West Los Angeles College

Therapeutic Agents for the Nervous System

Introduction

● Complex system for controlling and coordinating movements and functions of the body
● Nerves perform internal involuntary functions
● Better understood when broken down into divisions

The Nervous System Functions

● Four main functions:
  ➢ Impulses sent to central nervous system (CNS)
  ➢ Impulses sent from CNS
  ➢ Coordination of activities of all parts of nervous system
  ➢ Sensory function that detects changes in the body

• Examples of internal involuntary functions are the heartbeat, digestion, and interpretation of visual signals.
• Each division of the nervous system has specific functions.

• Where are smooth muscles found? (The smooth muscles include those in the blood vessels, stomach, and other large organs.)
• The four main functions of the nervous system include:
  (1) sending impulses to the CNS;
  (2) sending impulses back to the peripheral nervous system (PNS);
  (3) coordinating the activities of all parts of the nervous system (e.g., those functions that rely on outside stimulation);
  (4) detecting various changes in the body, such as temperature, acting as a sensory organ.
Nervous System Structure

- Keeps body in balanced mode: **Homeostasis**
- CNS: Brain and spinal cord
- PNS: Peripheral nerves; four distinct functions (two efferent; two afferent)
- Two efferent: Highways for motor impulses from CNS muscles
- Afferent: Carry impulses from soft tissue areas, involuntary muscles of body, and other organs back to CNS
- **Neuron**: Smallest functional part of the CNS

- The various branches of the peripheral nervous system (PNS) allow the CNS to work optimally because each area of the nervous system is responsible for a specific type of motor action or sensory response.
- Impulses in the afferent system are carried via the visceral (internal organ) and somatic (skeletal) branches of the nervous system.
- The CNS is composed of the brain and the spinal cord, whereas the PNS is located outside the CNS and consists of the afferent (sensory) and efferent (motor) branches. The efferent division is further divided into the somatic and autonomic systems. The ANS consists of two main branches: the SNS and the PSNS.

The Neuron

- Billions of neurons make up the nervous system
- Billions of nerves run through the body carrying messages back and forth from CNS
- Four main sections: Cell body, dendrites, axon, nerve terminal
  - Dendrites receive electrical impulses

- What are dendrites? (Dendrites are extensions from the cell body of the neuron that receive electrical impulses from the nerve terminals of adjoining neurons.)
- The dendrites are extensions that receive electrical impulses from the previous neuron's nerve terminal.

The Neuron (Cont.)

- Cell body processes electrical message before it enters the axon
- Myelin sheath is a specialized insulation wrapped around axon
  - Composed of same fatty matter as in white matter of brain
- It helps with impulse conduction

- What is the function of the cell body? (The function of the neuron cell body is to convert chemical signals into electrical signals.)
Neuron Structure

- Insulation by the myelin sheath forces electrical impulses to jump from one axon to the next through the gaps in the sheath.

The Neuron (Cont.)

- PNS nerves form bundles made of axons
- Ganglions: Bundles of cell bodies
- CNS: Axons called tracts; cell bodies called nuclei or ganglia
- Neurotransmitters: Chemicals that transmit electrical impulses

Nerve Transmission

- Three main states of a neuron: Polarized, depolarized, repolarized
- Polarized or resting state:
  - Negative charge inside neuron potassium (K⁺) and chloride (Cl⁻)
  - Positive charge outside sodium (Na⁺)

- A neurotransmitter activates the cell membrane by binding to a membrane receptor, which stabilizes the conformation of the receptor, thereby opening an ion channel.

- The negative charge inside the neuron comes from the protein ions that are present.
- In the transmission of a chemical message from one neuron to another, three basic states need to occur within each neuron: polarized, depolarized, and repolarized.
- When the cell is in a resting state, an overall negative charge occurs inside the neuron that consists of potassium ions (positive) and chloride ions (negative). The outside of the neuron is more positive, with sodium as the positive charge. At this point, the cell is polarized and waiting to be excited. When a neurotransmitter activates the cell membrane, an influx of positive sodium ions occurs, changing the negative charge inside the cell to a positive charge. This activation is called depolarization. The cell restores the resting state by allowing the inside positive charges (potassium ions) to escape. As the transition back to the resting state occurs, the cell actively transports the sodium back to the outside and allows the potassium to reenter the cell.
Nerve Transmission (Cont.)

