



If you have to make a cup of tea what is it that you would do?

Write down the steps in making a cup of tea.

1. ....
2. ....
3. ....
4. ....
5. ....

You must have realised from the above activity that there is a certain sequence while doing things.

The process of human development too follows a certain order. It proceeds in stages which are interrelated. Though the process of development follows a specific sequence and pattern, the rate of development varies at different stages for different individuals.

The knowledge of the developmental pattern enables parents and teachers to guide the child's learning and helps to prepare children ahead of time for the changes that take place in their bodies.

To understand the pattern of development, it is necessary to recognize the fundamentals of development and identify the causes of variations in development.

The fundamental facts about development are called as 'Principles of Development'.

**Let us try to understand this with an example.**

Have you seen any child sitting at birth?

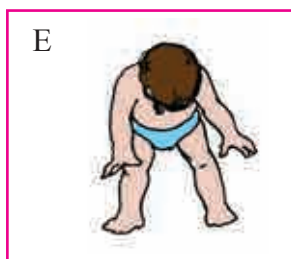
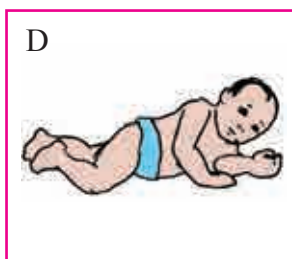
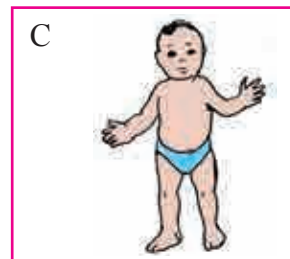
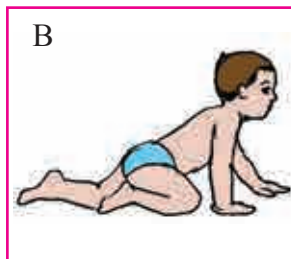
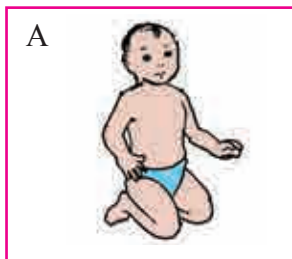
Have you heard an infant utter words during the first two months of its life?

Have you seen a baby holding a toy at birth?

So what does this tell us?

### Activity :

Can you identify and write down the sequence from birth to walking looking at the pictures given below :



1. ....

2. ....

3. ....

4. ....

5. ....

6. ....

Do you notice that there is an order and continuity in an individual's development?

### 2 Principles of Development :

From the above activity you have realized that development has a specific direction, it is continuous and it involves changes. Principles of development apply to all domains of development. Let's look at these in detail.

#### 1 Development involves change :

Development refers to changes that occur through growth and development. Growth is quantitative which means it refers only to physical aspects eg. increase in height and weight. Development is qualitative in nature and refers to all aspects such as physical, motor, cognitive, language, emotional, social and moral. It includes all the changes leading towards maturity.

#### 2 Development is continuous :

Development is a process of change which continues from the moment of conception till death. As we have already studied in the

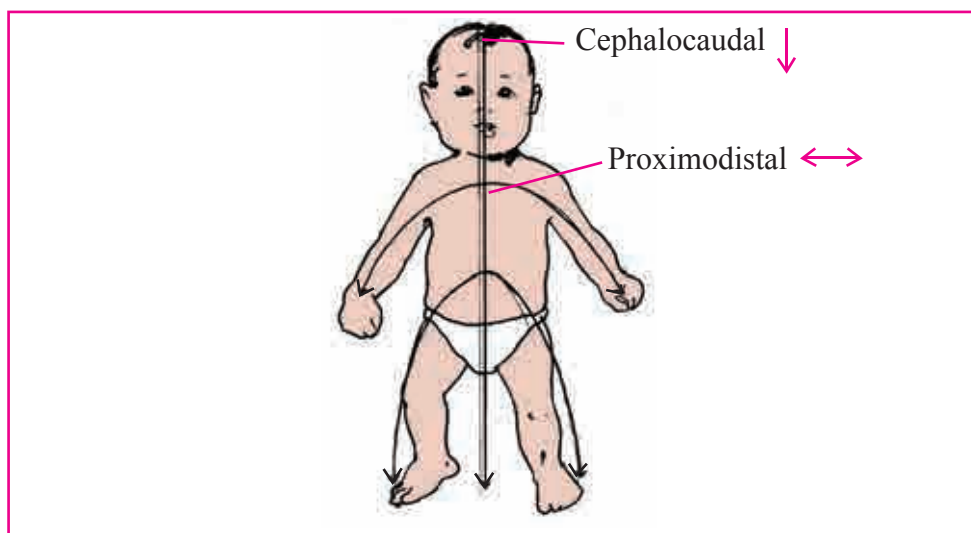
definition of development earlier, it is a series of quantitative and qualitative changes which proceed continuously. What happens at one stage has its influence on the following stage. For example, the tooth of a baby may appear overnight but the process of this development has begun as early as the fifth foetal month. However, development proceeds at a slow pace and the teeth are ready to erupt only when the baby is about five months old.

