Chapter # 19
Growth and Development

Q.1.(a) Give the Quranic Injunction indicates the creation of pairs?

وَمِنْ كُلِّ شَيْءٍ خَلَقْنَا زَوْجَيْنِ لَعَلَّكُمْ تَذَكَّرُونَ ۝

"And of every thing We have created pairs : that ye may receive instruction."
(Al-Quran 51:49)

(b) Differentiate between growth and development?

Ans. DEVELOPMENT:

It is a programmed series of stages from a simpler to complex form.

Stages in the development:

Following are the stages in the development of plants:

(1) Cell division (2) Elongation
(3) Differentiation of cells in tissues (4) Formation of organs

GROWTH:

It is an irreversible increase in size.

Growth pattern:

The growth pattern in plants is called open growth. Open growth means the growth throughout of the life which involves adding of new organs like branches, leaves, roots etc. in lower plants the whole body can grow gut in higher plants the entire body can not show growth.

Meristem:

The groups of cells (called growing points) which are capable of division are called meristem. The higher plants have meristematic cells at stem and root for growth.

Types of meristem:

Meristems are of three types:

(i) Apical meristem (ii) Intercalary meristem (iii) Lateral meristem

(i) Apical meristem:

These are the growth zones found at the tips of roots and shoot and are concerned with extension of plant body. As they increase the number of cells at tips of roots and stem so they play an important role in primary growth.

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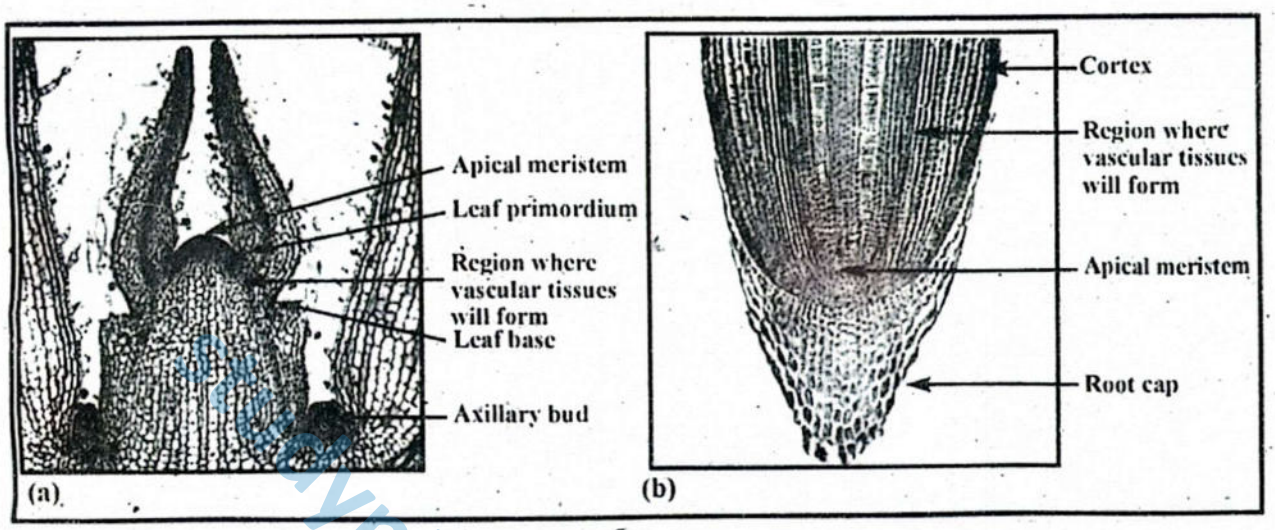
(ii) Intercalary meristem:

These group of cells are present at bases of inter nodes. These are parts of apical meristem which are separated from apex by permanent tissues. As they are temporary, so they are responsible for production of leaves and flowers.



(iii) Lateral meristem:

These are the cylinders of dividing cells which are responsible for increase in diameter of stem and root.

Occurrence

They are found in dicots and gymnosperms.

Example:

Vascular and cork cambium are its examples.

Types:

Lateral meristem is of two types:

(a) Determinate (b). Indeterminate

(a) Determinate types lateral meristem grows to certain size and then stop e.g. leaves flowers and fruits.

