
<td>experimental physiology</td>
</tr>
<tr>
<td>amitriptyline (3-(10,11-dihydro-5H-dibenzo[a,d]cycloheptene-5-ylidene)-N,N-dimethylpropan-1-amine)</td>
<td>non-selective serotonin reuptake inhibitor</td>
<td>inducing sleep</td>
<td>antidepressant drug</td>
</tr>
<tr>
<td>Substance</td>
<td>Mechanism</td>
<td>Neurological effect</td>
<td>Occurrence / Use</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>---------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>atropine (((\text{RS})-(8\text{-methyl-8-azabicyclo[3.2.1]oct-3-yl})\text{3-hydroxy-2-phenylpropanoate}))</td>
<td>muscarinic acetylcholine receptor antagonist</td>
<td>parasympathetic inhibition, mydriasis</td>
<td>poison of deadly nightshade, therapeutic drug</td>
</tr>
<tr>
<td>barbiturates (e.g., phenobarbital) (5\text{-ethyl-5-phenylpyrimidine-2,4,6(1\text{H},3\text{H},5\text{H})-trione})</td>
<td>GABA-A receptor modulator</td>
<td>sedation, sleep, anesthesia</td>
<td>sedative drugs</td>
</tr>
<tr>
<td>benzodiazepines (e.g., diazepam) (7\text{-chloro-1-methyl-5-phenyl-3H-1,4-benzodiazepin-2-one})</td>
<td>GABA-A receptor modulator</td>
<td>sedation, sleep, anesthesia</td>
<td>sedative drugs</td>
</tr>
<tr>
<td>botulin toxin</td>
<td>acetylcholine-release blocker</td>
<td>paralysis</td>
<td>toxin of Clostridium botulinum, muscle relaxant</td>
</tr>
<tr>
<td>bromoacetone ((1\text{-bromoacetone}))</td>
<td>neurogenic inflammation</td>
<td>lachrymation</td>
<td>incapacitating agent ('tear gas')</td>
</tr>
<tr>
<td>bromocriptine (((5'\alpha)-2\text{-bromo-12'-hydroxy-5'-\text{2-methylpropyl})-3',6',18-trioxo-2'-\text{(propan-2-yl)ergotaman)})</td>
<td>dopamine-D2-agonist</td>
<td>relief of dopamine deficiency and endocrine dysfunctions</td>
<td>endocrine disorders and Parkinson disease</td>
</tr>
<tr>
<td>α-bungarotoxin</td>
<td>nicotinic acetylcholine receptor antagonist</td>
<td>paralysis, respiratory failure</td>
<td>experimental physiology</td>
</tr>
<tr>
<td>capsaicin (((\text{E})-N-[(4\text{-Hydroxy-3-methoxyphenyl})\text{methyl}]\text{-8-methyl-6-enamide}))</td>
<td>neurogenic inflammation</td>
<td>local inflammation</td>
<td>spice, topical analgesic</td>
</tr>
<tr>
<td>carbamates</td>
<td>acetylcholinesterase inhibition (reversible)</td>
<td>symptoms of organophosphate poisoning</td>
<td>insecticides</td>
</tr>
<tr>
<td>carbon dioxide (environmental)</td>
<td>unresolved</td>
<td>loss of consciousness</td>
<td>component of air</td>
</tr>
<tr>
<td>carbon monoxide (endogenous)</td>
<td>hemoglobin poison</td>
<td>unconsciousness</td>
<td>incomplete combustion</td>
</tr>
<tr>
<td>carbon monoxide (endogenous)</td>
<td>neuro(gaso) transmitter</td>
<td>basic neuronal function</td>
<td>cellular production</td>
</tr>
<tr>
<td>chlorotoxin</td>
<td>chloride channel blocker</td>
<td>muscle convulsions</td>
<td>poison of the scorpion</td>
</tr>
<tr>
<td>cocaine (\text{methyl (1R,2R,3S,5S)-3-(benzoyloxy)-8-methyl-8-azabicyclo[3.2.1]octane-2-carboxylate)})</td>
<td>reuptake blocker</td>
<td>heightened awareness, local anaesthesia</td>
<td>plant-derived poison</td>
</tr>
<tr>
<td>curare (e.g., tubocurarine) (6,6'\text{-dimethoxy-2,2',2'\text{-tetramethyltubocuraran-2',2'-dium-7',12'-diol)})</td>
<td>nicotinic acetylcholine receptor antagonist</td>
<td>flaccid muscle paralysis</td>
<td>plant-derived poison, muscle relaxant</td>
</tr>
<tr>
<td>dendrotoxin</td>
<td>potassium channel blocker</td>
<td>muscle convulsions</td>
<td>poison of the mamba snake</td>
</tr>
<tr>
<td>diclofenac ((2\text{-2,6-dichloranilino) phenylacetic acid}))</td>
