CHAPTER II

EARLY INTERVENTION
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WHAT IS "EARLY INTERVENTION"?

"Early Intervention" means early training, to give experience in early developmental period of a child viz. in infancy and pre-school years. The term "Early Intervention" is preferred because it encompasses broader range of services, assuming the child is an active learner and not just a passive receiver of stimulation.

Early Intervention implies a 'stepping in' in order to modify action. It is very aptly applied to the additional help needed by child with delay in development. Thus, early intervention reflects the belief that earlier is better in order to prevent, remedy or compensate for early developmental disorders.

Early Intervention services include a range of educational, health and social services for young children and their families with special needs. In brief the term "Early Intervention" has been broadly used to describe efforts designed to prevent or ameliorate developmental or behavior problems resulting from environmental or biological influences.

EARLY INTERVENTION - HOW EARLY? WHY?

It is generally accepted that the earliest years of a child's life are the keystone to future development. The period from birth to five years of age is the most critical because the brain is growing fast and is probably at its most plasticity phase. Till the age
of five the brain reaches 90 percent of its adult weight and the half of intellectual growth is over.

It is well known that any living system is most impressionable to the environment during the period of rapid changes which is called as a "sensitive period". The functional connectivity both anatomical and physiological, developed during this sensitive period in response to enriched environmental stimuli results into higher intellectual functioning of man. In mentally retarded children this critical period also exists.

**DEFINITION OF " EARLY INTERVENTION " :**

Early intervention has generally been defined either at the level of programme involvement or in terms of provision of a certain therapeutic or educational treatment.

Denhoff (1981)\(^{24}\) used the term to refer as "Programs of enrichment designed to provide developmentally appropriate activities to babies and toddlers who have or who are at risk for a variety of conditions".

Bricker et al, (1984)\(^{14}\) defined early intervention as efforts aimed at eliminating existing or anticipated deficits in children during the first 36 months using therapeutic or educational interventions.

Caldwell et al, (1975)\(^{19}\) used the term to refer to the manner in which a quality environment facilitates optimal child development.

The above definitions which are typical of the
field, clearly reflect a child-focused emphasis with no explicit acknowledgement of other influences that affect behaviour and development. Dunst (1985) proposed a social system definition of early intervention that does consider these broader based issues.

Dunst defined early intervention as the "Provision of support to families of infants and young children from members of informal and formal social support networks that impact both directly and indirectly upon parent, family and child functioning".

HISTORICAL PERSPECTIVES ON EARLY CHILDHOOD SPECIAL EDUCATION:

The field of early childhood education is one that is relatively new. Despite this fact, however there are historical roots.

Rousseau J.J. (1911) has noted that Emill (1762) stressed the importance of beginning the child's education at birth. He believed that strong discipline and strict lessons were appropriate conditions for optimal learning. Children should be treated with sympathy and compassion as humans in their own right.

All through the mid 17th century the prevailing belief was that children were born with fixed developmental destinies, the mid 17th century, saw the rapid growth of a philosophical movement that emphasized the possibilities for releasing and encouraging human potential. This was a giant step for society and was in great contrast to the previous view that people were born into castes or social situations and were destined to stay there.
The idea that one can intervene effectively with retarded children has a long history from Itard's experiment with the wild boy of Aveyron to the Iowa studies of the 1930's by Skeel and Dye.

Itard in the late 18th (eighteenth) century attempted to teach the "wild boy of Aveyron", using a set of sensory training techniques and that is currently characterized as behavior modification. However, Itard's student, Edourd Seguin is generally acknowledged as the most important pioneer in this field. In 1846 Seguin developed a 'physiological method of education' for disabled children. This method was based on a detailed assessment of individual strengths and weaknesses and a specific plan of sensorimotor activities designed to correct specific difficulties.

Crissey in 1975 noted in his book that through pains-taking observations Seguin described the early signs of developmental delay and emphasized the importance of early education.

Seguin's pessimism about the benefits of special education initiated later in life, was complemented by his belief in the critical importance of early intervention. He stated—"If the idiot cannot be reached by the first lesson's of infancy, by what mysterious process will years open for him the golden doors of intelligence" (quoted in Talbot, 1964, pp 62). Seguin was indeed, one of the first "early interventists".

Seguin's methods were later adapted by Montessori in 1890. Like Edourd Seguin, Montessori believed in
developing the child's natural curiosity through systematic training of the senses. Montessori's approach was out of favour in the United State for sometime. The 1960s brought a resurgence of interest in Montessori techniques. Montessori's "Sensorial Materials" are advocated for use with handicapped children because they are manipulable, three dimensional and concrete. In the Montessori approach emphasis is given on task analysis, sequencing and individualization evident. So this approach has proved as worthy for use with children who have limited abilities as well as those who are gifted.

**NATURE v/s NURTURE CONTROVERSY**:

The dominant figure in the emerging field of child developmental evaluation was Arnold Gesell, a pediatrician and psychologist. As the Director of one of several child study centers, he conducted extensive studies of the skills of normally developing children, the abilities of youngsters with Down Syndrome and the developmental accomplishments of those who were born prematurely or who sustained perinatal injuries (Gesell, 1923, 1925, 1929). His observation methods produced a wealth of data that still continue to influence the construction of developmental assessment instruments to this day.

Gesell's theoretical orientation was clear, and his impact on the clinical study of children was enormous. He was a strong believer in the primary of biologically determined maturation. His disdain for the relative impact of experience on the developmental process was striking and the possibility of altering that process through early intervention was viewed as futile. The
conceptual legacy of Gesell's maturational perspective was linear model of human development that was used by clinicians to predict long term outcomes based on the rate of acquisition of specific developmental milestones in early infancy. During the 1950s, this model was linked to the growing recognition of a correlation between adverse perinatal events and later neuro-developmental disorders. This resulted in the popularization of an influential paradigm of biological determinism known as the "Continuum of reproductive casualty" (Lilienfeld and Parkhurst, 1951, Lilienfeld and Pasamanick 1954).

As the maturationist view of development attracted support during the first half of the twentieth century, its influence was countered by the comparable powerful concepts of behaviorism. The behaviorists believed that in the absence of significant brain damage, developmental outcomes in children are controlled largely by environmental forces. One of the most eloquent early spokes-persons for this interventionist approach to human development was John B. Watson, a prominent psychologist who wrote "since the behaviorists find little that corresponds to instincts in children, since children are made not born failure, to bring up a happy child, a well adjusted child, assuming bodily health falls upon the parent's shoulders. The acceptance of this view makes child rearing the most important of all social obligations" (Watson 1928, pp 8).

The controversy over the relative impact of nature and nurture on the developmental process in early childhood has been an enduring one. While the maturationists
championed the belief in biological determination, the behaviorists advocated the tenets of operant conditioning and environmental manipulation. Each position has had strong support. Yet when examined in isolation, both perspectives have been found to be quite limited.