(b) Indeterminate lateral meristem grow continually replenish themselves remaining youthful e.g. vegetative root and stem.

Q.2. Discuss different types of growth? Explain different phases of growth?

Ans. There are two types of growth:

(i) Primary growth (ii) Secondary growth

(i) PRIMARY GROWTH:

This growth takes place by the adding of apical meristem.

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(ii) SECONDARY GROWTH:

Secondary growth involves the formation of secondary tissue which is added by inter calary or vascular cambium. Secondary growth increases the thickness of plants.

PHASES OF GROWTH:

Growth has following four phases:

(1) Cell division (2) Elongation

(3) Maturation (4) Differentiation

(1) Cell division:

In this phase the number of cells increase by mitosis. The division takes place at the tip of root and shoot forming small cells. These cells have spherical nuclei which are present in the center of cytoplasm. Vacuoles are absent in these cells. After the division the daughter cell starts enlarging. The synthesis of cytoplasm and cell wall material also takes place at this phase.

(2) Elongation:

This zone is present a little distance from apex of root and shoot. It is few millimeters in length. It uptakes water and increase the volume of cells until 150 fold. During this phase plasticity of cell wall increase and wall pressure is reduced. New cytoplasm is formed and cell wall material gets deposited.

(3) Maturation:

The cells get matured means cells attain their maximum size. Some of the cells do not elongate as that of developing pith and cortex while some cells elongates like that of fibers and tracheas, their direction is length wise.

(4) Differentiation:

During this growth phase the following change takes place:

(i) The walls of the cells become thick.

(ii) Walls of many kind of cells and tissues become pitted.

(iii) Xylem vessels become thick.

(iv) Many new structural features develop.

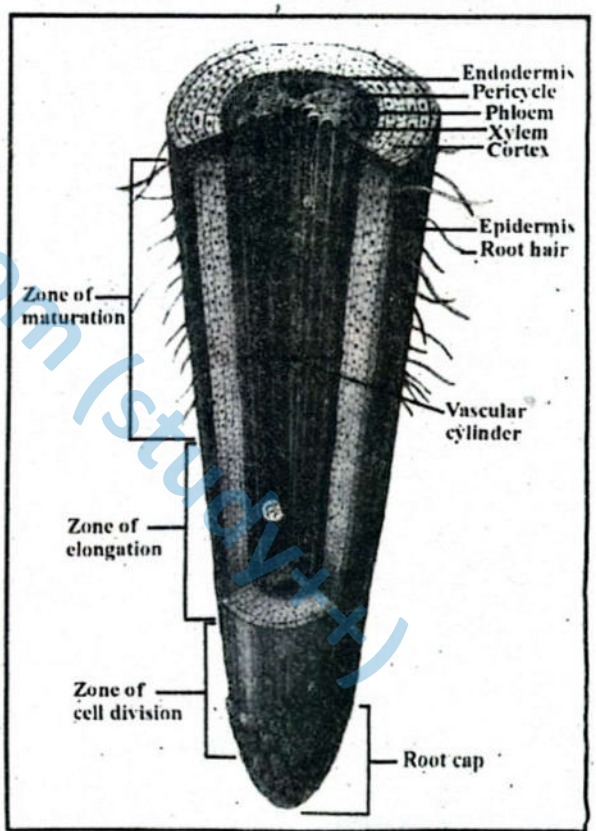

Fig. The root tip is divided into four zones.

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Q.3. Explain different factors which control the rate of growth.

Ans. The growth rate in controlled by two types of factors.

(1) External factors (2) Internal factors

(1) EXTERNAL FACTORS:

External factors include temperature, light, oxygen, carbon dioxide etc. the detail of these factors are as follows:

(i) Temperature:

Growth rate is increased with the rise of temperature and it is decreased with the decrease in temperature. The optimum temperature is (25-30°C) and less than (5-10°C) at which rate of growth is maximum. But if the temperature is very high at (35-40°C) the rate of growth stops and plant may die.

(ii) Light:

Plants absorb light to complete its process of photosynthesis thus it is a very important factor. Plants absorb only a fraction of light. The intensity, quality and duration of light control the effect of growth in different ways.

(a) Intensity:

As the intensity of light increases the cells starts dividing rapidly. Thus light intensity increases growth rate.