<td>prostaglandin synthetase inhibitor</td>
<td>pain relief</td>
<td>analgesic drug</td>
</tr>
<tr>
<td>Substance</td>
<td>Mechanism</td>
<td>Neurological effect</td>
<td>Occurrence / Use</td>
</tr>
<tr>
<td>-----------</td>
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<td>------------------</td>
</tr>
<tr>
<td>domperidone</td>
<td>dopamine antagonist</td>
<td>disorientation, dizziness</td>
<td>antinauseant</td>
</tr>
<tr>
<td>(5-chloro-1-(1-[3-(2-oxo-2,3-dihydro-1H-benzo[d]imidazol-1-yl)propyl]piperidin-4-yl)-1H-benzo[d]imidazol-2(3H)-one)</td>
<td>dopamine antagonist</td>
<td>dopaminergic</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>ecstasy</td>
<td>neurotransmitter</td>
<td>appetite modulation</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>See 3,4-methylenedioxymethamphetamine</td>
<td>neurotransmitter, presynaptic inhibition</td>
<td>endogenous mediator</td>
<td></td>
</tr>
<tr>
<td>endorphin</td>
<td>neuromodulator</td>
<td>pain reduction, mood improvement</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>enkephalin</td>
<td>neuromodulator</td>
<td>pain reduction, mood improvement</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>ergotamine</td>
<td>neurotransmitter antagonist/antagonist</td>
<td>hallucination</td>
<td>ergot fungus alkaloid</td>
</tr>
<tr>
<td>ethanol, acute</td>
<td>unresolved</td>
<td>drunkenness</td>
<td>alcoholic beverages</td>
</tr>
<tr>
<td>ethanol, chronic</td>
<td>unresolved</td>
<td>peripheral neuropathy, brain damage (neuronal loss)</td>
<td>alcoholic beverages</td>
</tr>
<tr>
<td>ether</td>
<td>membrane destabilization</td>
<td>anesthesia</td>
<td>inhalation anesthetic</td>
</tr>
<tr>
<td>(diethyl ether)</td>
<td>opioid</td>
<td>pain relief, analgesic, drug of abuse</td>
<td></td>
</tr>
<tr>
<td>fentanyl</td>
<td>GABA-A receptor antagonist</td>
<td>anxiety</td>
<td>benzodiazepine antidote</td>
</tr>
<tr>
<td>(N-1-(2-phenylethyl)-4-piperidinyl)-N-phenylpropanamide</td>
<td>Ca(^{2+}) channel blocker</td>
<td>parkinsonism</td>
<td>anti-migraine drug</td>
</tr>
<tr>
<td>flunazemil</td>
<td>Ca(^{2+}) channel blocker</td>
<td>parkinsonism</td>
<td>anti-migraine drug</td>
</tr>
<tr>
<td>(ethyl 8-fluoro-5-methyl-6-oxo-5,6-dihydro-4(H)-benzo[f]imidazo[1,5-a][1,4]diazepine-3-carboxylate)</td>
<td>dopamine antagonist</td>
<td>parkinsonism</td>
<td>antipsychotic drug</td>
</tr>
<tr>
<td>flunarizine</td>
<td>dopamine antagonist</td>
<td>parkinsonism</td>
<td>antipsychotic drug</td>
</tr>
<tr>
<td>(1-[bis(4-fluorophenyl)methyl]-4-[[2R]-3-phenylprop-2-en-1-yl]piperazine)</td>
<td>endorphin agonist</td>
<td>euphoric action</td>
<td>addictive drug</td>
</tr>
<tr>
<td>haloperidol</td>
<td>dopamine antagonist</td>
<td>parkinsonism</td>
<td>antipsychotic drug</td>
</tr>
<tr>
<td>(4-[4-(4-Chlorophenyl)-4-hydroxy-1-piperidyl]-1-(4-fluorophenyl)-butan-1-one)</td>
<td>metabolite hexane-2,5-dione is a neurotoxic crosslinker</td>
<td>polyneuropathy</td>
<td>solvent</td>
</tr>
<tr>
<td>heroin (morphine diacetate)</td>
<td>metabolite hexane-2,5-dione is a neurotoxic crosslinker</td>
<td>polyneuropathy</td>
<td>solvent</td>
</tr>
<tr>
<td>n-hexane</td>
<td>metabolite hexane-2,5-dione is a neurotoxic crosslinker</td>
<td>polyneuropathy</td>
<td>solvent</td>
</tr>
<tr>
<td>Substance</td>
<td>Mechanism</td>
<td>Neurological effect</td>
<td>Occurrence / Use</td>
</tr>
<tr>
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</tr>
<tr>
<td>histamine (2-(1H-imidazol-4-yl)ethanamine)</td>