With the advent of Piaget's "cognitive revolution" in the fifties and sixties (Cairns, 1983), the stage was set for rapprochement between the polarities of nature and nurture.

PIAGET'S SPONTANEOUS COGNITION:

According to Piaget the purpose of education is to provide opportunities that allow a child to combine experiences into coherent systems (Scheme) that constitute the child's knowledge. Therefore each child's capacity to learn is thought to be uniquely experimentally based.

Piaget's concept of the child as an active learner stimulated by inborn curiosity, has prompted the development of pre-school programmes designed to allow the child to become an active initiator.

It was recognized that biological and social factors mutually influence one another in development of the child.

FREUD'S CONCEPT OF AFFECTIVE DEVELOPMENT:

While Gesell was espousing maturation and Watson emphasized the role of classical conditioning in the development of child, in 1933 Sigmund Freud added
yet another dimension to understanding of the child. He described the stages which the child passes through in his psychosexual development as the oral, anal, phallic, oedipal, latency and pubertal phase. If there is wrong treatment or poor opportunity in any of these stages, the child is unable to develop a mature personality.

HEBB'S INTERACTION MODEL:

In the late 1950s D.O. Hebb insisted that child development was not the result of either heredity or environment alone. Hebb proposed that behavior is produced by the interaction between genetic and environmental variables. It is this interaction model of child development that is espoused currently as the most realistic approach to the education of young handicapped children.

INTERVENTION PROGRAMMES FOR CHILDREN WITH SPECIAL NEEDS:

The creation of project "Head-Start" is thought to have evolved through a series of influences. One of the earliest attempts to demonstrate the close relationship between nurturing environmental stimulation and mental growth processes grew out of the Iowa growth studies in the late 1930s. Two one-and-half years old infants, tested and classified as moderately to severely retarded, were placed in a facility for mentally retarded adult because children's facilities were crowded. They were somewhat star attractions among the women in the adult institution.

As their placement was unusual, those responsible felt that closer monitoring of their condition was
important, consequently, they were tested after six
months and revealed a dramatic increase in scores,
estimated to be 77 and 87 before the end of year (Skeel
and Dye, 1939)70.

After the results of Iowa growth studies in the
late 1930s, Skeel and Dye transferred 12 children under
3 years of age from an orphanage to an institution
for the retarded. The children were cared by mentally
retarded adolescent girls. Follow-up testing demon­
strated that those placed in the stimulating environ­
ment increased their intelligence test scores while
those who remained in the orphanage decreased their
intelligence test scored (Skeel, 1942)71.

Samuel Kirk (1958)49 also conducted experiments
on the influence of early education on the development
of young mentally handicapped children. Kirk suggested
that inadequate cultural environment might be a cause
of mental retardation.

Benjamin Bloom (1964)10 claimed that "about 50%
of the (intellectual) development takes place between
conception and age 4 and about 30% between ages 4 and
8, and 20% between ages 8 and 17" (pp 18).

Bloom's argument was advanced by J. Mcvicker
Hunt's popular book, "Intelligence and Experience"
(1961)42 which so eloquently argued against the notion
of fixed intelligence. Hunt supported well his conten­
tion that heredity sets the limits, whereas environment
determines the extent to which the limits will be
achieved. It is believed that the expression of one's
native intelligence is determined in large by the quality, intensity and variety of environmental experience to which one is exposed during development.

By the late 1960s and early 1970s such optimism had faded. In its place came numerous proclamations that early intervention has failed. Even to this date both views can be heard. A more balanced picture is necessary.

Caldwell (1973)\textsuperscript{18} reminded us just how this field of early childhood special education really is. She characterised the period before the 1950s as a period of "forget and hide". The next two decades were time to "screen and segregate" the most recent decade as a "identify and help".

THE HISTORY OF EARLY INTERVENTION IN INDIA:

The health development of young children with an age range of 0 - 6 years is a natural priority of any nation. The Indian National Policy For Children (1974)\textsuperscript{54} and the National Policy On Education (1986)\textsuperscript{55} emphasised investment in the development of the young children through various early childhood care and education (ECCE) programmes, especially the programmes focusing on children coming from the sections of population in which the first generation learners predominate. (First generation learners are those whose fore-parents never had any education).

In India there are 110 million children under six years of age (UNICEF, 1985-89)\textsuperscript{77}. Out of which about 50% belong to families living in material poverty
and do not have sufficient access to the means of all round development. Concerted efforts are needed to provide specific divergent and convergent services to meet this requirement. Integrated Child Development Services (ICDS) Scheme was initiated by the Government of India at the beginning of Fifth Five Years Plan (1975-'80) especially to improve the quality of lives of these pre-schoolers by taking their holistic view.

The services of "Early Intervention" for the pre-school mentally retarded subjects are of recent origin in India. The centers of such service programmes are few and at a beginning level in only large cities.

One of the pioneering study of early intervention programme was carried out at Madras in 1970. This study from India and other similar studies from the West emphasise that basic objectives of the early intervention programme should be to maximize cognitive, communication and motor skills and to assist the family.

The "Infant Development Clinic" at the B.M.Institute of Mental Health, Ahmedabad was started in April, 1976, to provide diagnostic and ameliorative services to infants at risk.

"The Association For The Welfare Of Person With Mental Handicap" in Maharashtra (A.W.M.H.) felt this concern very deeply as way back in 1983. After two years of intensive work by a group of pediatricians, therapists, social workers and special educators, three centers became operational in July, 1985. At present seven community centers are spread out vertically over the cities.
In 1985-86 Thakur Hari Prasad Institute (THPI), Hyderabad, has started "Diagnostic Unit" for children below 5 years in "Surya Jyoti Project" in collaboration with Action Sonnenschein, Munic, West Germany.

"The research society for the care, treatment and training of children in need of special care" has started a project in collaboration with the occupational Therapy Department in the year 1987-88, on "Efficacy of Developmental Occupational Therapy in Infants and Pre-school Children who are developmentally handicapped" and is still continuing.

The project on "Early Intervention with Infants at Risk" was initiated in June, 1987, by the Andhra Pradesh Association for the welfare of the Mentally Retarded with UNICEF assistance. The project is based at Niloufer Children's Hospital in Hyderabad, which has the largest neonatal special care nursery in the State. The infant at risk are referred by obstetricians, pediatricians and other specialists from Hyderabad, Secundrabad and neighbouring rural areas to the special care nursery for management of perinatal complications.

Indchem Research and Development Laboratory, Madras, is engaged in research and development in the field of electronics and telecommunication and their application in service of society. In March, 1987, the Laboratory undertook a project to utilise the Microcomputer in the development and application of mentally retarded children. The pilot project was presented at "National Workshop" organised at New Delhi, on 26th April, 1987, by Federation for the Welfare of Mentally
Retarded. This programme is to cover whole range of management of mentally retarded children from identification and screening to assessment and training. An enthusiastic team comprising a developmental psychologist, a neonatologist, an educationist, special educators, parents, psychologists, social workers, a system analyst and computer programmers is engaged in the project work. The project bears the significant code name 'Upanayan'. It is expected that the outcome of it will throw some light on the effective use of computers in early intervention in India.