#### 3 Development follows a predictable pattern :

Development is specific to all and follows a predictable definite pattern. Many longitudinal studies on children demonstrate that developmental changes follow a specific pattern which is similar in all individuals. During the prenatal period a genetic sequence of traits appears at fixed intervals and continues during the post-natal period. Development takes place according to two laws of directional sequences which are as follows.

(a) **Cephalocaudal sequence** : Development proceeds from head to toe. The head and brain develops first followed by the neck , torso and rest of the body.

(b) **Proximodistal sequence** : Development proceeds from centre to extremities. The child first gains control over the spine followed by strengthening of the arms upto the fingers.



**Fig re 2S equence of developmental pattern**

**Table 2D ifference between Cephalocaudal and Proximodistal pattern**

Cephalocaudal	Proximodistal
<ul style="list-style-type: none"> <li>Development takes place in the body from head to toe.</li> </ul>	<ul style="list-style-type: none"> <li>Development proceeds from near to far i.e from the central axis of the body to extremities.</li> </ul>
<ul style="list-style-type: none"> <li>In the prenatal stage improvement in structure and function come first in the head region, then in the trunk and last in the leg region.</li> </ul>	<ul style="list-style-type: none"> <li>In the prenatal stage the arm buds lengthen and then develop into the hands and then fingers.</li> </ul>
<ul style="list-style-type: none"> <li>In the postnatal stage, the baby is able to move the head, then the trunk region followed by rest of the body.</li> </ul>	<ul style="list-style-type: none"> <li>In the post-natal stage, infants will first learn to move their arms. Once the motor skills for their limbs are developed then finger manipulation and other finer movements will start developing.</li> </ul>

### Activity :

**Can you remember what develops first?**

1. Head and Trunk
2. Arms and legs
3. Fingers and feet
4. Head and legs

#### **4 Development proceeds from general to specific :**

The nature of development proceeds from general (simple) to specific (complex). e.g. with respect to motor development the infant makes random body movement but is incapable of making specific movements such as reaching

out for a toy. Similarly with regard to emotional behaviour, an infant approaches a strange or unknown object with some kind of general fear. Later, fears become more specific in nature. e.g. fear of strangers. The expression may take several forms such as crying, hiding or turning away.

#### **Try this :**

**Identify which is general and specific in reference to motor and language development**

Waving , grasping , saying ‘mummm’, kicking legs randomly ,craw , saying ‘dudhu’, picking up food, bird

#### **5 Development proceeds at a different rate :**

Development is continuous from conception till death. The rate of development varies at different stages of life, sometimes slow and sometimes rapid. Development does not occur at an even pace. The rate of development is fastest during prenatal stage i.e. a microscopic cell develops into a fully-grown foetus in a period of nine months. The rate of development varies during the postnatal stages. For example, the brain grows rapidly during early infancy, whereas maturity of the reproductive system is delayed until adolescence.

#### **6. There are individual differences in development :**

Though the pattern of development is similar to all children, yet they develop in their own way and at their own pace. This means that all the children do not reach the same point of development at the same age due to the impact of genetic and environmental influences on them. Heredity determines the potential of the child whereas environment determines the extent to which the potential is achieved. Some children start walking earlier whereas some children start walking a little later.

#### **7 Areas of development are interrelated :**

There is an interrelationship between all areas of development such as physical, social, emotional, language and cognitive. e.g. A child who has good health is likely to be socially and intellectually more active.

#### **8. Development is a product of maturation and learning**

##### **Maturation**

Maturation is the unfolding of characteristics present in the individual from birth. These characteristics develop with age to their optimum potential.

##### **Learning**

Learning refers to the changes in an individual as a result of experience and practice. Through learning children acquire a range of skills and competence. Some learning is the outcome of imitation, identification and conditioning.

##### **Interrelation between Maturation and Learning**

Maturation and learning work together for overall development in a child. Maturation is a natural process that facilitates the process of learning. Learning becomes effective when

appropriate maturity has been attained. e.g. A child will learn to walk or talk only when he/she develops physical maturity and has opportunities to practice.

### Phylog netic functions :

Creeping, crawling, sitting, walking etc are known as phylogenetic functions. These functions are acquired with age and do not require any training. They are not much influenced by the factors in the external environment.

### Ontog netic Functions :

In contrast to phylogenetic functions, ontogenetic functions such as swimming, riding a bicycle or dancing are largely dependent on training. These functions are influenced more by environmental factors such as training, practice and opportunities available. Even though these skills can be acquired by training, certain level of maturation is essential without which training will be futile.

**Table 2D Difference between Maturation and Learning**

Maturation	Learning
<ul style="list-style-type: none"> <li>The unfolding of characteristics present in the individual from birth.</li> </ul>	<ul style="list-style-type: none"> <li>Learning refers to the changes in the individual as a result of experience and practice.</li> </ul>
<ul style="list-style-type: none"> <li>As a result of Maturation <b>Phylogenetic</b> functions are seen e.g. crawling, walking</li> </ul>	<ul style="list-style-type: none"> <li>As a result of learning <b>Ontog netic</b> functions are seen e.g. swimming, cycling</li> </ul>
<ul style="list-style-type: none"> <li>Development cannot be achieved beyond a certain limit even after learning, if there is a lack or absence of maturation</li> </ul>	<ul style="list-style-type: none"> <li>Lack of opportunities due to poverty, parental neglect, prevents children from developing their hereditary potential.</li> </ul>

#### Activity :

**Classify as phylog netic and ontog netic function**

- walking, climbing, classical singing, cycling
- playing a 'tabla' scribbling, canvas painting, coloring within a circle.
- sitting, creeping, swimming, crawling
- picking up finger food, smiling, dancing, grasping

#### Activity :

**Circle -the odd one out :**

- walking, climbing, talking, cycling
- development of head, trunk, arms, legs
- sitting, creeping, swimming, crawling
- eating, smiling, dancing, grasping

#### Environmental Influence

In a similar situation, twins, siblings or children of the same age can react differently depending upon their experiences and individuality.

