UNIT 5 : PRE-NATAL DEVELOPMENT

UNIT STRUCTURE

5.1 Learning Objectives

5.2 Introduction

5.3 Concept of Pre-Natal Development

5.4 Conditions Affecting Pre-Natal Development

5.5 Neo-Natal Period

5.5.1 Actions and Reactions of the Neo-Nate

5.6 Let Us Sum Up

5.7 Further Reading

5.8 Answer To Check Your Progress

5.9 Possible Questions

5.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- comprehend the pre-natal stage of development
- understand how development take place in pre-natal stage
- identify the conditions affecting pre-natal development
- know the actions and reactions of the Neo-Nate.

5.2 INTRODUCTION

The Second Unit of this Block must have given you a clear understanding about different stages of life-span in which pre-natal period is the first phase of human life. You must be aware that sudden development does not take place in individual and rather it follows a particular pattern and sequence. The development of human being starts with the conception in the mother's womb. Since conception, different changes take place and a single cell turn to a full-fledged baby ready to come out to the world as an individual. The period from conception to birth is termed as Pre-Natal Stage of human life-span, which is most critical from developmental perspectives, as it is the base phase of human life. As investigated by research studies,

most of the development take place before birth. In this unit, discussion will be made in detail about this period and how development take place throughout the period. Moreover, after going through this unit, you will also be able to know the different conditions that affect the development in this phase and different actions and reactions of the neonate after he enter to the next phase from pre-natal period.

5.3 CONCEPT OF PRE-NATAL DEVELOPMENT

Before going in depth into the different developmental process and changes of the pre-natal period, let's acquaint yourself with the first period of human life-span.

Pre-natal Period:

Life's journey begins with conception in the womb of the mother. The approximate nine month period spent in mother's womb is known as the pre-natal period. This is the most important period of life. This period begins at the time of conception and end at birth, which is approximately 270 to 280 days in length or nine calendar months. Pre-natal development is orderly and predictable, hence, it is possible to give a timetable of the important developments taking place during this period.

Conception (How life begins?):

Pre-natal period starts at the moment of conception. The first step in the development of a human being is that moment of conception. New life begins with the union of a male sex cell called *spermatozoon* and a female sex cell called *ovum*. These sex cell are developed in the reproductive organs (the gonads). Conception take place through the fertilization process of ovum (egg Cell) by spermatozoon (sperm**).** Fertilization in humans refers to the fusion of male and female sex cell that facilitates the development of a new organism. Fertilization is the natural life process, which results in the formation of a new cell, this cell is called as **zygote**. In humans, the process of fertilization takes place in the fallopian tube. Zygote formation in human or another multicellular organism is the first developmental stage in the process of reproducing a complete individual. The zygote further divide into a mass of cells known as **blastocyst** which will transform into an embryo

which will further transform into a foetus and over a period of months the foetus will transform into an offspring. Sexual intercourse is the natural process leading to fertilization. But with the advancement of medical science, the fertilization event that leads to zygote formation can happen through medically assisted fertilization such as in-vitro fertilization (IVF).



Figure 5.1: Fertilization leading to Zygote Formation

Image Source: https://media.istockphoto.com/vectors/process-of-human-fertilization-vector-id1151753982

Conditions determined at Conception:

As already mentioned pre-natal period is the most significant period of human life-span. At the time of conception, certain conditions are determined that influence the individual's later development. These conditions play a very significant role in individual's life.

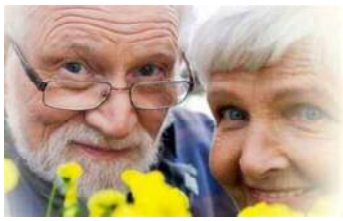
A. Hereditary Endowment: The first important happening at the time of conception is the determination of the newly created individual's hereditary endowment. The maturation of reproductive cells is important in determining what the hereditary endowment of the newly created person will be. Within each sex cell whether the sperm or the ovum there are 23 pairs of chromosomes, within each of which are strings of microscopically small particles-these are called **Genes.** These genes are the physical substances passed from parents to children. There is a common saying that children carries most of their psycho-physical traits from their parents and grandparents through genes. From the two parents the child receives a new combination of parental genes. This combination of genes in parents of the newly created being is made up of the genes they received from their parents.

As such the children may receive some common traits in common with one or both of the parents or their grandparents such in appearance, nature, habit etc. The following diagram will help you to understand why children resemble to their parents or grandparents-

Every man and every women at conception received 23 chromosomes from each parent as a whole 46 in all.