- **Neurotransmitter activates cell membrane (depolarization); sodium rushes through channels (negative inside changes to positive)**
- **Repolarization: Cell restores resting state by allowing potassium to reenter the cell and sodium is transported back to outside**

What happens to the potassium ions during depolarization? (When the cell is depolarized, the positively charged potassium ions escape to the outside of the cell to compensate for the presence of the positively charged sodium ions.)

Neuronal Impulse Transfer Cycle

- The impulses are made by the change in polarity of the axon. This triggers the same response in other neurons.

Central Nervous System: Brain Structure

- The brain is composed of two types of matter:
  - Gray matter: Neuron cell bodies and dendrites
  - White matter: Bundles of nerve fibers (myelinated axons)
- Brain has several sections with specific functions

The nerve fibers are woven in a pattern and make up the contents of the brain.
The brainstem connects the brain to the spinal cord and consists of three main areas: the midbrain, pons, and medulla oblongata and is part of the CNS.
Central Nervous System: Brain Structure

- Cerebrum is largest area
  - Contains ability to reason, remember, speak a language, create
- There are two hemispheres:
  - Right controls logical thinking processes
  - Left controls creativity
    - Hemispheres: Four different lobes, each with own function

Even though the cerebrum's two hemispheres have specialized processes, their functions are complementary. Which higher cognitive functions are concentrated in each hemisphere? (Speech and language are controlled by the left hemisphere. Facial recognition, spatial orientation, and music functions are controlled by the right hemisphere.)

Central Nervous System: Brain Structure (Cont.)

- Functions cover six senses: Hearing, vision, balance, taste, touch, and smell
  - Also motor functions to muscles
- Cerebellum: At base of brain, controls most of muscle functions, precise movements of the body, including balance, posture, overall coordination
- Brainstem connects brain to spinal cord
- Three main areas: Midbrain, pons, medulla oblongata
  - Three areas linked to many areas of the brain

How does a stroke affect the brain and body? (Because the nerves of the brain crisscross, damage to one side of the brain, such as from a stroke, can affect motor control in the opposite side of the body.)

The brainstem is linked to areas of the brain by nerve fibers.

Blood-Brain Barrier

- Protects brain and spinal cord
- Allows only certain types of small molecules to enter brain (lipid-soluble drugs)
- Prevents molecules from entering and possibly damaging the brain via chemical reaction
- Drugs are either water or fat soluble
- More fat-soluble drugs can cross the blood-brain barrier

How is the CNS protected from most infections? (The blood-brain barrier consists of capillaries [tubes of endothelial cells] that do not allow many substances, including proteins, toxins, and most antibiotics, to pass through their membranes into the brain and spinal cord. Molecules that can get through are usually very small or fat soluble.)
Thalamus and Hypothalamus

- Between midbrain and cerebrum
- Produce chemical reactions linking nervous system to endocrine system
- Hypothalamus: Built-in thermostat, appetite center
- Thalamus:
  - In charge of most sensory stimuli
  - Interprets and relays messages sent via nervous system
  - Initiates motor impulses from the cortex

- The hypothalamus also relays messages to the thalamus.

Spinal Cord

- Spinal cord is divided into sections, each identified by attachment location along spinal cord
- There are five main areas: Cervical (neck); thoracic (chest); lumbar (lower back); sacral (below lower back); and coccygeal areas

- What is a “spinal tap,” and what purpose does this procedure serve? (The lumbar puncture procedure is used to extract cerebrospinal fluid [CSF] from the lumbar area of the spine or to inject some types of chemotherapy. Analysis of CSF can show a case of meningitis. A lumbar puncture can also be used to measure and/or reduce intracranial pressure, such as after a head injury.)

Spinal Cord (Cont.)

