

# CHAPTER I

## INTRODUCTION

**“ The body is your temple. Keep it pure and clean for the soul to reside in”**

**–B.K.S Iyengar(1976)**

Today the society is facing numerous disabilities and chronic illnesses related to aging, heredity, environment, genetical and life style disorders such as cancer, diabetes, osteoporosis and cardio vascular diseases, neurological disorders such as autism, mental retardness, cerebral palsy as well as many incurable diseases such as AIDS. Modern medical science provide the rationale for the integration of various traditional healing techniques including yoga to promote healing, health and longevity. Yoga has a lot of offer to humankind in terms of preventive, promotive and rehabilitative methods in addition to many management methods to tackle modern illnesses. While modern science looks outward for the cause of all illness, the yogi searches the depth of his own soul. This two-way search can lead to many answers for the troubles that plague modern man.

The context in which an individual lives is of great importance on health status and quality of life. It is increasingly recognized that health is maintained and improved not only through the advancement and application of health science, but also through the efforts and intelligent lifestyle choices of the individual and society. According to the World Health Organization, the main determinants of health include the social and economic environment, the physical environment and the person's individual characteristics and behaviours.

## **1.1 CENTRAL NERVOUS SYSTEM**

The nervous system of human body is the decision and communication center. The central nervous system (CNS) is made of the brain and the spinal cord and the peripheral nervous system (PNS) is made of nerves. Together they control every part of the daily life, from breathing and blinking to helps to memorize facts for a test. Nerves reach from the brain to the face, ears, eyes, nose, and spinal cord, and from the spinal cord to the rest of the body. Sensory nerves gather information from the environment, send that information to the spinal cord, which then speed the message to the brain. The brain then makes sense of that message and fires off a response. Motor neurons deliver the instructions from the brain to the rest of the body. The spinal cord, made of a bundle of nerves running up and down the spine, is similar to a superhighway, speeding messages to and from the brain at every second. The functions of Central Nervous System (CNS) depends on the following:

- The brain
- The Spinal cord

### **1.1.1 STRUCTURE OF THE BRAIN**

Human brain consists of cerebrum, brain stem and the cerebellum. The largest part of the human brain is the cerebrum, which is divided into two hemispheres. Underneath lies the brainstem, and behind that sits the cerebellum. The outermost layer of the cerebrum is the cerebral cortex, which consists of four lobes namely frontal lobe, parietal lobe, temporal lobe and the occipital lobe.

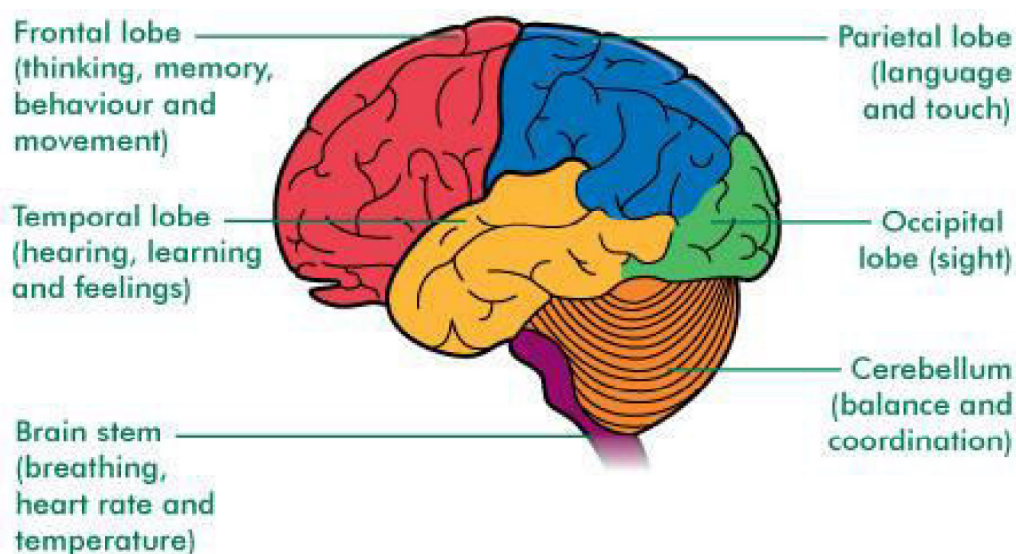
- **Cerebrum**

The outermost layer of the cerebrum is the cerebral cortex, which consists of four lobes namely frontal lobe, parietal lobe, temporal lobe and the occipital lobe.

The location and the functions of these lobes are as follows;

- The frontal lobes are located in the front of the brain and are responsible for voluntary movement and, via their connections with other lobes, participate in the execution of sequential tasks, speech output, organizational skills, and certain aspects of behaviour, mood, and memory.
- The parietal lobes are located behind the frontal lobes and in front of the occipital lobes. They process sensory information such as temperature, pain, taste, and touch. In addition, the processing includes information about numbers, attentiveness to the position of one's body parts, the space around one's body, and one's relationship to this space.
- The temporal lobes are located on each side of the brain. They process memory and auditory (hearing) information and speech and language functions.
- The occipital lobes are located at the back of the brain. They receive and process visual information.

**Figure 1**  
**STRUCTURE OF THE BRAIN**



### 1.1.2 ANATOMY OF THE BRAIN

Like all vertebrate brains, the human brain develops from three sections known as the forebrain, midbrain and hindbrain. Each of these contains fluid-filled cavities called ventricles. The forebrain develops into the cerebrum and underlying structures, the midbrain becomes part of the brainstem and the hindbrain gives rise to regions of the brainstem and the cerebellum.

- **Cerebral cortex**

It is greatly enlarged in human brains, and is considered the seat of complex thought. Visual processing takes place in the occipital lobe, near the back of the skull. The temporal lobe processes sound and language, and includes the hippocampus and

amygdala, which play roles in memory and emotion, respectively. The parietal lobe integrates input from different senses and is important for spatial orientation and navigation.

- **Brainstem**

It connects to the spinal cord and consists of the medulla oblongata, pons and midbrain. The primary functions of the brainstem include: relaying information between the brain and the body; supplying some of the cranial nerves to the face and head; and performing critical functions in controlling the heart, breathing and consciousness.

- **Thalamus**

Between the cerebrum and brainstem lie the thalamus and hypothalamus. The thalamus relays sensory and motor signals to the cortex and is involved in regulating consciousness, sleep and alertness. The hypothalamus connects the nervous system to the endocrine system — where hormones are produced — via the pituitary gland.

- **Cerebellum**

It lies beneath the cerebrum and has important functions in motor control. It plays a role in coordination and balance, and may also have some cognitive functions.

### **1.1.3 STRUCTURE OF THE CEREBELLUM**

The cerebellum is divided into an anterior lobe, a posterior lobe, and the flocculonodular lobe. The anterior and posterior lobes are connected in the middle by the vermis. The cerebellum has a much thinner outer cortex that is narrowly

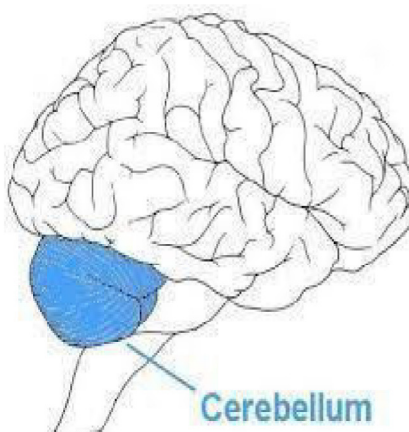
furrowed horizontally. Viewed from underneath between the two lobes is the third lobe the flocculonodular lobe. The cerebellum rests at the back of the cranial cavity, lying beneath the occipital lobes, and is separated from these by the cerebellar tentorium, a sheet of fibre. It is connected to the midbrain of the brainstem by the superior cerebellar peduncles, to the pons by the middle cerebellar peduncles, and to the medulla by the inferior cerebellar peduncles. The cerebellum consists of an inner medulla of white matter and an outer cortex of richly folded grey matter. The cerebellum's anterior and posterior lobes appear to play a role in the coordination and smoothing of complex motor movements, and the flocculonodular lobe in the maintenance of balance although debate exists as to its cognitive, behavioral and motor functions.

#### **1.1.4 LOCATION OF CEREBELLUM**

It lies beneath the cerebrum and has important functions in motor control. It plays a role in coordination and balance, and may also have some cognitive functions.

**Figure 2**

#### **LOCATION OF CEREBELLUM**



### **1.1.5 FUNCTIONS OF THE CEREBELLUM**

- Located at the base of the brain, this area is primarily responsible for precision, coordination and timing aspects of motor movements and cognitive processes. The health of the cerebellum is extremely important as it provides a constant flow of information to other areas of the brain, which is vital for proper brain function.
- When cerebellar function begins to decline and leads to problems in balance, changes in cognitive and motor performance, and disturbances in other body functions. This also disrupts the constant flow of information from this area to other brain regions. This can, in turn, cause problems in other areas of the brain leading to seemingly unrelated symptoms, including anxiety, fatigue, restless leg syndrome, movement disorders, depression, and many other conditions.
- Therefore, changes in balance and coordination of movement are carefully evaluated by a healthcare professional. Recognizing these potential signs of poor brain function may help to find and stop long-term neurodegenerative conditions down the road.

### **1.1.6 CEREBROSPINAL FLUID**

Cerebrospinal fluid is a clear, colourless transcellular fluid that circulates around the brain in the subarachnoid space, in the ventricular system, and in the central canal of the spinal cord. It also fills some gaps in the subarachnoid space, known as subarachnoid cisterns. The four ventricles, two lateral, a third, and a fourth ventricle, all contain choroid plexus that produces cerebrospinal fluid. The third

ventricle lies in the midline and is connected to the lateral ventricles. A single duct, the cerebral aqueduct between the pons and the cerebellum, connects the third ventricle to the fourth ventricle. Three separate openings, the middle and two lateral apertures, drain the cerebrospinal fluid from the fourth ventricle to the cisterna magna one of the major cisterns. From here, cerebrospinal fluid circulates around the brain and spinal cord in the subarachnoid space, between the arachnoid mater and pia mater. At any one time, there is about 150mL of cerebrospinal fluid – most within the subarachnoid space. It is constantly being regenerated and absorbed, and replaces about once every 5–6 hours (**Kenneth S. Saladin, 2010**)

## **1.2 FUNCTIONS OF THE CENTRAL NERVOUS SYSTEM**

### **1.2.1 BALANCE AND CONTROL**

The motor system of the brain is responsible for the generation and control of movement. Generated movements pass from the brain through nerves to motor neurons in the body, which control the action of muscles. The corticospinal tract carries movements from the brain, through the spinal cord, to the torso and limbs. The cranial nerves carry movements related to the eyes, mouth and face.