## 2.2 Factors Influencing Growth and Development :

Each individual is unique . No two children of the same age are not similar in their body type, skin colour, posture and behaviour. Diversity is seen not only in physical characteristics but also in behaviour. This diversity results from interaction between biological and environmental factors which make an individual unique .

Following are the factors which affect Growth and Development :

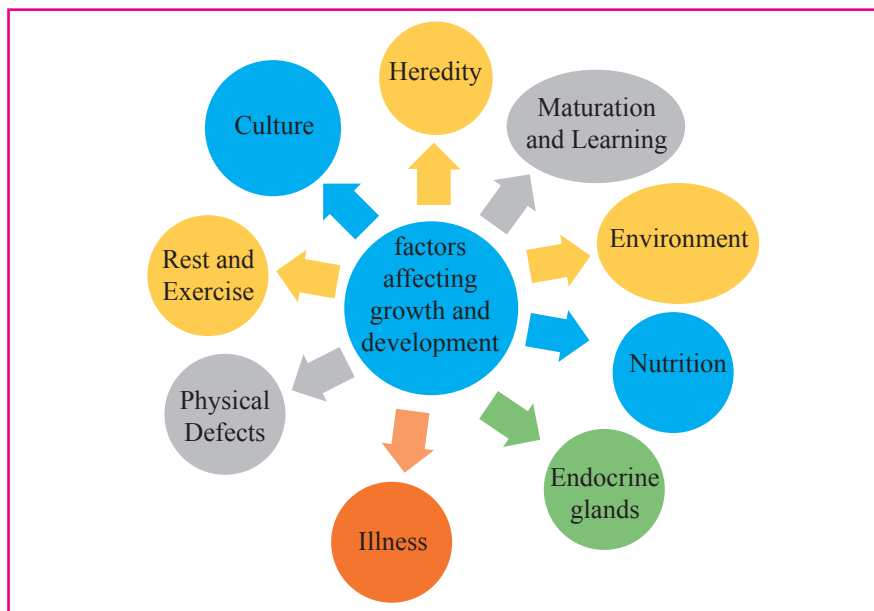


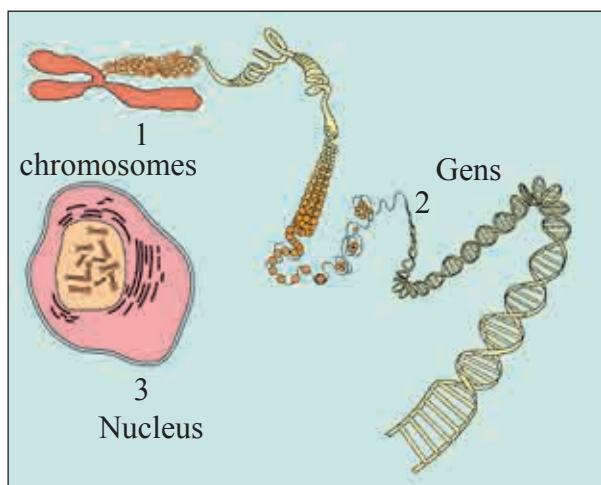
Figure 2.2 Factors affecting Growth and development

### 1 Heredity :

It refers to the genetic attributes inherited from the biological parents at the time of fertilization. Heredity affects development right from the prenatal stage influencing a wide range of characteristics eg. colour of skin , hair, eyes, height, health, intellect, temperament.

### Chromosomes and Genes :

The ovum (female reproductive cell) and the sperm (male reproductive cell) have 23 pairs of chromosomes. Chromosomes contain smaller units of genetic material called DNA. Amongst these chromosomes, 22 chromosomes are called as '**Autosomes**' and one chromosome is called the '**Sex chromosome**'.



Each chromosome contains genes which are the functional units of heredity. Each gene has its particular place and function in inheritance.