(b) Quality:

Two types of light have opposite effects on growth. Red light increase cells elongation while blue light increases cell division but retards cell enlargement.

(c) Duration:

Duration of light effects the growth of vegetative and reproductive structures. It may induce or suppress flowering. This phenomenon is called photoperiodism.

(iii) Oxygen:

Oxygen is necessary for the respiration of plants. The supply of the oxygen should be regular to continue the metabolic activities. A very light supply of oxygen inhibits growth.

(iv) Carbon dioxide:

Carbon dioxide is important for photosynthesis then it can slow down the rate of growth.

(2) INTERNAL FACTORS:

The internal factors include hormones, water, nutrition and vitamins.

(i) Hormones:

There are many hormones which control the rate of growth e.g. auxins giberrellins etc. Indole-3acetic acid (IAA) causes elongation of cells.

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(ii) Water:

Plants absorb water for the elongation of cells. If the water is not supplied to the plant then their growth stops.

(iii) Nutrition:

The growing points need nutrition. If the nutrition is decreased the growth of the plants also slow down.

(iv) Vitamins:

Vitamins are synthesized in the plant in presence of light. If plants grow in dark, the vitamin deficiencies takes place and growth of the plants stop.

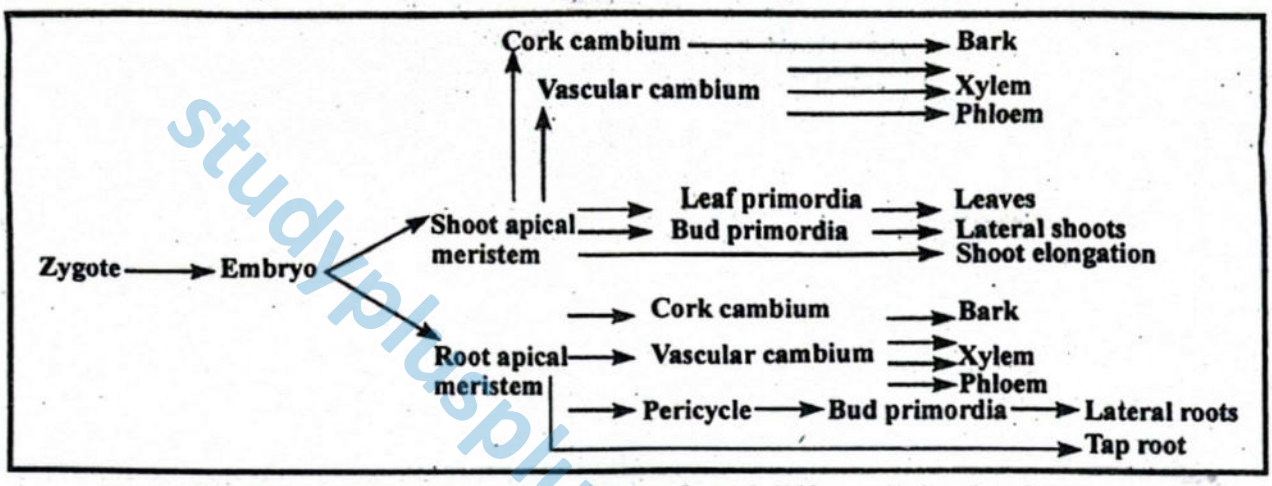

Fig. Graphic representation of growth and differentiation in plants

Q.4. Write a detail account on growth correlation.

Ans. Correlation:

The reciprocal relationship between growth and development is called correlation. As the growth of organs takes place at different rates in different directions then the development of different parts take place.

APICAL DOMINANCE:

Apical dominance is one of the best correlative effect in plants. The apical bud when grows suppresses the growth of lower axillary bud. It was proved by an experiment also. The auxin of the terminal bud is responsible for inhibiting the growth of lateral buds and this phenomenon is called ***apical dominance***.

Experiment:

An experiment was performed by Thimann and Skoog in 1934 with reference to the apical dominance. They conclude that auxin are responsible for apical dominance as they diffuse from lateral bud and cause inhibition to the growth of lateral shoots which is called ***inhibitory effect***. The removal of apex releases the lateral buds from apical dominance. It is called ***compensatory effect***.

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Hormones:

Basically auxin controls the apical dominance but cytokinin also plays an important role in apical dominance. In some cases when cytokinin is applied on the inhibited bud. It allows lateral buds to be released from apical dominance.