Gross movement – such as locomotion and the movement of arms and legs – is generated in the motor cortex, divided into three parts: the primary motor cortex, found in the prefrontal gyrus and has sections dedicated to the movement of different body parts. These movements are supported and regulated by two other areas, lying anterior to the primary motor cortex: the premotor area and the supplementary motor area. The hands and mouth have a much larger area dedicated to them than other body parts, allowing finer movement; this has been visualised in a motor cortical homunculus. Impulses generated from the motor cortex travel along



the corticospinal tract along the front of the medulla and cross over (decussate) at the medullary pyramids. These then travel down the spinal cord, with most connecting to interneurons, in turn connecting to lower motor neurons within the grey matter that then transmit the impulse to move to muscles themselves. The cerebellum and basal ganglia, play a role in fine, complex and coordinated muscle movements. Connections between the cortex and the basal ganglia control muscle tone, posture and movement initiation, and are referred to as the extrapyramidal system.

### **1.2.2 SENSORY PROCESS**

The sensory nervous system is involved with the reception and processing of sensory information. This information is received through the cranial nerves, through tracts in the spinal cord, and directly at centres of the brain exposed to the blood. The brain also receives and interprets information from the special senses (vision, smell, hearing, and taste). Mixed motor and sensory signals are also integrated. From the skin, the brain receives information about fine touch, pressure, pain, vibration and temperature. From the joints, the brain receives information about joint position. The sensory cortex is found just near the motor cortex, and, like the motor cortex, has areas related to sensation from different body parts. Sensation collected by a sensory receptor on the skin is changed to a nerve signal, that is passed up a series of neurons through tracts in the spinal cord. The posterior column–medial lemniscus pathway contains information about fine touch, vibration and position of joints. Neurons travel up the back part of the spinal cord to the back part of the medulla, where they connect with "second order" neurons that immediately swap sides. These neurons then travel upwards into the ventrobasal complex in the thalamus where they connect with "third order" neurons, and travel up to the sensory

cortex. The spinothalamic tract carries information about pain, temperature, and gross touch. Neurons travel up the spinal cord and connect with second-order neurons in the reticular formation of the brainstem for pain and temperature, and also at the ventrobasal complex of the medulla for gross touch.

Vision is generated by light that hits the retina of the eye. Photoreceptors in the retina transduce the sensory stimulus of light into an electrical nerve signal that is sent to the visual cortex in the occipital lobe. Vision from the left visual field is received on the right side of each retina (and vice versa) and passes through the optic nerve until some information changes sides, so that all information about one side of the visual field passes through tracts in the opposite side of the brain. The nerves reach the brain at the lateral geniculate nucleus, and travel through the optic radiation to reach the visual cortex.

Hearing and balance are both generated in the inner ear. The movement of liquids within the inner ear is generated by motion (for balance) and transmitted vibrations generated by the ossicles (for sound). This creates a nerve signal that passes through the vestibulocochlear nerve. From here, it passes through to the cochlear nuclei, the superior olivary nucleus, the medial geniculate nucleus, and finally the auditory radiation to the auditory cortex.

The sense of smell is generated by receptor cells in the epithelium of the olfactory mucosa in the nasal cavity. This information passes through a relatively permeable part of the skull to the olfactory nerve. This nerve transmits to the neural circuitry of the olfactory bulb from where information is passed to the olfactory cortex. Taste is generated from receptors on the tongue and passed along the facial and glossopharyngeal nerves into the solitary tract in the brainstem. Some

taste information is also passed from the pharynx into this area via the vagus nerve. Information is then passed from here through the thalamus into the gustatory cortex.

### **1.2.3 EMOTIONS**

Emotions are generally defined as two-step multicomponent processes involving elicitation, followed by psychological feelings, appraisal, expression, autonomic responses, and action tendencies. Attempts to localize basic emotions to certain brain regions have been controversial, with some research finding no evidence for specific locations corresponding to emotions, and instead circuitry involved in general emotional processes. The amygdala, orbitofrontal cortex, mid and anterior insula cortex and lateral prefrontal cortex, appeared to be involved in generating the emotions, while weaker evidence was found for the ventral tegmental area, ventral pallidum and nucleus accumbens in incentive salience. Others, however, have found evidence of activation of specific regions, such as the basal ganglia in happiness, the subcallosal cingulate cortex in sadness, and amygdala in fear.

### **1.2.4 COGNITION**

The executive function of the brain is a set of cognitive processes that allow the cognitive control of behaviours. Selecting and successfully monitoring behaviours that facilitate the attainment of chosen goals. Executive functions include the ability to filter information and tune out irrelevant stimuli with attentional control and cognitive inhibition, the ability to process and manipulate information held in working memory, the ability to think about multiple concepts simultaneously and switch tasks with cognitive flexibility, the ability to inhibit impulses and prepotent responses with inhibitory control, and the ability to determine the relevance of information or appropriateness of an action. Higher order executive functions,

require multiple cognitive processes including planning, reasoning, and problem solving.

The prefrontal cortex plays a significant role in mediating executive functions. Neuroimaging during neuropsychological tests of executive function, such as the stroop test and working memory tests, have found that cortical maturation of the prefrontal cortex correlates with executive function in children. Planning involves activation of the dorsolateral prefrontal cortex (DLPFC), anterior cingulate cortex, angular prefrontal cortex, right prefrontal cortex, and supramarginal gyrus. Working memory manipulation involves the DLPFC, inferior frontal gyrus, and areas of the parietal cortex. Inhibitory control involves multiple areas of the prefrontal cortex as well as the caudate nucleus and subthalamic nucleus. Task shifting doesn't involve specific regions of the brain, but instead involves multiple regions of the prefrontal cortex and parietal lobe. **(Chatterjee C.C, 2016)**

### **1.2.5 REGULATIONS OF FUNCTIONAL SYSTEMS**

Autonomic functions of the brain include the regulation, or rhythmic control of the heart rate and rate of breathing, circadian rhythm, endocrine system sensory processing, and speech and language.

#### **1.2.5.1 HEART RATE**

Blood pressure and heart rate are influenced by the vasomotor centre of the medulla, which causes arteries and veins to be somewhat constricted at rest. It does this by influencing the sympathetic and parasympathetic nervous systems via the vagus nerve. Information about blood pressure is generated by baroreceptors in aortic bodies in the aortic arch, and passed to the brain along

the afferent fibres of the vagus nerve. Information about the pressure changes in the carotid sinus comes from carotid bodies located near the carotid artery and this is passed via a nerve joining with the glossopharyngeal nerve. This information travels up to the solitary nucleus in the medulla. Signals from here influence the vasomotor centre to adjust vein and artery constriction accordingly.

#### **1.2.5.2 RATE OF BREATHING**

The brain controls the rate of breathing, mainly by respiratory centres in the medulla and pons. The respiratory centres control respiration, by generating motor signals that are passed down the spinal cord, along the phrenic nerve to the diaphragm and other muscles of respiration. This is a mixed nerve that carries sensory information back to the centres. There are four respiratory centres, three with a more clearly defined function, and an apneustic centre with a less clear function. In the medulla a dorsal respiratory group causes the desire to breathe in and receives sensory information directly from the body. Also in the medulla, the ventral respiratory group influences breathing out during exertion. In the pons the pneumotaxic centre influences the duration of each breath, and the apneustic centre seems to have an influence on inhalation. The respiratory centres directly sense blood carbon dioxide and pH. Information about blood oxygen, carbon dioxide and pH levels are also sensed on the walls of arteries in the peripheral chemoreceptors of the aortic and carotid bodies. This information is passed via the vagus and glossopharyngeal nerves to the respiratory centres. High carbon dioxide, an acidic pH, or low oxygen stimulate the respiratory centres. The desire to breathe in is also affected by pulmonary stretch receptors in the lungs which, when activated, prevent the lungs from overinflating by transmitting information to the respiratory centres via the vagus nerve.

### **1.2.5.3 CIRCADIAN RHYTHM**

The hypothalamus in the diencephalon, is involved in regulating many functions of the body. Functions include neuroendocrine regulation, regulation of the circadian rhythm, control of the autonomic nervous system, and the regulation of fluid, and food intake. The circadian rhythm is controlled by two main cell groups in the hypothalamus. The anterior hypothalamus includes the suprachiasmatic nucleus and the ventrolateral preoptic nucleus which through gene expression cycles, generates a roughly 24 hour circadian clock. In the circadian day an ultradian rhythm takes control of the sleeping pattern. Sleep is an essential requirement for the body and brain and allows the closing down and resting of the body's systems. There are also findings that suggest that the daily build-up of toxins in the brain are removed during sleep. Whilst awake the brain consumes a fifth of the body's total energy needs. Sleep necessarily reduces this use and gives time for the restoration of energy-giving ATP. The effects of sleep deprivation show the absolute need for sleep.

### **1.2.5.4 ENDOCRINE SYSTEM**

The lateral hypothalamus which contains orexinergic neurons that mainly controls appetite and arousal through their projections to the ascending reticular activating system. The hypothalamus controls the pituitary gland through the release of peptides such as oxytocin, and vasopressin, as well as dopamine into the median eminence. Through the autonomic projections, the hypothalamus is involved in regulating functions such as blood pressure, heart rate, breathing, sweating, and other homeostatic mechanisms. The hypothalamus also plays a role in thermal regulation, and when stimulated by the immune system, is capable of generating a fever. The

hypothalamus is influenced by the kidneys – when blood pressure falls, the renin released by the kidneys stimulates a need to drink. The hypothalamus also regulates food intake through autonomic signals, and hormone release by the digestive system.

#### **1.2.5.5 SENSORY PROCESSING**

The cerebrum has a contralateral organisation with each hemisphere of the brain interacting primarily with one half of the body: the left side of the brain interacts with the right side of the body, and vice versa. The developmental cause for this is uncertain. Motor connections from the brain to the spinal cord, and sensory connections from the spinal cord to the brain, both cross sides in the brainstem. Visual input follows a more complex rule: the optic nerves from the two eyes come together at a point called the optic chiasm, and half of the fibres from each nerve split off to join the other. The result is that connections from the left half of the retina, in both eyes, go to the left side of the brain, whereas connections from the right half of the retina go to the right side of the brain. Because each half of the retina receives light coming from the opposite half of the visual field, the functional consequence is that visual input from the left side of the world goes to the right side of the brain, and vice versa. Thus, the right side of the brain receives somato sensory input from the left side of the body, and visual input from the left side of the visual field.

#### **1.2.5.6 SPEECH AND LANGUAGE**

The left and right sides of the brain appear symmetrical, but they function asymmetrically. For example, the counterpart of the left-hemisphere motor area controlling the right hand is the right-hemisphere area controlling the left hand. There are, however, several important exceptions, involving language and spatial cognition.

The left frontal lobe is dominant for language. If a key language area in the left hemisphere is damaged, it can leave the victim unable to speak or understand, whereas equivalent damage to the right hemisphere would cause only minor impairment to language skills. **(Chatterjee C.C, 2016)**

### **1.3 CEREBRAL PALSY**

Cerebral palsy (CP) is the most common motor disability in childhood. The word “Cerebral” refers to the brain’s cerebrum which is the part of the brain that regulates motor function. “Palsy” describes a paralysis of voluntary movement in certain body parts for example upper and lower limbs. cerebral palsy refers to a group of neurological disorders that appear in infancy or early childhood and permanently affect body movement and muscle co-ordination, impairment or loss of motor function.