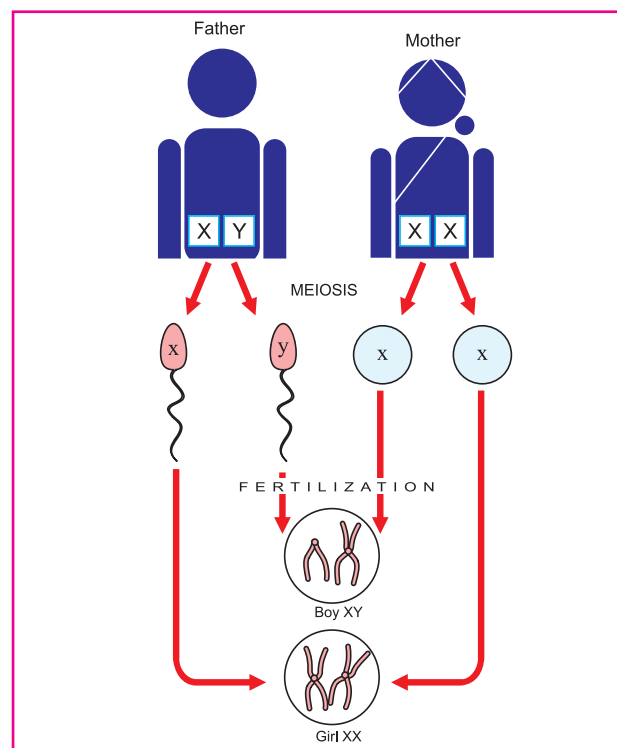
At conception, an ovum containing 23 single chromosomes from the mother combines with a sperm containing 23 single chromosomes from the father. The two sets of genetic information combine so that the growing embryo has 23 pairs, i.e. 46 chromosomes which is a mixture of genes from both the biological parents.

Fig re 2C hromosomes and g nes

## Sex determination :

The sex chromosomes are referred to as **X** and **Y**, and their combination determines the sex of the foetus. Women have **XX** pair of chromosomes while men possess **XY** pair of chromosomes.

During fertilization an **X** chromosome is already present in the ovum. If it unites with **X** chromosome from the sperm then the foetus will be a female offspring. If the **X** chromosome from the ovum unites with **Y** chromosome from the sperm then the foetus will be a male offspring. So, it is clear that sex of the foetus is determined by the male chromosome.



**Fig re 25 ex Determination**

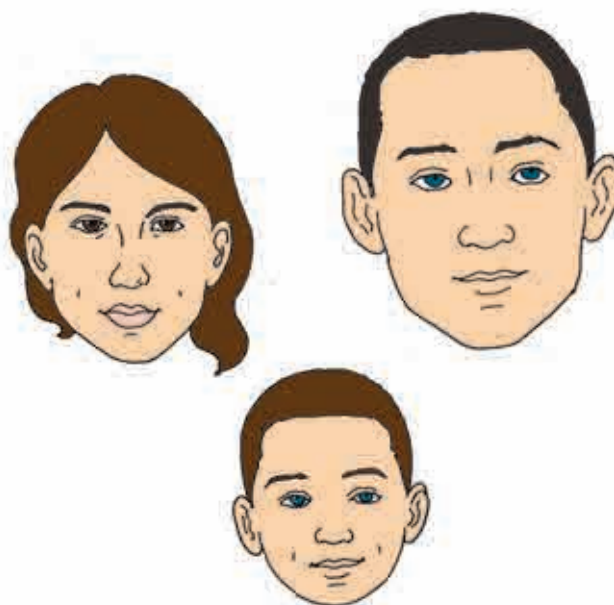
## Dominant and Recessive Genes :

Just as chromosomes work in pairs similarly genes also work in pairs. These genes give us the characteristics that we inherit from our parents. In a pair, one gene is dominant other one is recessive. The dominant gene shows the characteristics in the immediate next generation whereas the recessive gene remains passive. Heredity is also responsible for some inborn genetic defects and abnormalities in an infant.

### Activity :

**Try and identify which gene or trait in the child is dominant and whom has he inherited it from?**

- Eye color
- Dimples,
- Hair
- Shape of the face





## Reflection / Darpan



Look at yourself and identify and write which visible traits you have inherited?

## 2 Maturation and learning

Maturation and learning are two very important factors that influence growth and development. Both are inter-related. Children acquire skills when they show physical and mental readiness to learn. Maturation indicates readiness to learn skills and learning leads to the acquisition of skills. e.g. A child who indicates readiness to write (maturation) will acquire the skill with appropriate guidance and training (learning).

## 3 Environment :

### a) Prenatal environment :

Prenatal development depends on various factors such as age, hormonal levels, diet, health, emotional state of mother, drugs, alcohol and medicines consumed by the mother during pregnancy, diseases and infection in mother during pregnancy. Presence of any of these factors affect the development of the foetus leading to developmental defects and impairments in the infant.

### b) Post-natal environment :

During postnatal period, external environmental factors are more active and influential as the individual is continuously interacting with the surrounding environment.

- Environmental experiences and responses soon after birth and during early stages of life have long lasting effects on the child's self-concept, personality, behaviour, emotionality and social relationships.
- Child's home and family are the first and the most influential factors. The home environment, housing conditions, socio-economic status of the family, family size, diet, health services, parenting styles, parent's education and attitude towards children are directly related to a child's physical, social and emotional development.
- The school, teachers and peers play an important role by inculcating habits, values and attitudes in the child.
- Society at large also directly and indirectly influences child's social, religious, cultural and moral values. Social changes such as globalization, urbanization, industrialization have positive as well as negative effects on the development of a child.

### Activity :

#### Identify the followings prenatal and postnatal environment

- Diet of the pregnant woman .....
- Size of family .....
- Social economic condition of a prospective mother .....
- Drugs and medicine taken during pregnancy .....

## 4 Nutrition :

An individual's body requires a balanced diet for growth and development. Foods which provide nutrients like proteins, carbohydrates, fats, minerals and vitamins in sufficient amounts are



called nutritive foods. At a younger age when the rate of development is rapid, the requirement of nutrients is also very high. The nutritional requirement should be fulfilled by balanced diet containing nutritious foods. Deficiencies of different nutrients will have various adverse effects on the body resulting in a condition known as 'malnutrition'.