Center For Research In Mental Retardation of Valabhadas Dagara Indian Society For Mentally Retarded, Malad, where this research work is going on has conducted research project on "Low Birth Weight, Prematurity and Mental Retardation" in 1987-88. Continuation of the early detection followed by early intervention of mentally retarded children is being carried out at this center with the co-ordinative approach of pediatrician, neurologist, psychologist, neuro-developmental therapist and special educator.

After initial assessment, implementation of programme as per the individual need is decided by Multidisciplinary team. An interaction-based child approach is maintained between the child and a trainer in the presence of mother. Emphasis is given on various types of cutaneous, visual, auditory and sensory stimuli in particular order to reach the maximum potentiality of the damaged brain. Results indicate that early stimulation is effective in prompting developmental progress in infants and toddlers. The research work is still in progress and will be continued further.
APPROACHES TO EARLY INTERVENTION

There are number of widely differing techniques of early intervention:

1. Neuro-development therapy approach
2. Cognitive development theory approach
3. Behaviour modification approach
4. Montessori method approach

These are the main theoretical perspectives of development that have influenced the contents of curricula for handicapped infants and young children.

NEURODEVELOPMENTAL THERAPY APPROACH

The neurodevelopmental treatment approach developed by Bobath and Bobath (1975) is the most popular and comprehensive therapy to improve motor performance of young children with physical disabilities and for retarded children in age group of 0 - 5 years. Neurodevelopmental therapy is based on developmental neurology and functional developmental stages, the significance of which is stressed below in brief.

DEVELOPMENTAL NEUROLOGY:

The human brain develops earlier than the rest of the body. At birth it is about 25% of its adult weight, at six months nearly 50% and at two and half years about 75%. The actual weight of brain of newborn baby is around 325 - 350 grams, and at age of five about 1,250 grams which is almost equal to the adult brain (Figure - 1)
Before birth and in the first two or three years of life, the brain is growing faster. In the first year of life and in the last three months of pregnancy the growth rate is about 1 - 2 mg. per minute. Not all parts of the brain grow at the same rate. The cerebellum, the co-ordinator of muscular movement grows very fast from shortly before birth until about a year after. This referred as post-natal growth of cerebellum.

Anatomical development of the brain begins at the end of the first six months of pregnancy and ends at about two years. During the growth spurt, important changes of brain are crucial to physical and intellectual development.

THE BRAIN CELL:

The key components of the brain is the neuron which sprouts a single axon, essentially a long wire covered with white insulation. This carries the nerve impulses not as a continual steam of electricity, like water through a pipe, but as series of impulses like bullets from machine gun. From the main cell body other shorter branches extend, these are the dendrites which may be few or many and simply or profusely branched. These receive message from sense organs like eye, skin, ear or in most cases from other neurons. These messages may be of different kinds and given neuron combines or 'Sums' the impulses. It picks up through its dendrites. On the basis of this information a neuron increases or decreases the rate at which it produces pulses of electricity. At the end of the axon the pulses of electricity cause a flow of chemicals to be released which cross the gap between neurons to
stimulate or inhibit the next neurons in the chain. Thus a message, electrical and/or chemical in nature is passed along a chain of neurons or perhaps rather a web than a chain. The sub-microscopic gap or a junction at which the impulse is transported between two neurons is the synapse. A synapse acts as a kind of valve forcing impulses to flow in one direction so that messages do not meet head on. The synapse seems to act as a super filter, sorting important message from trivial one and merging simple message into complex blends (Figures 2 and 3).

It is worth mentioning here, how the brain uses the messages from a sense organ like the eye. When a child works at his painting, message of an electrical nature is sent along neurons to the parts of the brain. The cerebral cortex is activated and gives him a picture of the external world including his picture in three dimensional array and endowed with colour and brightness. What is sent to his brain is not an accurate copy of the picture but a simplified electrical and chemical code which the brain by its pattern of activity somehow turns it into a mental picture of the world inside his head.

**VULNERABLE PERIOD IN BRAIN GROWTH:**

From last three months of pregnancy until two years of age there is a tremendous growth due to branching of the nerve cells to form inter-nerve cells connections. The part of nerve cells that associate at nerve synapses are the fine tendrils of the nerve cells, the dendrites. Though this has not been established
the richness of branches of the axo-dendritic net work which look like a forest of tree branches under the microscope may be the important in the development of intelligence (Figure - 4).

The sprouting and proliferation of dendritic branching is no doubt under the guidance of heredity but there is a degree of plasticity which may well depend on the quality of environmental experience provided by environment. G. Machhi of Italy (1983) defined neuroplasticity as the capacity of CNS to adapt to new physiological conditions emerging either during its maturation or its interaction with the environment. Therefore, neuroplasticity consists in the ability of the nervous system to adapt its structural organization to new situations.

The role of stimulating environment on the development of intellectual and social competence has been the object of research since the day of Itard (1801). Recent research has shown that mental retardation is not solely due to hereditary factors, rather it is determined in large part by the social environment. Eggert (1982) reviewed a number of studies and suggested that mental retardation from the psychological perspective represents a multiple handicap in which cognitive impairment, speech disorders, motor impairment and behavioural disturbances are associated with social and psychological structures and situation of affected families.

PATHOLOGY AND VULNERABILITY OF THE DEVELOPING BRAIN:

Of the very great variety of things which can
go wrong with the developing brain are bizarre patholo-
gies which are associated with chromosomal anomalies
(e.g. Down Syndrome) and later injuries caused by
physical trauma, hypoxia and hypoglycemia in the peri-
natal period.

In Down Syndrome the basic abnormality found
in cerebral cortex, involves primarily the dendritic
spines of pyramidal neurons of the motor area. It has
been postulated that such structured abnormalities
could explain synaptic dysfunction and indirectly there-
fore they could also explain some degree of mental
retardation (Huttenlocher, 1974; Purpura, 1974).

Maternal smoking (alkaloids) is a well esta-
blished cause of intrauterine growth retardation.
Nicotine constricts uterine blood vessels, which causes
a decrease in uterine blood flow, thereby lowering
the supply of oxygen and nutrients in the intervillous
space that is available to the embryo. The resulting
deficiency in the embryo impairs cell growth and may
have an adverse effect on mental development. Page et al.
(1981) believe that the growth deficit results from
the direct toxic effect of smoking. High levels of
carboxyhemoglobin present in the blood of both the
mother and the embryo may alter the capacity of the blood
to transport oxygen. As a result, fetal hypoxia occurs.

These growth pathologies of the brain often depend
at least as much on the stage of brain development at
which they are inflicted. In this respect they resemble
classical teratology, inflicted during the first tri-
mester of human gestation except that they occur well
beyond the ordinary teratological period of embryogenesis, in the remainder of fetal life and postnatally until the second or third birth day. Such alterations of brain growth, although not destructive of structures already in place tend to produce permanent deficits and distortions in brain's architecture and failure to recover due to the incapacity of the developing brain for rehabilitation after the normal period for the accomplishment of a particular developmental stage.

