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Genetic and Environmental Influences on Human Development

11.1 Introduction

We may often wonder about the reasons and forces which shape our personality and character. Each one of us has a specific kind of nature which takes that particular form because of the effect of two major factors. The first is the genetic make-up which we inherit from our parents, and the second influence comes from the various experiences we have in our interaction with our surrounding environment. This includes all the things we see and hear from the time of birth and all the interactions we have with other people as we grow up.

In this lesson the influences of genetic as well as environmental factors on human development will be discussed. The joint influence of these two factors will also be discussed in detail.

11.2 Objectives

After reading this lesson you will be able to :

- apprise the interdependence of genetic and environment on human development;
 - explain the development of human life from the time of conception;
 - illustrate the effects of environmental conditions on pre-natal development;
 - define socialization;
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- List the agents of socialization.

11.3 Human life from the time of Conception

As described in the last lesson an individual life begins when the female ovum (egg) is fertilized by the male sperm. At this moment of conception human life begins, when the zygote is formed. This single fertilized cell divides into many cells, and these cells have the capacity to deal with specialized functions. In the early stage of development, the organism is called a fetus. Behaviour in the form of bodily movements starts at the beginning of the fetal period, that is 8-9 weeks after conception.

The fetal development of human behaviour takes place according to the growth and readiness of the nervous system. At the end of the second month, the size of the head is half of the total body. The head becomes smaller in proportion as age increases. The functions that deal with information coming from the sensory channels and that relate to movement (motor), first develop in the head region of the fetus, and later develop in body parts away from the head.

Environmental Influences on the unborn child

Two types of environmental conditions are important to note. Some maternal characteristics and external harmful agents can cause considerable risk for the developing embryo or fetus. Very young mothers, particularly those under 17, and mothers over 35 years of age have greater risk of prenatal and birth complications and death of the fetus or the new born (neonate). Inadequate diet and nutritional deficiency of the mother increases the risk of congenital defects, still birth and infant mortality during the first year. Prolonged and severe emotional stress of the pregnant mothers increases the chances of miscarriage, premature delivery and temperamental state of the babies.

Besides the maternal characteristics, a number of environmental agents such as diseases, viruses, drugs, chemicals and radiation can adversely affect the prenatal development and produce birth defects. Such external harmful agents are known as *teratogens*. Maternal diseases such as rubella (German measles), syphilis, genital herpes, AIDS (Acquired Immune Deficiency Syndrome), chicken pox, cholera, diabetes, hepatitis, mumps, tuberculosis and influenza etc., several drugs such as alcohol, marijuana, tobacco, cocaine, heroin, LSD, some antibiotics and medicines in excess doses and X-ray and other exposure to radiation and several other chemicals and environmental pollutions are known teratogens which cause birth defects increasing the risk in the development of the embryo, the fetus or the new born.

Cell – The basic unit of human life.

Some behaviours which occur in the human infant are not caused by external stimulation. The internally caused actions are crying, stretching, sneezing, chewing, and smiling. At the time of birth, certain specific responses to external stimulation can occur. These are called reflexes. The sucking reflex is present at birth and is caused by touching the lips or cheek. When the bottom of the baby's foot is scratched by the fingers, the toes of the baby are extended. This is called the Babinski reflex.

There is some development of the child's sense organs before birth. At birth the infant can

Babinski reflex – Extending the toes when the bottom of the baby's foot is scratched.

make out the difference between lights of different brightness, and she can also see colours. A few days after birth, when the mucous secretion has drained from the ear, sensitivity to sound becomes noticeable. Sensitivity to taste and smell is also present, and bodies show responses to changes in temperature. They react differently when given warm and cold milk. The feeling of hunger and thirst are present in the newborn. Pain sensitivity is present at birth and the senses of movement and balance are also present.

11.4 Postnatal Development

The development from prenatal to postnatal behaviour is a gradual process, related to growth. The new born infant has postural reflexes which include the movement of the arms at the elbows, and of the legs at the knees. A common example of this is the “startle response” which results from sudden loss of support. If the baby is held in with its face up so that its arms and legs were free to move, any sudden move results in the spreading of hands and legs. This startle response is present at birth and continues through life.

Local reflex movements take few more years to develop. Specific motor movements develop, for example, picking up very small objects as specific reflex movements develop. In the first month the infant can hold up its chin for very short periods of time only. In the second month the chest can be raised. At 7 months the infant can sit straight only with support, at 8 months she can sit on a grown up’s lap and hold objects.