<td>vasoactive paracrine mediator, modulator of neurotransmission</td>
<td>headache, nausea, anaphylaxis</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>hydrogen sulfide (environmental)</td>
<td>Inhibition of mitochondrial respiration</td>
<td>respiratory distress, death</td>
<td>gas wells</td>
</tr>
<tr>
<td>hydrogen sulfide (endogenous)</td>
<td>neuro(gaso) transmitter</td>
<td>nausea, apnea</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>γ-hydroxybutyric acid (4-hydroxybutanoic acid)</td>
<td>neurotransmitter</td>
<td>sedation, anesthesia</td>
<td>anesthetic, drug of abuse</td>
</tr>
<tr>
<td>isoflurane ((RS)-1-chloro-2,2,2-trifluoroethyl difluoromethyl ether)</td>
<td>unresolved</td>
<td>anesthesia</td>
<td>inhalation anesthetic</td>
</tr>
<tr>
<td>kainic acid ((2S,3S,4S)-3-(carboxymethyl)-4-(prop-1-en-2-yl)pyrrolidine-2-carboxylic acid)</td>
<td>glutamate (kainate) receptor agonist</td>
<td>excitotoxicity</td>
<td>experimental neurophysiology</td>
</tr>
<tr>
<td>ketamine ((RS)-2-(2-Chlorophenyl)-2-(methylamino)cyclohexanone)</td>
<td>glutamate NMDA receptor antagonist</td>
<td>anesthesia</td>
<td>injection anesthetic</td>
</tr>
<tr>
<td>kolokol-1 (structure not revealed)</td>
<td>endorphin agonist + anesthetic drug</td>
<td>unconsciousness</td>
<td>incapacitating mixture, chemical weapon</td>
</tr>
<tr>
<td>lead</td>
<td>unresolved, speciation-dependent</td>
<td>developmental neurotoxicity</td>
<td>chemical element, environmental and occupational exposure</td>
</tr>
<tr>
<td>lidocaine (2-(diethylamino)-N-(2,6-dimethylphenyl)acetamide)</td>
<td>sodium channel blocker</td>
<td>excitation propagation blockage</td>
<td>local anesthetic</td>
</tr>
<tr>
<td>lysergic acid diethylamide (LSD) ((6aR,9R)-N,N-diethyl-7-methyl-4,6,6a,7,8,9-hexahydroindolo-[4,3-fg]quinoline-9-carboxamide)</td>
<td>NMDA receptor antagonist</td>
<td>psychedelic experience</td>
<td>drug of abuse</td>
</tr>
<tr>
<td>manganese</td>
<td>unresolved, speciation-dependent</td>
<td>manganism</td>
<td>chemical element, occupational exposure</td>
</tr>
<tr>
<td>melatonin (N-[2-(5-methoxy-1H-indol-3-yl)ethyl]acetamide)</td>
<td>hormone</td>
<td>harmonization of circadian rhythm</td>
<td>anti jet-lag drug</td>
</tr>
<tr>
<td>mepyramine (N-(4-methoxybenzyl)-N,N-dimethyl-N-pyridin-2-ylethane-1,2-diamine)</td>
<td>histamine H1 Receptor antagonist</td>
<td>drowsiness</td>
<td>drug for relief of allergy symptoms</td>
</tr>
<tr>
<td>mercury</td>
<td>unresolved, speciation-dependent</td>
<td>developmental neurotoxicity, tremor, personality disorder</td>
<td>chemical element, environmental exposure</td>
</tr>
<tr>
<td>mescaline (2-(3,4,5-trimethoxyphenyl)ethanamine)</td>
<td>serotonin agonist/antagonist</td>
<td>hallucinations</td>
<td>peyote cactus</td>
</tr>
<tr>
<td>methamphetamine, methylamphetamine (N-methyl-1-phenylpropan-2-amine)</td>
<td>various</td>
<td>increased attentiveness (initially)</td>
<td>stimulant, drug of abuse</td>
</tr>
<tr>
<td>Substance</td>
<td>Mechanism</td>
<td>Neurological effect</td>
<td>Occurrence / Use</td>
</tr>
<tr>
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<td>-----------------</td>
</tr>
<tr>
<td>N-methyl-D-aspartate (NMDA)</td>
<td>glutamate (NMDA) receptor agonist</td>
<td>excitotoxicity</td>
<td>experimental neurophysiology</td>
</tr>
<tr>
<td>β-N-methylamino-L-alanine</td>
<td>glutamate receptor excitotoxin, incorporation into proteins</td>
<td>ALS-PDC disease</td>
<td>neurotoxin of cycad plants</td>
</tr>
<tr>
<td>3,4-methylenedioxy-methamphetamine (MDMA), “ecstasy”,</td>
