

Medical Terminology

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Lecture Nine

NERVOUS SYSTEM

Word Elements • The Nervous System



WORD ELEMENT	REFERS TO
arachn/o	spider
cephal/o	head
cerebell/o	the cerebellum
cerebr/o	the cerebrum; also, the brain in general
cortic/o	outer layer or covering
encephal/o	brain
gangli/o; ganglion/o	ganglia (singular: ganglion)
gli/o	glue
hydr/o	water
iatr/o	physician; to treat
-mania	suffix meaning "morbid attraction to" or "impulse toward"
meningi/o	a membrane
ment/o	referring to the mind
-nesia	memory
myel/o	in connection with the nervous system, refers to the spinal cord and medulla oblongata
neur/o	a nerve cell; nervous system
-oid	like
-paresis	weakness, loss of movement
-phasia	speech
-phobia	suffix meaning "morbid or unreasonable fear"
-plegia	paralyzed
schiz/o	to split
psych/o	referring to the mind
spin/o	referring to the spinal cord

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An Overview of the Nervous System

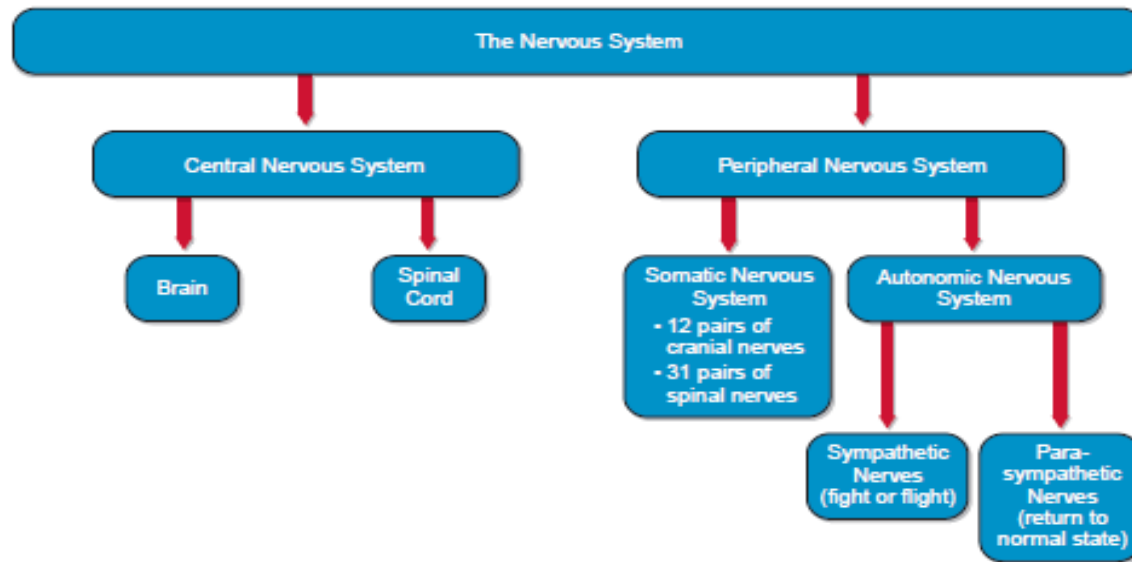
The nervous system is one of the most complex systems in the body. It coordinates both the body's involuntary or unconscious functions, such as reflexes and thought processes, and the voluntary movements of walking, eating, talking, etc. The nervous system works in conjunction with the endocrine system to maintain homeostasis (home/o is the combining form for alike or the same; the term means "a state of equilibrium" or "staying the same") and is responsible for quick changes that are short lived to maintain this balance; the endocrine system initiates slow changes that are longer term. It also controls voluntary and involuntary movement, detects environmental changes, and registers sensory information (like pulling your hand away from a hot stove).

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The nervous system has two main divisions: the **central nervous system (CNS)** and the **peripheral nervous system (PNS)** (Fig. 7-1). The CNS consists of the brain and spinal cord. The PNS, which may be divided into the **somatic** and **autonomic nervous subsystems**, controls skeletal muscles by means of the cranial and spinal nerves (Fig. 7-2).