Paternal Grandparents (23 +23) **Maternal Grandparents (23+23)**





In mating each passes on half of his/her chromosomes to every child





Father (23) **Mother (23)**

Father passes half of his Chromosomes to child By the way of a sperm

Mother too contribute half of the chromosomes.

23 23

Child 23 +23=46

These 46 chromosomes constitute everything that determines the heredity of the child.

Diagram 5.1: The hereditary process determined at conception

B. Sex of the newly created individual:

Determination of the individual's sex is another important happening at the time of conception. Sex of the newly created individual or whether the child will be a male or female depends on the kind of spermatozoon that unites with the ovum. As discussed in the above diagram, each sperm and ovum contains 23 chromosomes. The father produces sperm of two kinds in equal number-one half of all mature sperm carry the X chromosomes and the other half carry Y chromosomes. But, mother produces egg or matured ova all of one kind, each with a large X chromosomes. These X and Y chromosomes are sex determining chromosomes. It the mature **ovum (X)** is fertilized by **Y-** bearing spermatozoon, the offspring will be **a Boy**, but if the mature **ovum (X)** is fertilized by **X-** bearing spermatozoon, the offspring will be a **Girl.**

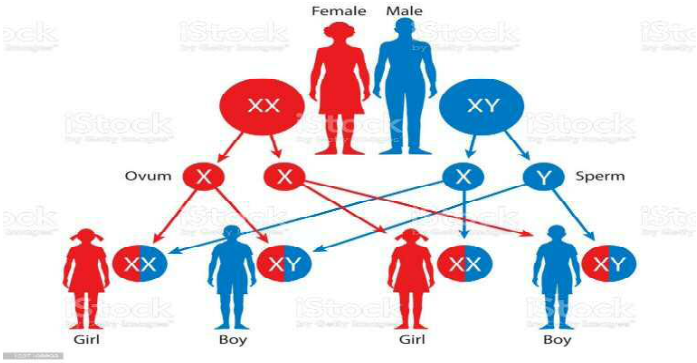


Figure 5.2: Sex determination of baby at conception

Image Source*: https://media.istockphoto.com/illustrations/sex-determination-in-humans-illustration-id1257168903*

C. Number of Offspring: Another important happenings that is determined at the time of conception is number of off spring. While most human are singleton, twins or multiple birth also occur. When a matured ovum is fertilized by one spermatozoon, the result is singleton, if the fertilized ovum or the zygote splits into two or more distinct part during the early stages of cell cleavage, it results in identical twins, triplets or multiple birth. It is important to mention here that, if two or more ovum are released simultaneously by mother and are fertilized

by different spermatozoon, it result in non-identical twins or triplets.

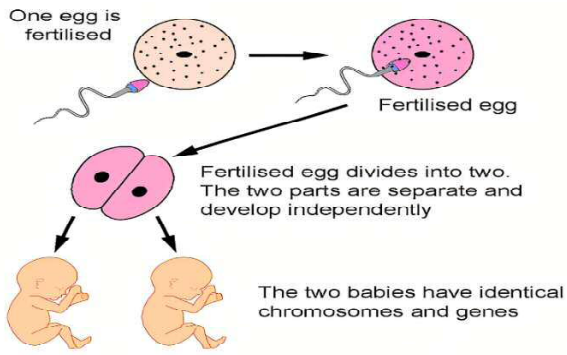


Figure 5.3: Determination of off-spring at the time of conception.



LET US KNOW

- The first developmental period in the life-span is next to the shortest of all, the shortest is the period of new born.
- Zygote is a eukaryotic cell formed by the fertilization of two gametes. Thus, an egg cell or ovum fertilized by a sperm cell is a zygote.
- If the fertilized ovum or the zygote splits into two or more distinct part during the early stages of cell cleavage, it results in identical twins, triplets or multiple birth.



CHECK YOUR PROGRESS

Q 1: What is fertilization?

.....

.....

Q 2: What is a Zygote?

.....

.....

Q 3: What is blastocyst?

.....

.....

Q 4: A child receives ..... chromosomes from each parent at the time of conception.

Q 5: How is the sex of the baby determined at conception?

.....