Cerebral palsy (CP) is a group of permanent movement disorders that appear in early childhood. Signs and symptoms vary among people. Often, symptoms include poor coordination, stiff muscles, weak muscles, and tremors. There may be problems with sensation, vision, hearing, swallowing, and speaking. Often babies with cerebral palsy do not roll over, sit, crawl, or walk as early as other children of their age. Other symptoms may include seizures and problems with thinking or reasoning, either of which occurs in about one third of people with cerebral palsy. While the symptoms may get more noticeable over the first few years of life, the underlying problems do not worsen over time. cerebral palsy is caused by abnormal development or damage to the parts of the brain that control movement, balance and posture. Most often the problems occur during pregnancy; however, they may also occur during childbirth, or shortly after birth. **(Archie Hinchcliffe, 2007)**



A study by the centres for the disease control & prevention shows the average prevalence the cerebral palsy is 3.3 children /1000 births. cerebral palsy does not affect life expectancy depending on how the condition is managed, motors skills can improve or decline throughout the life time. Although cerebral palsy varies in each individual most children with this disability are still able to have full and rich life.

### **1.3.1 CAUSES OF CEREBRAL PALSY**

In many cases the cause of the cerebral palsy is unknown. Possible causes include genetic abnormalities, cognitive brain mal formation, maternal infection or foetal infection. The cause of cerebral palsy is a brain injury or brain malformation that occurs while the brain is developing before, during, or after birth. As a result of the brain damage during brain development a child's muscle control, muscle coordination, muscle tone, reflex, posture and balance can be affected. It can also affect a child's fine motor skills, gross motor skills, and oral motor functioning injury.

The brain damage may cause its characteristic symptoms as follows;

- **Damage to the white matter of the brain.** This white matter is responsible for transmitting signals inside the brain and the rest of the body.
- **Abnormal development of brain** (cerebral dysgenesis). Any interruption of the normal process of brain growth during foetal development can cause brain mal formation that interferes with the transmission of brain signals.
- **Bleeding in the brain**(intra cranial hemorrhage) . Bleeding inside the brain from blocked or broken blood vessels is commonly caused by foetal stroke.

**Severe lack of oxygen in the brain.** A lack of oxygen in the brain caused by an interruption in breathing or poor oxygen supply is common for brief period of time in babies due to the stress of labor pain and delivery. If the supply of oxygen is cut off or reduced for lengthy period an infant can develop a type of brain damage called hypoxic ischemic encephalopathy, which destroys tissue in the cerebral motor cortex and other areas of the brain. (Archie Hinchcliffe, 2007)

### 1.3.2 SIGNS AND SYMTOMS OF CEREBRAL PALSY

- Impairments resulting from cerebral palsy range in severity, usually in correlation with the degree of injury to the brain. Because cerebral palsy is a group of conditions, signs and symptoms vary from one individual to the next.
- The primary effect of cerebral palsy is impairment of muscle tone, gross and fine motor functions, balance, control, coordination, reflexes, and posture. Oral motor dysfunction, such as swallowing and feeding difficulties, speech impairment, and poor facial muscle tone can also indicate cerebral palsy.
- Associative conditions, such as sensory impairment, seizures, and learning disabilities that are not a result of the same brain injury, occur frequently with cerebral palsy. When present, these associative conditions may contribute to a clinical diagnosis of cerebral palsy.

The visible symptoms of the children with cerebral palsy are as follows;

- Lack of muscle co-ordination
- Stiff and tight muscles and exaggerated reflexes.
- Weakness in one or more arm or leg.

- Walking on the toes, a croached gait or scissored gait.
- Variation in muscle tone either too stiff or too floppy.
- Shaking or random involuntary movements.
- Delays in reaching motor skill.
- Excessive drooling or difficulties in swallowing or speaking.

### 1.3.3 TYPES OF CEREBRAL PALSY

There are different *kinds* of cerebral palsy, depending on the parts of the brain that have been damaged, and each kind is recognised by the way in which the child's postural tone is altered.

- **Spasticity:** The muscles are stiff and the child moves in patterns that are not useful in a limited way. As the child tries to move, the muscles become stiffer. In such children the movement areas and pathways of the cortex area of the brain are damaged.
- **Athetosis:** There is movement all the time or unwanted and uncontrolled movements occur. The muscles may be stiff one moment and floppy the next. In such conditions the basal ganglia of the brain are damaged.
- **Ataxia:** The muscles constantly quiver when the child tries to move. So the child may stiffen him to overcome this. In these conditions the cerebellum is damaged.
- **Hypotonia:** The muscles are constantly floppy.

### **1.3.4 DIAGNOSIS OF CEREBRAL PALSY**

- Early diagnosis of cerebral palsy will reveal an infant with significant delays in many important areas of growth and developmental maturation long before a recognizable pattern of motor deficit is apparent.
- There will be abnormalities of tone and patterns of motor behaviour that are associated with difficulties in maintaining the body in space, restricting movement and affecting the ability to interact with environment. The motor difficulties will lead to limitations in movement that may, in time, result in fixed deficits that will further reduce function and participation.
- Early diagnosis provide an opportunity to asses these problems and the individual needs of the infant and should lead initiation of the habilitation process.
- The neuropathological state of the infant will delay progression of motor development. Appropriate treatment is essential to reduce deficits, assist in motor progression and help to maintain appropriate levels of physical fitness.
- Similarly, the infant may have limitations in speech and cognitive development that must be addressed by relevant and coordinate treatment programes. (Alfred L. Scherzer, 2001)

### **1.3.5 ASSOCIATED CONDITIONS OF CEREBRAL PALSY**

- A baby with cerebral palsy may have been damaged early in pregnancy and may therefore have abnormal movements even before birth. While the motor in cerebral palsy is predominant, a number of associated conditions are frequently present and must be considered in the overall developmental needs of the affected child.

- These include abnormalities of vision, hearing and speech, seizure disorders and learning disabilities among the vast majority and frequent social, emotional and interfamily problems.
- The intellectual capacity of the child may be damaged making him slow to learn and understand.
- Perceptual problems can lead to a child becoming fearful of moving around, this is because of difficulty in grasping ideas of such things as distance, perspective and high and low and cannot make sense of his environment and how his body fits into it.
- Mental retardation is not necessarily present with cerebral palsy, but is likely to be associated with severe spasticity. (Archie Hinchcliffe, 2007)

### **1.3.6 EARLY INTERVENTION FOR CEREBRAL PALSY CHILDREN**

Now it is fortunate enough to have available techniques for early identification and tools for early intervention of the infant with cerebral palsy. Even those with severe involvement may be expected to develop some independent function and eventually make their contribution to society. This progress has become possible as the traditional, primarily orthopaedic approach in cerebral palsy has increasingly expanded to include multiple professionals who must deal with the array of needs of the child who has developmental disabilities. Concurrent early intervention special education programs up to age three have expanded both resources and the range of modalities that can now be offered. Extension to preschool and school services that now offer inclusion and mainstream programs enables increasing number of these children to become successful in finding a place within the community. For those who require continuous supervision and assistance,

opportunities are expanding for meaningful independence within a residential setting.  
(Alfred L. Scherzer, 2001)

### 1.3.7 TREATMENT AND THERAPIES FOR CEREBRAL PALSY

There are rapidly proliferating numbers of procedures claimed to be effective for neuromodulation and alleviation of symptoms of a large array of mental, physical, and learning disorders. A great many, if not most, involve intentional application of rhythmic stimulation of various sorts, *including* auditory, visual, electrical, and electromagnetic or some combination thereof. While many of the procedures are advertised as new, clinically proven and evidence-based, the fact is that in most cases very similar procedures have been used for decades, or even centuries, and the evidence for their efficacy largely is anecdotal. Their proliferation presents a confusing situation for clinical practitioners and consumers alike in attempting to understand, recommend, or use them. In this chapter the author attempts to clarify some of the confusion by presenting an historical overview of relatively specific procedures using rhythmic stimulation for healing purposes from antiquity to present day. Some details of each are provided and support for efficacy of each is discussed when available. Summary comments are provided regarding various subcategories of procedures, underlying mechanisms of their effectiveness, and reasons for their increasing popularity despite continuing skepticism or rejection by mainstream medicine. Common therapies for special children were listed below;

- Treatment may include one or more of the following: physical therapy; occupational therapy; speech therapy; water therapy; drugs to control seizures, alleviate pain, or relax muscle spasms for example benzodiazepines.

- Surgery to correct anatomical abnormalities or release tight muscles; braces and other orthotic devices; rolling walkers; and communication aids such as computers with attached voice synthesisers.
- A Cochrane review published in 2004 found a trend toward benefit of speech and language therapy for children with cerebral palsy, but noted the need for high quality research.
- The treatments with the best evidence are medications (anticonvulsants, botulinum toxin, bisphosphonates, diazepam), therapy (bimanual training, casting, constraint-induced movement therapy, context-focused therapy, fitness training, goal-directed training, hip surveillance, home programmes, occupational therapy after botulinum toxin, pressure care) and surgery (selective dorsal rhizotomy).
- Yoga for the Special child is multi-level comprehensive program of yoga techniques designed to enhance the natural development of children with special needs. Yoga is gentle and beneficial, safe for babies and children with Down Syndrome, cerebral palsy, Microcephaly, Autism and other developmental disabilities.
- These methods also provide an effective treatment for children diagnosed with Attention Deficit Disorder, ADHD and Learning Disabilities. Because yoga is not just an amazing way to work on all the systems of the body, enhance the brain areas and to keep the mind peaceful, but also, it is an excellent complement to all the other kind of therapies allowing the child to understand and assimilate them easily.
- Through the practice of specific types of breathing exercises more oxygenation is brought to all the brain cells stimulating all its areas and

improving attention and concentration. Asanas or yoga positions combined with the breath, improves metabolism, calms nervous system and better sleep.(Alfred L. Scherzer 2001)

#### **1.4 YOGA**

**“Yoga is not an ancient myth buried in oblivion. It is the most valuable inheritance of the present. It is the essential need of today and the culture of tomorrow”.**

**–Swami Satyananda Saraswati (1969)**

Yoga is an essential spiritual discipline based on an extremely subtle science which focuses on bringing harmony between mind and body. It is an art and science for healthy living. "Yoga" also refers to an inner science comprising of a variety of methods through which human beings can achieve union between the body and mind to attain self-realisation. The aim of yoga practice (sādhana) is to overcome all kinds of sufferings that lead to a sense of freedom in every walk of life with holistic health, happiness and harmony. The widely practiced yoga Sadhanas (Practices) are Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana (Meditation), Samadhi /Samyama, Bandhas and Mudras, Shat-karmas, Yukta-ahara, Yukta karma, Mantra japa, etc. Yama's are restraints and Niyama's are observances. These are considered to be pre-requisites for the Yoga Sadhanas (Practices). Asanas, capable of bringing about stability of body and mind ‘ kuryat-tad-asanam-sthairyam...’, consists in adopting various body (psycho-physical) patterns, giving ability to maintain a body position (a stable awareness of one’s structural existence) for a considerable time.



