Nervous system
THE NERVOUS SYSTEM

The nervous system is comprised of the brain, the spinal cord and nerves.

FUNCTION

The nervous system has 3 general functions:
- a sensory function
- an interpretative function
- a motor function.
STRUCTURE
The main divisions of the nervous system
the central nervous system (CNS)
peripheral nervous system (PNS)

The Central Nervous System
Consists of the brain and spinal cord.

The brain is divided into
- Cerebrum
- Cerebellum
- Brainstem
Cerebrum - the largest part of the brain.

- It is the centre for thought and intelligence.
- It is divided into right and left hemispheres.
The right controls movement and activities on the left side of the body.

The left controls the right side of the body.

Within the cerebrum are areas for speech, hearing, smell, sight, memory, learning and motor and sensory areas.
Cerebral cortex - the outside of the cerebrum.
- Function is learning, reasoning, language and memory.

Cerebellum - lies below the cerebrum at the back of the skull.
- Functions are to control voluntary muscles, balance and muscle tone.
Medulla Oblongata lies within the midbrain between the pons and spinal cord, it forms the brainstem.

- The medulla controls heart rate, breathing, swallowing, coughing and vomiting.
- The midbrain and the pons relay messages between the medulla oblongata and the cerebrum.
Internal structure of the brain

- Spinal cord
- Medulla Oblongata
- Cerebellum
- Midbrain
- Diencephalon
- Cerebral hemisphere
- Pons
The spinal cord.

- The spinal cord lies within the spinal column, which consists of 30 boney casings called vertebrae.
- The spinal cord is a continuation of the brain stem and is a two-way conduction pathway of nerves to and from the brain and is a major reflex centre.
Spinal Cord—Protective Layers (2)

- Body of vertebra
- Epidural space
- Ventral root
- Epidural space
- Dorsal root ganglion
- Dorsal root
- Subarachnoid space
Anatomy of the autonomic nervous system
The Peripheral Nervous System

The main divisions of the Peripheral Nervous System are

The autonomic nervous system

- The autonomic nervous system controls the automatic functions of the body:
- Brings information from receptors in the internal organs to the CNS and motor neurons to, smooth muscle, cardiac muscle, and glands. These responses are normally involuntary
Autonomic nerves regulate the activity of smooth muscle, cardiac muscle and glands
Automatic nervous system is divide into two

- **Sympathetic system**, (called the “fight-or-flight” system)
  
  Acts when we are excited or find ourselves in a threatening situation: pounding heart, rapid breathing

- **Parasympathetic system**, (called the “resting and digesting" system)
  
  most active when the body is at rest.
The somatic nervous system.

- The somatic nervous system allows us to consciously, or voluntarily, control our skeletal muscles.
- The somatic system contains 12 cranial nerves and 31 spinal nerves.
Motor nerves carry impulses from the brain to the skeletal muscles and somatic tissues, which creates voluntary movement.
NERVOUS SYSTEM

CENTRAL NERVOUS SYSTEM (CNS)

Brain

PERIPHERAL NERVOUS SYSTEM (PNS)

Sensory (afferent) neurons (somatic and autonomic)

Input

Cranial nerves and spinal nerves

Output

Spinal cord

Motor (efferent) neurons

Somatic (voluntary)

Autonomic (involuntary)

Sympathetic

Parasympathetic

EFFECTORS

Skeletal muscle

Cardiac muscle, smooth muscle, and glands
Nerves

- Nerves are made up of special cells called neurons.
- A neuron is a cell that forms the basic unit of the nervous system.
- Neurons are comprised of a dendrite, a cell body and an axon.
- Neurons have the amazing ability to gather and transmit electrochemical signals -- they are something like the gates and wires in a computer.
- Pulses travel to the dendrite into the cell body and then onto the axon.
- Some nerves are covered by a special sheath called myelin, which increases the conductivity of the neuron.
Neurons have three basic parts

**Cell body** - This main part has all of the necessary components of the cell, such as the nucleus (contains DNA), endoplasmic reticulum and ribosome (for building proteins) and mitochondria (for making energy).
Axon - This long, cable-like projection of the cell carries the electrochemical message (nerve impulse or action potential) along the length of the cell.