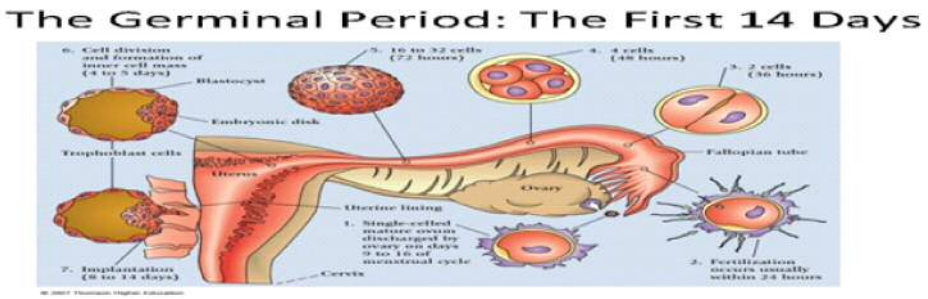
.....

Three sub-stages of pre-natal period: (Pre-Natal Development):

To know about the developmental norms of pre-natal period, it is essential to be clear with the stages of this period. The pre-natal period is divided into three stages. Each of these stages are characterized by its own peculiar type of development.

1. Period of Ovum/Zygote or Germinal Stage:

This period covers the period from fertilization or conception to end of second week. During the two weeks of this period, the size of the zygote or fertilized ovum is that of a pinhead. During first half of this period the size remain unchanged and free and unattached because it does not receive any outside source of nourishment. The zygote is kept alive by the yolk in the ovum. In this period, the zygote passes down the fallopian tube to the uterus, it divides into many times and separates into outer and inner layer. The *outer layer later develops into* ***the placenta, the umbilical cord and the amniotic sac***. The inner layer develops into a new human being. While the zygote completes its journey the lining of the uterus completes its preparation to receive the ovum. When the zygote finds a place in the uterine wall it gets nourishment through the blood vessels. After ten days after fertilization, the zygote becomes implemented in in the uterine wall. Once, it is implanted, it becomes parasite throughout the pre-natal period in the uterus.



Source:https://slidetodoc.com/presentation_image_h/72fadb6d4f718dc6f558229babe235cb/image-8.jpg

2. **Period of Embryo or Embryonic Stage:**

The second sub stage of pre-natal period is period of embryo or it is also termed as embryonic stage. This period ranges from the end of second week from conception to second lunar month. This period occurs once the zygote finally implants into the uterine wall of the mother. During this period, the embryo develops into a miniature human being. This period is characterized by rapid developmental changes. All the essential features of body both external and internal are established in this period. Major development occurs in the head region first and in the extremities last. The placenta, the umbilical cord and the amniotic sac are developed which protect and nourish the embryo until the time of birth. The sex organs are well developed enough to distinguish the sex of the embryo. Some features such as eye, arms, ears and feet too become recognizable. At the end of this period, the embryo weighs on the average 1 ¼ ounces and measures in length 1 ½ inches.



Source:https://assets.babycenter.com/ims/2015/01/pregnancy-week-8-brain-nerve-cells_square.jpg?width=600

3. **Period of Fetus or Fetal Stage:**

The third and the most important sub stages of pre-natal development. This period covers the period from end of second lunar month to the

time of birth. This is the longest period of pre-natal development. Major development during this period can be presented as-

- Changes take place in the relative size of the already formed body parts and its functioning.
- Fetal heartbeat can be detected about the fifteenth week.
- By the end of fifth month, the different organ assumes nearly like the one they will have in adult body.
- Nerve cells starts increasing rapidly in numbers during second, third and fourth month.
- Fetal starts kicking and turning between eighteen (18) and twenty two (22) weeks and increase rapidly up to ninth month.
- At five month, course hair begins to grow on the eyebrows and eyelashes.
- By 28-32 weeks, respiratory system develops.
- By the end of seventh month, the fetus is well developed though born at this period are considered pre-matured.
- By the end of eight month, the fetus is completely formed though smaller than that of normal or full term fetus.
- During 7th and 8th month, fetal growth slows down a little and movement are curtailed die to cramped conditions in mother's womb.
- About a week before birth, the baby stops growing having average weight of just 7 pounds and a length of 20 inches.
- By the end of this period, the fetus takes a head-down position in the pelvic region in preparation for birth.



Source:https://www.scienceabc.com/wp-content/uploads/2015/05/stages-of-fetal-development.jpg



LET US KNOW

- **Lanugo:** A wolly hair that grows over the body of the fetus while they are developing in the womb. These hairs disappear either by birth or shortly after when vellus hairs replace them.
- A baby born at five or six month practically has no hope of survival because the respiratory system is not developed during that period.