The child can crawl at 9 months and walk with help at 11-12 months. By one year of age the child can pull himself up by holding on to furniture. At 14 months the child can stand without any help and at 15 months s/he can walk alone. These figures are averages, some children may go through these sequences faster and some slower. In fact some children skip some intermediate steps and move to the next. There are individual variations in the pattern of development.

INTEXT QUESTIONS 11.1

Fill in the blanks

1. Zygote is formed at the moment of _____ .
 2. In the early stage of development the human organism is called a _____ .
 3. _____ reflexes is caused when the bottom of a baby’s foot is scratched.
 4. _____ . response results from a sudden loss of support.
 5. By the age of 9 months the child can _____ .
 6. At the age of 15 months the child can _____ .
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11.5 Development of Speech and Language

At birth, the child is able to make certain sounds, such as the “birth cry” of every baby just born. A few weeks after birth the baby is able to make more types of sounds. Some are related to discomfort, others occur with no clear reason. As the vocal chords develop more, sounds like “Ma-ma” and “Da-da” are made by the baby, which does not relate any meaning to them in the beginning. The sounds are just easy for the baby to make.

The social context soon becomes important and the child learns to associate “Ma” with his mother. This is the beginning of meaningful language. Speech is a sensory-motor reaction which becomes language when meaning becomes attached to words. Words are spoken by the child from the age of one year. The more exposure the child has to relate words with things around her, the better is her language development.

11.6 Genetics and Environment

In the beginning of this lesson we discussed that things like our physical appearance and gender are a result of genetic influence. Let us understand the influence of genetics and environment on development.

Genetics

The small particles in the nucleus of the cell which contain the genes are responsible for traits or characteristics we inherit (such as eye colour, hair colour etc.). These are called chromosomes. Chromosomes exist in pairs in all the cells of the body. The human cell has 46 chromosomes arranged in 23 pairs. One member from each pair comes from the mother and the other one from the father. The genes, which are the actual trait carriers, are found in very large numbers in each chromosome.

The two most important chemicals which are involved in genetic transmission are “DNA” or deoxyribonucleic acid and “RNA” or ribonucleic acid. These two complex chemical acids work together. The DNA determines physical characteristics, such as eye colour, brain characteristics, baldness, and many other things. Basically, the DNA molecules are found in the fertilized ovum. They remember what the parents were like and pass the message for making of the child.

The RNA acts as an assistant to DNA. The DNA remains in the cell’s nucleus and guides the cell’s activities by producing RNA. The RNA then moves out and controls cellular functions. The fertilized zygote brings together various combinations of chromosomes.

In this way, different genes are transferred from each child of the same set of parents. For this reason each child bears more similarity to his or her blood relatives than to anyone else. At the same time there are also many differences amongst blood relatives.

Only identical twins (monozygotic) have identical chromosomes and genes as they are formed by duplication of a single zygote. Twins who are not similar to one another (fraternal twins), develop from two separate zygotes (dizygotic). These fraternal twins may resemble each other, like any brother and sister, but they will also be different from one another in many ways.

11.7 Phenotype and Genotype

It is common knowledge that there is more colour blindness or lack of sensitivity to certain colours among males than females. A grand mother and mother can transmit this condition to the male child without being colour blind themselves. This is because in the male this disorder is dominant, whereas in female it is recessive. The genes form pairs. If both genes in a pair are dominant, the individual will display the specific trait (e.g. colour blindness). If one gene is dominant and the other recessive, the dominant will still prevail. The recessive gene will be passed on and may show up in a later generation.

The dominant gene, therefore, is the one responsible for a particular trait to show up in a person. The characteristics which show up are displayed (eye, colour, etc.) are called phenotypes. The recessive gene does not show up as a trait, unless paired with another gene just like it. The characteristics that are carried genetically (as recessive genes) but are not displayed are called genotypes.