- Composed of inner gray matter that houses many nerve cells
- Outside white matter: Nerve fibers
- Meninges: Thin covering lining the inside of bones; covers and protects brain and spinal cord from bony structure of skull and spinal column
- CSF
  - CSF cushions brain and spinal cord; it is watery liquid
  - Meninges and CSF protect and cushion CNS

- In addition to its cushioning role, CSF also circulates to deliver nutrients and remove wastes from the brain and spinal cord.
Cranial Nerves

- Originate in brain matter
- Specific function labeled by Roman numerals and name
- Most nerves have sensory and motor fibers

Peripheral Nervous System: Autonomic System

- Subdivision of PNS
- Controls automatic functions
- Involuntary has two branches: Sympathetic nervous system (SNS) and parasympathetic nervous system (PSNS)
  - Both regulate organs, tissues, and blood vessels; both made of nerves and ganglia

Peripheral Nervous System: Autonomic System (Cont.)

- Both systems have neurons of approximately the same length from CNS to target tissue
- Ganglia: Where synapse (relay) is located
- Nerve fibers are preganglionic or postganglionic
- Neurotransmitter has own receptor to contact opposite synapse

- Both branches of the PNS respond to outside and inside stimuli.
- The parasympathetic nervous system (PSNS) is the division of the ANS, which functions during restful situations.
- The primary NTs of the SNS are norepinephrine and epinephrine. Four main types of receptors respond to these NTs:
  - Alpha-1 (a1)-receptors are located in peripheral blood vessels, the heart, and the eyes;
  - a2-receptors are primarily located on smooth muscle
  - Beta-1 receptors are primarily located in the heart muscle;
  - Beta-2 receptors are located in the respiratory system, blood vessels, and elsewhere in the body.

- Where are the receptors for neurotransmitters? (Receptors for neurotransmitters are on the dendrites.)
**Sympathetic Nervous System**

- Sympathetic nerves emerge at thoracic and lumbar regions of spinal cord
- Function is to respond to stressful situations; “flight or fight” response
- During “flight or fight”: Nonessential body systems are shut down
- Energy is redirected to other areas, muscles
- Preganglionic nerves in gray matter of spinal cord responsible for “fight or flight” behavior
- Send impulses to various organs and tissues for emotions (anxiety, hate, stress)

- What systems are nonessential during a “fight or flight” response? (Nonessential systems include the urinary and digestive systems.)
- When sympathetic preganglionic neurons synapse, they affect a large number of postganglionic neurons.
- This creates a widespread effect that enables humans to respond quickly and powerfully to dangerous situations.
- During the fight-or-flight stress response, the sympathetic nervous system (SNS) shuts down the nonessential systems of the body, which redirects energy to other areas such as the muscular system.

**Sympathetic Nervous System**

- Two main neurotransmitters: Norepinephrine and epinephrine
- Four types of receptors:
  - Alpha-1 receptors: Located in peripheral blood vessels, the heart, and the eyes
  - Alpha-2 receptors: Located on the smooth muscle
  - Beta-1 receptors: Located on the heart muscle
  - Beta-2 receptors: Located in the respiratory system and elsewhere

- Sympathomimetics or adrenergics are drugs that mimic natural sympathetic neurotransmitters.
- The main neurotransmitters of the SNS are norepinephrine and epinephrine.

**Parasympathetic Nervous System**

- This is opposite or counterbalance of sympathetic system
- Nerves emerge from brainstem and sacral part of spinal cord
- Preganglionic nerves are located in gray matter of brainstem and spinal cord
  - Activation of digestive system
  - Slows heart rate
  - Works during rest
  - Is inhibited when sympathetic activates under stress

- Reflexes such as gagging, blinking, exhaling, and the classic knee-jerk are involuntary reactions of motor neurons in the somatic nervous system.
Cholinergic Agents and Cholinergic Blockers

- Main neurotransmitter of parasympathetic: Acetylcholine (ACh)
- ACh:
  - Is important for CNS and PNS
  - Works quickly with short duration of action

- Acetylcholine is released when people are at rest.
- Two types of cholinergic agents that activate the PSNS are those that mimic acetylcholine and those that stop the destruction of acetylcholine by the enzyme acetylcholinesterase. Because these cholinergic drugs mimic the PSNS, they are referred to as parasympathomimetic agents.