5.4 CONDITIONS AFFECTING PRE-NATAL DEVELOPMENT

The above discussion has revealed that pre-natal period is one of the most important and crucial period of human development. But there are some conditions which may affect the baby and its development. As a learner of developmental psychology as well as a laymen too, you all should be cleared with these conditions. Pre-natal period is greatly influenced by a wide variety of factors. Some of such factors are-

1. **Nutrition of the mother:**

   The unborn babies' nourishment comes from the maternal bloodstream through the placenta. The malnutrition of the mother will affect the growth and development of the foetus. Hence, mother must be careful in taking balanced diet and proper nutrition such as protein, fats, milk, carbohydrates, folic acid, vitamin C found in various green vegetables and fresh fruits.

2. **Drugs:**

   Certain unprescribed drugs taken by the mother during the pregnancy can have serious developmental effect on the foetus. Narcotics and dosage of these drugs may prove very harmful to both the expectant mother and the foetus. Since drugs permeate the mother's bloodstream and get transmitted to the foetus, hence mother and family members should be very careful in taking drugs.

3. Age of the Mother:

The mother's age at the time of conception and delivery is also an important factor to be considered. Before 21 years of age, the female reproductive system is not fully matured and the hormones needed for reproduction have not reached their optimal levels. The best age for a women to bear a child is 23 to 30. Children generally born before or after this age in average may pronounced various types of genetic abnormalities.

4. RH factors:

Certain substance present in the blood of the foetus which is not present in the mother's blood may create some problems. It may lead to biochemically incompatible. Moreover, incompatibility between the maternal and paternal blood types may cause damage of the cells in the foetus leading to physical or mental complication, miscarriage, still birth or death shortly after birth.

5. Illness and infections:

Though many infectious illness of the mother during the pre-natal period do not cross the placenta, but there are some serious infections that may cross the placenta and affect the baby leading to mental retardation. Some of such well known disease or infections illness is rubella virus or German measles.

6. Birth Complication:

Another important factor affecting pre-natal period is birth complication. Prematurity and anoxia are two of the main complications that can occur in infant's delivery and may lead to retardation and intellectual disfunctioning.

7. Smoking and alcohol:

Consumption of smoking and alcohol during pregnancy is very harmful and it must be avoided as it may lead to damage of child's physical and mental development. Research studies revels that smokers tens to have more spontaneous abortions, more still births and increased heartbeat.

8. Emotional state of mother:

For many women, pregnancy is a time of depression, anxiety and worry. The indirect influences in the form of attitudes of significant people, particularly the mother has a significant impact on the unborn child. Severe and prolonged maternal stress affect the baby's development. This stress may cause hyperactivity of the mother's adrenal glands leading t release of an increased supply of hormone hydrocortisone which may cause physical irregularities and create other allied problems during birth.

9. Environmental Factor:

Besides the above mentioned factors, there are some other environmental factors may affect the unborn baby. Chemicals, radiations, extreme heat, humidity and other hazards of modern life may affect both mother and the fetus.

The expectant mother, the father and the other family members should be conscious about these factors and be very careful in keeping the mother being unaffected from these factors or conditions. A healthy mother living in a healthy environment can give birth to a heathy and happy baby which in turn live a healthy and happy life.

5.5 NEO-NATAL PERIOD

The second important period after pre-natal is the neo-natal period. This period ranges from the time of birth to 10 -14 days post birth. The period right after birth is called as Neo-natal period or period of new born. This is the shortest of all period after birth. This is the time, when the fetus must adjust to life outside the uterine walls of the mother where it has lived for approximately nine month.

The word-"Neonate" is derived from the Greek word-"Neos" which means new and the Latin verb-"Nascur" which means-born. According to medical criteria, the neonatal period begins with birth and ends when the naval heals. This neo-natal period is subdivided into two periods-

A. Period of Partunate

This period ranges from birth to fifteen to thirty minutes after birth.

The period begins when the baby has emerged from the mother's body and lasts until the umbilical cord has been cut. Until the cut of umbilical cord, the baby continues to be a parasite and he/she makes no adjustment to the new environment outside mother's body.

B. The period of Neonate

This period covers the time from cutting the umbilical cord to approximately the end of the second week of post-natal period. With the cutting of umbilical cord, the baby becomes a separate and independent individual. During this period the most important task for the baby is to make adjustment to the new environment outside the womb.