Importance:

The apical dominance has great importance in

1. Tap root development
2. Inhibition of sprouting of lateral buds in potato tubers.

Q.5. What is the difference between embryology and development? What are the different stages of development?

Ans. EMBRYOLOGY:

The study of the growth and differentiation experienced by an organism during its development from single fertilized egg to highly complex living being just like that of his parents is called embryology.

Development:

Development is an ordered sequence of irreversible steps, with each step setting up necessary conditions for next step. It consists of following steps:

(i) Gamete formation:

This is the first step in which male produces sperms and female produces eggs.

(ii) Fertilization:

Egg and sperm fuse with each other to form zygote.

(iii) Cleavage:

Zygote undergoes repeated division and blastomeres are formed.

(iv) Gastrulation:

Germinal layers are formed.

(v) Organogenesis:

In this stage organs of the body are formed and cells interact and differentiate.

(vi) Growth:

The size of the organs increase in size and a complete individual is formed.

Q.6. Explain the development of chick.

Ans. The development of chick consists of following steps:

1. FERTILIZATION:

After the formation of gametes the internal fertilization takes place when ovum *enters* the oviduct. The zygote produced is protected in a shell which is secreted by shell gland.

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Egg:

The egg of the chick is surrounded by various accessory coverings secreted by female reproductive tract. Egg undergoes different developmental processes and becomes chick but for this he needs suitable temperature.

Incubation:

Incubation means to give the suitable temperature to egg. It is done by two methods:

(i) By mother (ii) By incubator

(i) By mother:

Mother gives her body temperature to eggs by sitting on it for 21 days.

(ii) By incubator:

In incubating eggs artificially the incubators are regulated at temperature between 36-38°C. At this temperature the chick completes development and is hatched on twenty first days.

2. CLEAVAGE:

After the fertilization cleavage starts in egg which is a series of mitotic divisions.

Discoidal cleavage:

In chick there is a discoidal cleavage where cell division is confined to small disc of protoplasm lying on the surface of yolk at animal pole.

Divisions:

In the cytoplasmic region a cleavage furrows appear. The first two cleavage planes are vertical while the third is horizontal parallel to the surface which separates the cytoplasm from yolk. After that the divisions are irregular which increase the member of cells.

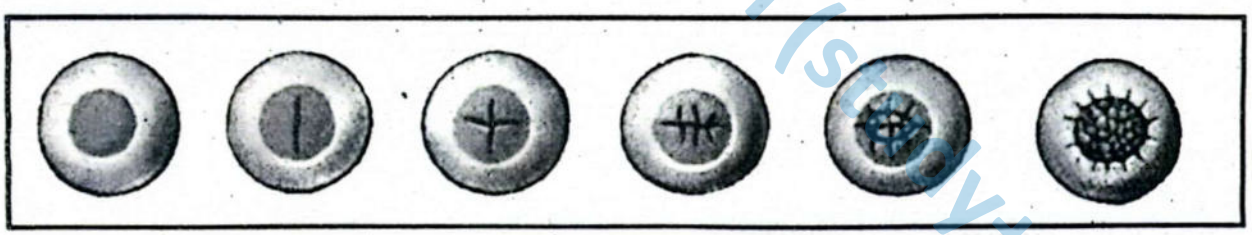

Fig. Cleavage stages in chick

3. MORULLA:

The cells which are formed from the divisions of cleavage are called blastomere. Cleavage results in formation of rounded closely packed mass of blastomeres which is morula.

Blastoderm:

Morula consists of disc shaped mass of cells two or more layers in thickness called blastoderm. They lie very close to yolk. Blastoderm has two types of cells (i) in the center which are smaller and prominent (ii) at the periphery which are flattened and larger.

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4. BLASTULA:

As the morulla stage is very short so the development embryo soon changes to blastula. The blastula consists of cells blastomeres and a cavity called blastocoele. The discoidal cap of cells above the blastocoele is called blastoderm.

Zone of junction:

The marginal area of blastoderm in which the cells remain undetached from yolk and closely adherent to it is called zone of junction.

5. GASTRULATION:

The movement and rearrangement of cells in the embryo is called gastrulation. During the gastrulation the following portions are formed.