The brain's later vulnerability is related to quite a prolonged period of vulnerability rather than to sharp critical points in time. Especially in species like humans of such periods can be predicted from the crude general sequences (Dobbing 1981,b)\(^2^7\) (Figure-5).

**THE FIRST HUMAN TRIMESTER OF GESTATION:**

Neural tube defects are numerically the main teratological malformation in human babies occurring during the first gestational trimester at about four weeks after conception. A recent development suggests means of preventing them in certain circumstances. (Dobbing, 1983)\(^2^8\).

**THE SECOND HUMAN TRIMESTER AND MICROCEPHALLY:**

Virtually all brain cells of whatever type are diploid and therefore, their total number is related to the total amount of DNA in the brain. One cell type (neurons) multiplies at a different time and rate from another (glia) and hence a graph of total brain DNA against time will reveal the timing of both these periods (Figures-6 A-B).
For the human forebrain, the earlier of the period of brain cell multiplication from 10 to 18 weeks of gestation, must be assumed to be that of neuroblast multiplication (Dobbing and Sands 1973).

The first indication that the photogenesis of microcephaly may be temporally related to the first half of the second gestational trimester came from the concurrent and independent observation (Miller and Blot, 1972) that microcephaly in the survivors of atomic attacks on Japan occurred mainly in those whose fetal age corresponded to the same period of gestation (Figure - 7).

**THE THIRD HUMAN TRIMESTER AND THE FIRST FEW POST NATAL YEARS:**

The brain as a whole does not grow along a straight line in any species, but passes through a transient period of rapid growth known as the brain growth spurt. During this time, especially large number of brain structures as well as new biochemical and other related functions are developing (Dobbing, 1981 b).

The following are some of the physical consequences of growth restriction during the comparable period in experimental animals.

1. All parts of the brain are not reduced to the same extent, for example the cerebellum is much more reduced in weight than is the rest of the brain (Dobbing et al, 1971). This is almost certainly attributable to the cerebellum's peculiar
growth characteristics. In human as well as in animals it grows much faster till postnatal period from the rest of the brain (Dobbing and Sands, 1973). Thus on assumption that long term vulnerability is related to speed on early growth, restriction of the whole growing brain would be expected to affect the part which grows fastest. This differential effect on the cerebellum is also associated in animals with a detectable clumsiness (Lynch et al., 1975). It is therefore possible that some human clumsiness may be of similar aetiology.

2. Histologically it is possible to detect a differential absence of granular neurons in the cerebellum by appropriate quantitative techniques (Dobbing et al., 1971). Also there appears to be a loss of cerebral cortical neurons in certain layers.

3. The deficit in brain lipids is greater than that expected from the reduction in brain size (Dobbing 1981b). The lipid picture is further distorted by there being a differential reduction specifically in myelin lipids.

Cragg (1972) has found that the number of synapses per cortical neuron is substantially reduced. This potentially important finding has been substantiated by Thomas et al., (1979) by using modern techniques of quantitative histology. In rats moderately undernourished for a period, corresponding in human terms from mid-gestation until about the third birthday, there was a deficit of 38% in the number of synapses per neuron in frontal cortex at the end of the period.
of undernutrition. Restoration of a highly nutritious diet until adulthood resulted in an apparent recovery illustrating that some features of restricted brain growth can be recovered at least to some extent by vigorous rehabilitation of a kind which is frequently not available to human populations.

A series of growth pathologies of the developing brain in relation to the developmental stage at which they occur have shown range from serious malformation during the first human gestational trimester (through severe microcephaly thought to occur mainly in the early second trimester) to the relatively less severe effects produced during the prolonged brain growth spurt from the third trimester until at least the second birthday.

The experimental study of regeneration of destroyed neurons or regenerative sprouting of damaged axons as well as of collateral regeneration of intact neurons resulting in new synaptic connections is now in progress in many laboratories. To repair nerve tissue lesions, neuroplasticity may operate. It could be by means of synaptic reorganization through either regenerative or collateral sprouting of intact axons which may operate in the compensation phenomenon involving structures located in undamaged area (G. Macchi 1983) \textsuperscript{36}. An anatomical clinical approach in man can only tentatively be expressed in terms of hypotheses derived from experimental data that there is a great deal of attraction for the concepts of CNS regeneration of neurons or regenerative sprouting. Similar to what has been reported in peripheral nervous system, Bernstein and Bernstein in 1973\textsuperscript{8} suggested the reorganization of previous point to point synaptic contacts with
the denervated structures in case of initial minimal tissue destruction. Many reactions of the damaged brain such as glial and connective tissue reactions may not allow regenerating axon to reach the denervated areas contrary to what happens in peripheral axonal sprouting.

The important concepts of early influences on later achievement is still a nebulous one in nearly all branches of pediatric and educational research. Knowledge of the abilities of the newborn, his primitive reflexes and milestones is important not only for understanding of human development as whole, but for the overall assessment of a child for the recognition of possible neurological damage in the prenatal and perinatal period. This is important in establishing prognosis for his future (Chart of Milestones).

**DEVELOPMENTAL ASSESSMENT:**

Developmental assessment has been described as a systematic form of observation which allows some estimation to be made of the extent of activities of the brain. The purpose of the assessment is to identify deviation from normal development and behaviour as early as possible (Figures 8 to 17).

By neurological examination of child's postures and spontaneous reactions, muscle tone, reflexes, an examination of cranial nerve and special senses, the following deformities can be found in developmentally delayed and cerebral palsy children.

1. Immobility - total or partial.
2. Hypotonicity.
3. Hypertonicity.
4. Weakness - general or specific.
5. Abnormal reflex activity.
6. Asymmetry.

Neurodevelopment Therapy (NDT) is an approach that is directed towards normalizing muscle tone, inhibiting abnormal patterns of movements and applying peripheral stimulation to facilitate the development of automatic postural responses, that are presumed to provide the supporting substrate for the development of motor milestones. This approach suggests that problems can be reduced or overcome by handling techniques which help to stimulate and develop normal patterns of movements.

The NDT is based on the idea that the teaching of normal movements and correction of postures is impossible as long as the muscle tone is abnormal and tonic reflexes are present. Before the patient can be expected to have normal co-ordination in voluntary movements and skill, we have to help him to inhibit his abnormal posture and movement reactions and we have to develop such automatic movements as fighting reflexes and equilibrium reactions (Bobath 1975). Abnormal posture reflexes activity is inhibited through a special technique of manipulation i.e. reflex-inhibiting posture. Automatic movements such as fighting reflexes are facilitated. Spontaneous movements are induced by moving clients into position. Bobath (1984) argues that normal automatic movements are under control in an adequate reflex inhibiting posture.
Bobath (1967) has emphasised the importance of early intervention i.e. before nine months of age in order to capitalise on the plasticity of the infant brain and encourage sensorimotor learning and prevent compounding of mental handicap. In addition, abnormal postural patterns are usually weaker in the infant and are therefore more modifiable. At this stage too, deformities can be avoided and more rapid results can be achieved.