The neo-natal period is a time of radical adjustment. It is a period of transition from an internal to an external environment. The neo-natal period is often termed ***as a plateau in development***, because there is a temporary halt in the process of growth and development. The rapid development of pre-natal period suddenly come to a stop with birth, this regression though lasts for a week after birth. By the end of the neonatal period, the baby's state of development is usually back to where it was at the time of birth.

Characteristics of Neo-Natal Period:

The neo-natal period has the following salient features-

- This is the beginning or the early period of existence as an individual rather than a parasite in mother's body.
- The neo-natal period is a time of radical adjustment.
- The neo-natal period is a hazardous period both physically and psychologically due to their adjustment in the new environment.
- It is the shortest of all developmental period post birth.
- During this period, the new-born's complete helplessness gradually gives away to increasing independence.
- There are certain conditions that effects the adjustment of neo-nate in the new environment, such as-pre-natal environment, parental attitude, postnatal care etc.
- The neo-natal period is often termed as a plateau in development,

because there is a temporary halt in the process of growth and development.

5.5.1 Actions and Reactions of the Neo-nate:

Neo-natal period is the most important as well as the shortest period of human development. This period marks the beginning of foetus as an independent human being. Besides the parents and family members we all as a laymen are curious and excited to experience the actions and reactions of the neo-nate. The activities and reactions of the neo-nate can be listed below-

Movements of body of the baby appear as soon as the foetus emerges from the mother's body. Because of the neurophysiological immaturity of the infant, one could not expect its movements to be coordinated or meaningful. In spite of their random, meaningless nature movements or actions of the infants can be classified into two categories-

1. **Mass Activity of the Neo-nate:**

   Mass activity in neo-nate occurs throughout the entire body when any area is stimulated, though the activity is most pronounced in the stimulated area. Normally mass activity increases in intensity and frequently with each passing day. The greatest activity generally occurs early in the morning when the infant is rested after a relatively long sleep. It is lowest at noon when it is apt to be fatigued as a result of having been bathed or dressed during the morning. The pre-natal and birth experiences influences the infant's activity. The baby who have been most active as foetus in mother's womb, tend to be more active during the neo-natal period. A long and difficult labour or heavy medication of the mother can cause the infant to be relatively inactive for the first few days after birth. It is said that *infant delivered by caesarean section are usually less active than those born through normal delivery.* The greatest amount of activity is in the trunk and legs and the head moves the least.

The following conditions leads to increased activity in baby-

- Hunger, pain and general discomfort give rise to great activity and activity tends to be less when the baby is nursed or fed by the mother.
- Removal of cloths and cover from the body.
- Environmental conditions like light, sounds produces increase in infant's activity.
- Crying and awakening.

2. Specific activities or reflexes of the neo-nate:

Specific activities in the neo-nate involve certain limited areas of the body. They includes some reflexes which are definite responses to specific sensory stimuli and which remain unchanged with repetition of the same stimulus and generalized responses which use larger group of muscles. This may aroused by either external or internal stimuli. Most of the important reflexes in the baby are-pupillary reflexes, reflexes of the lips and tongue, sucking, flexion, knee jerk, sneezing. With the passing of days, these reflexes become stronger.

Some of the common generalized responses in the baby includes-spontaneous eye-movement, shedding of tears, sucking of fingers, yawning, hiccupping, mouthing, frowning and wrinkling, turning the trunk, body jerk, prancing, kicking , salivating, turning and lifting the head etc.

3. Vocationalisation:

Another important form of reaction that a baby make is through vocationalisation. The vocationalisation of the newborn infant is classified into two categories-crying and explosive sounds. During the neo-natal period, baby make responses through crying. Normally, crying starts with birth. Birth cry is reflex activity that causes the lungs to inflate, making breathing possible. Besides crying, the baby makes produce reaction through some explosive sounds uttered without meaning.



CHECK YOUR PROGRESS

Q 6: In which period do the zygote implants in mother's ovum?

.....

.....

Q 7: What is the derivative meaning of Neonate?

.....

.....

Q 8: Why is neo-natal period often termed as a plateau in development?

.....

.....

Q 9: What are the conditions that leads to increased activity in baby?

.....

.....