INTEXT QUESTIONS 11.2

1. Speech is a :
 - (a) Sensory – reaction
 - (b) motor – reaction
 - (c) sensory motor reaction
 - (d) none of the above

 2. The small particles in the nucleus of the cell which contain genes are called :
 - (a) Chromosomes
 - (b) Phenotype
 - (c) Genotype
 - (d) Phenomes

 3. Fraternal twins are those developed from :
 - (a) a single zygote
 - (b) identical zygotes
 - (c) the same chromosome
 - (d) two separate zygotes
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11.8 Environment and its interaction with hereditary factors

Nature refers to what a child has inherited genetically, from the parents (e.g. eye colour, appenarence, etc). The influence of environment on the development of the child (e.g.

liking for a type of music) is referred to as nurture. The earlier view of child development focused either entirely on nature or nurture. Many favoured heredity, and believed that we are born with certain talents and personalities. These determine who we are and what we become.

In the other view, the focus was on the role of environment. We learn to do things for which we get rewards (or praises) and do not do things for which we are punished (including disapproval from elders). Both views contained some truth but neither is complete. To understand the development of a person, we have to study the complex interaction between nature and nurture (or heredity and environment)

Let us consider an example. A child is born with a talent for music. In the child's family, this talent for music is expressed by the child at an early age, through his activities of singing and listening to music. The parents notice the child's interest in music and expose the child to more music and give him a toy musical instrument (e.g. ek tara or flute). The child's interest in music grows further and his talent develops and this make the parents offer even more musical experiences (e.g. playing music on stage, attending music concerts etc.). This has a further positive effect on the child's talent and his desire to play music.

It is thus clear that both the child's inherited talent and environment shaped his/her development. The child had the talent for music, but this led to a change in the environment by making her parents provide more musical experiences at home. Now these experiences in the environment further developed the child's talent and motivation and made the parents introduce more musical experiences to the child. The process goes on and on like this in a form of transaction. This approach to understanding development is called a transactional model (TA).

The TA model is able to explain why brothers and sisters, though physically in the same environment, always grow up in "different" ways. This simply means that the environment of family life is always changing in the process of adjusting to the personalities of its members. A first born child grows up with very different experiences than a middle born or youngest child. A child who displays temper tantrums (getting angry easily, without sufficient cause) has a very different experience with her parents as compared to her easy going brother.

Let us take another example to make the point more clear. Suppose you as a parent (if not today, then in the future) are facing difficulty with your argumentative 12-year old. The T.A. model reminds you that you must first think about the factor which has brought your child to this point. Is it a personality trait that is troubling you? Is she stubborn (does not listen to others) all the time and is thus part of her nature? Does she resist any change in her usual routine? Does she lack the ability to talk to you about what's troubling her, and could that be upsetting her? The child represents one part of the puzzle or problem which has to be solved.

The next questions you have to ask are : What is my role in all this? Am I somehow rewarding the very behaviours? Am I trying to stop by paying too much attention to them? Am I having too much expectation from a 12-year old? Am I reminded of my younger sister with whom I had faced a similar problem, and could be causing irritation in me now? The environment which includes you forms the other-part of the picture.

Finally, you need to put the two together to obtain a full picture of what is going on and how to bring about a positive change. In which way my behaviour is effecting my child? And most importantly, what do I need to change to break this pattern of behaviour (argumentation in the child) located in its transactions with nurture? How can I better understand the forces behind my child's behaviour so as to improve my response to it?

This may sound very theoretical to some of you but it's exactly the questions which many parents are always asking themselves, even if they are not aware of it. By understanding the TA-model you will be in a better position to understand the interaction between nature and nurture which is responsible for your child's behaviour and development. This will help you in deciding which role you can play for effective development and improve the child's behaviour.

In summary according to the transactional model of development, the child changes the environment which in turn changes the child. The child's development is like a complex dance in which nature and nurture both lead, and are led.

11.9 Socialisation and its Agents

As a child grows up, there is a deliberate and conscious effort made through active training to make the child learn the values and expectations of the society he or she lives in. The child has to learn to adjust and accommodate her behaviour according to the rules for appropriate behaviour in the society. Parents, teachers, elders as well as the peers (same age group children) all influence and control the behaviour of a child.

According to the Indian view, a child comes to this world with certain behavioural tendencies which carry over from previous births. The role of the family is to bring up the child in such a way (palan) that her positive capacities are developed fully and negative tendencies are controlled. Apart from the family, there are also other influences on the child from the outside environment. The important agents of socialization include media, day-care centers, peer group, school and religion.