### Activity :

List the foods rich in the following nutrients.

Carbohydrates, protein, Vitamin A, Vitamin B, Vitamin C, Iron, Fats

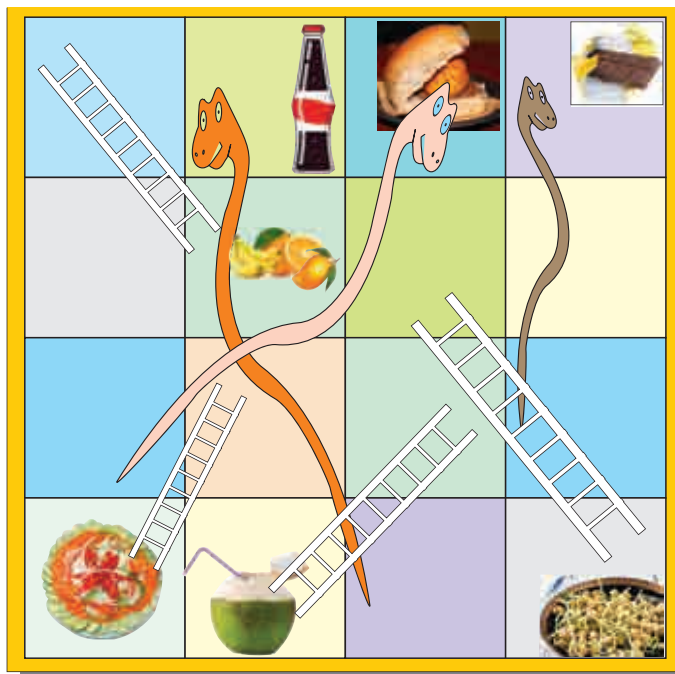
### Reflection / Darpan



Play this game and write down what you learnt from it.

### Activity :

1. List five health foods from your diet.
2. List down a few examples of healthy foods that you could include in your lunch box.



### Malnutrition :

The term malnutrition refers to the condition in which the body does not receive adequate nutrients for proper functioning. Malnutrition may range from mild to severe and can be life-threatening. It can be due to starvation in which a person has an insufficient intake of calories, or it may be related to lack of one particular nutrient (for example, vitamin D deficiency). Malnutrition can also occur due to the individual's inability to digest or absorb nutrients from the food he/she consumes, due to certain medical conditions. Many children suffer from malnutrition due to poverty, superstitions related to eating habits, ignorance and gender bias.

### Effects of malnutrition :

- Stunted physical growth
- Poor health status and stamina
- Nutritional deficiency diseases such as anaemia, skin infections, night blindness, Kwashiorkor, Marasmus.
- Negative effect on social and emotional adjustments.
- Susceptible to infections, diseases and depression
- Increases the risk of hypothermia (the inability to maintain normal body temperature)

India is facing a serious problem of malnutrition, according to the Global Nutrition Report released on November 3, 2017.

**Table 2D** Diseases predominantly found in children due to malnutrition :

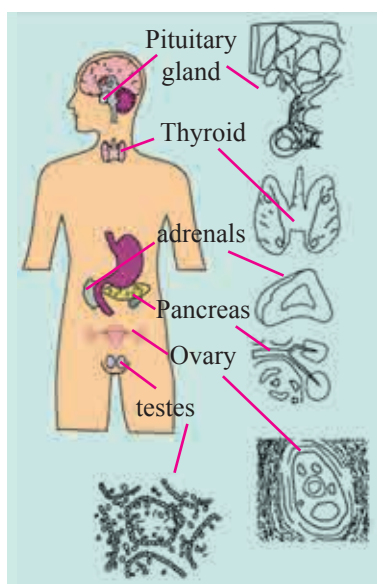
Kwashiorkor	Marasmus
<p>Kwashiorkor is mainly caused by inadequate protein intake for a long time. The main symptoms are:</p> <ul style="list-style-type: none"> <li>• Edema (swelling usually seen in hands, arms, feet, ankle and legs caused by extra fluid trapped in body tissues)</li> <li>• Poor kidney functioning</li> <li>• Liver enlargement</li> <li>• Depigmentation of skin and hair</li> <li>• Swelling of the belly.</li> </ul>	<p>Marasmus (to waste away) is caused due to inadequate intake of protein and energy. Marasmus can result from a continued diet of inadequate energy and protein. The main symptoms are:</p> <ul style="list-style-type: none"> <li>• Chronic diarrhoea</li> <li>• Respiratory infections</li> <li>• Intellectual disability</li> <li>• Extreme wasting of the muscles</li> <li>• Stunted growth.</li> </ul>

## 5. Endocrine Glands :

Endocrine glands are ductless glands that are situated in different parts of the body. These glands are not connected by any duct hence are called ductless. These glands secrete certain chemical substances called ‘Hormones’ which play a significant role in maintaining the internal balance of the body also known as ‘homeostasis’. Hormones influence regular functioning of the body, growth and development, sleep and mood. The hormones are directly released in the blood stream and are circulated to specific body parts for performing various body functions.