(i) Epiblast:

Blastoderm divide in two layers, the upper layer of cells is called epiblast. Actually it is presumptive, ectoderm and mesoderm.

(ii) Hyboblast:

The lower layer of cells of blastoderm is called hypoblast. It is presumptive endoderm.

(iii) Area pellucida:

The hypoblast cells grow outward over the surface of yolk, then downward around it to form endodermal lining of yolk sac. The central cells of blastoderm can be separated from yolk and under these central cells fluid is formed raising them off the yolk and giving the area a translucent appearance. This area is called area pellucida.

(iv) Area opaca:

The area where the cells are unseparated from yolk is called area opaca. Area opaca is white and transmits light

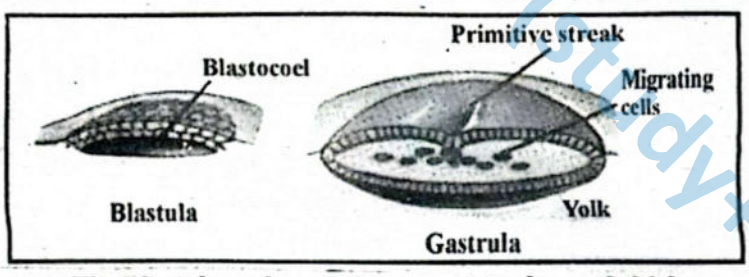

Fig. Blastula and gastrula stages in embryo of chick

Formation of notochord and mesoderm:

During this one of the important step is formation of primitive streak.

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Primitive streak:

The mesodermal cells migrate medially and caudally from both sides and form a mid line thickening called primitive streak. This primitive streak with the passage of time grows rapidly lengthwise. During this process the shape of blastoderm is changed from circular to pear shaped.

The anterior end of the primitive streak is called primitive mode as it contains an aggregation of cells. This primitive node is actually a notochordal cells while rest of the cells are mesodermal cells. The primitive streak represents the dorsal and lateral lips of blastopore.

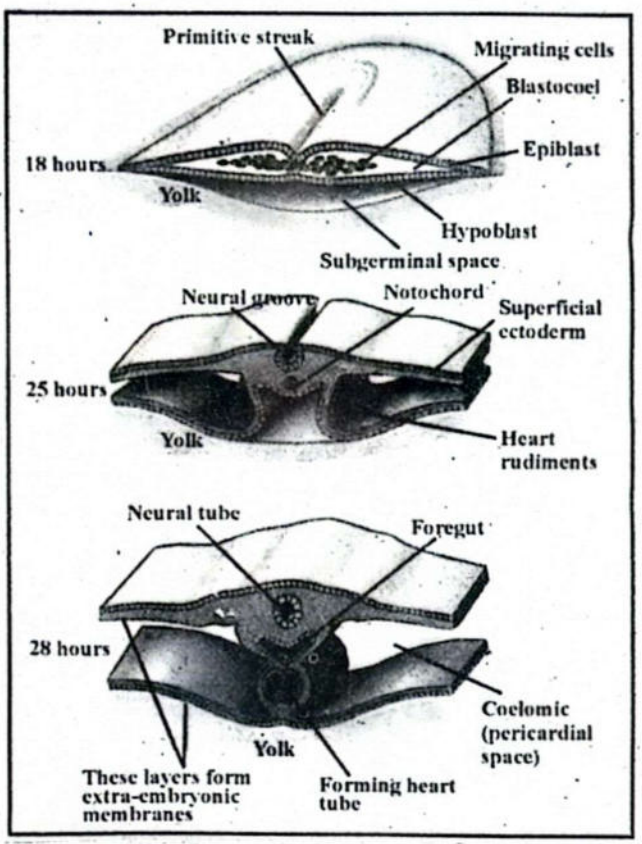

Fig. Gastrulation in the chick

Formation of primitive ridges:

The migration between the cells of epiblast and hypoblast continuously takes place and form a groove on primitive streak. This groove is called primitive groove which has thickened margins called primitive ridges.

Hensen's node:

At the cephalic end of primitive streak, closely packed cells form a local thickening known as Hensen's node.

Formation of notochord:

After the formation of primitive streak and endoderm, cells begin to push in from the region of Henson's node to form the rod like notochord. In embryo of 18 hours notochord is very prominent.