<td>release of serotonin, epinephrine and dopamine</td>
<td>heightened awareness and euphoria</td>
<td>drug of abuse</td>
</tr>
<tr>
<td>methyllethylketone (butan-2-one)</td>
<td>unresolved</td>
<td>potentiation of solvent neurotoxicity</td>
<td>solvent</td>
</tr>
<tr>
<td>1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP)</td>
<td>mitochondrial inhibitor</td>
<td>parkinsonism</td>
<td>experimental neurophysiology</td>
</tr>
<tr>
<td>methysergide</td>
<td>serotonin antagonist, partial</td>
<td>cardiac valve dysfunction</td>
<td>anti-headache drug</td>
</tr>
<tr>
<td>monoamineoxidase (MAO) inhibitor</td>
<td>inhibition of monamine oxidase</td>
<td>increased sensitivity to neuroactive amines</td>
<td>antidepressant</td>
</tr>
<tr>
<td>morphine</td>
<td>endorphin agonist</td>
<td>pain relief, suppression of respiratory function</td>
<td>analgesic drug</td>
</tr>
<tr>
<td>muscarine</td>
<td>agonist of muscarinic acetylcholine receptors</td>
<td>hallucinations</td>
<td>poison in Amanita mushrooms</td>
</tr>
<tr>
<td>muscimol</td>
<td>GABA-A agonist</td>
<td>hallucinations</td>
<td>poison in Amanita mushrooms</td>
</tr>
<tr>
<td>naloxone</td>
<td>endorphin antagonist</td>
<td>restlessness</td>
<td>opiate antidote</td>
</tr>
<tr>
<td>nicotine</td>
<td>nicotinic acetylcholine receptor agonist</td>
<td>nicotine intoxication</td>
<td>tobacco ingredient, insecticide</td>
</tr>
<tr>
<td>nitric oxide</td>
<td>Neuro(gaso) transmitter</td>
<td>vasodilation</td>
<td>endogenous mediator, atmospheric occurrence</td>
</tr>
<tr>
<td>nitriles</td>
<td>axonopathy</td>
<td>excitation (EEC-syndrome) and more</td>
<td>industrial chemicals</td>
</tr>
<tr>
<td>nitrous oxide (laughing gas)</td>
<td>unresolved</td>
<td>anesthesia</td>
<td>inhalation anesthetic</td>
</tr>
<tr>
<td>noradrenaline</td>
<td>neurotransmitter</td>
<td>hypertension, tachycardia</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>organophosphates</td>
<td>acetylcholinesterase inhibitors</td>
<td>acute: salivation, convulsions, respiratory arrest</td>
<td>insecticides, chemical weapons</td>
</tr>
<tr>
<td>Substance</td>
<td>Mechanism</td>
<td>Neurological effect</td>
<td>Occurrence / Use</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
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<td>------------------</td>
</tr>
<tr>
<td>oxalyl diaminopropionic acid</td>
<td>glutamate receptor excitotoxin</td>
<td>Lathyrism</td>
<td>neurotoxin of the grass pea</td>
</tr>
<tr>
<td>(3-[(carboxycarbonyl)amino]alanine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oxime antidotes</td>
<td>reactivation of inhibited acetylcholinesterase</td>
<td>no specific neurotoxicity</td>
<td>antidote for organophosphate poisoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>parathion</td>
<td>acetylcholinesterase inhibitor</td>
<td>typical symptoms of organophosphate poisoning</td>
<td>organophosphate insecticide</td>
</tr>
<tr>
<td>(O,O-diethyl O-(4-nitrophenyl)phosphorothioate)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pentetrazol</td>
<td>GABA-A receptor ligand</td>
<td>seizures</td>
<td>seizure research</td>
</tr>
<tr>
<td>(6,7,8,9-tetrahydro-5H-pyrazolo(1,5-a)azepine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>phencyclidine (angel dust)</td>
<td>NMDA receptor antagonist</td>
<td>hallucinations</td>
<td>drug of abuse</td>
</tr>
<tr>
<td>(1-(1-phenylcyclohexyl)piperidine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>phentolamine</td>
<td>alpha-adrenergic antagonist</td>
