

# Development of the Brain and Mind



## INFLUENCES ON DEVELOPMENT

Development of the mind or psyche through fetal, infancy, childhood, adolescence and adulthood stages, is the most fascinating aspect of human life. Each stage has its own repertoire of neuronal functions and vulnerabilities. Development of the brain incorporates and is driven by two major influences:

1. Evolutionary/Genetic
2. Environmental

Evolutionary past provides a pre-programmed genetic blueprint for organization and structure of nervous system, linking it to phylogeny. Thus, the brain incorporates not only the lived experience but also the evolution. Gene template provides uniform structure of the brain, such as neurons and its connections with major brain regions, unimpacted by the environment. Whereas, environmental influences shape the neural architecture within the context of the environment. There are transcription genes that depend upon environmental triggers for expression. Experience can change the actual structure of the brain. Every experience activates some neural circuits and leaves others alone. Neural circuits used over and over again get strengthened, and those that are not used are dropped resulting in “pruning”. Neurons that fire together, wire together.

In a new born, sensory system is more advanced than motor system. There is sequential development of various brain regions and systems. Sensory and motor

systems mature first. Association cortex which integrates memory, audio–visual inputs, object recognition mature later. Brain areas involved in complex decision making, impulse control, judgment, mature last. Maturation of brain systems and connectivity continues in adolescence through adulthood. Brain has capacity for neurogenesis throughout life. Neurons generated as a result of experience are not only functional but are associated with better memory and plasticity (Van Praag et al 2002). Brain areas associated with emotions and memory (pre-frontal cortex, amygdala, hippocampus and temporal lobe) are highly plastic, and therefore, amenable to learning even in adulthood.

Contrary to the common belief, the brain of a newborn is the most perceptive, sensitive and adaptable organ that continues to grow and mature into highest levels of complexity involved in the emotional, behavioural and cognitive functioning of an adult, incorporating the experience throughout the various stages of development. Psychological development includes an array of emotions and inner emotional life; myriad behavioural patterns; competencies; skills of interpersonal and social relationships; intellectual and cognitive abilities, in a highly individualistic and unique style. Emotional/social development starts immediately after birth or even before birth. Exposure of the fetus to stress hormones of the mother primes and sensitizes its nervous system leading to patterning of its excitation,

inhibition and regulatory functions. Thus, the early emotional experiences get embedded in the architecture of their brains. Experience wires the brain through learning and gene expression. Due to repeated exposure and neuronal plasticity, these experiences influence the strength of synaptic connections and embedding of the environment in the neural architecture. This contributes to both “biological evolution” and “cultural evolution”. Normal and abnormal development lie on a continuum.

### Influences on Development

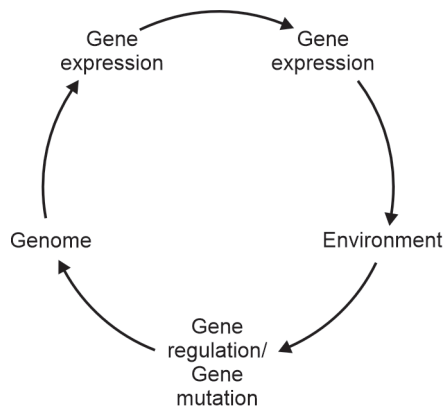


Fig. 1.1: Gene-environment interaction

#### **Genetic Factors**

Genetic abnormalities, family history of neurological/neurodevelopmental disorders, parental mental illness, temperamental adversity, low IQ.

#### **Adverse Environmental Factors (Pre and Post Natal)**

Diet, toxins, infections, stress, trauma, medications, parenting.

### THEORIES OF DEVELOPMENT

Historically, several theories have been proposed to explain the development of mind and personality from early childhood to adulthood. Most of these theories were propounded around the late 19th and early 20th century and have remained in vogue till late 20th century. Each theory, though,

provided only partial explanation, but taken together these have led to considerable accumulated knowledge about the human mind and its emotional, psychosocial, interpersonal and cognitive functions. These developments took place around the beginning and through the course of the last century that led to declaring the 20th century as the century of the child.

Further each of the theories of development have lent themselves to the formulation of therapeutic interventions, corresponding to the theoretical tenets. A brief and quick introduction to the theories of psychological development will always be helpful in understanding the genesis of psychopathology and in planning the therapeutic strategies for the given patient. For the sake of simplification, the explanatory theoretical models, as listed below, can be categorized in accordance with what they can explain best and how these are subjected to treatment formulations.

1. Psychoanalytic theories for intrapsychic functions and inner emotional life.
2. Behavioural theory for social and behavioural learning.
3. Piagetian theory for cognitive development.
4. Attachment theory for emotional attachment and bonding.
5. Temperament theory for stylistic uniqueness of behaviour.

### CHILD PSYCHOANALYTIC THEORIES

Sigmund Freud (1859–1936) made a major contribution and founded the psychoanalytic school of thought explaining psychopathology in adults, while focusing on childhood as a crucial phase of life. According to this theory, childhood experiences determined and shaped adult psychopathology and personality. Psychoanalytic theory not only explained the psychological basis of behaviour but also provided a framework for treatment of various disorders. Many others such as Anna Freud and Melanie Klein added a

developmental dimension to psychoanalysis making it suitable for assessment and treatment of children and adolescents.