Depending upon the type of neuron, axons can be covered with a thin layer of myelin, like an insulated electrical wire.

Myelin is made of fat, and it helps to speed transmission of a nerve impulse down a long axon.
Dendrites or nerve endings

- These small, branch-like projections of the cell make connections to other cells and allow the neuron to talk with other cells or perceive the environment.
- Dendrites can be located on one or both ends of the cell.
As messages travel from one neuron to the next they move across a synapse.

At each synapse there is a chemical called a neurotransmitter.

At various parts of the body specific neurotransmitters facilitate communication.

For example dopamine (motor function), serotonin (mood), endorphins (painkillers).

Sensory neurons carry messages from a receptor to the brain.

The brain then interprets the message.

Motor neurons then send the message to an affector in muscles and glands.
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Receptor (sensory organ) → sensory neuron → brain / spinal cord → motor neuron → effector (muscle/gland).
Why does routine loss of neurons not affect function until very late in life?

- Loss of neurons + loss of myelin = decreased brain mass
- decrease is not uniform throughout brain
- decline in size begins slowly at 30, much faster at 60, 10% gone at 90
- ventricles enlarge
Loss of brain mass = loss of learning new skills

What tends to have greater decline
- Response time
- Integration of things observed
- Alertness (brain reactivity time)
- Verbal ability
- Memory
NORMAL CHANGES ASSOCIATED WITH AGEING

- General reaction times slower due to less neurons, less neurotransmitters, decrease conduction time along the axon.
- Slower response to heat and cold.
- Decrease in deep sleep.
- Less efficient sympathetic nervous system may cause transient hypotension and fainting.
- Decrease ability to respond to multiple stimuli.
- Deterioration in short term memory.
- Decrease in urethral and internal sphincter control
- Difficulty falling asleep, frequent awakenings
Dementia

Dementia is an irreversible mental state characterised by decreased intellectual function, personality change, and impairment of judgement.

- Dementia manifests in the following conditions:
  - Alzheimer’s Disease.
  - Vascular problems.
  - Parkinson's disease.
  - Chronic alcoholism.
  - Pick’s disease.
  - Huntington’s Disease.
The main features of the disease are:
- Memory loss.
- Language difficulties.
- Slowing of mental processes.
- Impaired reasoning.
- Psychiatric symptoms.
- Changes in personality.
- Behavioural disturbances.
- Wandering and pacing.
- Disorientation.
- Failure to recognise things, people.
Implications for Nursing Assistants

Interventions

- Provide a calm, caring, and structured environment.
- Residents are sensitive to attitudes and seem to know instinctively whom they can trust.
- Non verbal language on the part of the carer is very important.
- Do not personalise the behaviour of the resident; most of the time their behaviour has nothing to do with you; it is part of the manifestation of the disease.
Generally

- Observe and record problem behaviours.
- Provide a routine.
- Provide consistency of care as much as possible.
- Ensure resident is well groomed. To enhance self-esteem.
- Diversional therapy, e.g. ‘sundowners’ program.
- Therapy - reality orientation, validation, fantasy.
Parkinson’s Disease

Parkinson’s Disease is a chronic progressive disease that is linked to decreased dopamine production and is marked by tremor and weakness of resting muscles and by a shuffling gait.

It is important to be aware that Parkinson’s-like symptoms can occur as side effect of some drugs and as manifestation of diseases such as cerebrovascular disease and Huntington’s Disease. This is referred to as Parkinsonism.
Presenting Problems

Key clinical features

- Bradykinesia.
- Muscular rigidity.
- Resting tremor.
- Postural instability
Other features

- Seborrhoeic dermatitis.
- Dysphagia.
- Constipation.
- Excessive salivation.
- Anxiety, depression.
- Dementia (mild to moderate).
- Postural hypotension.
- Intelligence is not affected.
Implications for Nursing Assistants