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Structure and Function

The structures that help the body perform the functions mentioned earlier are directed by neurons (neur/o means “nerve”), or nerve cells, and assisted by neuroglia (-glia means “glue”), the supporting tissues of the nervous system. The neurons carry electrical messages that coordinate the exchange of information between the body’s internal and external environments (think of them as the “messengers”), whereas the neuroglia offer protection and support to the nerve tissue (think of them as “assistants”).

The three principal parts of a neuron cell are the cell body , the dendrites , and the axon (Fig. 7-3). The cell body contains the nucleus and receives impulses from other cells through the dendrites. The dendrites, which project outward from the cell body, act as antennae that receive and transmit messages between the neuron and muscles, skin, or other neurons. The cell body passes these messages to the axon, which conducts electrical impulses away from the cell body. The connecting points for these message transfers are called synapses . Synaptic (adjective form of synapse) connections can occur between two nerve cells. The stimulus between the two cells is usually passed by means of a chemical called a neurotransmitter (neur/o means “nerve”; *transmitto* is Latin meaning “to send across”).

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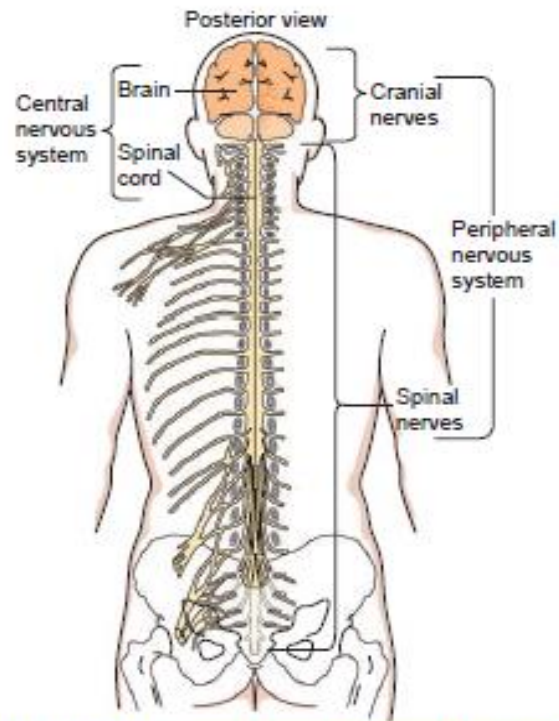


FIGURE 7-2 Posterior view. Divisions of the nervous system. The central nervous system is further divided into the brain and spinal cord. The cranial and spinal nerves are shown here as part of the peripheral nervous system. From Cohen BJ. *Medical Terminology: An Illustrated Guide*, 5th Ed. Philadelphia: Lippincott Williams & Wilkins, 2007.

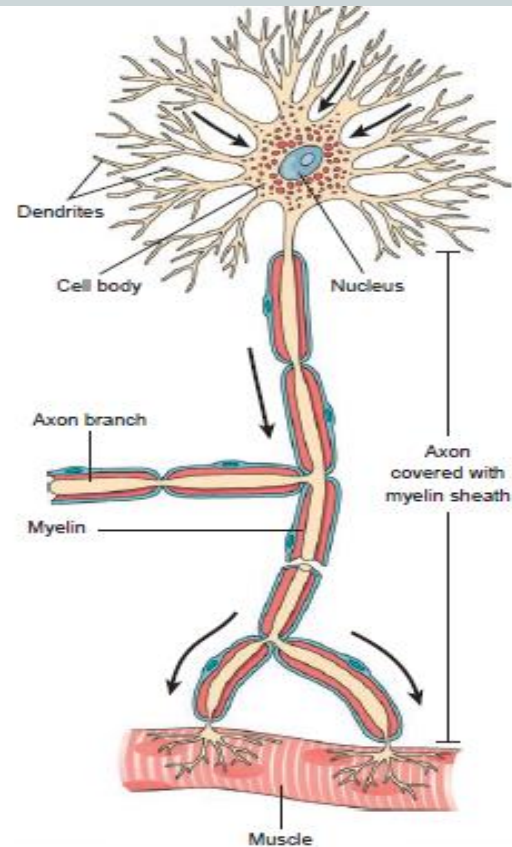


FIGURE 7-3 Motor neuron. The neuron is the basic functional unit of the nervous system. The arrows show the direction of the nerve impulse. Note the myelin sheath that covers the axon of the nerve. From Cohen BJ. *Medical Terminology: An Illustrated Guide*, 5th Ed. Philadelphia: Lippincott Williams & Wilkins, 2007.