According to psychoanalytic theories, a newborn begins its process of development from the somatic experiences or bodily sensations that it is born with. The infant has the ability to respond to and regulate the influences of internal and external stimuli on its neurological and physiological systems that translate into visceral and emotional experiences. Parental involvement in providing nurturance, fulfilment, relief and safety lays the foundation for development of relationships and emotional reactions in later life. There is a constant interplay between the genetic and biological forces with the experience of the child in the family and social environment, structuring and patterning the child's psyche or mental apparatus. According to Anna Freud, the leading child psychoanalyst, the charting of the mutual influences between the psyche and soma and their representation in mental life provides a framework for understanding both abnormal development and illness (A Freud 1965).

Infant's internal experience involves primacy of certain zones of the body called erogenous zones, i.e. oral, anal, phallic at different stages of development. The infant seeks gratification and relief from mounting tension periodically, till it masters the respective stage to move on to the next stage. Depending on the primacy of the erogenous zone, development progresses along the following phases:

#### **Oral Phase** (0–18 months)

During infancy, oral stimulation through feeding, sucking, biting, licking provides utmost pleasure and satisfaction. The child uses this oral experience for feeding and survival as well as for perceiving, regulating and altering his/her inner bodily sensations. Entire effort of the child centers around relief of physical tension and obtaining gratification. As the mother

tries to maximize the child's comfort, relieve tension and soothe him/her, there is development of an emotional bond between the mother and the baby and this leads to internalization of the image of the mother. The type of bonding between the mother and the child and the internalized maternal image forms the foundation of subsequent emotional and social relationships in later life.

Any disruption in the relationship between the mother and the child during this phase of life on account of any cause, e.g. separation of mother and child in infancy, mother's physical illness or mental illness particularly depression or schizophrenia, or physical abuse, can generate any form of psychopathology such as failure to thrive, anaclitic depression, stranger anxiety, hypersensitivity to simulation, fear or withdrawal reactions, or developmental lag.

#### **Anal Phase** (18–36 months)

At this stage of development, anal sensations are heightened focusing the child's attention to this part of the body. In the acts of defecation and urination, the child experiences bodily sensations, a sense of control on bodily functions; a physical act of doing something. These acts become a source of pleasure and also assume a sense of control that the child can exercise on his body and on the environment. The child sees how what is originally inside "becomes public". This is the age for toilet training where the child has to master control of defecation and urination in accordance with parental rules. Successful mastery over these functions involves internalization of external controls, and conveys a sense of autonomy, a sense of pride and ownership of body in the child. On the other hand, any disruption in parent-child relationship or in toilet training at this stage, can lead to defiance of parental rules, lack of autonomy, obstinacy, aggressiveness and temper tantrums, sense of shame, guilt in the child.

**Genital Phase** (36–48 months)

During this phase, there is crystallization of gender awareness, preoccupation with anatomical differences in sexes; and attention to sensations arising from penis and testicles in boys and vagina and clitoris in girls. By the age of 3, children are clearly aware of their gender identity and begin to explore theirs' and others' bodies. Children around this age experience pleasure sensation in their genitals and feel the tension arising from genital areas. They can exhibit their genital organs, self-manipulate, or touch or play with each other's genitals. In this phase, children take pride in their genitals, find their bodies pleasurable, a phenomenon termed as "phallic narcissism" (Burgner and Edgcombe 1975).

**Oedipal Phase** (4–6 years)

According to the classical psychoanalytic school, children during this phase are concerned with issues of love, sexual or aggressive feelings towards the parents of same or opposite sex, and gender roles. These feelings are a consequence of cognitive, affective, physical and social development at this stage and are resolved by developing mental structures consolidating the realizations that he/she is the child of his/her parents and that the parents have relationship with each other and that the parents have roles and lives of their own which is apart from their role as parents.

Parents are seen as sexual objects. The child clamours for exclusive parental attention and love from the parent of the opposite sex. The child realizes that he can achieve this by being good and compliant, paving the way for development of super ego. Child now understands the virtues of good behaviour and realizes that parents are separate individuals.

**Latency Phase** (7–10 years)

During this phase, child's concern with erogenous zones of the body, i.e. pre-

oedipal phase and the oedipal strivings decrease considerably. Sexual impulses diminish. Intellectual, cognitive, sensory motor and social aspects of development and functioning predominate in the behavioural and emotional expressions. Child begins to acquire several adaptive defense mechanisms such as identification, intellectualization, sublimation and humour to support the diversion and alteration of the original impulses (Bornstein 1951, Freud 1966).

**Adolescence** (12–20± years)

Adolescence is a period of rapid and profound changes in the biological, psychological and social functioning. There is period of pre-adolescence (10–12 years) when sexual curiosity and auto stimulation resurfaces; followed by early adolescence (12–14 years) when biological process of puberty sets in. Along with a growth spurt, there are rapid hormonal and bodily changes, and development of secondary sex characters. This phase is marked by anxiety as the adolescent finds their bodily changes out of control, even unacceptable and external, making them feel embarrassed and secretive about them. In mid-adolescence (14–16 years), sexual function is fully established and there is re-emergence of sexual feelings and fantasies along with awareness that the adolescent is capable of performing sexual functions now. They acquire an aggressive and provocative attitude towards parents and begin to object to any interference by them in their lives. They drift away from parents, moving towards their peer group, both of same sex and of opposite sex with increase in outside home activities. Late adolescence (17–20 years) is marked by development of a stable peer group, involvement in intellectual and academic pursuits, development of athletic or other artistic interests, and extra-curricular activities. By this time, adolescents are able to emotionally disengage from parents to become autonomous; develop their own identity and meaning; try to

develop intimacies outside home; and begin to establish heterosexual relationships. Preoedipal and oedipal strivings and fantasies towards parents are surrendered to the heterosexual partner, in which earlier components of attachments to parents such as dependency, exclusiveness, physical intimacy, possessiveness, and jealousy are all subsumed. These relationships move further through a process of maturation and consolidation culminating into development of a sense of self through evolving interests and ideals.