Cholinergic Agents and Cholinergic Blockers (Cont.)

- Two types of cholinergic agents:
  - Those that mimic ACh are called parasympathomimetics
  - Those that stop destruction of ACh by acetylcholinesterase are called anticholinergics
- Anticholinergics block ACh receptors
  - Side effects: Dry mouth, inhibition of urine output

- Parasympathetic acetylcholine receptors are located on smooth and cardiac muscle cells.
- Cholinergic blockers prevent ACh from combining with the receptor, causing the nerve impulse to stop; this is useful when patients must be sedated or when their eyes have to be dilated by an optometrist.

Somatic Nervous System

- Network of nerves that relay messages to CNS from outside world and return messages back to body
- Is part of PNS; regulates motor nerves that control voluntary actions of skeletal muscles and impulses from sensory receptors

- Receptor sites are sensitive to a stimulus and include smell, taste, touch, and hearing.
Conditions of Nervous System and Their Treatments

- Many disorders involve excessive muscle contractions, wasting away of muscles
- Causes: Some have no cause, hereditary, random genetic mutations
- Investigations: Environmental

Myasthenia Gravis

- *Myasthenia gravis* is a rare autoimmune disorder
- Electrical impulses from CNS to muscles throughout body (especially throat, eyes) are affected
- Cause: Sometimes tumor of the thymus
- Common side effect: Drooping eyelids

Myasthenia Gravis (Cont.)

- Muscles tire easily and take longer to recover
- Chronic disease: Worsens over time
- Respiratory system affected: Death results
- Drug treatment: Anticholinesterases
- Surgery: Remove thymus if tumor present
- No cure for myasthenia gravis except where cause is tumor

- Dysfunction of the nervous system produces a multitude of conditions.
- When a person suffers from myasthenia gravis, the immune system attacks and destroys the receptors that normally receive neuronal impulses.
- Vocal and vision difficulties often occur.
- Myasthenia gravis is a rare autoimmune disorder that affects the transmission of electrical impulses from the CNS to muscles throughout the body.
- Myasthenia gravis affects more women than men and only affects 3 in 100,000 people in the United States.
- Eight out of 10 people affected can be helped; only rare cases result in death when the respiratory system fails.
Drug Treatments for Myasthenia Gravis

- Class of drugs: Cholinergics
- Drug action: Block the destruction of the neurotransmitter ACh by enzyme acetylcholinesterase
- Side effects occur because of overstimulation: Nausea, vomiting, diarrhea, severe abdominal pain

Most patients with myasthenia gravis can lead relatively normal lives.

Polyneuropathy

- Characterized by:
  - Distal loss of sensation
  - Burning
  - Weakness
- Diabetic neuropathy is common side effect of certain medications

Symptoms of diabetic polyneuropathy (which often involves the feet) can include an array of symptoms, from numbness to tingling to pain in the feet.

Treatments for Polyneuropathy

- Difficult to treat
  - Drugs used: Antidepressants, narcotic pain medications, anesthetic medications
  - Cymbalta inhibits reuptake of serotonin and norepinephrine
- Non-drug treatments: Transcutaneous electrical nerve stimulation, daily foot inspections to prevent ulcers

People usually try multiple therapies.
Epilepsy

- Seizure disorder: Hyperexcitability of nerve cells in brain
- Diagnosis based on EEG
- Two types of seizures: Partial, generalized
  - Partial: Affect only one hemisphere of brain (twitching of limb/no loss of consciousness)

- An EEG is an electroencephalogram.
- To produce an EEG, electrodes are attached to the patient’s head and the electrical impulses corresponding to brain waves are transferred onto paper strips that can be read by a physician.

Epilepsy (Cont.)

- Generalized seizures:
  - Affect both hemispheres
  - Different levels of intensity from petit mal (least violent) to grand mal (longer and more intense)
    - Children: Petit mal (stare off into space)

- In grand mal seizures, also known as tonic-clonic seizures, the person loses consciousness and falls to the ground; a period of widespread muscle spasms (tonic phase) is followed by a period of muscle relaxation (clonic phase).