### Remember !

Endocrine glands are ductless glands that **secrete hormones** (chemical messengers) which carry **messages to particular organ or tissue** through the blood stream. These glands control **growth, development, metabolism and reproduction**. Endocrine glands secrete hormones in **response to external and internal stimuli**.



Glands	Hormones	Functions
Pituitary	Growth hormone	<ul style="list-style-type: none"> <li>• Regulates growth</li> <li>• Controls the functioning of endocrine glands</li> </ul>
Thyroid	Thyroxine	<ul style="list-style-type: none"> <li>• Controls the rate of metabolism</li> <li>• It also brings about balance in growth</li> </ul>
Parathyroid	Parathormone	<ul style="list-style-type: none"> <li>• Regulates calcium balance of the body</li> </ul>
Adrenal	Adrenaline	<ul style="list-style-type: none"> <li>• Prepares body for emergency</li> </ul>
Pancreas	Insulin	<ul style="list-style-type: none"> <li>• Maintains glucose level in the blood</li> </ul>
Testes	Testosterone	<ul style="list-style-type: none"> <li>• Responsible for growth and development of male reproductive system</li> </ul>
Ovaries	Oestrogen Progesterone	<ul style="list-style-type: none"> <li>• Responsible for growth and development of female reproductive system</li> </ul>

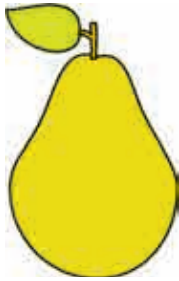
**Fig re 2E** The Endocrine System in the Human Body

**Table 2.3 Endocrine Glands**

<b>Name of the gland</b>	<b>Location</b>	<b>Hormone</b>	<b>Function</b>	<b>More (Hypersecretion)</b>	<b>Less (Hyposecretion)</b>
<b>Pituitary</b>	Base of brain, attached to Hypothalamus	Growth hormone FSH, etc.	i) Promotes growth, ii) Reabsorbs water from kidneys, iii) Controls function of other glands, iv) Responsible for onset of maturity.	Giant structure: Abnormal growth of height	i) Pituitary dwarfism ii) seldom reaches sexual maturity, however intelligence remains unaffected
<b>Thyroid</b>	In the neck	Thyroxin (Protein and iodine)	Affects rate of : general growth, bone development, circulation, function of reproductive organs and muscle development.	Hyperthyroidism (over active enlarged thyroid) increased metabolic rate, restless, weight loss, confused.	Hypothyroidism i) Goitre-lack of iodine ii) Myxedema underactive gland, lethargy iii) Cretinism - defect of thyroxin retards growth & development of skeletal & nervous system.
<b>Parathyroid</b>	Lie on either side of thyroid	Parathyroid hormone	Controls use of Calcium and phosphorus	Softens bones and weakens muscle activity	i) Tetany: muscle cramps
<b>Pancreas</b>	Situated in the abdomen, below the stomach	Insulin	Regulates carbohydrate, secreting juices for digestion	-	Increases blood sugar resulting in Diabetes mellitus.
<b>Adrenals</b>	On top of kidneys	Adrenaline, Fight/Flight emergency hormone	Important role in sexual maturity, controls mineral substances, prepares body for action.	High BP, increased heart rate and glucose content in blood, reduced blood coagulation	-
<b>Testes</b>	On each side of scrotum	Testosterone	Produce sperm and testosterone hormone Controls development of beard, deep voice in male		-
<b>Ovaries</b>	One on each side of pelvis, near to outer end of uterine tubes	Oestrogen (Estrogen) and Progesterone	Produce hormones and egg cells Controls development of secondary sex characteristics, causes thickening of lining of uterus. Controls menstrual cycle, ovulation, change regarding fertilization, pregnancy, birth of baby.		-

**Activity :**

This reminds you of which part or **g** and of the body.



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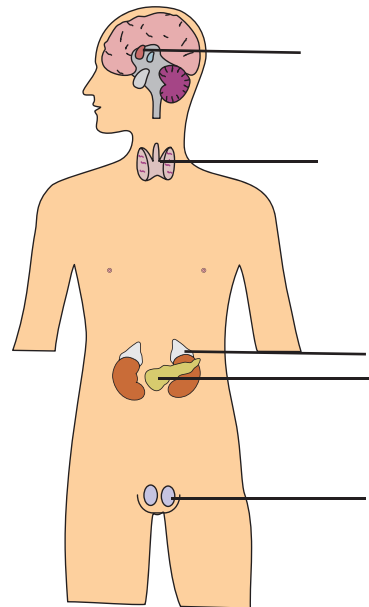
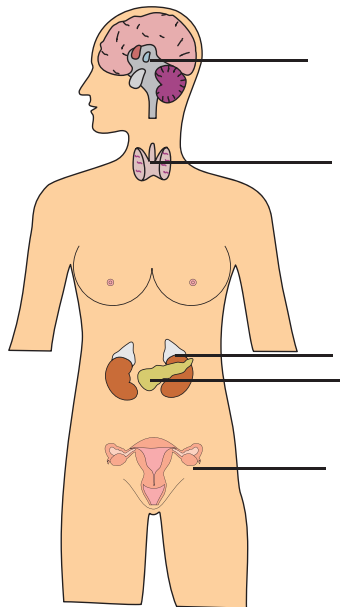
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**Activity :**

Label the **g** ands



**6. Illness :**

The health status is one of the major factors influencing growth and development. Children whose health is good have a better developmental status. Certain illnesses are regarded natural at certain ages. Respiratory infections and gastrointestinal infections are common during babyhood specially when teething. Ordinary illnesses do not have any permanent effect on development but severe illnesses may stunt a child's growth. If illnesses occur at the time of rapid growth and development, the effects can be severe affecting all the areas of growth and development in the child.