In adolescence, the individual, psychologically re-organizes the representation of the bodily and sexual changes; accepts sexuality and the body with pleasure and pride; develops value system of their own which is separate from that of the parents; learns to regulate drives of love and aggression; and develop intimacies outside family.

In summary, the psychoanalytic theory concerns itself with the child's inner world and intrapsychic functioning, dealing with the child's emotions, thoughts and wishes, frustrations, dreams and fantasies, worries and pleasures.

Psychoanalysis is an exploration into and understanding of child's own private and personal experience of life, his own understanding of persons, issues and the world. Psychoanalytic theory has contributed most to understanding of children suffering from emotional disorders.

### **LEARNING THEORY OR BEHAVIOURISM**

Behaviourism as a movement in psychology was initiated in America by JB Watson (1878–1958) who applied methods of animal research to human behaviour paving the way for use of more objective methods in behavioural analysis as opposed to subjective methods used in psychoanalysis. Behaviourism was based on learning theories propounded by Pavlov's classical conditioning (1927); Thorndike and Skinner's Instrumental or Operant

conditioning. According to Watson, learning could shape entire human behaviour and virtually all behaviour could be explained on principles of conditioning (Watson 1919).

According to Pavlov's classical conditioning principles, a stimulus that is neutral or which does not elicit a reflex response, can be made to elicit a reflex response when it is paired with a stimulus that actually elicits the reflex response.

Classical conditioning concerns with stimuli (called unconditioned stimuli) that elicit reflex responses (called unconditioned responses). These unconditioned responses are reflexes, i.e. these are involuntary or automatic and therefore not learnt. However, these reflex behaviours (unconditioned responses) can be learnt as a conditioned response so as to be elicited by neutral stimuli which is termed as conditioned stimulus.

The process by which a new and neutral stimulus gains the power to produce a unconditioned response is called classical conditioning. The concept of conditioning was applied to explain the development of all types of adaptive or maladaptive behaviour. Another type of learning that was described was operant conditioning where the consequences of behaviour were considered more important. Thorndike (1932) formulated Law of Effect which stated that consequences that follow the behaviour help learning. Positive consequences or positive feedback facilitates learning and negative or no consequences produce opposite effect. B.F. Skinner (1953) expanded the concept further. According to him, behaviours are operant, i.e. it influences or operates on the environment; and operant behaviour strengthens (increases) or weakens (decreases) as a function of its effect on the environment.

The process of learning operant behaviour is called operant conditioning. Most behaviour exhibited in everyday life can be considered as operant.

According to learning theories, all behaviours are operationalized into learning paradigms based on classical or operant conditioning principles and these are then subjected to modification techniques collectively called behaviour modifications or behaviour therapies. Here, the focus lies on alteration of behaviour as a means of altering the clinical disturbance. It is assumed that there is plasticity in behaviour, and it is amenable to change under systematic conditions of learning.

Further developments in behaviour therapies emphasized on role of cognition (thoughts and beliefs) in shaping one's own environment and viewed maladaptations as faulty cognitions. Based on these assumptions, a whole new form of therapy called cognitive behaviour therapy was formulated which became the most influential and effective mode of psychotherapy in due course.

Around the same time, experimental research by Ivan P. Pavlov (1849–1936) on classical conditioning formed the basis for learning theory, which was extended to explain the learning of developmental tasks and behaviours. Edward L. Thorndike (1874–1949) explained learning of new behaviours on the basis of consequences that follow which help learning. This learning was described as operant conditioning in which behaviours increased or decreased as a result of consequences that followed them. This led to founding of the behavioural school of psychology as a general theory of child development that explained the processes involved in psychological dysfunction or disorder and stimulated emergence of behaviour therapy as yet another form of psychological method of behavioural change.

### **PIAGETIAN THEORY**

Jean Piaget (1952) propounded the theory of cognitive development which was a stepwise process of evolution of cognitive structures through internal representation

of the environment and its organization and integration at successively higher and more complex stages. Piagetian theory explained how children develop the capacity to think logically, how they attribute different meanings to some events at different stages and how they actively contribute to their own experience.

Cognition is a complex concept to describe the “internalized schemas or frames of reference which the child uses in his interaction with the external world” (Daregowski 1977) or in other words it can be construed as the child's mental representations of the world, both physical and social; and of the self. Piaget distinguishes between the “affect which is an energizing force while ... cognition provides the structure for this energy”. Cognition has also been understood as information processing system or as the workings of the thought process, or as the higher intellectual processes and structures, or as logical thought.