Epilepsy (Cont.)

- Other causes: Skull fracture, tumor
- Treatments: Drugs to surgery (operable tumor)
- Drug types: Anticonvulsants
- Patient takes medicine on time every day

- What is the recommended first aid response for each type of seizure? (Petit mal: First aid is usually not necessary, but make sure that the person remains in a safe environment until the episode passes. Take note of how long the seizure lasts. [Seek medical help if the seizure lasts for more than 5 minutes.]
  Grand mal: Remain calm and take note of how long the seizure lasts. Prevent physical injury by making the area safe for the person. Do not restrain him or her, and do not put anything in his or her mouth. After the seizure is over, place the person on his or her side in case of vomiting.)

- All anticonvulsant medications require a physician to guide the discontinuation of the medication to avoid seizure activity; therefore these medications should not be abruptly stopped. Only suspension medications require shaking, only benzodiazepines used as anticonvulsants require the federal law prohibits cautionary warning label, and not all anticonvulsant medications need to be taken with a full glass of water.
Drug Treatments for Epilepsy

- Anticonvulsants inhibit impulses within CNS by inhibiting one or more of the ions:
  - Sodium, calcium, potassium
- Correct doses stop seizures
- Drugs are various agents: Hydantoins, barbiturates, succinimides, benzodiazepines

Hydantoins are crystalline substances derived from urea or allantoin.
Barbiturates are controlled substances, derived from barbituric acid, that cause relaxation and sleepiness.
It usually takes days to weeks for these medications to work.

Alzheimer's Disease

- Degenerative brain condition
- Progresses as one ages but can occur in younger people
- Early-stage, mid-stage, and late-stage categories
- There is loss of neuronal synapses: Information from memory banks
- Person cannot process information and memory loss occurs

Former President Ronald Reagan and actor Charlton Heston were affected by Alzheimer's disease (AD).
Aricept (Donepezil) is an acetylcholinesterase inhibitor approved for use in treating the symptoms of Alzheimer disease.

Alzheimer's Disease (Cont.)

- Brain cells are replaced by deposits of protein (tangles and knots)
- Brain shrinks in size; memory affected
- Dementia, an abnormal loss of memory and basic mental function, occurs
- Other symptoms include inability to perform normally familiar tasks, difficulty talking, disorientation in familiar surroundings

Although multiple types of dementia (progressive conditions of deteriorating cognitive function) have been recognized, AD is the most common and accounts for 50% to 70% of cases.
Most people suffering from AD lack ACh.
Drug Treatment for Alzheimer's Disease

- Treatments include medications and skilled nursing facilities
- Main therapy: Cholinesterase inhibitors (donepezil, tacrine) and memantine
- Other agents: Nimodipine, physostigmine, may delay progressive disease

- Nimodipine is a calcium channel blocker that has a widening effect on blood vessels in the brain.
- Physostigmine inhibits acetylcholinesterase and is derived from the Calabar bean.

Parkinson's Disease

- Loss or deficiency of dopamine
- Basal ganglia: Group of cells (gray matter) located in medulla (white matter) of cerebrum
- Function: Regulate muscle tone, body movement
- Dopamine: Natural chemical in brain that inhibits movement
- ACh activates neurons and dopamine inactivates them
- Lack of dopamine: Movement without ending

- Michael J. Fox and Mohammed Ali both are affected by Parkinson's disease (PD).
- PD is a progressive disorder of the basal ganglia and is associated with the loss or deficiency of the neurotransmitter (NT) dopamine
- Anticholinergic medications cause dry mouth, constipation, urinary retention, blurred vision, and confusion.

Symptoms and Signs of Parkinson's Disease

- You will see from the figure that PD affects several areas of the body.
Parkinson's Disease (Cont.)