The clear theoretical statement underlying the Bobath's approach and its grounding in neurophysiology should not blind us to the fact that the aim of their treatment is quite explicitly to permit ultimately the development of skilled movement for day to day life and self help activities (Bobath, 1967).

**COGNITIVE DEVELOPMENT THEORY APPROACH**

This theoretical approach most often applied to the young retarded child is of Jean Piaget (1952), a Swiss Psychologist. Professor Piaget had revealed how a child learns and how he matures intellectually in a highly scientific and critically valid way. Through exploring and experimenting the child enriches, works over, organises and reorganises his modes of the world.

Piaget divides cognitive development into three main stages:

Stage I : Sensori-motor stage (birth to two years).
Stage II : Conceret operation (two to eight years) breakdown in two major phase.
A] Pre-conceptual (two to four years).
B] Intuitive stage (four to eight years)

Stage III : Formal operations (eight to eleven years)

I. THE SENSORI-MOTOR PERIOD :

This is the period generally until about two years during which the baby is gaining experience through his senses and absorbing it into himself as patterns of behaviour. Piaget used the word "assimilation" for simple straight forward absorbing of such experience and accommodation for the adaption that goes on when the "schema" built up by previous experience has to be adopted to new and perhaps unexpected experience.

This absorbtion of sensorimotor experience and enrichment of schema (through the process of assimilation and accommodation he builds up organised patterns of thought and action known as schema) is the interaction between the human being and his environment goes on all over life.

SIX SUB-STAGES OF SENSORIMOTOR PERIOD ARE DISTINGUISHED:

1. **Reflective stage** (0 - 2 Months)

   The infant shows little, apart from reflective behaviour.
2. **Primary circular reaction** (2 - 4 months)
Reflex activities are modified by the experience. The infant's repertoire is expanded by random body movements which will be repeated if he perceives that, they lead to a certain result. He begins to co-ordinate his movements.

3. **Secondary circular reaction** (4 - 8 months)
A transition occurs from body centered activities to outside stimuli. The child will change from one activity to another to achieve a goal. A child may repeatedly kick their legs to move a suspended mobile, reach out to grasp nearby object or shake a rattle placed in the hand. The first sign of co-ordinating different responses become evident. Infant between four and eight months can co-ordinate looking at and reaching into a smoothly flowing response sequence, an object may be looked at, grasped and mouthed in a co-ordinated pattern. Such inter-relationships between response systems are typically not found until the third stage of sensory motor period.

4. **Co-ordinating the secondary reactions** (8 - 12 months) is marked by the solution of simple problems. An infant uses clearly established and familiar behaviour but to a new end. During this stage one observes the first evidence of object permanence in infant.

5. **Tertiary circular reaction** (12 - 18 months)
The infant continuously varies his responses to the same object or experiments with new
responses to effect the same result. The infant in this stage has learned a fundamental equivalence rule enabling him to realise that several different responses may serve to produce the same consequence. The infant is learning new way for solving old problems.

6. **Mental Combination** (18 - 24 months). This stage is characterised by an increasing ability to determine the means internally via mental representation.

At the end of sensorimotor period the child has developed a concept of permanent objects and distinguishes between himself and his environment.

II. **CONCRETE OPERATION**:

II.a) **The pre-conceptual period** (2 to 4 years) - This stage is important as the child's acquisition of language and development of mental imagination provide him with a new means of dealing with his environment. Symbolic process begins to develop. During this stage the child's ability to classify objects and to understand the relationship between objects belonging to the same class is limited and will often lead him to false conclusion, for example, if he first learns the term 'dog' in reference to the family pet, he may be confused when it is also used for all other dogs.

II.b) **The intuitive stage** (4 to 8 years) is still characterised by ego centric thinking and subjective judgements but symbolic functioning continues to develop.
The child is made increasingly aware of discrepancies between his judgement of the way objects will behave and what he observes of their actual behaviour. This continual correction of false beliefs by the facts of reality eventually leads to correct judgements and operational thinking.

III. THE FORMAL OPERATION STAGE

The child demonstrates a growing ability to deal with abstract concepts and can handle several relevant variables simultaneously in problem solving situation. He is increasingly able to carry out symbolic manipulation and will formulate hypotheses about the possible consequences of an action.

Thus, cognitive development in Piagetian terms may be summed up as the maintenance of balance between the internal and external world of the person which follows an invariant sequence, according to identified developmental laws of successive stage of complexity. The actual mental process such as learning, memory, perception, etc. change qualitatively with age.

CONTENTS, AREAS AND GOALS OF THE COGNITIVELY ORIENTED CURRICULUM:

The main premise underlying the cognitively oriented curriculum is that there can not be a basic understanding of self and world without the ability to place the self in time and space and to classify and order objects and events. Within the Piagetian framework, this means that two kind of capabilities
have to be developed by the child. First, the child must begin to make connections between objects, between events and between objects and events. That means he must construct relationships among the things in his environment and then expand his system of relationships into an organised way of dealing with the world. Second, the child must begin to construct mental representations of himself and of his environment and to deal with these representations in increasingly complex and abstract ways. These two are complementary; the ability to construct and make use of relationships goes hand-in-hand with the ability to construct meaningful representations.

Piaget's cognitively oriented curriculum is committed to the child's experiencing concepts on the motoric level and being involved in direct physical manipulation of the environment at all levels of representation; involvement on verbal level is gradually added but the motoric level is never entirely displaced. Motoric experience with concepts provides a base for later verbal experience. By using his body to experience concepts, to operate the objects, the child develops a feel for the concepts and this facilitates verbal expression.

The cognitive goals are implemented along the levels of representation delineated by Piaget, specifically from the index level (casually relating marks or sounds to objects or using other reference giving clues as signals of objects) to the symbol level (identifying objects from pictures differing in degree of abstractness, models and using motor encoding in various representational ways) and finally to the sign level
The motoric and verbal levels of operation are similarly integrated, or "feel" into the levels of representation. For example -

1. The child uses his body to operate the objects and to experience concept, and

2. The child is brought to progressively higher levels of verbalization starting from the point at which the teacher provides the verbal stimulus and progressing to the point at which the child is able to verbalize spontaneously, not only action just completed, but also action completed in more remote past.

The Cognitively Oriented Curriculum is based on Piagetian theory and is specifically designed to enable children to produce meaningful mental representation and to derive relationships among objects and events, both real and represented. Piagetian ideas, basic to curriculum, are that there is a sequence to mental growth, that development occurs in a series of steps and this sequence is always in direction of simple to complex and concrete to abstract. From Piaget's research, four categories of curriculum content areas have been outlined. They are classification, seriation, temporal relation and spatial relations.