Jean Piaget (1952) provided a theory of development of intellectual structures which is recognized as one of the most influential theories of cognitive development. According to Piaget, cognitive development involves a continuous process of mentally adapting to and organizing the environment through a process of assimilation and accommodation in the mind of the child. Over time, mental schemas or organized mental structures are created, coordinated and enlarged to involve all aspects and domains of human experience. These schemas are synthesized at each stage of development leading onto the next higher level of organization. Piaget has described four discreet stages of cognitive development:

#### **Sensori Motor Stage**

(Birth through 18–24 months)

Child at birth is endowed with sensory motor reflex functioning system devoid of any symbolic or conceptual representations

of the world. In their interaction with the environment, these reflexes get patterned, stronger and more and more differentiated through constant process of experience and feedback. For example child roots, sucks and grasps initially the breast, then his own body part, i.e. thumbs (by the second month) followed by other objects in the environment, when simultaneously these reflexes get associated with gaze and touch (by 4–5 months).

Feedback from random movements of limbs, head or eyes give rise to intentional behaviour of repeating the act, thus forming an internal structure for behaviour. Thereafter, the child brings in an element of novelty by slightly altering the behaviour and then looking for feedback. By the second year of life, symbolic function begins to develop when children start playing peek-a-boo and related games. Child develops capacity for symbolic play and use of language.

### **Pre-operational Stage**

(2 through 5–7 years)

This stage is also called intuitive stage or pre-logical state. The child is slowly developing mental images of objects, understands object permanence, learns concept of time and space, acquires enduring memory and symbolic functions which is further facilitated by developing language.

### **Stage of Concrete Operations**

(6–11 years)

At this stage, children learn to deal with concrete objects as they exist or are experienced by the child. Logic begins to develop; thinking is no more intuitive or inconsistent. Concepts are formed as mental operations or structures and these get more and more organized. According to Piaget, mental operation is “any representational act which is a part of an organized network of related acts” (Flavell 1963).

Classification is a form of mental operation where the child constructs curvilinear

relationships according to a property creating vertical hierarchy. Seriation is another example where objects are ordered horizontally in rows according to a particular property. These mental operations get stabilized and get further connected logically.

### **Stage of Formal Operations**

(11 years to Adulthood)

At this stage, children can form hypothesis where reasoning involves hypothetical situations as against empirically derived situations of childhood. Now, the children’s thought is not structured by the concept of actual objects or perception. There is development of logical and scientific reasoning. They can distinguish fact from fiction, they can think about their own or other’s thinking, taking thoughts as objects.

### **COGNITIVE DEVELOPMENT IN ADULTHOOD**

Several authors believe that cognitive development continues into adulthood even after the fourth stage of Piaget.

### **DEVELOPMENT OF SOCIAL COGNITION**

Cognitive and social development occurs in a parallel and reciprocal manner where cognitive skills mediate social interaction which further provides context for cognitive development. Infants have the ability to recognize emotions in facial expressions and respond accordingly.

Children relate to people as they do to things, moving from external/physical properties of objects to their internal and conceptual attributes. Social cognition incorporates emotional cognition, empathy, and moral reasoning. In social cognition, the child also learns to understand that other people too have thoughts, intentions, and feelings that are separate from their own. This provides the child with what is called “theory of mind” or “mind reading”, involving the concept of self and of others and of the relationship between them that has implications for social relationships,

empathy and moral judgement. Brain has mirror neuron systems which get similarly activated while watching a certain act or while performing the same act. It means that there is common neural coding for production of an action and perception of same action. This represents the neural basis for imitation, motor learning, learning of gestures, phonetics, actions by observation. Mirror neuron systems are also linked to emotional attachment, recognition of internal emotional states of others thereby serving to develop empathy and theory of mind.

The way children reason about feelings has been analyzed by Nannis (1988) and presented in a sequential manner. Initially feelings are seen as generated by external events or happenings; then these are viewed as being located internally like a body organ with no control over them by the child. At the next stage of development, feelings are understood as diffuse within the person rather than as concrete things in the concrete body. Further, the feelings are conceptualized as being influenced by self. Finally, the most complex conceptualization of feelings evolves and that the “feelings involve regulation and integration of internal processes and external events. Feelings are part of a system with universal laws or principles” (Nannis 1988).

### **ATTACHMENT THEORY**

Attachment is innate, biologically based, enduring emotional bond that unites one person with another. It commonly manifests as seeking proximity and contact with the attachment figure, feeling comforted and secure in presence of attachment figure. Attachment basically serves the purpose of protection and nurturance by the mother or caregiver to the baby providing survival and safety to the young ones. According to Bowlby (1969, 1973), a psychoanalyst and a psychiatrist, mother–infant attachment behaviour is typical to species that evolved to promote infant survival. According to

Bowlby, infants are tuned to respond socially to their social partners, and the attachment process varies according to experience in its intensity and quality on secure–insecure dimension. Secure attachment is derived from the confidence the infant has that his help-seeking signals will evoke adult’s response promptly. In case, the quality of care is insensitive, or unpredictable, the infant goes into insecure attachment mode. Many adult personality disorders could be understood as the aftermath of insecure attachment in infancy and early childhood (Bowlby 1973). Attachment theory finds application in clinical and therapeutic situations such as in day-care experience for infant; as a risk-factor for insecure attachment; in determining custody issues in child where the concepts of “best interest of the child” and “psychological parenting” (as against biological parenting) become the determining forces in legal proceedings; and in understanding emotional disorders of infancy and early childhood.