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CENTRAL NERVOUS SYSTEM

The CNS is the body's control center. All nerve messages originate and/or terminate in the brain or spinal cord. The brain and spinal cord interpret the messages and determine the body's responses. The brain is one of the largest organs in the body and is responsible for most activities, including thought and memory processes. Sections of the brain control different body functions, such as breathing and temperature regulation. From the outside, the brain is separable into two hemispheres, each consisting of four lobes: the frontal, parietal, occipital, and temporal (Fig. 7-4).

The names of the lobes relate to their location relative to the skull (i.e., frontal relates to the front part of the head; parietal refers to the sides or "walls" of the head; occipital relates to the back of the head; temporal relates to the temples or area posterior to the eyes on the side of the head). The major parts of the brain include the following (Fig. 7-5)

Cerebrum: The cerebrum, the largest part of the brain, is where memories and conscious thoughts are stored. It also directs some of our bodily movements. An outer layer of gray matter called the cerebral cortex protects the cerebrum, which is divided into two hemispheres: left and right. Please note that although groups of neuron cell bodies that exist within the PNS are called ganglia, a group of neuron cell bodies within the CNS is normally called a nucleus (plural: nuclei).

- **Cerebellum:** The cerebellum, like the larger cerebrum situated above it, also has two hemispheres. The cerebellum helps us perform learned body movements smoothly and helps maintain our equilibrium.
- **Diencephalon:** The diencephalon contains both the thalamus and the hypothalamus .

The thalamus processes sensory information, such as touch, taste, and sight, and directs the impulses to certain parts of the brain. The hypothalamus, which is the hormone and emotion center of the brain, controls autonomic functions such as heart rate, dilation of blood vessels, and hormone secretion.

- **Brain stem:** The brain stem contains the mesencephalon (or midbrain), the pons , and the medulla oblongata .

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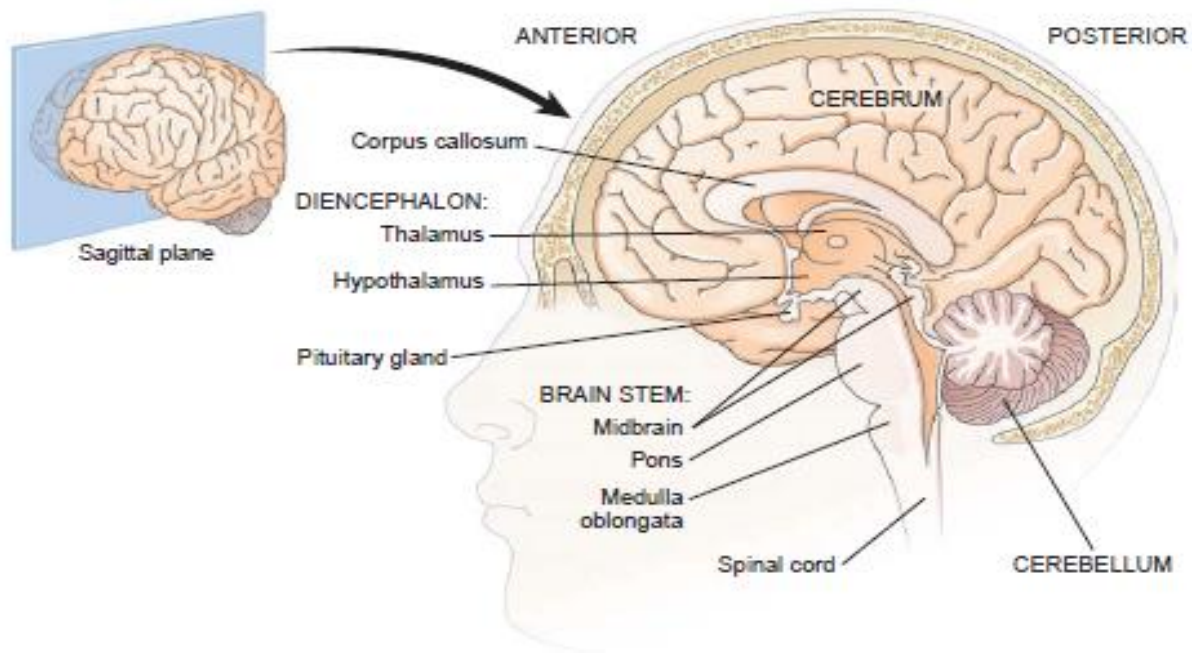