1. Grouping or classification - is approached first through having the child make relational or functional discrimination. Things go together either because they are used for same activity (e.g. a spoon and a fork go together because they are both used for eating) or because they get their
meaning from one another (e.g. a hammer and nails). More complex groupings are based on descriptive discrimination, that is on certain attributes that can be perceived, such as size, shape or colour. The most abstract means of grouping is based on gross discrimination or conceptual labelling (e.g. vehicles, furniture or other such general categories).

2. Ordering or seriation is approached through having the child deal with objects in terms of their relationship in size, quantity or quality (e.g. big/small, more/less, rough/smooth). The preschool goal is to enable the child eventually to deal with sizes, quantities and qualities.

3. Spatial relation - How the child perceives himself in space and how he perceives relationship in space is approached through expression of the orientation of the child's body and the orientation of other objects in space. Through motoric experience and later through verbal experience with concepts of position (e.g. in/out), of direction (e.g. to/from) and of distance (e.g. near/far). The child is aided in his development of meaningful constructions of space and spatial relationship.

4. Temporal relation: To understand and respond to temporal relations, child begins to deal with time in terms of periods having a beginning and an end; he begins to understand that events
can be ordered chronologically and that time period can be of variable length.

Specific preschool goals have been derived from each of these curriculum content areas.

**COGNITIVE DEVELOPMENT VIEW OF DEFICITS:**

Piaget's most helpful distinction in thinking about intelligence is his account of assimilation and accommodation as co-operator of adaption. Cowan, in 1978, observed that mental retardation might be viewed as a dominance of one process. A predominance of assimilative processes in young children would produce repetition of old schemes on objects and very little accommodation. Later in the life-span there would be very little or slow cognitive change because there would be no benefit or growth from past experience.

The stage characteristic of the Piagetian model have stimulated much research on retarded development. The earliest of these studies were conducted by Woodward (1959), Inhelder (1968) and Ramey and Haskin (1981). In general they found that the development of retarded children parallel that of normal children but occurs much more slowly and reaches a ceiling at a lower level.

In a survey of a number of studies of sensorimotor development of young retarded children, Dunst (1978) concluded that organically impaired infants manifest patterns of sensorimotor development in the ordinal sequence originally proposed by Piaget. He observed that as retarded infants go through the stages in the same order as nonretarded infants, it is possible to calculate the degree to which their stages are
synchronized (stage congruence) like those of non-retarded infants (65% to 70% of the time).

Rogers (1977)\textsuperscript{65} examined profoundly retarded institutionalised children on four scales (object permanence, problem solving, spatial relationship and vocal gestural imitation) measuring stages III and IV. She found stage congruence about 30% of the time with the most congruence between space and problem solving scales and the least between space and imitation (10%), imitation and object permanence (17.5%), imitation and problem solving (20%).

Kahn (1976)\textsuperscript{47} has investigated the relationship between sensorimotor development and meaningful expressive language in 16 profoundly retarded children (4 to 8 years old). Eight of the subjects showed no evidence of expressive language; of these five were below stage VI in all domains (object permanence, means ends abilities, operational causality and vocal gestural imitation) and other three were in Stage VI in two of the four subscales. Of the other eight who manifested functional language, seven were in stage VI in all subscales.

Woodward and Stern (1963)\textsuperscript{82}, in study of 83 profoundly and severely retarded children, also found that children who had functional language were also exhibiting stage V - VI sensorimotor performance.

Inhelder (1958)\textsuperscript{44} applied certain concepts of Piaget's theory to mental retardation. She observed that in general the responses of the retarded are quite similar to those of the normal children of younger
age substantiating the developmental theory, that retarded children progress through the similar stages as normal children and in the similar order but their rate of development is slower. In her classification scheme for mentally retarded, Inhelder considered the cognitive stages attained and proposed four categories:

a] The profoundly and severely retarded who is viewed to be fixated at the level of sensory motor intelligence.

b] The moderately retarded who is presumed to be incapable of surpassing the pre-operational, intuitive sub-period.

c] The mildly retarded who is characterised as being unable to progress beyond the level of concrete operations.

d] The person with borderline intelligence who is capable of using only the simpler forms of formal operations.

**BEHAVIOUR MODIFICATION APPROACH**

Behavior modification means the systematic application of a large number of established psychological principles to the acquisition and the maintenance of behaviour.

The learning theory which has been frequently applied to helping mentally handicapped people is
Operant conditioning deals with behaviour usually thought as voluntary rather than reflexive. Operant conditioners are concerned primarily with the consequences of behaviour and the establishment of functional relationships between behaviour and consequences.

Early application of operant conditioning techniques to human beings was directed toward establishing that the principles governing animal behaviour also govern human behaviour. The use of these principles to change human behaviour usually called behaviour modification, did not really emerge in non-laboratory settings until 1960.

Skinner's (1953) theoretical application of operant conditioning techniques to complex human behaviour and pioneer studies of Ayllon and Michael (1959). Birnbrauer et al. (1965) anticipated the enormous impact on American Psychology and education.

The application of behaviour modification in real-life setting had become so prevalent by 1968, that a new journal the "Journal of Applied Behaviour Analysis" was founded to publish the results of research.

Baer, Wolf and Risely (1968) defined applied behaviour analysis as the "Process of applying some times tentative principles of behaviour to the improvement of specific behaviours and simultaneously evaluating whether or not any changes noted are indeed attributable to the process of application".
Behaviour modification for the mentally handicapped started primarily in United States in 1960's as an effective intervention technique. A number of clinical studies and manuals pertaining to behaviour modification with mentally retarded children appeared during this period, have proven particularly effective in teaching behaviour to very low functioning in retarded children.

Werner (1948) described that low functioning individuals often seem less able to generate internal mental concepts of their own. They are also most likely to become "caught" by external stimuli and their own internal need states. Low functioning retarded children may thus be well-suited to approaches that stress tangible rewards (food, praise, etc.).

The problem exhibited by the mentally retarded children may be the absence of adaptive behaviour like sensory motor skills (turning, sitting, standing, walking), communication skills (smiling, speaking), self-help skills (eating, dressing, toileting) or social skills (greeting others, etc.). It can also be the presence of some maladaptive or problem behaviours like aggression temper tantrums, self injurious behaviour, stereotype behaviour, overactivity, fear-phobia and so on.

There are number of specific teaching techniques that have been developed to establish new adaptive behaviour. A wide range of techniques based on reinforcement and other learning principles are used.
Reinforcement:
Our behaviour is often determined by its consequences. Parents and teachers make children learn by encouragement, praise and prize. This is known as reinforcement. It is defined as any event which when follows a behaviour strengthens the probability or the frequency of the behaviour occurrence.

Positive and negative reinforcers:
A positive reinforcer is any stimulus or events whose contingent presentation increases the rate of performance and response.

Types of reinforcers:
1. Primary reinforcers e.g. food, drink, etc.
2. Secondary reinforcers e.g. money, points, etc.
3. Social reinforcers like smile, hug, praise, attention and so on.