During the middle of the 20th century, animal experiments by Harlow (1958) provided evidence for the psychological phenomenon of attachment which is conceptualized as an enduring emotional bond between two persons manifesting as proximity seeking and contact seeking that serves the purpose of survival, protection and nurturance of the young ones. John Bowlby (1969, 1973) a psychoanalytically oriented psychiatrist brought together ideas from psychoanalysis, developmental psychology and the evolutionary theory, which developed, into an elaborate theory of attachment. Attachment theorists expanded their work and brought into focus, the issues of quality of parent–child relationships. Their understanding of adult personality disorders was described as a long-term consequence of impaired infant–parent attachment. Attachment theory has been an influential and powerful theory of child development that highlighted the importance of early child care.



## TEMPERAMENT THEORY

Another significant theory of development came from research on temperament. Temperament is an ancient concept that emphasized the individual differences in behavioural style arising from differences in the constitution and neurobiology.

Temperament refers to unique and innate, psychobiological characteristics in children that underlie a wide array of behavioural and reaction patterns. Temperament is constitutional, present at birth and evident in first few months postnatally, and refers to stylistic aspects (how) of behaviour rather than the content (what) or the motivation (why) of behaviour. Temperament concept serves to tie together a variety of behavioural dispositions commonly used to distinguish one individual from another. Temperament is applicable to children, adults and even to animals (pets, livestock). These are a set of behavioural tendencies that are unique to the individual and are relatively stable across situations and during the course of time.

Temperament acts as a significant force in children in guiding their own development where children are viewed as active participants rather than being passive recipients involved in shaping their environment and experience. Involvement of these biologically endowed temperamental characteristics contributing to children's own development provides a link between the genetic and neuro-physiological characteristics of the child with socially relevant behavioural patterns. Individual differences in behavioural styles evident in neonates and young infants are easily perceived by the primary caregiver.

Pioneering research in this area was done by Alexander Thomas, Stella Chess and others (1968) who undertook an intensive, in depth, observational, longitudinal study of new borns in the New York City called New York Longitudinal Study (NYLS) in 1956. Original cohort comprised of 138 children from 85 families and 97% of the

sample was followed up through 30–40 years. They described nine categories of temperament:

1. *Activity level*: The motor component in child's functioning.
2. *Rhythmicity*: Regularity or predictability of biological functions such as sleep-wake cycle, hunger, elimination schedule, etc.
3. *Approach or withdrawal*: The nature of child's initial response to a stimulus (food, toy, person) which could be positive, i.e. approach; or negative, i.e. withdrawal.
4. *Adaptability*: The ease or rapidity with which initial (withdrawal) response is changed in the direction of desired (approach) behaviour.
5. *Threshold of responsiveness*: The intensity level of stimulus required to evoke a discernible response.
6. *Intensity of reaction*: The energy level in response irrespective of its quality or direction.
7. *Quality of mood*: The amount of happy, joyful behaviour, as contrasted to unhappy or crying behaviour.
8. *Distractibility*: The effectiveness of extraneous environmental stimuli in interfering with or altering the direction of the ongoing behaviour.
9. *Attention span and persistence*: Attention span refers to the length of time an activity is pursued by the child. Persistence is the continuation of the activity despite obstacles.

According to Thomas, Chess and Birch (1968), the "degree of fit" between the children's temperament and the environmental expectations and demands determines the degree of stress the child encounters during the course of development. "Goodness of fit" is adaptive and healthy whereas "poorness of fit" can create conditions for maladaptation and problems in the domain of behaviour and emotions.

Several temperamental dimensions have been described by different researchers

and some of those with established validity are:

1. *Emotionality*: This may be positive or negative. Negative emotionality (fear, anger, distress) predisposes to maladaptation.
2. *Adaptability* can be high or low and refers to adaptation to novelty. Low adaptability manifesting as shyness, withdrawal and behavioural inhibition and is found to be a risk factor for maladaptation.
3. *Reactivity*: Reactivity relates to Pavlovian concept of the strength of nervous system. It involves the relative strength of stimulus intensity and the response intensity exhibited by individuals in given situations. There are individual differences in how intense a stimulus must be to evoke a reaction; as well as how intense a reaction is to a stimulus of a given intensity.
4. *Activity*: It refers to the frequency and intensity of motor activity in behaviour. To some extent, activity levels are also related to arousal levels where activity helps to regulate the arousal levels or vice versa.
5. *Attention regulation*: This concept refers to the extent to which the child will shift attention from his/her activities or distress in response to external stimuli. To some extent, this concept overlaps with the notion of soothability or distractibility.
6. *Sociability*: Sociability involves appreciation of company of others in the form of socially reciprocal interchange. Sociability is a highly heritable trait.
7. *Difficultness*: This concept was operationalized by Thomas et al (1968) as a sum of five out of nine temperament variables described by them. Difficultness in a child was described as predominant negative mood, withdrawal, low adaptability, high intensity of emotional response and low regularity of biological rhythms.

Temperament concept provides ample understanding of human social development as well as of psychobiology of behaviour and emotions. Developmental psychologists have viewed it as an intervening variable between the genetic constitution and environmental experiences.