### **1.4.1 BENEFITS OF YOGA ON HUMAN BODY SYSTEM**

The practice of yoga not only works on the physical body by keeping it fit while strengthening and elongating the muscles, it also helps the nervous and circulatory systems by purifying and balancing them. In the past, traditional healers used yoga postures as a method for healing emotional disorders and illnesses. As a result of regular practice, many benefits will occur. This includes greater endurance, flexibility, deeper breathing, and an overall improvement in mood and emotional well-being. The traditions of hatha yoga provide powerful physical results and are intended to serve as a foundation for the mental and spiritual dimensions of yoga. Hard work can silence the mind, but has no power to alter or transcend emotional and karmic patterns held in the unconscious mind.

The practice of asanas promotes flexibility of the muscles and strength in the bones and tissues. It also massages the organs, brings balance to different internal and glandular functions, promotes the flow of vital energy, prana (also known as qi in Chinese, or ki in Japanese), and balances the physical and metaphysical parts of the body (koshas). Asanas are techniques that promote awareness, concentration, meditation, and relaxation through the physical body. As the practice becomes more regular, there are significant results. Such results include good mental and physical health through stretching, massage and the stimulation of the energy channels of the internal organs.

Scientific studies have shown that the practice of yoga has curative abilities and can prevent disease by promoting energy and health. That is why more and more professionals have started using yoga techniques in patients with different mental and physical symptoms, such as psycho-somatic stresses and different diseases. Our

bodies have a tendency to build up and accumulate poisons like uric acid and calcium crystals, just to mention a few. The accumulation of these poisons manifests in diseases and makes our bodies stiff. A regular yoga practice can cleanse the tissues through muscle stretching and massaging of the internal organs. This brings the waste back into circulation so that the lungs, intestines, kidneys, and skin are able to remove toxins in a natural way. **(Shrikrishna, 2004)**

#### **1.4.2 YOGA THERAPY**

Yoga therapy is a type of therapy that uses yoga postures, breathing exercises, meditation, and guided imagery to improve mental and physical health. The holistic focus of yoga therapy encourages the integration of mind, body, and spirit. Therapeutic yoga is an inherently holistic approach, simultaneously working on the body, mind, and spirit. Various yoga practices systematically strengthen different systems in the body, including the heart and cardiovascular system, the lungs, muscles, and the nervous system. Yoga practices can improve function of the digestive system, foster psychological well-being, and improve oxygen delivery to tissues. Yoga also can help the body more efficiently remove waste products, carcinogens, and cellular toxins. **(GeetaIyer, 2017)**

Yoga therapy may be defined as the application of yogic principles to a particular person with the objective of achieving a particular spiritual, psychological, or physiological goal. The means employed are comprised of intelligently conceived steps that include but are not limited to the components of Ashtānga yoga, which includes the educational teachings of yama, niyama, āsana, prānāyāma, pratyāhāra, dhāranā, dhyāna, and samādhi. Also included are the application of meditation, textual study, spiritual or psychological counseling, chanting, imagery, prayer, and

ritual to meet the needs of the individual. Yoga therapy respects individual differences in age, culture, religion, philosophy, occupation, and mental and physical health. The knowledgeable and competent yogin or yoginî applies yoga therapy according to the period, the place, and the practitioner's age, strength, and activities.

**(N. Chandrasekaran, 2012)**

### **1.4.3 PRINCIPLES OF YOGA THERAPY**

- Teach what is appropriate to the individual (yukta-shikshana).
- Differences in different people must be respected (bheda).
- Teachings must consider the situation, place, or country from which the student comes (desha).
- Each person needs to be taught according to his or her individual constitution, age, disposition, etc.(i.e., obese, lean, young, old, etc.) (deha).
- The method of instruction depends on the time of year, the seasons, etc. (kâla).
- Depending on the occupation of the student, he or she will need to be taught different things (e.g., a runner would be taught differently than a philosopher) (vritti).
- One must understand the capacity of the student, how much endurance he or she has, how much memory, how much time to study or practice (shakti).
- The teaching must conform to the direction of the mind (i.e., it must take a person's interests into account, such as exercise, devotion, God, chanting, etc.

**(N.Chandrasekaran, 2012)**

## 1.5 VINYASA YOGA

The word “vinyasa” can be translated as “arranging something in a special way” like yoga poses for example. Baptiste yoga, jivamukti, power yoga and prana flow could all be considered vinyasa yoga. Vinyasa is also the term used to describe a specific sequence of poses. Vinyasa is a Sanskrit term often employed in relation to certain styles of yoga, that usually refers transition between two different positions. “Nyasa” -denotes to place and “Vi” -denotes in a special way.

From time immemorial the Vedic syllable are chanted with the correct (high, low, and level) notes. Likewise, sruti (pitch) and laya (rhythm) govern Indian classical music. Classical sanskrit poetry follows strict rules of chandas (meter), yati (caesura), and prasa (assemblage). Further, in mantra worship, nyasas (usually the assignment of different parts of the body to various deities, with mantras and gestures) such as Kala nyasa, Matrukanyasa, Tatwanyasa—are integral parts. Likewise yogasana (yogic poses), pranayama (yogic breathing exercises), and mudras (seals, locks, gestures) have been practiced with vinyasas from time immemorial.

"However, these days, in many places, many great souls who teach yoga do so without the vinyasas. They merely stretch or contract the limbs and proclaim that they are practicing yoga (**Srivatsa Ramaswami, 2005**)

### 1.5.1 HISTORY OF VINYASA YOGA

The main concept of vinyasa is originated from the basic sequences of Sri Krishnamacharya (1888 – 1989) yoga poses and is elaborately explained and enlightened by Srivatsa Ramaswami who is the disciple of Sri Krishnamacharya. According to Srivatsa Ramaswami the Sanskrit word Vinyasa comes from a prefix “Vi” which means variations, and a suffix “Nyasa” which means “within prescribed

parameters". The purpose of vinyasakrama is to train the body and so that the practitioner can make sure and steady progress. Yogasana (yogic poses) Pranayama (yogic breathing exercise) and mudras have been practised with vinyasas from time memorial (**Srivatsa Ramaswami, 2005**)

### **1.5.2 COMPONENTS OF VINYASA YOGA**

The components of vinyasa yoga consists of philosophy of yoga along with several asana sequences and many therapeutic applications. They were listed as below ;

1. On your feet yogasanas
2. Asymmetrical seated vinyasa sequence
3. Seated posterior stretch sequence
4. On one leg yogasanas
5. The supine sequence
6. The bow pose sequence
7. The triangle pose sequence
8. The inverted posture sequence
9. Meditative pose sequence
10. The lotus pose sequence
11. Viseshavinyasa karmas
12. The winding down procedure

### **1.5.3 SIGNIFICANCE OF COMPONENTS OF VINYASA YOGA**

#### **1.5.3.1 ON YOUR FEET YOGASANAS**

The first asana sequence in the vinyasa method of doing yogasana practice is the standing sequence known as the hill pose. The hill pose, or what is known in Sanskrit as *tadasana*, is a posture that tends itself to a variety of vinyasa sequences, which are exceptionally useful in exercising the entire body. The progression of vinyasas proceeds from the fingers to knuckles, wrists, elbows, shoulders then the neck, thorax, thoracic spine and lumbar spine. The *krama* (order of postures) then sequentially involves the hip joint and the pelvis, the knees, ankles and dorsum of the feet. Thus the entire body is involved and *tadasana* is the centre piece of the sequence, which contain several important poses such as the forward bend (*uttanasana*) and the squat (*utkatasana*).

#### **1.5.3.2 ASYMMETRICAL SEATED VINYASA SEQUENCE**

Since it is basically seated sequence that is important for pranayama and other meditative efforts (*sadhanas*), it is imperative to master the basics for the seated poses. The asymmetrical seated poses help to correct any imbalance by working both sides of the body separately, especially the lower extremities. Doing seated postures such as lotus pose, hero pose and others which involve the hip joints, knees and ankles. The vinyasas of varying difficulties help a practitioner attain *asana siddhi* (perfection seated pose).

#### **1.5.3.3 SEATED POSTERIOR STRETCH SEQUENCE**

The posterior portions of the lower extremities are difficult to exercise. They contain considerable muscle tissue that requires special efforts to work on. Stretching

the legs and trying to touch the toes while sitting could be awkward for many people. The seated posterior stretch sequence will help to uniformly stretch the heels, calves, hamstrings, thighs and gluteal muscles, and then go on to stretch the back, spine shoulders and neck. It improves the blood circulation (Rakthasancharah) to the posterior portion of the body and helps to maintain good health and vigour.

#### **1.5.3.4 ON ONE LEG YOGASANAS**

The sequence involves standing on one leg and doing a number of vinyasas. These are generally known as austerity postures (tapasanas). Several sages and devotees used to stand on one leg and meditate on their chosen Lord, to have His vision, to listen to their master's voice, or to get the boon they desired from him.

#### **1.5.3.5 THE SUPINE SEQUENCE**

Lying down poses or sputa asanas enables many people to do many useful yogic exercises. The sequence starts from the lying down position. One could sit down first, then lie down on one's back and start from there. In vinyasakrama one must start from samasthiti and go through a certain series of vinyasas such as dandasana and then lie down. There is also an involved procedure by which one goes through the plough posture (Halasana).

#### **1.5.3.6 THE TRIANGLE POSE SEQUENCE**

One of the most popular asanas among younger practitioners is trikonasana or the triangle pose. A number of vinyasas centered on and progressing from the triangle position were described in this sequence.

### **1.5.3.7 THE INVERTED POSTURE SEQUENCE**

The inverted postures have a very important place in yoga asana practice. They are unique innovations of yogis. All antigravity poses have a tonic effect on the internal organs if done properly. Like the external muscles the muscle tissues inside the body also slowly lose their tone. The yogis invented a simple procedure to try to correct this natural process as much as possible through inverted poses.

### **1.5.3.8 MEDITATIVE POSE SEQUENCE**

Other than the lotus pose, there are few yoga postures that are used for pranayama and meditations. Vajrasana or the bolt pose is the hub for several vinyasas and asanas. Vajrasana is a compact and relatively easy pose. Many yogis who are not comfortable with lotus pose choose vajrasana for their yoga sadhanas (meditative practices).

### **1.5.3.9 THE LOTUS POSE SEQUENCE**

The lotus posture (padmasana) is considered by conventional yogis to be the most important seated posture. If this pose is done according to vinyasakrama, where movements that progressively lead to the postures are done followed by various elaborations, subsequent counter pose, and the return sequence it can be a lot more fun. It is a great posture to be in as a yogi and practice some of the subtler aspects of yoga.