A negative reinforcer is usually the termination of punishment or punishing stimulus.

Four important rules should be followed in reinforcement:
1. Contingency - Reinforcement should be given only when the desired behaviour occurs.
2. Immediacy - Reinforcement should be given soon after the desired behaviour occurs.
3. Consistency - The behaviour should be reinforced every time.
4. Clarity -
The child should be clearly aware that reinforcement has given.

HOW TO IMPLEMENT A PROGRAMME:

i. Specify the goal
ii. Identify the reinforcer
iii. Teach the behaviour
iv. Fade out the reinforcement

BEHAVIOUR PROCEDURES TO ESTABLISH NEW ADAPTIVE BEHAVIOUR:

1. Shaping -
   Shaping is a technique which is used in building up new behaviour, especially with severely retarded children. In shaping the components of particular skill behaviour is reinforced step by step.

2. Chaining -
   When a child fails to perform a complex task, the task is broken into a number of easy steps and then can be taught to the child. The first step is followed by the second step then by third step in forward chaining. In backward chaining the last step is started first in a backward fashion.

3. Prompting -
   The therapist initially guides physically. Prompting can be effectively used in teaching self-help skills. It speed up the acquisition of new skills.
4. **Cueing**: While a therapist physically guides, she adds verbal instructions. These serve as cue to a child. Later just by telling, child will respond.

5. **Fading**: Fading is always used along with prompting and cueing. Once the child learns to do something, gradually the therapist fades out prompting and cueing.

**BEHAVIOUR PROCEDURES TO DECREASE UNDESIRABLE BEHAVIOUR:**

1. **Restriction of the environment** - When it is found out that there is something wrong in the immediate environment which is leading to problem behaviour then attempts are made to change it, if possible, so that the problem behaviour shall not occur following such changes.

2. **Extinction** - Rearranging the consequences of a behaviour problem so that attention or activity rewards do not follow. This is more commonly known as ignoring.

3. **Time-out** - Time-out means putting the child in a situation where any possibility for reward is removed entirely for a fixed period of time.

4. **Restrain** - This includes restrictions on the physical movement of the child.
5. **Response Cost** -
This method is generally used when tokens are being used for desirable behaviours. Following a particular problem behaviour, some of the tokens earned by child are taken back.

6. **Restitution** -
Means restoring the disturbed environment back to normal conditions.

Another approach to behaviour modification is based on principles of Pavlov's classical conditioning (1927, 1957)\(^{58, 59}\). The influences of Pavlov's research on the development of behavioural psychology was substantial. His contribution was however, primarily methodological. Although he conceptualized the application of conditioning to human pathology, he did not attempt to define or engage in the treatment of human problem.

Classical conditioning is specially used to eliminate phobia in children by systematic desensitization through graded exposure in reality.

Desensitization implies the ladder method by which an individual is exposed to situation of gradually increasing stimuli.

**SOCIAL LEARNING APPROACH:**

Bandura & Bandura et al. (1969, 1963)\(^6,7\) has demonstrated that all people, particularly children, acquire large part of their behaviour by watching and copying others.
IMITATION:

Imitation is a process by which new behaviours are learned. Children imitate their parents in their acts and ways of talking. In normal children, it is a natural event and need no training. The capacity to imitate is a valuable tool to learning. Retarded children often lack it. Teaching them the skills of imitation using methods of modelling, prompting and reinforcing would help them to learn the skill more easily.

The naturally occurring consequences for imitation are sufficiently reinforcing that imitation of a variety of different models is a typical developmental pattern for the preschooler. For those children who do not imitate other's behaviours as readily, shaping of appropriate imitative responses is the usual recourse. Without this, technique of reinforcing imitation has been used with retarded and autistic children, to teach them complex behaviours such as physical manipulation and vocalization (Baer, Peterson and Sherman, 1967).

Most of the consequences which have been scientifically tested by operant educators and psychologists have been used to some degree with retarded and normal pre-schoolers. Ice-cream and social praise were effectively used as reinforcers by the mother of an autistic pre-school child to teach puzzle assembling (Risley and Wolf 1966). Contingent attention of teachers and parents has been used as a reinforcer for many developmentally important behaviour including increasing the rate of manipulative play (Hall et al. 1972), use of
outdoor playground equipments (Harris and Sherman, 1973) and social interaction and co-operative play between peers (Hart, Reynolds, Baer, Brawley and Harris, 1968). Food and other tangible reinforcers have been used in many of the same situations, especially when adult's attention has been ineffective as a reinforcer. By pairing social praise with tangible reinforcers the effectiveness of social praise as reinforcers can be increased (Ullman et al. 1965).

Techniques, used to eliminate socially undesirable behaviours have been proved effective at preschool level also. Extinction has been used effectively to eliminate crying (C.D. Williams, 1959). Reinforcement of incompatible behaviour associated with extinction has reduced crying while increasing smiling and increasing more gentle play behaviour (P. Brown and Elliott, 1965).

Baker et al. (1980) reviewed some of the efforts of teaching self-help skills to retarded children through operant procedures. In each study "Parents were taught to break the skill into components, model the steps, prompt and guide as necessary, reinforce successive approximations, fade prompt reinforcers and record progress". In addition to teaching self-help skills like dressing, eating and toileting, several studies successfully employed operant techniques to eliminate destructive behaviours such as head banging or hand biting.
MONTESSORI METHOD APPROACH

Montessori approach particularly seems to be a fruitful one in teaching children with special needs. Philosophically Montessori does not emphasize distinctions between children based on categorical 'labels'. The method is appropriate to the needs of both, the gifted and the very limited children. In 1890, Dr. Maria Montessori developed the method through her work with economically disadvantaged and socially and intellectually handicapped children. Montessori was remarkably successful in teaching some mentally retarded children to read and write, began a training programme for young normal children. Her preschool techniques continue to be popular in normal nursery schools.

Maria Montessori felt intactively that the question of defective was definitely one of pedagogy rather than of medicine. She dedicated herself to the education of defective children during 1898-1900. The aim of the therapy was not only that the pupil should learn something but also to awaken their mind, their personality.

The work of Jean Itard (1774 - 1838) and Seguin (1812 - 1880) influenced Montessori. Seguin carefully worked out a method of education for defectives calling it the "Physiological Method". His ideas on education like Itard were centered around the fundamental education of the senses, but he placed emphasis on educating the child's muscular and nervous system. His idea that normal children could benefit from a similar approach impressed Montessori. Montessori principles are supported by our present day understanding of the function of human nervous system.
Montessori claims to be the first to discover the "sensitive periods of infancy" and to make use of these for the standpoint of education. Through the senses the child is able to orientate himself with the outer environment. The child has an instinct to co-ordinate his movements and to bring them under control.

"Exercises of practical life" are important within the "formative period". The importance of these exercises is the analysis of movement. The exercises of practical life include all activities children observe from the beginning of their life e.g. cleaning the table, pouring, spooning, pounding, grinding, etc. They are necessary for the self-preservation and care for environment inside and outside his housing place.