5.6 LET US SUM UP

After going through this unit, it can be summarized as-

- Pre-natal period being the first phase of human life. The approximate nine month period spent in mother's womb is known as the pre-natal period.
- An egg cell or ovum fertilized by a sperm cell is a zygote. When the zygote further divide into a mass of cells, it is known as **blastocyst** which will transform into an embryo which will further transform into a fetus and over a period of months the fetus will transform into an offspring.
- There are certain conditions that are determined at conception influencing the individual's later development. These are- hereditary Endowment (genes), sex of the newly created individual and the

number of Offspring.

- Every man and every women at conception received 23 chromosomes from each parent as a whole 46 in all.
- The **father** produces sperm of two kinds in equal number-one half of all mature sperm carry the X chromosomes and the other half carry Y chromosomes, i.e. **XY**. But, **mother** produces egg or matured ova all of one kind, each with a large X chromosomes, i.e., **XX**
- If the fertilized ovum or the zygote splits into two or more distinct part during the early stages of cell cleavage, it results in identical twins, triplets or multiple birth.
- The pre-natal period is divided into three stages-period of ovum, period pf embryo and period of foetus. Each of these stages are characterized by its own peculiar type of development.
- There are some conditions which may affect the baby and its development- Nutrition of the mother, Drugs, Age of the Mother, Birth Complication etc.
- The second important period after pre-natal is the neo-natal period. This period ranges from the time of birth to 10 -14 days post birth. The period right after birth is called as Neo-natal period or period of new born.
- Movements of body of the baby appear as soon as the foetus emerges from the mother's body.

  The baby who have been most active as foetus in mother's womb, tend to be more active during the neo-natal period. A long and difficult labour or heavy medication of the mother can cause the infant to be relatively inactive for the first few days after birth.



5.7 FURTHER READING

1) Hurlock Elizabeth B (1980): Developmental Psychology: A life-span Approach, Mc Graw Hill Companies, Inc., New York.

2) Goswamee Gayatree (2008): Child Development and Child Care, Arun Prakashan, Guwahati, Assam.

3) Mangal S.K (2006 2nd Edition): Advanced Educational Psychology, Published by Asoke K Ghosh, Prentice Hall of India Private Limited, New Delhi

4) Signh Punam (2011): Developmental Psychology, Centrum Press, New Delhi.



5.8 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: Fertilization in humans refers to the fusion of male and female sex cell that facilitates the development of a new organism.

Ans to Q No 2: Zygote is a eukaryotic cell formed by the fertilization of two gametes. Thus, an egg cell or ovum fertilized by a sperm cell is a zygote.

Ans to Q No 3: When the zygote further divide into a mass of cells, it is known as blastocyst which will transform into an embryo which will further transform into a fetus and over a period of months the fetus will transform into an offspring.

Ans to Q No 4: A child receives 23 chromosomes from each parent at the time of conception.

Ans to Q No 5: It the mature ovum (X) is fertilized by Y-bearing spermatozoon, the offspring will be a Boy, but if the mature ovum (X) is fertilized by X- bearing spermatozoon, the offspring will be a Girl.

Ans to Q No 6: Period of ovum.

Ans to Q No 7: The word- “Neonate” is derived from the Greek word-”Neos” which means new and the Latin verb-“Nascur” which means-born

Ans to Q No 8: The neo-natal period is often termed *as a plateau in development*, because there is a temporary halt in the process of

growth and development. The rapid development of pre-natal period suddenly come to a stop with birth, this regression though lasts for a week after birth.

Ans to Q No 9: The following conditions leads to increased activity in baby-

- Hunger, pain and general discomfort give rise to great activity and activity tends to be less when the baby is nursed or fed by the mother.
- Removal of cloths and cover from the body.
- Environmental conditions like light, sounds produces increase in infant's activity.
- Crying and awakening.



5.9 POSSIBLE QUESTIONS

A. Short Questions (Answer each questions in about 150 words)

Q 1: How is a zygote form?

Q 2: Write about the neo-natal period.

Q 3: What is the role of chromosomes in human's life?

Q 4: State some mass activities of neo-nate.

B. Long Questions (Answer each questions in about 300-500 words)

Q 1: Discuss the process of life formation in mother's womb.

Q 2: Discuss the conditions that are determined at the time of conception.

Q 3: Elaborate the three stages of pre-natal period.

Q 4: Describe the factors that affects the pre-natal period of human development.

Q 5: What are the sub-stages of neo-natal period? Discuss the action and reactions of neo-natal period.

*** ***** ***