### **1.5.3.10 VISESHA VINYASA KRAMAS**

These are several subroutines in the overall vinyasa methodology . These subroutines, which are more commonly practiced, include the sun salutation and



several sequences stemming from the down ward facing dog position, an important hub pose. The sequence of vinyasas can be practiced independently.

#### **1.5.3.11 THE WINDING DOWN PROCEDURE**

All the asana sessions should ended with some pranayama practice. One should choose a comfortable seated pose from the vinyasas of padmasana, vajrasana, siddhasanvirasanaet.

#### **1.5.4 SIGNIFICANCE OF VINYASA YOGA**

- Vinyasakrama yoga is an ancient practice of physical and spiritual development. It is a systematic method to study, practice, teach, and adapt yoga
- To build real change in a student's capacity for action, Krishnamacharya utilized a method which he entitled vinyasa krama ("krama" means "stages"). This step-by-step process involves the knowledge of how one builds, in gradual stages, toward a "peak" within a practice session.
- This progression can include elements like using asanas of ever-increasing complexity and challenge or gradually building one's breath capacity.
- The vinyasakrama refers to movement and sequence methodology, a new way of approach to yoga postures and practice is unique in all of yoga.
- By integrating the functions of mind, body and breath in the same time frame, the practitioner will experience the real joy of yoga practice.

- Each of the important postures is practised with many elaborate vinyasas or variations. Each variation is linked to the next one by a succession of specific transitional movement.
- Vinyasakrama is the art of knowing to do integrated the work of a certain stage of practice and are ready to move on (**Srivatsa Ramaswami, 2005**)

### **1.5.5 BENEFITS OF YOGA ON CHILDREN WITH CEREBRAL PALSY**

Like any other practices there are several benefits of yoga for cerebral palsy children as well. Some of the benefits of the poses for cerebral palsy children include;

- The twisting and bending massages the internal organs and improves as well as stimulates the digestive system.
- With stretching and twisting movements we can also improve the cardiovascular system. Both heart and lungs get benefit from the yoga poses.
- Through Pranayama an aerobic activity, which improve lung capacity and made available to all the vital organs of the body.
- Another organ system that benefits from the yoga poses is lymphatic system. The whole immune system becomes healthier. The active interaction between some of the vital organs also become more powerful. The soft muscle of the lungs and the diaphragm are also strengthened.
- The skeletal and muscular system of the body also benefited from the yoga poses. The focus on balance and alignment in the yoga poses can be really beneficial for both skeletal and muscular system with improvement in the flexibility. (**Shrikrishna 2004**)

## **1.6 MANTRA CHANTING**

Mantras are sacred sound syllables from the vedic tradition. For thousands of years they have been refined to impart healing powers for spiritual development and total rejuvenation of mind and body. The mantras are energy based sounds and thought based waves. Likened to flames of fire they energize PRANA the life force and eventually quieten the mind. Mantras are means of purifying the mind. Each Mantra is a store house of infinite divine power and all mantras are equally powerful. Mantras also work according to one's karma and positive and negative energy that were accumulated. Repetition of mantras set up vibrations that activate the chakras whereby there is an even flow of beneficial energy in the body. Mantras can be used in single or in combination with others for the healing process (Vijayakumar, 2004)

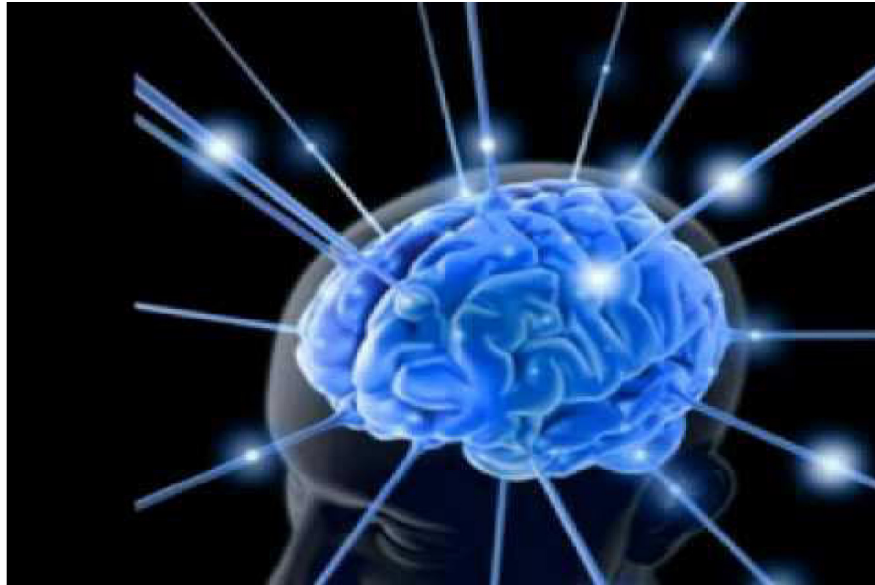
Mantra is not a mere collection of words. It is a compounded set of words with enormous significance. It emanates from the inner power of man. Filled with such power, the mantra, when it is pronounced properly, brings out the divine power in man. The vibrations produced by the utterance of the mantra, uniting with the cosmic nāda (primal sound) in the universe, become one with the Universal Consciousness. It is these cosmic vibrations, which assumed the form of the Veda (sacred revelations of spiritual knowledge) (Selvalakshmi, 2017)

### **1.6.1 SCIENCE OF MANTRA**

The science of mantra is very ancient and was once widely practised in all parts of the world. Reference to mantra is found in the oldest Vedic scriptures, which are claimed to be more than 5,000 years old. Mantra brings about state of resonance between the individual and the depths of his inner being. They allow the individual to unleash inner cosmic powers, forces and knowledge. The sound patterns of the

mantra stimulate a certain effect on the mental and psychic nature of an individual. Each mantra will create, or draw out, a specific symbol within one's psyche. It is the strength of the sound, the colour of the sound, the frequency, the velocity and the 'temperature' of the sound which are responsible for the revitalization that mantra brings. A, Aa, E, Ee, O, Oo etc., are all vowels and are spoken with sounds that come from within i.e: stomach, buzzing in the ear, nasal tones, tongue rolling etc. each of which stimulates one part of the body or other there by corresponding to achakra. These chakras have different tones and move and different frequencies, the root being the slowest and most dense to Ajna or third eye chakra being the fastest . The beej mantra or single seed syllable of the chakra balances the chakra and thereby purifies it. **(Swamy Sathyananda Saraswathi,1984)**

**Figure 3**  
**TRANSMISSION OF IMPULSES IN THE BRAIN**  
**DURING MANTRA CHANTING**



Chanting certain mantras puts pressure on tongue, vocal chords, lips, palate and other connecting points in the body. The vibration from the mantra stimulates a gland called hypothalamus. It is responsible for the regulation of many body functions including immunity and some happy hormones. By activating the hypothalamus the control tower of the brain, which regulates communication between the nervous system and the endocrine system, taking in information from the entire body, before transmitting outward again, via chemical messengers. These couriers, such as serotonin and dopamine, are known as the “happiness hormones,” due to the impact they have on the moods. The hypothalamus is responsible for many bodily functions tend to think of as automatic, like temperature, metabolism and nervous system, as well as pituitary secretion, affecting everything from mood, appetite, sleep, etc.

### 1.6.2 SIGNIFICANCE OF MANTRA CHANTING

- By combining sound, breath and rhythm, mantra meditation channels the flow of energy through the mind-body circuit, adjusting the chemical composition of our internal states and regulating brain-hemisphere imbalances, contributing to a natural abatement of fear and despair—emotions that underlie both of these common afflictions.
- By balancing the nervous system, chanting regulates the chronic stress and tension that is the norm for many people in today's hyper-stimulated lifestyle. And by balancing the endocrine system, chanting normalizes hormone production, which balances our moods and overall sense of well-being.
- The vedic mantras also gives a person relief from stress making them more resilient. The vibrations from chanting the helps body to release the relaxing hormones that keep depression at bay.
- The thoughts make the person. The one who has the positive thoughts is happier and the one full of worries is the sad one. The thoughts not only have effect at that moment but they definitely make impression on the personality of the individual, which could have a very long lasting impact. In this background while the good thoughts itself would be making things better, what needs to be said about the super-powered mantras that are rich in meaning as well as energy.
- Given the fact that "we tend to become what we keep thinking about", when one chants the Sacred panchakshara that hails the God as Perfection and Auspicious, it would take one towards that blissful perfection. It takes to the union with the Supreme God. What else can be more rewarding. Even the

worst sinner would get corrected and get to the glorious states if chants this mantra piously. (Swamy Sathyananda Saraswathi 1984)

### 1.6.3 PRANAVA MANTRA (AUM)

**Figure 4**

#### **PRANAVA MANTRA (AUM)**



According to Hindu philosophy, AUM is the primordial sound from which the whole universe was created. Aum, also called the Pranava, is the original word of power, and is recited as a mantra. A mantra is a series of verbal sounds having inherent sound-power that can produce a particular physical or psychological effect, not just something that has an assigned intellectual meaning. The word mantra derives from the Sanskrit expression ‘**mananaathhraayathe**’ which loosely means “**a transforming thought**”; literally, “that which, when thought, carries one across [the worldly ocean of sorrow]”. The power of a mantra lies in its ability to produce an objective, perceptible change in the yogi who repeats it correctly. According to the Mandukya Upanishad, "AUM is the one eternal syllable of which all that exists is but the development. The past, the present, and the future are all included in this one sound, and all that exists beyond the three forms of time is also implied in it". (Shyam Sundar Goswami,2011)

#### 1.6.4 SIGNIFICANCE OF AUM

AUM is not a word but rather an intonation. It, like music, transcends the barriers of age, race, culture and even species. It consists three Sanskrit letters, aa, au and ma which, when combined together, make the sound AUM or OM. It is believed to be the basic sound of the world and to contain all other sounds. It is a mantra or prayer in itself. If repeated with the correct intonation, it can resonate throughout the body so that the sound penetrates to the centre of one's being, the atman or soul. There is harmony, peace and bliss in this simple but deeply philosophical sound. By vibrating the sacred syllable AUM, the supreme combination of letters, if one thinks of the Ultimate Personality of Godhead and quits his body, he will certainly reach the highest state of "stateless" eternity, states the **Bhagavad Gita**.

**Figure 5**

#### **THE POWER OF AUM**



During meditation, when one chant AUM, can create within oneself a vibration that attunes sympathy with the cosmic vibration and we start thinking universally. The momentary silence between each chant becomes palpable. Mind moves between the opposites of sound and silence until, at last, it ceases the sound. In the silence, the single thought AUM is quenched, there is no thought. This is the state of trance,



where the mind and the intellect transcend as the individual self merges with the Infinite Self in the pious moment of realization. It is a moment when the petty worldly affairs are lost in the desire for the universal. Such is the immeasurable power of AUM.