In all these activities the child may be said to be playing but the real aim is to satisfy an unconscious need. Repetition of these activities is laying down in the nervous system establishing fresh co-ordinations. Thus, activities lead the child to acquire the new power which will be needed for his future.

The Montessori's "Sensorial Materials" have much in common with instructional materials frequently employed by teachers of mentally retarded children and children with physical, neurological, perceptual or sensory handicaps. They are manipulable, three dimensional and concrete. They are designed to focus the child's attention on silent features and not to distract him with irrelevant stimuli, and they are used sequentially.
Also one of the main features incorporated in the design of piece of sensorial apparatus is implementation of the idea, that child's muscular activity should be prepared for later application. e.g. Several pieces of apparatus require the child to use the thumb-index finger so that they are strengthened and coordinated as these three fingers are the ones that later control the pencil for writing.

Once the child has enough sensorial experience with the material, the three period lesson is introduced.

**THE THREE PERIOD LESSON** :

1st Period : The association of the sensory perception with the name.

2nd Period : Recognition of the object corresponding to the name.

3rd Period : The remembering of the name corresponding to the object.

**THE SIGNIFICANT TEACHING POINTS AND THEIR RELATIONSHIP TO THE PRINCIPLES UNDERLYING A PIECE OF MONTESSORI'S SENSORIAL APPARATUS** :

1. Sensorial apparatus provides the child with sensori-motor activities which have been systematically planned for the five senses and so permit the child to form new concepts through experience and exercise.

2. The child accomplishes one step at a time and gradually moves on to more complicated tasks.
3. Where possible each sense is isolated to provide an intense experience.

4. Where possible there is a "control of error" in the apparatus so that the child can correct his own mistakes. This promotes "auto education" which is more effective than being taught by another person.

5. The materials encourage the child to work in an ordered way as they are designed and presented as per the need.

6. The satisfactory completion of a task serves as reward and the child is therefore encouraged to engage and concentrate upon and complete the activity again. Thus, he has disciplined himself to complete a task.

7. Many of the materials help to develop the muscular co-ordination and some prepare the muscles for later specific task.

8. Appropriate language is taught for the new experience and skill acquired and therefore, his language development is enhanced.

9. Many of the materials provide the child with both direct and indirect experiences in the field of mathematics, reading, science and music.

The sensorial apparatus evoke deep concentration which may be regarded not only as a help to explore the environment but also the development of the mathematical mind.
In Montessori method structural environment is important. The structure, however, is intrinsic to the materials employed and to the learning environment itself. The materials have been designed in such a way that their sequential use was believed to parallel the progressive growth of child's developing mind. Montessori believed that a child progresses through sensitive periods of development and that the key to optimizing his learning is to match the task and the materials with which it is performed by the child.

**MONTESSORI ENVIRONMENT PROVIDES:**

1. Simple interesting apparatus
2. Orderly arrangement
3. Neutral background

While working in Montessori's structural environment, a child chooses what helps him to construct himself. He learns to respect the work of others, waits for his turn and solves the problem.

According to Montessori's view, the children's real wish is to be always at work. The child's power of choosing his work spontaneously comes following an inner guide.

The Montessori approach became one of the "alternative models" or "planned variations" employed through projects "Head Start." However, its effectiveness as an appropriate intervention for low income children has not been established (Karnes et al, 1981).
Goodman et al. (1984)\textsuperscript{37} said, "the Montessori training programme is beneficial for mentally retarded children because it emphasises visual, auditory and tactical perception and requires attentiveness and orderliness."

**REFERENCES**


Figure - 1
Growth of brain postnatal.
(Hultenlocher, 1974)

Figure - 2
The axon and the dendrites.
(John Briely, 1976)
## Time Schedule of Growth

<table>
<thead>
<tr>
<th>Component</th>
<th>Developmental Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dendrite</td>
<td>7 months of pregnancy to 4 years of life.</td>
</tr>
<tr>
<td>Nerve Cell (Nucleus)</td>
<td>Conception to 6 months of pregnancy</td>
</tr>
<tr>
<td></td>
<td>Mycline cover</td>
</tr>
<tr>
<td></td>
<td>Birth to 16 years (adult)</td>
</tr>
<tr>
<td>Axon</td>
<td>Conception to 6 months of pregnancy</td>
</tr>
<tr>
<td>Mycline Cover</td>
<td>Birth to 16 years (adult)</td>
</tr>
</tbody>
</table>

## Stimulation of Growth

<table>
<thead>
<tr>
<th>Component</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dendrite</td>
<td>Information co-ordination</td>
</tr>
<tr>
<td></td>
<td>Only the ability to sprout</td>
</tr>
<tr>
<td></td>
<td>Genetically determined</td>
</tr>
<tr>
<td></td>
<td>Not the exact time</td>
</tr>
<tr>
<td></td>
<td>Not the family number</td>
</tr>
<tr>
<td>Nerve Cell Body</td>
<td>Computer</td>
</tr>
<tr>
<td></td>
<td>Finally genetically determined in time and number</td>
</tr>
<tr>
<td>Axon</td>
<td>Telephone</td>
</tr>
<tr>
<td></td>
<td>Finally genetically determined in time and number</td>
</tr>
</tbody>
</table>

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*Figure 3. Neurone and neuronal connections (Anastasiow, 1990)*
Increased apparent arborization of neurons and density of dendritic spines with increasing age (Huttenlocher, 1974)

A greatly simplified scheme to describe the common mamalian pattern of brain growth (Dobbing, 1981 b)
a] Total DNA-P equivalent to total cell number, in the human forebrain from 10 gestational weeks to 4 postnatal months, showing the two phases characteristics of prenatal cell multiplication.

b] A semi-logarithmic plot of the same data as appears in 6 [a] to show the sharp separation of the two phase, at 18 gestational weeks. Regression lines with 95% confidence limits are added.

(Dobbing, 1931 b)
Figure - 8
Fullterm normal newborn baby, flexed position.
(Illingworth, 1987)

Figure - 9
Abnormal appearance of child aged 8 days, hands tightly closed, the legs tend to cross and extend.
(Illingworth, 1987)
Figure - 10
6 weeks normal child, head held in same plane as rest of body. (Illingworth, 1987)

Figure - 11
6 weeks, cerebral palsy child
Figure - 12
6 weeks, normal child chin held off intermittently
(Illingworth, 1987)

Figure - 13
6 weeks, mentally retarded child showing prone position
similar to that of new born baby. (Illingworth, 1987)
Figure - 14
14 weeks, normal child, back much straighter.
(Illingworth, 1987)

Figure - 15
16 weeks, spastic child, head is laging, marked flexion of knee.
Figure - 16
Normal posture when child is held by hands in the axilla (Illingworth, 1987)

Figure - 17
Spastic child cross legs, clench hands when child is held by hands in the axilla (Illingworth, 1987)