FIGURE 7-5 Sagittal section of the brain. The major parts of the interior brain structures are shown. From Cohen BJ. Medical Terminology: An Illustrated Guide, 5th Ed. Philadelphia: Lippincott Williams & Wilkins, 2007.

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Disorders of the Nervous System

Disorders of the nervous system can result from trauma, vascular insults, tumors, systemic degenerative diseases, and seizures, to name a few. Behavioral disorders make up a separate category of their own.

Brain Trauma

Head injuries can inflict trauma on the skull and brain. This may result in skull fractures, hemorrhage or bleeding, swelling, or direct injury to the brain itself. The injury may be mild, involving bruising to the brain tissues, or it can be severe, causing destruction of the brain tissue and massive swelling to the brain. A couple of the more common types of brain injuries include the following:

- **Concussion (cerebral concussion: violent shaking of the brain) may result from a fall or blow to the head. A concussion may cause temporary loss of consciousness followed by a short period of *amnesia* (a- means “without”; -mnesia means “memory”). Dizziness, nausea, and headache are common with a concussion.**

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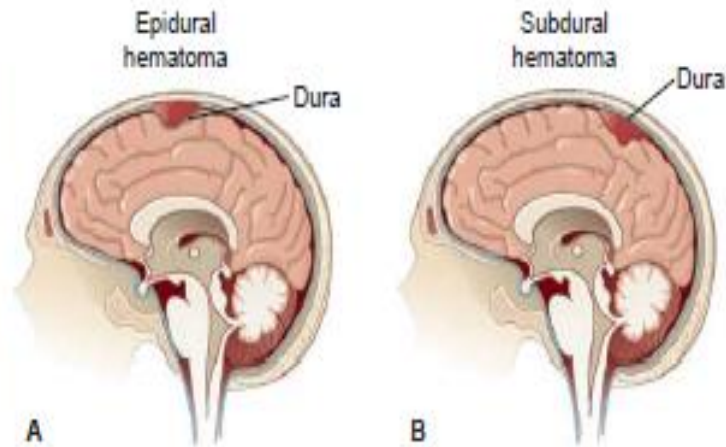
- **Subdural hematoma (sub- means “under”; dural pertains to the dura layer of the meninges; hemat/o means “blood”; -oma means “a tumor” or “a collection of”) is a collection of blood trapped in the subdural space beneath the dura mater and may result from a blow to the front or back of the head (Fig. 7-7).**
- **Epidural hematoma (epi- means “on top of”; dural pertains to the dura layer of the meninges; hemat/o means “blood”; -oma means “a tumor” or “a collection of”) is when blood collects**
between the duramater and the skull, causing pressure on the blood vessels and interrupting blood flow to the brain. This condition is caused by a skull fracture or blow to the head.

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FIGURE 7-7 Cranial hematomas. Locations of epidural, subdural, and intracerebral hematomas are shown. **A.** Epidural hematoma occurs with a traumatic brain injury when blood accumulates between the dura and the skull. **B.** Subdural hematoma occurs within the dura layer. From Cohen BJ. *Medical Terminology: An Illustrated Guide*, 5th Ed. Philadelphia: Lippincott Williams & Wilkins, 2007.



Vascular insults

A vascular insult is an injury, attack, or trauma to the blood vessels. An injury to the blood vessels in the brain can result from an aneurysm (localized dilation of a vessel wall or chamber) that ruptures or an embolus or blood clot that blocks the blood flow to the brain tissues.

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Tumors

Tumors are lesions or neoplasms that may cause localized dysfunction, producing an increase in intracranial pressure (ICP) .