Parents have the most direct effect on the development of the child. They are role models for children. Their responses to child behaviour, giving approval or disapproval etc. mould the personality of child and plays a very important role in acquiring rules. In addition, parents arrange the environment of a children in different ways. They take the child outside in specific settings like museum, church, temple, mosque, hill station, sea beach. The grand parents and aunts and uncles of the child also contribute in the socialization process. Children learn manners and skills by observing parents.

During the life span of a person, at different ages, specific rituals are performed. These rituals or samskaras represent the changes in the child from one stage to another. They contribute in forming the identity of the child.

Nowadays, children search and know the world through TV, magazines, books, comics, radio and films. This media influences the socialization of the child in significant ways. A positive influence can be learning the importance of family values by watching good and informative programmes. Watching aggressive and programmes based on violence can influence the child negatively.

In the present way of life, when both parents are doing jobs, very young children have to be left at day-care centers. These centers, therefore, play an important role in the socialization of the child because the child will learn many things about appropriate behaviour in the society. For children from poor background, the Aganwadis under the programme of Integrated Child Development (ICDS) help children to learn about appropriate social behaviour and the importance of community life.

The influence of the peer group of the child, particularly during middle childhood is very important. In the interactions with the children of the same age group, a child learns the importance of team work, sharing, and trust. One of the significant effects of this is that the child learns to adjust and accommodate to the view point of the others.

The school which the child attends is another very important socializing agent. The child learns different types of social, intellectual, and physical skills in school. The school provides the child with a miniature society where he or she has to learn the right values and rules and follow them. Teachers act as role models whose behaviour the children learn by imitation. Values such as honesty, democracy and fairness etc. are learnt in the school setting.

Finally religion also plays an important role in socialization. In India there is freedom to follow any religion of one's choice. Religion informs our beliefs about God, the purpose of our existence, the importance of family, social and spiritual life. Through the different festivals and rituals which are part of religion. We learn values of helping, sharing and sacrifice for others.

INTEXT QUESTION 11.3

Fill in the blanks in the following.

1. _____ refers to the influence of the environment on the development of the child.
 2. What the child has inherited genetically from the parents is called _____.
 3. The approach which looks at development as a continuous interaction between nature and nurture is called _____.
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11.10 What You have learnt

- In this lesson we learnt about the development in the early part of human life from the time of conception and the influence of genetic and environmental factors.
 - Speech is a sensory-motor reaction which becomes language when meaning becomes attached to words.
 - The small particles in the nucleus of the cell which contain the genes which are responsible for traits or characteristics we inherit (such as eye colour, hair colour etc.) are called chromosomes. Chromosomes exist in pairs in all the cells of the body.
 - The two most important chemicals which are involved in genetic transmission are “DNA” or deoxyribonucleic acid and “RNA” or ribonucleic acid.
 - The dominant gene, therefore, is the one responsible for a particular trait to show up in a person. The characteristics which show up are displayed (eye, colour, etc.) are called phenotypes. The recessive gene does not show up as a trait, unless paired with another gene just like it. The characteristics that are carried genetically (as recessive genes) but are not displayed are called genotypes.
 - Nature refers to what a child has inherited genetically, from the parents (e.g. eye colour, appearance, etc). The influence of environment on the development of the child (e.g. liking for a type of music) is referred to as nurture.
 - The TA model is able to explain why brothers and sisters, though physically in the same environment, always grow up in “different” ways. This simply means that the environment of family life is always changing in the process of adjusting to the personalities of its members.
 - According to the transactional model of development, the child changes the environment which in turn changes the child.
 - The child has to learn to adjust and accommodate her behaviour according to the rules for appropriate behaviour in the society.
 - The role of the family is to bring up the child in such a way (palan) that her positive capacities are developed fully and negative tendencies are controlled. Parents have the most direct effect on the development of the child.
 - During the life span of a person, at different ages, specific rituals are performed. These rituals or samskaras represent the changes in the child from one stage to another. They contribute in forming the identity of the child.
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11.11 Terminal Exercise

1. Describe the process of pre-natal development from the time of conception.
2. Outline the changes which take place in the child from birth till the acquisition of language.
3. Briefly describe the transactional model of development.
4. What is socialization? Who are its main agents?

Key to Intext Questions

11.1

- 1) Conception
- 2) Foetus
- 3) Babinski
- 4) startle
- 5) stand by holding
- 6) walk alone

11.2

- 1) c
- 2) a
- 3) d

11.3

- 1) Nurture
 - 2) Nature
 - 3) Transactional model
-