### **1.6.5 BIJA MANTRAS**

In Vedic tradition, “Bija Mantras” are used as tools for the expansion and widening of one’s mind by utilizing the power of sound vibrations. “Mantra” is a Sanskrit word made up of two syllables: “man” (mind) and “tra” (liberate). Thus in its most literal translation the word “Mantra” means “to liberate one’s mind”. In Sanskrit a “seed” is called “Bija.” The word “Mantra” when translated by virtue of its practical use relates to a sound that can “create transformation”. Certain sounds which cannot be translated into a literal meaning but have the power to create great transformative growth and expansion in humans at the physical, emotional and spiritual levels are known as “Bija” or Seed Mantras.

### **1.6.6 SOURCE OF BIJA MANTRAS**

Any form of sound in the universe is vibrational energy. Human speech or words is also a combination of sound waves each of which resonates at specific vibrational frequencies. According to ancient Indian texts as well as the latest works in quantum physics, the whole universe was created through cosmic sound energy which was then followed by heat and light energy and eventually life forms. So the sound vibrations are intimately connected to our “prana” or “life energy”.

### 1.6.7 CONCEPT OF BIJA MANTRAS

In vedic healing and spiritual traditions, specific mono syllable seed sounds or “Bija Mantras” were developed to create balance and harmony in the human body, mind and soul. Each and every part of human body functions at a specific rhythm and pulse and when all the systems are balanced and tuned with each other leads to perfect harmony and health. On the other hand, any imbalance in the body can lead to mental, physical or emotional dis-ease. Sound therapy is a very effective way to heal and rejuvenate ourselves as every cell in our body is mainly composed of water which makes them excellent sound resonators. The recent developments in the field of Psychoacoustics, the ancient practice of using sound energy for holistic healing practices is now gaining even more credibility. (**Shyam Sundar Goswami, 2011**)

### 1.6.8 IMPACT OF BIJA MANTRAS ON CHAKRAS

In yoga there are seven specific Bija Mantras that vibrationally align the energy centers or chakras through sound energy:

1. Root Chakra – Bija mantra: LAM (Pronounced as **lum in alum**)
2. Sacral Chakra – VAM (**vum as in thumb**)
3. Solar Plexus Chakra – RAM (**rum**)
4. Heart Chakra – YAM (**yum as in yummy**)
5. Throat Chakra – HAM (**hum as in humming**)
6. Third Eye Chakra – U (**u as in uber**)
7. Crown Chakra – Om (**aum**)

One can chant each mantra while lying down or by sitting in a cross legged meditation pose and can focus on a particular chakra and chant its specific seed mantra repetitively in one sitting or do all seven in succession one after the other. These mantras are very powerful even when they are chanted silently. The expansion of the mind from the "I" into the all encompassing cosmic energy is a wondrous transformation. Let us all lead each other through this divine journey with unconditional love, light and joy. (Swamy Sathyananda Saraswathi 1984)

### **1.6.9 FUNCTIONAL IMPACT OF CHAKRAS ON HUMAN PHYSIOLOGY**

The literal meaning of the word Chakra is 'Wheel' or 'Circle' but in the yogic context a better translation of the Sanskrit word is 'Vortex' or 'Whirlpool'. The Chakras are vortices of Psychic energy and they are visualized and experienced as circular movement of energy at particular rates of vibration. In each person, there are myriads of chakras, but in the practices of tantra and yoga, only a few principal ones are utilized. These chakras span the full spectrum of man in being, from the gross to the subtle. The Chakras relate to physiological as well as psychic center whose structures correspond more or less with the traditional descriptions. These nerve centers are not situated inside the spinal cord itself, but lie like junctions on the interior walls of the spinal column. If dissect and see the grey matter in the cross section resembles the lotus shape and the ascending and descending tracts of nerve fibers correspond to the nervous (nadis). These communicating nerve fibers control the different physiological functions of the body. Chakra are like centrally placed electricity poles from electrical wires that runs to different places, house and street lights in the vicinity, this arrangement is the same for each every chakra. The nadis that emerge from each chakra carry prana (breath) in both directions. There is a forward and backward pranic motion in the nadis. The outgoing communication and

the incoming reaction enter and level the chakras in the form of this pranic flow to the corresponding nadis. (Swamy Sathyananda Saraswathi, 1984)

**Table I**  
**FUNCTIONAL CHAKRAS ON PHYSICAL LOCATION**

Physical location	Bija Mantra	Chakra Activation
Perenium	LAM	Muladhara
Base of the spine	VAM	Svadhishthana
Navel centre	RAM	Manipura
Heart centre	YAM	Anahata
Throat	HAM	Vissudhi
Eyebrow centre	OM	Ajna
Sahashara	OM	Sahashara

#### 1.6.10 FUNCTIONAL CHAKRAS WITHIN THE BRAIN

Neurosurgeons and yogis share common ground because both aim to know the truth and reality about themselves it is only the approach differs. While scientific researchers have approached the brain objectively and have attacked and dissected it with knives and scales, probed it with electrodes, photographed, and X-rayed, stimulated and drugged it in order to mechanically and externally manipulate its circuits into giving up their secrets, Yogis decided to scientifically discover the secrets of the brain by experiencing in directly through meditation. Their findings agree with those of modern science. (Shalila Sharamon, Bodo J. Bagiski, 2000)

Yogis discovered through meditation that within their bodies was circuits and centers with both physically and psychic components, they called nadis and chakras. Though we take this for granted now, we must remember that these studies were made thousands of years ago without the aid of modern microscopes and equipment. Not only did yogis achieve a wonderfully complete and physical system of techniques, but way back then they also based their techniques on the discovery that they are six major primary centers in the body, the chakras in hierarchical, interconnected network within the spinal cord. They also observed that each of these chakras had its own definite physical, psychological and behavioral characteristic, connected to the brain by a network of energy flows, all of which did not necessarily correspond to purely physical structures; they also discovered many secondary centers. The Chakras in the spinal cord were found to be points manipulated by focusing attention, mental and psychic energy, and breath and body postures, to derive certain physical and psychic experiences. The techniques allow to learn to control the most basic and vital instincts and needs of body, emotions, mind, psyche, and spirit. **(SwamySathyanandaSaraswathi 1984)**

#### **1.6.11 CHAKRA ACTIVATION DURING CHANTING OF BIJA MANTRAS**

This practice must be adopted systematically. For the first Month, you should only perform the techniques for the ajna chakra. Then the second month adds those for mooladhara. In third month, add those for swadhisthana. In the fourth month, do those practices for manipura and selected practices for ajna, mooladahara and swadhisthana chakras. In this way you should continue, adding the practice for each chakra, until you reach binduvisaraga during the seventh

Figure 6

### MANTRAS AND THEIR FUNCTIONAL CHAKRAS

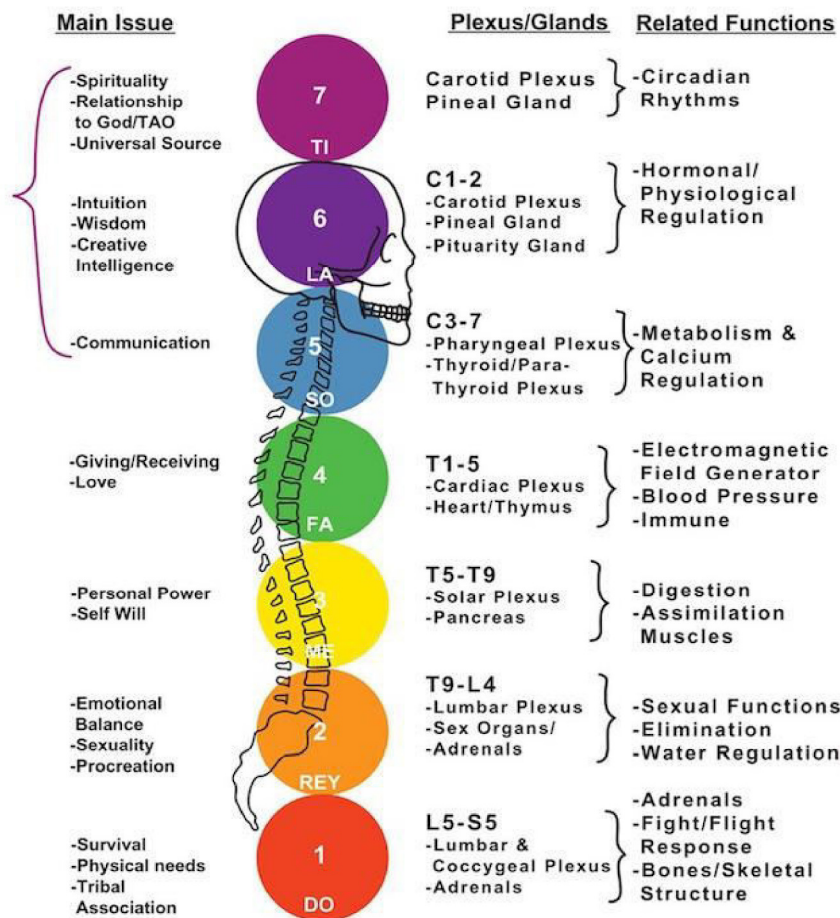


The first month is concerned with awakening ajna chakra and not the lowest one, mooladhara, it is treated in the second month. It may seem more logical and consistent to start with mooladhara practices, but it is a rule in kundalini yoga that there should be awakening of ajna chakras first. Unless this is achieved, then the awakening of the lower chakras may rock the stability of the practitioner, one may experience physical, mental and emotional shocks one cannot bear. In the eight month, some practice influences the chakras as a whole. These should be done for one to 4 month. Note that some practices influence more than one chakra, but given each practice once as sadhana for the chakra, it is most likely to affect. In addition, it should be noted that nothing can be gained by randomly selecting one chakra sadhana program and just practicing it for a day or two and then commencing another

practice, the techniques should be performed systematically. (Swamy Sathyananda Saraswathi, 1984).

Figure 7

**CHAKRAS AND GLANDS ACTIVATION DURING  
CHANTING OF BIJA MANTRAS**



**1.6.12 GAYATHRI MANTRA**

For many centuries, Gayatri mantra was kept secret by Gurus and Yogis because of its power. As with so many other secret, ancient practices, it's only in recent times that this amazing mantra has become widely available to all. The 'Gayatri mantra' is one of the greatest prayers mankind has. Just by recitation of

'Gayatri Mantra', each person could get rid of miseries at all levels, said Spiritual Guru and Founder of Art of Living (Sri Sri Ravi Shankar, 2011).