Tumors may be benign or malignant. Two examples of tumors occurring in the nervous system include astrocytomas (*astr/o* means “star shaped”; *cyt/o* means “cell”; *-oma* means “tumor”) and meningiomas (*mening/o* means “meninges”; *-oma* means “tumor”).

Tumors may metastasize from other parts of the body such as the breast or lung.

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Systemic Degenerative Diseases

Degenerative diseases frequently develop slowly over time. There usually is a progressive deterioration that may start out affecting individual components of the body and end up involving one or more body systems.

Examples of systemic degenerative diseases include multiple sclerosis , Parkinson and Alzheimer disease .

Multiple sclerosis (MS) is a progressive degenerative disease with symptoms caused by demyelination (de- means “loss of”; myelin refers to the myelin sheath; -tion means “state of”) or patchy loss of the myelin sheath (covering of the neurons).

The symptoms include leg weakness, double vision, numbness, tingling, and paralysis. Parkinson disease usually develops after age 60 and occurs with the loss of the neurotransmitter dopamine , which inhibits transmission of nerve impulses. Weakness, tremors, facial mask (no expression), and muscle rigidity are some of the symptoms (Fig. 7-9). As the disease progresses, dysphagia (dys- means “difficult”; phag/o means “swallowing”; -ia is a suffix meaning “condition of”) and difficulty with mastication (chewing) may develop. Alzheimer disease, one of the most common types of dementia (de- is a prefix meaning “apart from”; ment refers to mind; -ia is a suffix meaning “condition of”), is a degenerative and eventually fatal condition involving atrophy of the cerebral cortex that produces a progressive loss of intellectual function.

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CLINICAL FEATURES

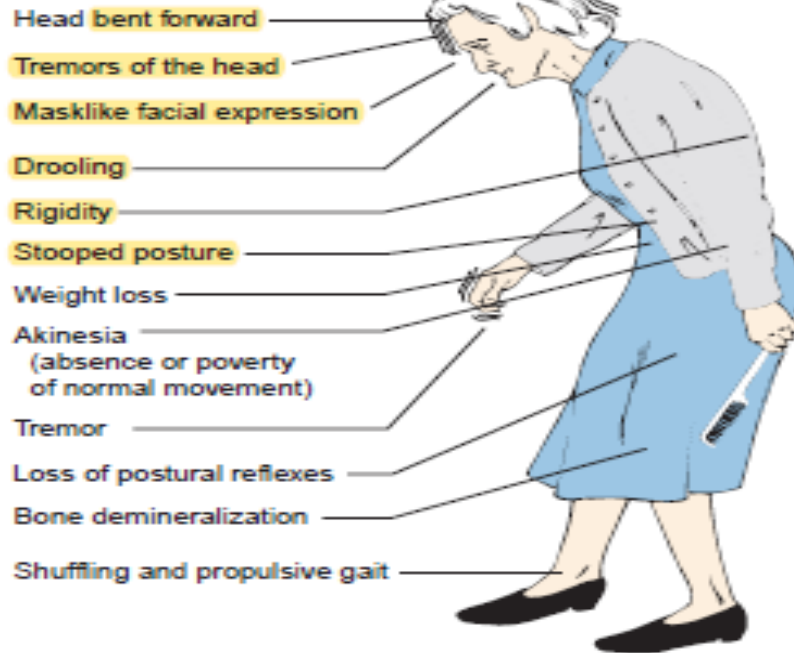


FIGURE 7-9 Parkinson's disease. Patients with Parkinson's disease may exhibit all or only a few of the clinical features identified here. Early signs may include weakness and decreased flexibility. As the disease advances, rigidity and lack of associated muscle movements may be seen. Modified from Rosdahl CB. Book of Basic Nursing, 7th Ed. Philadelphia: Lippincott-Raven, 1999:1063, Figure 77-3.

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Seizure Disorders

A seizure occurs when there is an abnormal uncontrolled burst of electrical activity in the brain. Seizures may occur as a result of trauma, tumors, fevers, medications, or other causes. The end result may be unnoticed since it may be as subtle as experiencing weird odors or staring off into space; or it may be as obvious as the more well-known seizures in which the person loses consciousness and involuntarily moves his or her arms and legs. This last kind of seizure is commonly called a convulsion.