The on/off syndrome

- After taking medications for some time, some residents may find that the drugs act for a shorter time.
- There can be sudden fluctuations in performance, which can be frustrating for carers.
- A great deal of understanding is needed to recognise the ‘on/off’ syndrome and deal sympathetically with it.
- Educate resident on how to keep elbows close to sides to reduce the impact of tremor whilst dressing and writing.
- Encourage resident to swing arms when walking to improve balance.
- If the resident suddenly cannot move, they may be experiencing ‘freezing’. Ask the patient to visualise a line on the floor and step over it to initiate walking.
- Encourage resident to hold on to something to reduce tremor.
Eating

- Assist resident when required but maintain independence.
- Ensure food is in small pieces.
- Allow plenty of time for eating.
- Encourage resident to sit upright.
- A mental condition which occurs as a reaction to a stressful event
Communication

- As there is limited facial expression and an absence of body language as well as fluctuations in ability, patience is needed when communicating with these residents.
- Encourage resident to participate in social activities.

Diet

- High fibre.
- Food with medications.
- Low protein.
Management:

- Medication
- Surgery (although there is no long-term ‘cure’ for Parkinson’s Disease)

Mobility

- Sit resident in high chair.
- Exercise.
- Well-fitting shoes.
- Educate resident on how to turn in a wide circle
Cerebral vascular accident (CVA)

A cerebral vascular accident is a disruption of blood supply to the brain resulting in loss of brain function

- **Specific causes**
  - Aneurysm.
  - Arteriosclerosis.
  - Hypertension.
  - Haemorrhage
Presenting Problems:

The presenting problems of a CVA reflect the location of the CVA in the brain as different areas of the brain are responsible for different functions.

Generally there may be:

- Dizziness, headache, poor concentration, “pins and needles”.
- Change in level of consciousness, weakness.
- Speech, sensory, motor deficits.
- Spasticity, paralysis.
- Incontinence.
- Changes in behaviour and/or personality.
Implications for Nursing Assistants

- Personal care and assistance with activities of daily living.
- Work with other members of the health care team - Physiotherapist, occupational therapist/Diversional therapist, dietician, and speech therapist.
- Rehabilitation.
- Encourage as much independence as possible to promote dignity and self-esteem.

Management

- Generally management depends on the cause - for example, a brain haemorrhage may require surgical intervention and also on the nature and severity of the deficit.
Personality Disorder.

- A group of mental disorders that cause a person to be unable to adapt to normal social situations
- **Bi-polar Disorder**
  - A chemical imbalance in the brain, which causes the person to experience periods of intense elation, interspersed with periods of intense depression

- **Depression**
  - A feeling of sadness, despair and emptiness that may be caused by feelings of inadequacy, loss, tragedy and/or a chemical imbalance
MULTIPLE SCLEROSIS

The cause of MS is unknown

- The disease involves repeated episodes of inflammation of nervous tissue in any area of the central nervous system (brain and spinal cord)

- Episodes occur when the body's own immune cells attack the nervous system.

- The location of the inflamed areas varies from person to person and from episode to episode.
The inflammation destroys the covering of the nerve cells in that area (myelin sheath), leaving multiple areas of scar tissue (sclerosis) along the covering of the nerve cells.

This results in slowing or blocking the transmission of nerve impulses in that area, leading to the symptoms of MS.
- Symptoms vary because the location and extent of each attack varies.
- There is usually a stepwise progression of the disorder, with episodes that last days, weeks, or months alternating with times of reduced or no symptoms (remission).
- Reoccurrence (relapse) is common although non-stop progression without periods of remission may also occur.
Multiple sclerosis (MS) affects approximately 1 out of 1,000 people.

- Women are affected more commonly than men.
- The disorder most commonly begins between 20 to 40 years old, but can happen at any age.
- Risks include a family history of MS and living in a geographical area with a higher incidence rate for MS.
Central nervous system (brain and spinal cord)

In multiple sclerosis, the myelin sheath, which is a single cell whose membrane wraps around the axon, is destroyed with inflammation and scarring.