Figure 8

**GAYATRI MANTRA IN SANSKRIT VERSION**



Figure 9

**GAYATRI MANTRA IN ENGLISH VERSION**





### **1.6.12.1 MEANING OF GAYATHRI MANTRA**

General meaning: We meditate on that most adored Supreme Lord, the creator, whose effulgence (divine light) illumines all realms (physical, mental and spiritual). May this divine light illumine our intellect. **(Sri Sri Ravi Shankar 2011)**

## **1.7 CEREBRO MUSCULAR FUNCTION**

Any interruption of the normal process of brain growth during foetal development can cause brain malformation that interferes with the transmission of brain signals which is responsible for the cerebromuscular coordination. Tension caused by emotional distress of some sort make the muscle contract. Any effort to loosen this tension can cause tremors in the muscle. The muscle tone is affected by the neuromuscular impulses. Lack of rhythm in the neuromuscular impulses causes tremor. By promoting proper muscle tone asanas bring about emotional stability also. One particular quality of asanas is that it brings flexibility to the joints. Tension not only appears in the muscle but also in the joints too. The more tense makes more rigid the joints . So either remove the tension from the mind or remove the rigidity from the joints. By learning to relax through loosening of the muscles and joints we have a sense of happiness which in turn affects the mind. Stretching is the way to release these tension through asanas. Different exercises work on different muscle group and joints.

### **1.7.1 MUSCLE COORDINATION**

It is the ability to execute smooth, accurate, controlled motor responses (optimal interaction of muscle function). Coordination is the ability to select the right muscle at the right time with proper intensity to achieve proper action. Coordinated

movement is characterized by appropriate speed, distance, direction, timing and muscular tension. The cerebellum is the primary center in the brain for coordination of movement. It is the process that results in activation of motor units of multiple muscles with simultaneous inhibition of all other muscles in order to carry out a desired activity. The ability to execute smooth accurate motor response depends on Deep sensations and Vision. Fine motor skills: Require coordinated movement of small muscles (hands, face). Examples: include writing, drawing, buttoning a shirt, blowing bubbles

Gross motor skills require coordinated movement of large muscles or groups of muscles (trunk, extremities). Examples: include walking, running, lifting activities. Hand-eye skills. The ability of the visual system to coordinate visual information. Received and then control or direct the hands in the accomplishment of a task .examples include catching a ball, sewing, using computer mouse etcetera. ([www.wikipedia.com](http://www.wikipedia.com))

### **1.7.2 VISUAL PERCEPTION**

Visual perception is the ability to interpret the surrounding environment using light in the visible spectrum reflected by the objects in the environment. The resulting perception is also known as visual perception, eyesight, sight, or vision (adjectival form: visual, optical, or ocular). The various physiological components involved in vision are referred to collectively as the visual system, and are the focus of much research in linguistics, psychology, cognitive science, neuroscience, and molecular biology, collectively referred to as vision science.

The visual system in animals allows individuals to assimilate information from their surroundings. The act of seeing starts when the cornea and then the lens of the eye focuses light from its surroundings onto a light-sensitive membrane in the back of the eye, called the retina. The retina is actually part of the brain that is isolated to serve as a transducer for the conversion of light into neuronal signals. Based on feedback from the visual system, the lens of the eye adjusts its thickness to focus light on the photoreceptive cells of the retina, also known as the rods and cones, which detect the photons of light and respond by producing neural impulses. These signals are processed via complex feedforward and feedback processes by different parts of the brain, from the retina upstream to central ganglia in the brain.

The retina in these more complex animals sends fibers (the optic nerve) to the lateral geniculate nucleus, to the primary and secondary visual cortex of the brain. Signals from the retina can also travel directly from the retina to the superior colliculus.

The perception of objects and the totality of the visual scene is accomplished by the visual association cortex. The visual association cortex combines all sensory information perceived by the striate cortex which contains thousands of modules that are part of modular neural networks. The neurons in the striate cortex send axons to the extrastriate cortex, a region in the visual association cortex that surrounds the striate cortex. ([www.wikipedia.com](http://www.wikipedia.com))

### **1.7.3 PROPRIOCEPTION**

The proprioceptive sense is believed to be composed of information from sensory neurons located in the inner ear (motion and orientation) and in the stretch receptors located in the muscles and the joint-supporting ligaments (stance). There are specific nerve receptors for this form of perception termed

"proprioceptors", just as there are specific receptors for pressure, light, temperature, sound, and other sensory experiences. Proprioceptors are some times known as adequate stimuli receptors. The initiation of proprioception is the activation of a proprioceptor in the periphery

Although it was known that finger kinesthesia relies on skin sensation, recent research has found that kinesthesia-based haptic perception strongly relies on the forces experienced during touch. This research allows the creation of "virtual", illusory haptic shapes with different perceived qualities.

Conscious and unconscious proprioception In humans, a distinction is made between conscious proprioception and unconscious proprioception: Conscious proprioception is communicated by the posterior column-medial lemniscus pathway to the cerebrum Unconscious proprioception is communicated primarily via the dorsal spinocerebellar tract to the cerebellum ([www.wikipedia.com](http://www.wikipedia.com)).

## **1.8 COGNITIVE FUNCTION**

The executive function of the brain is a set of cognitive processes that allow the cognitive control of behaviours. Selecting and successfully monitoring behaviours that facilitate the attainment of chosen goals. Executive functions include the ability to filter information and tune out irrelevant stimuli with attentional control and cognitive inhibition, the ability to process and manipulate information held in working memory, the ability to think about multiple concepts simultaneously and switch tasks with cognitive flexibility, the ability to inhibit impulses and prepotent responses with inhibitory control, and the ability to determine the relevance of information or appropriateness of an action. Higher order executive functions,

require multiple cognitive processes including planning, reasoning, and problem solving.

The prefrontal cortex plays a significant role in mediating executive functions. Neuroimaging during neuropsychological tests of executive function, such as the stroop test and working memory tests, have found that cortical maturation of the prefrontal cortex correlates with executive function in children. Planning involves activation of the dorsolateral prefrontal cortex (DLPFC), anterior cingulate cortex, angular prefrontal cortex, right prefrontal cortex, and supramarginal gyrus. Working memory manipulation involves the DLPFC, inferior frontal gyrus, and areas of the parietal cortex. Inhibitory control involves multiple areas of the prefrontal cortex as well as the caudate nucleus and subthalamic nucleus. Task shifting doesn't involve specific regions of the brain, but instead involves multiple regions of the prefrontal cortex and parietal lobe. ([www.wikipedia.com](http://www.wikipedia.com))

### **1.8.1 REGISTRATION**

It is the first stage in the information processing of the brain. The brain is exposed to a stimuli, at which point it analyzes and evaluates the information. Brain store the information for later use. It also adds it to mental schema and encodes it. This encoding process is known as cognitive ability of registration. If the information is not reinforced, the brain may simply forget it over time.

The sensory information is repeatedly transformed by the algorithms of the brain in both bottom-up and top-down processing. In order for the brain to process information, it must first be stored. There are multiple types of memory, including sensory, working, and long-term. First, information is encoded.

The brain processes information at astounding speeds. But it's not an invincible machine that absorbs every bit of knowledge that comes along. For this reason, instructional designers must consider the mental limits of the human mind and then work within those confines. That usually involves bite-sized content, visual illustrations, and interactive online exercises. ([www.wikipedia.com](http://www.wikipedia.com))

### **1.8.2 MEMORY**

There are three types of memory that instructional designers should be aware of:

- **Sensory Memory**

When our senses are triggered by a stimulus, our brains briefly store the information. For example, we smell freshly baked bread and can only remember its scent for a few seconds before it vanishes. Even though the bread is no longer in front of us, our mind's still hold onto its impression for a short period. The brain then has the option to process it through the memory banks or forget about it. In eLearning, sensory memory is triggered by a visually compelling image, background music, or any other element that utilizes the senses.

- **Short-Term Memory**

A process that falls under the purview of working memory, which temporarily stores information when it is triggered by stimuli. Short-term memory can only hold a maximum of 7 items at one time. It also has a time limit, which is usually between 10 seconds to a minute.

- **Long-Term Memory**

After passing through the short-term memory, relevant information is moved to long-term storage. At this stage, the brain is less likely to forget important details. However, even the long-term memory can diminish over time if we don't refresh our knowledge. Balance refers to an individual's ability to maintain their line of gravity within their Base of Support (BOS). It can also be described as the ability to maintain equilibrium, where equilibrium can be defined as any condition in which all acting forces are cancelled by each other resulting in a stable balanced system.

### **1.8.3 ATTENTION**

Attention is the behavioural and cognitive process of selectively concentrating on a discrete aspect of information, whether deemed subjective or objective, while ignoring other perceivable information. It is the taking possession by the mind in clear and vivid form of one out of what seem several simultaneous objects or trains of thought. Focalization, concentration of consciousness are of its essence. Attention has also been referred to as the allocation of limited processing resources.

The vast majority of current research on human multitasking is based on performance of doing two tasks simultaneously, usually that involves driving while performing another task, such as texting, eating, or even speaking to passengers in the vehicle, or with a friend over a cell phone. This research reveals that the human attentional system has limits for what it can process: driving performance is worse while engaged in other tasks; drivers make more mistakes, brake harder and later, get into more accidents, veer into other lanes, and/or are less aware of their surroundings when engaged in the previously discussed tasks. **(Kathleen M. Galotti, 2004)**

## 1.9 PSYCHO MOTOR FUNCTION

The brain controls all types of motor function that allow people to live as independently as possible motor control can be voluntary and in-voluntary. When the motor control centers in the brain are damaged, voluntary and involuntary motor skills do not function properly. This abnormality limits control and co-ordination of movement in children with cerebral palsy. The relationship between cognitive functions and physical movement. It may also referred to disorders or disturbances which slowdown a thought and reduction of physical movement in an individual. Psychology of relating to design administration and interpretation of movements of the body associated with mental activity it also deals with variables such as Intelligence, Attitude and personality traits. (Kathleen M. Galotti, 2004)

### 1.9.1 STATIC AND DYNAMIC BALANCE.

The Central Nervous System receives feedback about the body orientation from these three main sensory systems and integrates this sensory feedback and subsequently generates a corrective, stabilizing torque by selectively activating muscles. In normal condition, healthy subjects rely 70% on somatosensory information and 20% Vestibular & 10% on Vision on firm surface but change to 60% vestibular information, 30% Vision & 10% somatosensory on unstable surface.

**Balance can be classified in to :**

- **Static Balance:** it is the ability to maintain the body in some fixed posture. Static balance is the ability to maintain postural stability and orientation with centre of mass over the base of support and body at rest.



- **Dynamic Balance:** Defining dynamic postural stability is more challenging, Dynamic balance is the ability to transfer the vertical projection of the centre of gravity around the supporting base of support. Dynamic balance is the ability to maintain postural stability and orientation with centre of mass over the base of support while the body parts are in motion.