Epilepsy is a chronic disorder, characterized by recurrent seizures that result from the excessive discharge of neurons in the brain. It is usually accompanied by some alteration of consciousness. There are two basic types of epileptic seizures that should be mentioned, grand mal seizures and petit mal seizures . A grand mal seizure is severe and characterized by tonic-clonic convulsions, which are the alternating contraction and relaxation of muscles that produce jerking movements of the face, trunk, and/or extremities. A petit mal seizure is a milder form of seizure lasting only a few seconds and does not include convulsive movements.

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Behavioral Disorders

A number of behavioral disorders are related to the nervous system. They may be caused by physical changes, substance abuse, medications, or any combination thereof. The categories include anxiety, mood, and psychotic disorders.

Anxiety disorders: Anxiety disorders are characterized by feelings of apprehension or uneasiness, sometimes associated with the anticipation of danger. Common examples include **obsessive compulsive disorder (OCD)**, which often consist of repetitive behaviors; panic disorder; posttraumatic stress disorder (PTSD); and the various **phobias**, which are persistent and irrational fears of specific situations or things.

- **Mood disorders:** Mood disorders include **depression**, which results in prolonged periods of lost interest or pleasure in almost all activities, and **bipolar (formerly called manic-depressive) disorder**, which is characterized by manic and depressive episodes. A manic episode is one characterized by an atypically elated mood, inflated self-esteem, rapid speech, increased creativity, little need for sleep, and an inability to function normally as a result of these.

Patients with bipolar disorders alternately exhibit both behaviors: mania and depression.

- **Psychotic disorders:** Psychotic disorders are more serious than anxiety or mood disorders because they feature a loss of contact with reality and a deterioration of normal social functioning. **Psychoses** (singular: **psychosis**; psych/o means “mind”; -osis means “an abnormal condition”) are normally separated from **neuroses** (singular: **neurosis**; neur/o means “nerve”; -osis means “an abnormal condition”). An example of a psychosis is **schizophrenia** (schiz/o means “to split”; phren means “mind”; -ia is a suffix meaning “condition of”), which may manifest itself as paranoia, withdrawal, or psychotic symptoms, such as hallucinations and/or delusions.

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Pharmacology

Several major drug classifications are used to treat disorders of the nervous system. Pain control can be achieved using the same analgesics and narcotic analgesics discussed in earlier chapters. Sedatives (sedate comes from a Latin word meaning “to calm or relax”) and hypnotics (hypn/o means “sleep”) are used to produce a calming effect and sleep.

Anticonvulsants (anti- means “against”; convulse refers to a violent shaking) are administered for seizure activity, and antianxiety drugs (anti- means “against”; anxiety refers to a state of apprehension) are given to patients for anxiety suppression and muscle relaxation. For severe psychoses, antipsychotic (anti- means “against”; psych/o means “mind”)

medications are administered. It is important to note that some of these drugs must be taken for a period of several weeks before they become effective and that patient compliance may be difficult to achieve. Serious side effects may occur when taking antipsychotic medications; these include low blood pressure, blurred vision, muscle rigidity, persistent muscle spasms, tremors, and arrhythmias.

Some of the newer antipsychotic medications can have a negative effect on the immune system also and may cause diabetes and high cholesterol. Examples of traditional antipsychotic

drugs include haloperidol (Haldol), chlorpromazine (Thorazine), and perphenazine (Etrafon, Trilafon).

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Abbreviation Table • The Nervous System



ABBREVIATION	MEANING
ADHD	attention deficit hyperactivity disorder
CNS	central nervous system
CVA	cerebrovascular accident
ECT	electroconvulsive therapy
EEG	electroencephalography
ICP	intracranial pressure
IQ	intelligence quotient
LOC	level of consciousness

ABBREVIATION	MEANING
LP	lumbar puncture
MS	multiple sclerosis
OBS	organic brain syndrome
OCD	obsessive-compulsive disorder
PERRLA	pupils equal, round, and reactive to light and accommodation
PNS	peripheral nervous system
PTSD	posttraumatic stress disorder
SAD	seasonal affective disorder
TENS	transcutaneous electrical nerve stimulation
TIA	transient ischemic attack