- Severity of symptoms increases over years
- Most common symptoms: Tremors, muscle rigidity, loss of balance, hypokinesia, bradykinesia
- Diagnosis is difficult because of slow progression
- Treatment includes surgery, physical therapy, drugs
  - Drugs increase dopamine and ACh levels in brain
  - Drugs have major side effects

- Hypokinesia is a decrease in the range of motion.
- Bradykinesia is an overall slowing of motion and of performing simple tasks.
- As the disease progresses, the patient’s movement eventually stops and he or she becomes wheelchair bound. Swallowing can also become difficult and speech might become slurred.
- Signs of PD usually develop at approximately age 60 but can occur much sooner.
- Administration of anti-Parkinson’s drugs is often used as a method of diagnosing the disease.
- How do ACh and dopamine affect movement? (ACh activates the motor neurons and dopamine inactivates them. Together, dopamine and ACh are responsible for fine motor movements and improving balance.)

Multiple Sclerosis

- Multiple sclerosis (MS) is a deterioration of the myelin sheath
- Myelin sheath insulates surrounding neurons
- Sheath replaced by sclerotic (hard) tissue
  - Electrical impulses cannot pass through, no movement completed

- MS is an autoimmune disorder in which cells of the immune system break down the myelin sheath.

Multiple Sclerosis (Cont.)

- Average age of onset is early 30s
- Symptoms include muscle weakness, abnormal sensations (numbness, tingling), vision change, loss of coordination
- Patients experience periods of remission followed by attacks of loss of function
- Cause is an autoimmune disease

- Multiple sclerosis is much more common in women than in men; the ratio of women to men who have MS is roughly 2 to 1.
There is no cure for multiple sclerosis.

**Drug Treatments for MS**

- First line of treatment is disease-modifying immunotherapy to slow and minimize progression of the disease
- Second line of treatment is steroids
  - Given to treat flare-ups that can last from 1 to 3 months
- Interferons treat multiple sclerosis specifically, but other medications, such as antispasmodics, are used to treat the symptoms.
- Immune modulators such as interferon must be kept refrigerated and protected from light.

**Migraine Headache**

- Range of triggers: Hormonal changes, foods, stress, bright lights, and other changes in the environment
- Serotonin levels drop; this releases neuropeptides that travel to the meninges where they cause blood vessels to become dilated and inflamed
- No known cure
- Preventive measures: Exercise, avoiding triggers
- Migraine headaches are episodic, severe headaches that are frequently associated with nausea and/or light and sound sensitivity.
- The routes of administration for Imitrex (Sumatriptan) are orally, nasally, and subcutaneous injection.
Treatment for Migraine Headache

- First line of treatment: Nonsteroidal antiinflammatory drugs (NSAIDs) or aspirin
- Severe migraines: Triptans
- Pain relievers
- Preventive medications
  - Beta-blockers, calcium channel blockers, antidepressants

- These may be prescribed as monotherapy or polytherapy, depending on the individual.

Stroke

- Stroke: A disruption of blood flow or leakage of blood outside of vessel walls
- Can be due to ischemia or hemorrhage
- Prognosis is dependent on the severity of the damage to the brain
- Physical and/or speech therapy are often necessary to regain ability to function
- Symptoms: Slurred speech, headache, dizziness, loss of use or weakness on one side, visual problems

- Although stroke has several causes, most strokes are ischemic strokes.

Drug Treatment for Strokes

- Antithrombotic medications
- Hemorrhagic strokes may require neurosurgery
- Medications to lower cholesterol and high blood pressure
- Stroke prevention is low-dose aspirin (81 mg) taken daily

- Therapy may take place in a rehabilitation hospital, an outpatient center, or the home.
Depression and Its Treatments

- Range in severity from minor to major (thoughts of suicide)
  - Major: Difficult to treat, interferes with normal function
- Treatment: Psychotherapy, behavioral/cognitive therapy
- Drug treatment: SSRIs, SNRIs, TCAs, MAOIs

- SSRIs = Selective serotonin reuptake inhibitors.
- SNRIs = Serotonin/norepinephrine reuptake inhibitors.
- TCAs = Tricyclic antidepressants. [amitriptyline (Elavil), doxepin (Sinequan), nortriptyline (Aventyl)]
- MAOIs = Monoamine oxidase inhibitors. Nardil is a monoamine oxidase inhibitor (MAOI).
- In the United States, the lifetime prevalence of major depression is approximately 16%, and this incidence increases in those with chronic medical conditions such as diabetes and heart disease.
- These agents help increase the levels of serotonin and norepinephrine in the brain.
- A form of bupropion (Zyban) is used for smoking cessation; patients should not take the antidepressant Wellbutrin (also a form of bupropion) and Zyban together.

