Hydrocephalus is a condition in which excess cerebrospinal fluid accumulates, compressing the brain tissue and blood vessels. Because the cranial sutures have not closed, the infant's head enlarges. CSF accumulates because more is produced than is absorbed back into the bloodstream.

There are two types of hydrocephalus:

- **Noncommunicating** or **obstructive hydrocephalus** occurs in babies when the flow of CSF through the ventricular system is blocked, usually at the aqueduct of Sylvius or foramen magnum; this is usually due to a developmental abnormality.
- **Communicating hydrocephalus** results when the absorption of CSF through the arachnoid villi is impaired.
Hydrocephalus (Noncommunicating)

Spina bifida
- This is a group of neural tube defects that are congenital anomalies of varying severity
- Neural tube develops during the fourth week of gestation, beginning at the cervical area and progressing to the lumbar area

The basic problem is failure of the posterior spinous processes on the vertebrae to fuse, allowing the meninges and spinal cord to herniate
- Lumbar area is the most common location
- Cervical area shown here->
Types of Spina bifida

- **Spina bifida occulta** develops when the spinous processes do not fuse, but herniation of the spinal cord and meninges do not occur.
- Defect may not be visible; may be a dimple or tuft of hair on the skin over the site.
- Defect may be diagnosed on x-ray or when mild neurologic signs present due to tension on the cord during growth period.

- **Meningocele** is the same bony defect but with herniation of the meninges through the defect.
- Neurologic impairment is usually not present, although infection or rupture of the sac may lead to neurologic damage.
- **Meningomyelecele** is the most serious form of spina bifida.
- Herniation of the spinal cord and meninges results in considerable neurologic impairment.

The location and extent of the herniation determine how much function is lost.

This defect is often seen in conjunction with hydrocephalus.
Spina bifida

Cerebral Palsy (CP)

- CP is a group of disorders characterized by some degree of motor impairment
- It is caused by brain damage during the perinatal period; i.e. damage may occur before, during or shortly after birth and is nonprogressive
- Other areas of the brain may be damaged resulting in highly variable presentation
- 1 to 2 per 1,000 births
**Pathophysiology of CP**

- Brain tissue is altered by:
  - Malformation during development
  - Mechanical trauma
  - Hypoxia
  - Hemorrhage
  - Hypoglycemia
  - Hyperbilirubinemia
  - Any other factor causing necrosis

**Etiology of CP**

- Hypoxia or ischemia is the major cause of brain damage; it can occur prenatally, perinatally or postnatally.
- Hypoxia may be caused by placental complications or a difficult delivery
- Hypoxia may occur in premature infant by:
  - Vascular occlusion
  - Hemorrhage
  - Aspiration
  - Respiratory impairment

**Signs and Symptoms of CP**

- Effects may be apparent at birth but some cases show impaired motor development after several months
- CP is classified either on the basis of the area affected or on the basis of motor disability
- Three major groups have been identified
In addition to motor impairment, cerebral palsy may coexist with other problems and reflects the areas of the brain damaged. Some include:

- Intellectual function
- Communication and speech
- Seizures
- Visual problems

Seizure Disorders

- Result from uncontrolled, excessive discharge of neurons in the brain.
- The resulting activity may be localized or generalized.
- Seizure disorders are characterized by recurrent seizures or convulsions.
- 2.3 million Americans have seizure disorders (epilepsy).
- About ¾ of epilepsy patients develop the disorder before age 20.
Classification of Seizures

Partial seizures (focal)
- Simple
  - Motor (includes Jacksonian)
  - Sensory (e.g. visual, auditory)
  - Autonomic
  - Psychic
- Complex (impaired consciousness)
  - Temporal lobe or psychomotor
- Partial leading to generalized seizures

Classification of Seizures

Generalized (both hemispheres affected with loss of consciousness)
- Tonic-clonic (grand mal)
- Absence (petit mal)
- Myoclonic
- Infantile spasms
- Atonic (akinetic)
- Lennox-Gastaut syndrome (febrile seizures)

- Seizures may be primary (idiopathic) or secondary (acquired) with an identified cause like post-traumatic syndrome
- Seizures can be caused by:
  - Abnormality in the brain
  - Systemic causes like hypoglycemia or withdrawal from drugs
- Seizures may be temporary like febrile seizures in infants
- Patient can have more than one type of seizure
Treatment for seizure disorders

- Any primary cause should be treated and any specific triggers that precipitate seizures should be identified and avoided
- Anticonvulsant drugs are used to raise the threshold for neuronal stimulation
- If the area of brain excitability is small and accessible, surgery may help
- Combination of surgery and medication

Parkinson’s Disease

- Parkinson’s Disease (Paralysis agitans) results from dysfunction in the extrapyramidal motor system from progressive degenerative changes in the basal nuclei, especially the substantia nigra.
- A decreased number of neurons secrete dopamine, an inhibitory neurotransmitter leading to an imbalance between excitation and inhibition in the basal nuclei

The excess stimulation affects movement and posture by increasing muscle tone and activity, leading to:
- Resting tremors
- Muscular rigidity
- Difficulty in initiating movement
- Postural instability
- Many patients also have a decreased number of cortical neurons which is characteristic of dementia
Primary or idiopathic Parkinson’s Disease usually develops after age 60 and occurs in both sexes.
- Inheritance is not a factor
- Investigations looking at possible damaging effects of viruses or toxins on cells
- Secondary Parkinsonism may follow encephalitis, trauma or vascular disease
- Drug induced cases are also known

Dementia
- May be caused by several different illnesses
- Dementia is a progressive failure of many cerebral functions
- Dementias are characterized by reduction in cognitive functions; mental abilities are impaired with a decrease in orienting, recent memory, remote memory, language and alternations in behavior
Alzheimer's Disease

- Alzheimer's disease is characterized by a progressive loss of intellectual function that eventually interferes with work, relationships and personal hygiene.
- Typical changes with Alzheimer’s disease include:
  - Progressive cortical atrophy which leads to dilated ventricles and widening of the sulci especially in the frontal lobes.

![Alzheimer's brain images]
Neurofibrillary tangles in the neurons and senile plaques are found in large numbers in the affected parts of the brain. The plaques disrupt nerve transmissions. They are composed of beta-amyloid precursor protein (βAPP) whose role in the brain is being intensely studied. Some tangles are found in the brains of elderly persons whose cognitive functions are not impaired; it appears that the numbers and distribution of plaques are a significant factor in the disease.

Pre-senile or early-onset Alzheimer's disease is relatively rare and develops between the ages of 30-60 and is inherited; involves chromosomes 14, 19 and 21. Alzheimer's disease (senile dementia) affects people over age 65 and appears to be multifactorial in origin.

Senile dementia (AD) increases in incidence with age. Genetic factors may play a role; links to at least four genes are known. Other suspected factors include exposure to metals, e.g. aluminum. Viruses; prions. Mutated genes.
Signs and Symptoms

- Onset is insidious with a gradual loss of memory and lack of concentration
- Cognitive functions continue to decline
- Behavioral changes such as irritability, hostility and mood swings are common
- In time it becomes impossible to manage daily living activities
- In the late stages the person fails to recognize family members
- Finally become incontinent and unable to function in any way
- Survival ranges up to 20 years; average 7