Alexander Thomas and Stella Chess (1963, 1977) who carried out empirical studies on temperament and followed-up these children from infancy through adulthood, producing a wealth of developmental data on the vicissitudes and outcomes of the temperament–environment interaction. Temperament theory highlighted the need for attention to the innate biological propensities within the child himself who is not just a passive recipient of the environmental influences but is an active agent in shaping the environmental processes in a dynamic, interactive, reciprocal relationship. Temperament theory helped to explain the developmental course and outcomes in childhood and beyond, and provided a framework for interventions.

#### DEVELOPMENTAL NEUROBIOLOGY

The central nervous system constitutes the structural as well as functional substrate of the cognition, personality, emotion, consciousness and all other human qualities that constitute human psyche. Life starts at conception and it is clear that both pre- and postnatal influences produce significant effects on the developing brain. Although considered as one organ, brain comprises of several major areas such as cerebrum, thalamus and hypothalamus (diencephalon), midbrain (mesencephalon) and cerebellum; all performing highly specialized functions, interconnected through a higher level organization for a coherent functioning. Further, there are several functional systems of interest to psychiatrists such a limbic system, or basal ganglia. Even though there are separate and specific functional neuronal systems

sub-serving consciousness, memory, emotions, perception, cognition, attention, etc., they are also interconnected in a highly complex and interactive manner at a horizontal as well as vertical hierarchical plane.

Brain development starts with neurulation or the establishment of neural plate during the third week of gestation. From 5th to 18th week of gestation, rapid neural precursor cell division is followed by an extensive glial proliferation and subsequent myelination occurring between the 19th week of gestation and 2½ years of age (Dobbing and Sands 1973). The process of myelination of CNS occurs at different rates for different parts of the brain and is also completed at different time periods. Most rapid myelination occurs in first 2 years of life (Dobbing and Sands 1973), primary motor and sensory areas are fully myelinated by the age of 6; and associative areas only in second decade. Myelination of prefrontal cortex occurs the last of all and can go up to 4th decade (Yakovlev and Le Cours 1967). Disruption of process of myelination can occur by toxins, nutrition, and other environmental factors. Brain and nervous system are built, neuron-by-neuron, through interaction of genetic programming and environmental influences (Changeux and Danchin 1976). This is a use-dependant development where growth and interconnectivity of neuronal systems is facilitated by continuing use.

Further, the brain is not a static structure; it continues to change and has the potential to change throughout life. Environment plays a crucial role in building the brain where the environmental experience is incorporated in the memory circuits; learning (both implicit and explicit) alters the neuronal functions, establishes newer synaptic connections and modulates behaviour. Emotional memories are located in the amygdala. Eventually, the brain gets specialized into several structural and functional systems such as social brain, emotional brain, and executive brain.

Social brain includes amygdala, anterior cingulate, orbitofrontal areas of the prefrontal cortex and frontal portions of temporal lobe; built between 18 and 24 months of age and is driven by attunement between the right hemisphere of the mother and the right hemisphere of the child (Schore 2000). Early bonding between the mother and the child is primitive, with smell, touch and gaze playing the pivotal role. This early bonding evolves into lifelong patterns of attachment and interactions.

Executive brain incorporates frontal and prefrontal cortices subserving behavioural and emotional executive functions. Parietal lobes organize body image and inner subjective experiences and send projections to frontal lobe. Temporal lobes integrate sensory information with socioemotional aspects and send projections to frontal lobes. Frontal lobes provide the highest level of cognitive and emotional processing (Fuster 1997) and also integrate concepts of time, past and future memories (Fuster, Bonder and Kroger 2000, Ingvar 1985).

Emotional brain is primarily subserved by the limbic system that includes amygdala, hippocampus, cingulate gyrus and septum, connected to anterior thalamic nuclei mammillary bodies and hypothalamus.

Cerebral cortex or the neocortex or the neomammalian brain develops late and much more slowly than most other parts of the brain, and may continue to develop till the third decade of life. On the other hand, the primitive systems of the brain involved in arousal, activation and homeostatic functions, feeding and survival drives are fully functional at birth. The limbic system or the paleo-mammalian brain involved in social and emotional learning, emotional regulation, and memory develops through early childhood experiences. Thus, most of our behavioural patterns and emotional reactions get structured into organized patterns very early in life, much before our ability for conscious awareness, rational thought and reasoning develops. During

most of our conscious life, we remain under the influence of emotional brain and not rational brain.

Slow development of human brain allows for incorporation of the environment through prolonged period of education and learning, and for adaptation and change. This fact also underlies the finding that the environment, climate, nutrition, language, culture, parents and parenting factors shape the developing brain in a unique way. Unfavorable environment can lead to formation of maladaptive patterns and psychopathology whereas a favourable and a conducive environment can generate structures that produce healthy, adaptive and resilient patterns of behaviour throughout life.

### **INDIAN PERSPECTIVE**

People in India have reposed much faith in modern medicine and shown concern for physical health and relatively less attention has been paid to psychiatry and mental health. Traditionally, the psyche (mind) and mental health have always been relegated to the domains of philosophy, religion and spiritualism, which are deeply rooted in the lives of people even in the present-day society in India. Therefore, people often do not readily seek medical remedies for psychological problems. Modern psychological theories have been largely derived from the Western thought, such as Hegel's "rationalism", Schopenhauer's philosophy of "will-to-live"; Nietzsche's "Will-to-power" and "assertion of individuality" and William James "pragmatism". The Western psychological theories as applied to modern psychiatry were introduced to the traditional systems of health and healing in India only, recently.