Anxiety Disorders and Treatments

- Panic disorders, phobias, obsessive-compulsive disorder (OCD)
- Types include generalized and social anxiety disorders, phobias, panic disorder, post-traumatic stress disorder (PTSD)
- Treatments: Psychotherapy, behavioral therapy; antianxiety agents

- Anxiety is a normal physiologic reaction. It becomes problematic when it becomes so severe that it interferes with daily personal and social interactions.
- Antipsychotic medications may cause extrapyramidal symptoms, dizziness, and drowsiness.

Bipolar Disorder

- Symptoms include excessive mood swings
- Treatments:
  - Mood-stabilizing agents such as lithium
  - Anticonvulsants such as Tegretol or Depakote

- Specific symptoms of mania include agitation, hyperactivity, inflated self-esteem, risky or reckless behavior, and decreased sleep requirements.
- Bipolar disorder is characterized by excessive mood swings that range from manic (high) to depressive (low) states.
- Treatment for bipolar disorder primarily involves the use of mood-stabilizing drugs such as lithium (Eskalith).
- Valium is a Schedule IV controlled substance (C-IV) medication used as anticonvulsants require the auxiliary label: “Caution: Federal law prohibits the transfer of this drug to any person other than the patient for whom it was prescribed.”
Schizophrenia

- Episodes of psychosis
- Delusions
- Impaired social function
- Disorganized thought and speech
- Diagnosis is difficult

- For diagnosis, usually symptoms are recorded for at least 6 months.
- This disorder affects more males than females and usually appears in the early 20s in males.
- It cannot be cured, so treatment is for depression (antidepressants), mood swings (anticonvulsants), and anti-anxiety (drugs ending in -pam).
- Psychosis is defined as a mental illness characterized by the loss of contact with reality and may be a true mental illness, attributable to an underlying medical condition (e.g., dementia, drug withdrawal syndromes), or induced by substances such as medications, recreational drugs, or poisons.
- Anxiety disorders can be divided into several different types ranging from panic disorders such as PTSD and phobias to personality disorders such as OCD. Schizophrenia is a psychiatric disorder involving chronic or episodic psychosis.

Insomnia

- Three factors are present to diagnose:
  - Cannot initiate sleep, cannot maintain sleep, or waking up too early
  - Occurs even if there is ample opportunity to sleep
  - Impairs the daytime functions

- Antihistamines such as diphenhydramine-containing products are the most common treatments.
- Some antidepressants and benzodiazepines may also be used.
- The main ingredients in OTC products for insomnia are antihistamines, such as diphenhydramine.
- Insomnia is a complaint of difficulty initiating sleep, difficulty maintaining sleep, or waking up too early; its prevalence increases with age and is more common in women than men. Insomnia can be related to medication use.
- Of the three insomnia medications, Restoril is the brand name for temazepam, Ambien for zolpidem, and Lunesta for eszopiclone. Prozac is the brand name for fluoxetine, which is a selective serotonin reuptake inhibitor (SSRI) antidepressant.
- All benzodiazepines are C-IV medications.

Attention Deficit/Hyperactivity Disorder (ADHD)

- Difficulty focusing
- Boys are three times as likely to be affected
- School-age children
- Daydreaming

- Stimulants for the CNS are the most common drug treatments.
- Most are schedule II drugs or controlled.
- Although all of the medications [methylphenidate (Ritalin), dextmethylphenidate (Focalin), lisdexamfetamine (Vyvanse), atomoxetine (Strattera) listed are Schedule II controlled substances (C-II), Strattera is the only non-stimulant ADHD medication sold in the United States.
- Methylphenidate for the treatment of ADHD is available in a variety of dosage forms, Methylphenidate preparations come in tablets, chewable tablets, oral solutions, and transdermal patches, as well as capsules.