## 7 Physical Defects :

Some defects are congenital i.e. the infant is born with these defects. They may be due to genetic defects or harmful conditions during the prenatal period. Some defects may be acquired after birth due to severe illnesses, malnutrition, lack of immunization and accidents. Sensory defects such as loss of hearing or blindness have more serious impact on development. Similarly, orthopaedic defects also lead to long term effects on development.

**Activity :** List a few physical defects that you know or have seen in people

### Effects of physical defects

Children suffering from such defects have less acceptance in society, lesser academic opportunities to explore and learn which affects their all-round development.

## 8. Rest, Sleep and Exercise :

Rest and sleep are necessary for normal functioning and maintenance of body energy. Sleep helps in maintaining physio – chemical equilibrium of the body. If a child does not get adequate sleep and rest he / she may suffer from fatigue, lethargy, disorientation and illnesses. Exercise helps in improving appetite and functioning of other metabolic processes of the body. A child engaging in the regular exercise is generally more healthy, active and adaptive.

**Table : 5 Difference between Rest and Exercise**

Rest	Exercise
<ul style="list-style-type: none"><li>• Body regulates itself</li></ul>	<ul style="list-style-type: none"><li>• Keeps body fit and healthy</li></ul>
<ul style="list-style-type: none"><li>• Maintains physio-chemical equilibrium.</li></ul>	<ul style="list-style-type: none"><li>• Development of muscles, muscular control and co ordination</li></ul>
<ul style="list-style-type: none"><li>• Preserves energy for activity</li></ul>	<ul style="list-style-type: none"><li>• Releases pent-up energy</li></ul>
<ul style="list-style-type: none"><li>• Overcomes effect of toxins produced by activity or fatigue</li></ul>	<ul style="list-style-type: none"><li>• Eliminates toxins through sweating</li></ul>

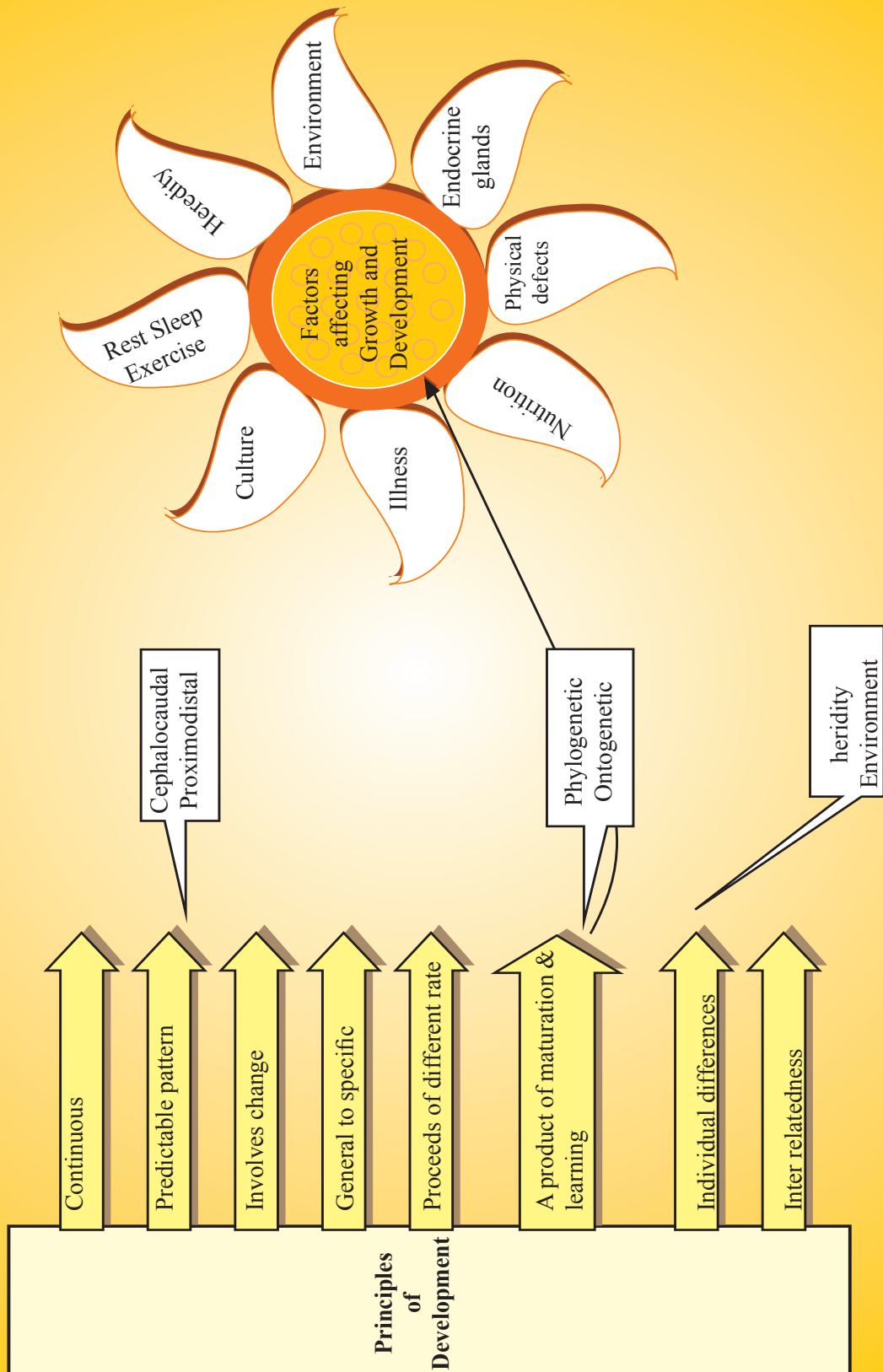
### Did you know?