In the Indian Vedanta, the true nature of "self" is construed as the "Atman" (Soul) which is a form of absolute existence that is, immortal, unchanging, eternal, without a beginning or an end, not conditioned by space, time or causation. The physical

body that is changing and mortal is the materialization of the results of past "Karma" or the actions. The "Karma" or the actions, which generate our bodies, belong to us and not to others and inevitably result in experiences in the next birth, thus implying continuity in lives and fruits of our actions even after death. Power of action or Karma cannot be destroyed and the same soul continues to materialize in the form of fresh body. Karma determines the character and vice versa. A well-balanced conduct and ordinary nonmoral actions can modify or arrest the fruits of karma (Charaka Samhita). Thus karma theory is not a theory of immutability, just as the phenotypic expressions of genotypes are dependent on the gene-environment interactions, which in itself can modify the genetic code.

This philosophy of life and theory of Karma conditions people to think, perceive and act in certain manner in the face of suffering due to disease or death. Apart from accepting a part of suffering as the necessary penance or expiation, they may ascribe external attributions to its cause and may seek magico-religious remedies for its cure. In many instances, the psychiatric treatment is delayed, at times denied in pursuit of these beliefs. On the other hand, in many situations where psychological distress is an understandable reaction to life's circumstances, problems are contained and resolved within the family or the individual's system of beliefs. It is important to understand these perspectives in order to make a proper judgement about the knowledge people have about mental disorders and the motivations they exhibit in pursuit of psychiatric treatment. One often sees the variations and gradations of these belief systems among people coming from varied sociocultural, geographical and religious backgrounds. Religious and philosophical explanations are more commonly invoked for psychiatric disorders than for physical disorders. The trend is, however, changing with education and

urbanization in favour of accepting modern medicine.

Since independence, developments in physical medicine and healthcare in India have made rapid progress. Ironically, till recently, health planning did not include mental health leaving considerable amount of morbidity and incapacitation unattended. Needless to say that mental health is at least as important, if not more, as the physical health.

### **Psychiatric Disorders of Childhood and Adolescence**

Contrary to what many people may believe, mental ill health is not limited only to adults, children are afflicted with it as much (Table 1.1). Population prevalence studies on rates of psychiatric disorders in children in India have shown that, depending upon the method of assessment and the definition and type of psychiatric disorders included, about 6% (Malhotra 2001), 7% (Verghese and Beig 1974); 12% (Srinath, et al) to about 30% (Deivasigamani 1990) of children have a significant disorder at a given time. National Mental Health Survey Data (2015–16) reveals that prevalence of mental disorder among 13–17 years olds was 7.3%; and prevalence was twice as high in urban metros (13.5%) as compared to rural areas (6.9%). Thus, 9.8 million adolescents aged 13–17 years are in active need of mental health treatment (National Mental Health Survey 2015–16). Considering that children and adolescents constitute over 50% of our total population, the burden of morbidity due to psychiatric disorders in children and adolescents in the country is enormous.

It has also been reported that 50% of all mental disorders begin before the age of 14 years, and 75% before 25 years of age. Also, many childhood psychiatric disorders continue into adulthood. There is considerable degree of continuity between the childhood and adult psychiatric disorders. General adult psychiatrists are focusing more and more on earliest phases

of life and there is significant blurring and overlap between childhood and adult psychiatric disorders.

Progress in genetics and developmental neuroscience in the last 30 years has revolutionized our understanding of the complex brain functions and its aberrations. There is a significant shift of focus from manifestations to underlying neurobiological mechanisms. Synthesis of all earlier theories of development and developmental neuroscience has led to the emergence of a new field, “developmental psychopathology”.

Child psychiatry has been recognized as a medical specialty in its own right only recently. It emerged not from the disciplines of adult psychiatry or paediatrics but from the fields of social work, education and psychology. However, it is necessary to provide it a status of a discipline, independent and separate from adult psychiatry, paralleling a logical distinction between the disciplines of paediatrics and internal medicine. The theory and practice of adult psychiatry is not directly applicable to child psychiatry for various reasons and so are the clinical methods.

It is well-recognized that childhood is the most important period in human life. The transformation of the human infant from a totally dependent state to a fully independent adult takes as long as 25 years, which is the longest time taken by any biological species. The infant not only grows in size but also in the complexity of functions that it attains. The process of development is guided by inherent genetic–biological factors which determine the potential the child is born with, and by environmental experiential factors that determine the realization of the inborn potential. Thus both the nature and the nurture are crucial to optimum development.