The mechanisms involved in static balance were best summarized by Bannister. He noted that normal standing required: Sufficient power in the muscles of the lower limbs and trunk to maintain the body erect. Normal postural sensibility to convey information concerning position. Normal impulses from the vestibular labyrinth concerning position. A central coordinating mechanism, the chief part of which is the vermis of the cerebellum. The activity of higher centers concerned in the willed maintenance of posture. With this mechanisms the dynamic balance requirements can be inferred as:

Sufficient power in the muscles of the body to maintain movement and stability. Normal postural sensibility to convey information regarding movement. Normal impulses from the vestibular system and visual system concerning movement and environment. Central co ordinating mechanism including cerebellum and basal ganglia. The activity of higher centers concerned in the willed/ involuntary maintenance of movement and stability. Correlation between Static and Dynamic Balance.

The lack of correlation between the two different conditions is likely due to the challenge imposed on the systems necessary for maintenance of postural stability. Maintenance of postural stability during both dynamic and static conditions involves establishing an equilibrium between destabilizing and stabilizing forces and requires

sensory information derived from vision, the vestibular systems, and somatosensory feedback. **(Geert Savelberg, Keith Davids, 2003)**

### **1.9.2 GAIT**

Human gait refers to locomotion achieved through the movement of human limbs. Human gait is defined as bipedal, biphasic forward propulsion of center of gravity of the human body, in which there are alternate sinuous movements of different segments of the body with least expenditure of energy. Different gait patterns are characterized by differences in limb movement patterns, overall velocity, forces, kinetic and potential energy cycles, and changes in the contact with the surface (ground, floor, etc.). Human gaits are the various ways in which a human can move, either naturally or as a result of specialized training

The CNS regulates gait in a highly ordered fashion. The signals fire in a rhythmic fashion that matches the movement seen in behavior. This rhythmic firing is the result of Central Pattern Generators (CPG) that are present throughout the tracts. Regardless of if a motion is voluntary or not, these processes occur. Therefore, CPG's are mostly autonomous to cognition.

Gait in humans is difficult to study due to ethical concerns. Therefore, the majority of what is known about gait in humans comes from fMRI data in different walking conditions. These studies have provided the field with several important discoveries.

There are numerous centers, both in the brain and in the spinal cord, that have been proposed to regulate gait. There are three centers that are specifically described to regulate locomotion:

- MLR- Mesopontine Tegmentum Locomotor Region
  
- SLR- Spinal Cord Locomotor Region
  
- CLR- Cerebellar Locomotor Region

These centers are coordinated with the posture control systems in place in the cerebral hemisphere and the cerebellum. With each behavioral movement, the sensory systems responsible for posture control respond. These signals act on the cerebral cortex, the cerebellum, and the brainstem. Many of these pathways are currently under investigation, but some aspects of this control are fairly well understood. **(Geert Savelberg, Keith Davids, 2003)**

#### **1.10 REASONS FOR SELECTION OF THE TOPIC AND VARIABLES**

The researcher found there were lesser initiatives for the special children regarding therapeutic approach of yoga. So the researcher analysed the ability and need of the special children from various special schools to select which consists of children affected by mental retardness, autism, cerebral palsy, Down syndrome, vision impairment and etcetera. The researcher found that, among the special children cerebral palsy children can perform yogic practices upto their level and felt it would bring much better health within them. The variables like cerebromuscular variables (muscle coordination, visual perception and proprioception) cognitive variables (registration, memory and attention) psychomotor variables (static balance, dynamic balance and gait) are very common for cerebral palsy children and play vital role in determining the mental health and personality traits. So the above mentioned variables were considered for the study. Based on these, the researcher selected the research topic as “ Efficacy of vinyasa yoga with and without mantra chanting on

selected cerebromuscular cognitive and psychomotor variables among children with cerebral palsy”.

### **1.11 OBJECTIVES OF THE STUDY**

1. To find out whether there was any significant difference on selected cerebromuscular variables due to the practice of vinyasa yoga with and without mantra chanting among children with cerebral palsy.
2. To find out whether there was any significant difference on selected cognitive variables due to the practice of vinyasa yoga with and without mantra chanting among children with cerebral palsy.
3. To find out whether there was any significant difference on selected psychomotor variables due to the practice of vinyasa yoga with and without mantra chanting among children with cerebral palsy.

### **1.12 STATEMENT OF THE PROBLEM**

The purpose of the study was to find out the efficacy of vinyasa yoga with and without mantra chanting on selected cerebromuscular, cognitive and psychomotor variables among children with cerebral palsy.

### **1.13 HYPOTHESES**

1. It was hypothesized that there would be significant differences on selected cerebromuscular, cognitive and psychomotor variables among children with cerebral palsy due to the practice of vinyasa yoga with and without mantra chanting than the control group.
2. It was hypothesized that there would be significant differences on selected cerebromuscular, cognitive and psychomotor variables among children with

cerebral palsy between vinyasa yoga with mantra chanting and vinyasa yoga without mantra chanting group.

#### **1.14 SIGNIFICANCE OF THE STUDY**

1. The study would be helpful to children affected with cerebral palsy to improve their health related fitness variables.
2. The cerebral palsy children can lead their life independently.
3. The study would create awareness among parents of cerebral palsy children as yoga can be an alternate therapy.
4. The study would create awareness among yoga therapists about variations and modifications of yogic postures can be effective for special children.
5. The study would establish the importance of mantra chanting.
6. The study would improve the Inter and Intra personal social activities of the cerebral palsy children.
7. The study would be a helpful for further researchers in this area.

#### **1.15 DELIMITATIONS**

The study was delimited in the following aspects

1. The study was conducted on 45 male children affected by cerebral palsy only.
2. The study was conducted on subjects residing in Chennai city, Tamilnadu only.
3. The subjects were selected from the National Institute of Empowerment of Persons with Multiple Disabilities (NIEPMD) only.
4. The age of the subjects ranged from 8 to 12 years only.

5. The selected independent variables were vinyasa yoga with and without mantra chanting only.
6. The selected dependent variables were cerebromuscular variables such as muscle coordination, visual perception, proprioception cognitive variables such as registration, memory, attention and psychomotor variables such as static balance, dynamic balance and gait only.
7. The practice of vinyasa yoga and mantra chanting was delimited to minimum of 50 minutes to maximum of 80 minutes per day from monday to friday for 22 weeks only.
8. The selected subjects were divided into three equal groups consisted of 15 subjects per group.

#### **1.16 LIMITATIONS**

1. The food habits of the subjects were not considered for the study.
2. Factors like personal habits, life style, climatic condition and daily routines were not considered for observation.
3. The heredity and previous fitness experience of the subjects were not taken into consideration for the study.
4. The socio economic status of the subjects were not considered for this study.
5. The other treatments, therapies and other medications taken by the subjects were not considered.
6. The attitude, family situation, learning capacity, knowledge and skill of the subjects were not taken in to consideration.

## **1.17 MEANING AND DEFINITION OF THE TERMS**

### **1.17.1 VINYASA YOGA**

Vinyasa is a Sanskrit term often employed in relation to certain styles of yoga, that usually refers transition between two different positions. Nyasa--denotes to place and Vi-- denotes in a special way. The Sanskrit word Vinyasa comes from a prefix “Vi” which means variations, and a suffix “Nyasa” which means “within prescribed parameters”. **(Srivatsa Ramaswami, 2005)**

### **1.17.2 MANTRA**

The mantras are energy based sounds and thought based waves. Likened to flames of fire they energies PRANA the life force and eventually quieten the mind. Mantras are sacred sound syllabus from the vedic tradition for thousands of years they have been refined to impart healing powers for spiritual development and total rejuvenation of mind and body. **(Vijayakumar, 2004)**

### **1.17.3 CEREBRO MUSCULAR**

The cerebral function of the brain on motor action on the limbs without any interruption of normal process, that interfere with the transmission of brain signals which is responsible for muscular coordination.

### **1.17.4 MUSCLE COORDINATION**

It is the motor coordination which refers to the combination of the body movements with the kinematic& kinetic parameters. This involves the integration of proprioceptive information detailing the position and movement of the Musculoskeletal system with the neural process in the brain and spinalcord which control, plan and rely motor command. **(Kathleen M. Galotti, 2008)**

### **1.17.5 VISUAL PERCEPTION**

It is the ability to interpret the surrounding environment by processing information that is contained in visible light. The resulting perception is also known as eyesight, sight or vision. **(Kathleen M. Galotti, 2008)**

### **1.17.6 PROPRIOCEPTION**

It is the sense of relative position of neighbouring parts of the body and strength of effort being employed in movement. In human being it is provided by proprioceptors (muscle spindles) in skeletal striated muscle and tendons and the fibrous capsules in joints. **(Kathleen M. Galotti, 2008)**

### **1.17.7 COGNITION**

The word cognition refers to the facts which are carried out by the cerebral Function of the Brain. It includes recognition, memory, recall, attention and calculation, specificity and sensitivity etc. **(Stephen K. Reed, 2007)**

### **1.17.8 REGISTRATION**

Classifying a stimulus in to a known category regarding shape, size etc. Pattern registration is a skill that people perform very well. Recalling of letters in a word is influenced by perceptual information and the context of the letter. **(Stephen K. Reed, 2007)**

### **1.17.9 MEMORY**

The storage facility and retrieval process of cognition. The number of correct items that people can immediately recall from a sequence of items is known as memory span. **(Stephen K. Reed, 2007)**

### **1.17.10 ATTENTION**

Mentally focussing on some stimulus. The characteristics of attention are selectivity and mental effort. Investing mental effort in one or more tasks, the amount of mental capacity required to perform a task is known as mental ability. **(Stephen K. Reed, 2007)**



### **1.17.11 PSYCHO MOTOR**

The relationship between the cognitive function and physical movement of the body. It may also referred to disorders or disturbances which slowdown a thought and reduction of physical movement in an individual. Psychology of relating to design administration and interpretation of movements of the body associated with mental activity it also deals with variables such as intelligence, attitude and personality traits. **(Geert Savelberg,Keith Davids (2003))**

### **1.17.12 STATIC BALANCE**

The ability to maintain postural stability on a stable surface or when not engaging in loco motor activitities . **(Geert Savelberg,Keith Davids (2003))**

### **1.17.13 DYNAMIC BALANCE**

The ability to maintain postural stability on a moving surface or when engaging in loco Motor activites.**(Geert Savelberg,Keith Davids (2003))**

### **1.17.14 GAIT**

Human Gait refers to loco motion achieved through the movement of Human Limbs. Human Gait is also defined as a biphasic forward propulsion of centre of gravity of the human body in which there are alternate sinuous movements of different segment of the body. **(Geert Savelberg,Keith Davids (2003))**

### **1.17.15 CHANTING**

A chant is the iterative speaking or singing of words or sounds, often primarily on one or two main pitches called reciting tones. Chants may range from a simple melody involving a limited set of notes to highly complex musical structures, often including a great deal of repetition of musical subphrases, **(Vijayakumar 2004)**

### **1.17.16 CEREBRAL PALSY**

Cerebral palsy (CP) is the most common motor disability in childhood. The word “Cerebral” refers to the brain’s cerebrum which is the part of the brain that regulates motor function. “Palsy” describes a paralyses of voluntary movement in certain body parts for example upper and lower limbs. **(Archie Hinchcliffe 2007)**