**Study on sleep and infant memory :** In the year 2015 a study or experiment was conducted by researchers from the University of Sheffield and Ruhr University Bochum, Germany. The study was conducted on 6-12 month old infants. The researchers demonstrated actions on a hand puppet. This was repeated three times with all the infants. One group of infant was allowed to nap and another group was not allowed to nap. Infants who napped right after the demo were better at recalling than infants who hadn't napped. The findings of this study suggests that the time for optimal learning of new information is just before sleep.

This associates with the research findings that adults too consolidate memories as they sleep.

## 9. Culture :

The term Culture broadly includes family environment, surrounding social environment, religion and value system. There are various cultural patterns all over the world. Culture varies with geographical location, socio-economic status, race and religion. The cultural patterns influence the child rearing practices followed by parents. Culture also has an impact on the values, experiences and opportunities available for children.





## Exercises

### Q. 1 Select and write the most appropriate word from the given alternatives.

- In Cephalocaudal sequence, development proceeds from .....  
a) head to toe      b) near to far  
c) head to neck
- According to ..... law the child first gains control over the spine, then arms and then fingers.  
a) cephalocadal      b) genetic  
c) proximodistal
- Each of the reproductive cells have ..... number of chromosomes.  
a) 2      b) 3  
c) 4
- Sex of the child is determined by .....  
a) male      b) female  
c) neither
- Swimming is a ..... function  
a) phylogenetic      b) ontogenetic  
c) genetic.
- ..... refers to the changes in the individual as a result of practice and experience.  
a) Maturation      b) Genes  
c) Learning
- ..... is caused due to inadequate intake of protein and energy.  
a) kwashiorkor      b) marasmus  
c) anemia.

### Q. 2 Match the column

A	B
1) Pituitary gland	a) Oestrogen
2) Thyroid	b) Insulin
3) Adrenal	c) Hypothalamus
4) Pancreas	d) Testosterone
5) Ovary	e) Thyroxine
6) Testes	f) Fight, flight hormone

### Q. 3 Differentiate between the following

- Cephalocaudal and Proximodistal
- Maturation and Learning
- Rest and Exercise
- Phylogenetic and Ontogenetic functions
- Growth and Development
- Phylogenetic function
- Malnutrition

### Q. 4. Define the terms

- Heredity
- Environment
- Chromosome
- Genes
- Maturation
- Learning
- Ontogenetic function

### Q. 5 List the following

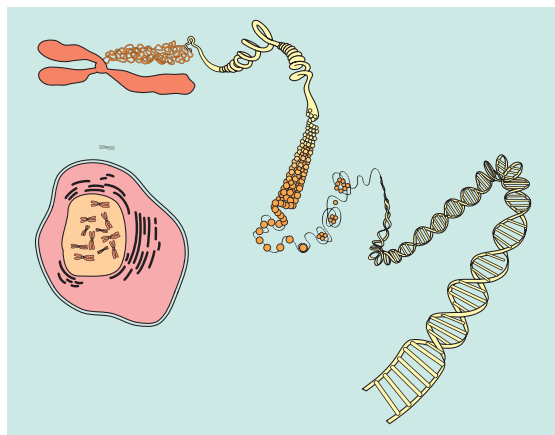
- Factors which affect growth and development
- Causes of malnutrition
- Effects of malnutrition
- Causes of physical defects
- Effects of physical defects
- Names of endocrine glands
- Social changes that influence child development
- Effects of lack of rest or sleep



**Q. 6. Complete the following table.**

Glands	Hormones
a) Pituitary	.....
b) .....	Thyroxine
c) Adrenal	.....
d) Testes	.....
e) .....	Insulin

**Q. 7 Label the diagram and explain the same.**



**Q. 8. Short notes**

1. Influence of heredity and environment
2. Kwashiorkor
3. Marasmus
4. Endocrine glands
5. Maturation and Learning
6. Sex determination
7. Advantages of exercise

**Q. 9. Write in detail your answer to the following questions**

1. Which are the Principles of development?
2. What are the effects of nutrition on development?
3. List the factors affecting growth and development. Explain any two factors in details.
4. What is the co-relation between prenatal and postnatal development?

### Project / Self Study

- Collect pictures of infants and young children doing various activities. Identify and classify them as Phylogenetic and Ontogenetic activities / functions.