Child’s mind at birth is not a blank slate. Children are born with unique styles of behaviours, reactions of new environment, patterns of body movements, attention

Table 1.1: When to suspect mental health problems	
Younger children	Older children
<ul style="list-style-type: none"> <li>• Frequent tantrums or irritability much of the time</li> <li>• Often seem fearful, nervous or worried</li> <li>• Frequent crying, easily driven to tears</li> <li>• Complain about frequent stomachaches or headaches, vomiting with no known medical cause</li> <li>• Are in constant motion and cannot sit quietly (except when they are engaged in an activity they enjoy, such as watching videos or playing video games)</li> <li>• Sleep too much or too little, have frequent nightmares, or seem sleepy during the day</li> <li>• Are not interested in playing with other children or have difficulty making friends</li> <li>• Remain self-absorbed, less responsive to environment</li> <li>• Academic difficulties, delayed speech, or poor socio-adaptive skills.</li> <li>• Repeat actions or check things many times (for example, repeatedly checking to make sure a door is locked) out of fear that something bad may happen</li> </ul>	<p>Any of the problems mentioned for younger children plus any of the following symptoms:</p> <ul style="list-style-type: none"> <li>• Have lost interest in things that they used to enjoy</li> <li>• Have low energy</li> <li>• Sleep too much or too little or seem sleepy throughout the day</li> <li>• Have periods of highly elevated energy and activity and require much less sleep than usual</li> <li>• Spend more and more time alone and avoid social activities with friends or family</li> <li>• Diet or exercise excessively or fear gaining weight</li> <li>• Engage in self-harm behaviors (such as cutting or burning their skin)</li> <li>• Smoke, drink, or use drugs</li> <li>• Engage in risky or destructive behavior alone or with friends</li> <li>• Have thoughts of suicide</li> <li>• Say that they think someone is trying to control their mind or that they hear things that other people cannot hear</li> <li>• Using tobacco, alcohol or other substances of abuse.</li> </ul>

span and threshold of responsiveness and adaptability, etc. These are referred to as the temperament of the child. Research has shown that infants differ in their temperament style at birth. Their reaction to the environmental and handling patterns are a two-way process, where the mother has to constantly modify her approach of handling of the child depending upon his/her temperament, and the child's behaviour gets moulded by the mother. It requires considerable amount of sensitivity and effort on the part of the mother to recognize the individuality of the child and alter her approach to suit or match it. This is only one example of how the development of children progresses in a complex and interactive manner.

Another very significant component of the emotional development in children is that of attachment or bonding. Attachment of the young one with the mother is an innate biological characteristic that fulfils

the needs of nurturance and security. Any factor that interrupts or interferes in the mother-child bonding process, such as separation, abandonment, abuse, can lead to adverse consequences for the emotional development of the child. The process and pattern of attachment with the mother in childhood also lays the foundations for our social and interpersonal relationships in adulthood. If the infant has secure and adequate attachment with the mother, such a child would be confident, secure, free from anxiety and fear during childhood and would have stable, intimate and fulfilling interpersonal relationships in adulthood. On the other hand, insecure attachment or lack of opportunities for attachment can lead to anxious dependent, demanding, adult social relationships. Such individuals have serious difficulties in getting along with others and remain constantly dissatisfied, unhappy and unstable in their social relationships.

School plays a crucial and a formative role in the development of cognitive, linguistic, social, emotional and moral functions and competencies. However, in the contemporary system of education, schools have to cope with heavy syllabi and curricula, poor teaching facilities, highly competitive examinations, which along with declining social prestige of teaching profession, low priority in national planning, limitations of resources, commercialization of education have seriously marginalized and compromised on their role in guiding and regulating the psychological development of children. School education has become a serious source of stress for children and parents. School phobia, psychosomatic complaints, emotional/behavioural problems, poor sleep, appetite, difficulties in coping and declining scholastic performance are common manifestations of stress in school children.

This situation is in contrast to that where opportunities for education are not available to a large segment of population in rural India. Education may be unavailable, inaccessible, unaffordable and even unattractive. Children are pushed into adult roles and trades such as domestic and industrial labour, prostitution at a very young age depriving them of the opportunities for proper growth and development.

Material, psychological and social deprivation is a serious risk factor contributing to psychiatric disorders in children. Research has shown that deprived children grow up to be more often intellectually deficient, educationally backward, delinquent and drug addicts with inadequacies in personality. They have low level of aspirations, and motivation, low self-concept and poor coping skills. Parental conflict and discord, single parent family, parental alcoholism and antisocial personality, child abuse, living in slums are some of the significant causative factors that contribute

to psychiatric disorders in children. Family violence and child abuse, which has been commonly reported from Western countries, is yet to be recognized and acknowledged in India.

Children's mental health has serious implications for the mental health of adults. Many mental disorders of adulthood such as alcoholism, drug addiction, personality disorders, depression, anxiety, social disorders like divorce, violence, abuse, terrorism, crime, etc. are in significant measures, consequences of traumatized and deprived childhood.

Mental health of children is much more intricately rooted in the sociocultural milieu and environment in which they live. Influences of religion, the belief system and the philosophy of life on the mental health of people, though are apparently protective and promotive, but these have not been systematically studied. It is believed that the strong family system that prevails in India has significant positive influence on mental health of children. Child rearing practices that are different in different cultures, guided by the cultural value systems and social norms also play a significant role in development of children.

It is, therefore, imperative that one looks at both the risk and the protective aspect of the given environment in which children live. It is known that a large proportion of children living in adverse circumstances grow up to be healthy adults. There are certain innate or intrinsic factors within the child such as high intelligence, or easy temperament or there may be certain positive and protective influences in the environment that contribute to resilience.

Psychiatric evaluation of children, therefore, must attempt a close and detailed examination of various innate biological, emotional, social and cultural aspects of the case leading to a full understanding of the issues, the causes of morbidity and possible remedies.

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