<td>hypotension, tachycardia</td>
<td>antihypertensive</td>
</tr>
<tr>
<td>(3-[(4,5-dihydro-1H-imidazol-2-ylmethyl)(4-methylphenyl)amino]phenol)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>piripedil</td>
<td>dopamine agonist</td>
<td>enhanced dopamine activity</td>
<td>antiparkinson drug</td>
</tr>
<tr>
<td>(2-[4-(benzo[1,3]dioxol-5-ylmethyl)piperazin-1-yl]pyrimidine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>polychlorinated biphenyls (PCB)</td>
<td>interference with thyroid hormones</td>
<td>chronic: lowered intelligence</td>
<td>environmental contaminant, formerly many application</td>
</tr>
<tr>
<td>3-quinuclidinyl benzilate</td>
<td>acetylcholine antagonist at muscarinic receptors</td>
<td>confusion, incapacitation</td>
<td>chemical weapon</td>
</tr>
<tr>
<td>(1-azabicyclo[2.2.2]oct-3-yl2-hydroxy-2,2-diphenylacetate)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sarin</td>
<td>acetylcholinesterase inhibitor</td>
<td>typical symptoms of organophosphate poisoning</td>
<td>chemical weapon</td>
</tr>
<tr>
<td>((RS)-propan-2-ylmethylphosphonofluoridate)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>saxitoxin</td>
<td>voltage-gated sodium channel blocker</td>
<td>paralytic shellfish poisoning</td>
<td>flagellate poison</td>
</tr>
<tr>
<td>(3aS-3a-α,4-α,10aR*)-2,6-diamino-4-({[(amino-carbonyl)oxy)methyl]-3a,4,8,9-tetrahydro-1H,10H-pyrrolo(1,2-c)purine-10,10-diol)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-serine</td>
<td>co-neurotransmitter, GABA (NMDA) receptor</td>
<td>excitatory</td>
<td>amino acid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>serotonin</td>
<td>neurotransmitter</td>
<td>various</td>
<td>endogenous mediator</td>
</tr>
<tr>
<td>(5-hydroxytryptamine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sertraline</td>
<td>selective serotonin reuptake inhibitor (SSRI)</td>
<td>restlessness</td>
<td>antidepressant</td>
</tr>
<tr>
<td>((1S,4S)-4-(3,4-dichlorophenyl)-N-methyl-1,2,3,4-tetrahydronaphthalen-1-amine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>solvents</td>
<td>unresolved</td>
<td>drunkenness, narcosis</td>
<td>industry, hobbies</td>
</tr>
<tr>
<td>styrene</td>
<td>unresolved</td>
<td>feeling of drunkenness, decreased color vision, vestibular effects</td>
<td>solvent</td>
</tr>
<tr>
<td>Substance</td>
<td>Mechanism</td>
<td>Neurological effect</td>
<td>Occurrence / Use</td>
</tr>
<tr>
<td>-----------</td>
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<td>------------------</td>
</tr>
<tr>
<td>succinylcholine, suxamethonium</td>
<td>acetylcholine agonist, nicotinic receptor</td>
<td>muscle relaxation</td>
<td>muscle relaxant drug</td>
</tr>
<tr>
<td>tabun</td>
<td>acetylcholinesterase inhibitor</td>
<td>typical symptoms of organophosphate poisoning</td>
<td>chemical weapon</td>
</tr>
<tr>
<td>tetanus toxin</td>
<td>GABA-release blocker</td>
<td>tetanic spasms</td>
<td>toxin of Clostridium tetani</td>
</tr>
<tr>
<td>tetraethylammonium</td>
<td>voltage-gated potassium channel blocker</td>
<td>muscle paralysis</td>
<td>experimental neurophysiology</td>
</tr>
<tr>
<td>tetraethyl lead</td>
<td>unresolved</td>
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<td>tri-o-cresyl phosphate (TOCP, TCP)</td>
<td>acetylcholinesterase inhibitor</td>
<td>organophosphate-induced delayed neuropathy</td>
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<td>chemical weapon</td>
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References


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