Formation of gastrocoele:

In embryo of 18-20 hours ectoderm spreads and become organized into a covered layer of cells merging peripherally with yolk and marginal area where expanding germ layers merge with under lying yolk is known as germ wall and cavity between yolk and endoderm is called gastrocoele is now turned as primitive gut.

Formation of mesoderm:

From Hensen's node dorsal mesoderm is formed and is organized. The organized mesoderm is called somites. The lateral plate mesoderm is splitted into two sheet like layers i.e. somatic mesoderm and splanchnic mesoderm. There is a space between splanchnic mesoderm and somatic mesoderm which is called coelom.

NEURULATION:

The process of neurulation is as follows:

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Formation of neural plate:

A presumptive neural ectoderm over the notochord on dorsal surface of gastrula is present in form of band. With the elongation of gastrula the band thickens to form neural plate. In chicks of 18 hours, neural plate is seen as flat thickened area of ectoderm.

Neurula:

In embryo of 21-22 hours a longitudinal folding has occurred establishing the neural groove in mid dorsal line on either side of neural folds. In 24 hours embryo, the folding of neural plate is clearly visible. At this stage embryo is called neurula.

Formation of neural tube:

The anterior end of neural groove is widest and forms future brain and rest of the portion is spinal cord. In the meantime, the neural plate sinks and neural folds grow toward one another and meet in the mid dorsal line, fuse and convert the neural groove in neural tube.

Formation of neurocoel:

At each of neural tube a small opening called anterior and posterior neuropores are seen which is close. Later on with the formation of neural tube there is a formation of central nervous system and cavity enclosed is known as *neurocoel*.

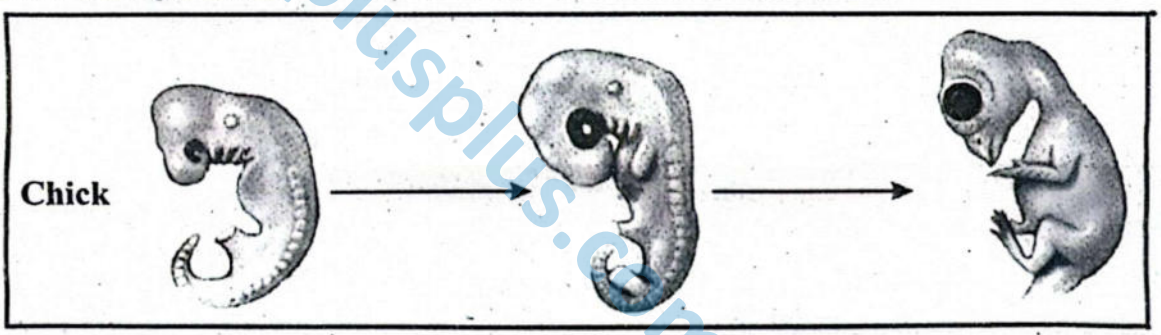

Fig. Early chick embryos

Q.7. Write the contribution of different scientists explaining the mechanisms of development.

Ans. Sperms and eggs fuse with each other to form zygote. Zygote undergoes repeated division and form cells. Each cells has genes inherited by parents. Some of the genes remain active during differentiation while other switch off. Many experiments were performed to find out the role of nucleus and cytoplasm during development, which are as follows:

First experiment:

This was performed by Hans Dietrisch in 1892. For his experiment he took sea urchin egg that was at two cell stages. He separated this egg into two cells. After sometime it was found that the separated cells developed into normal larvae. Dietrisch concluded that both these cells contain all genetic information.

Second experiment:

Spemann performed another experiment. He took salamander zygote for his experiment. He separated the zygote in two equal halves with the help of minute ligature

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of human hair. One half contain nucleus. As the development starts the cleavage completed in half containing nucleus but enucleate half does not divide. Eventually, when nucleated side had reached a 16 cell stage, one of the cleavage nuclei crossed the narrow cytroplasmic bridge to enucleate side. After that it also starts dividing.

Third experiment:

This experiment was performed by Spemann. He separated the embryo of salamander in two halves both containing nucleus. Both of them developed in complete embryos. He also observed that from a 16 cell embryo even if a single cell is separated it contains a complete set of genes and form a complete embryo.

Observation of the Spemann:

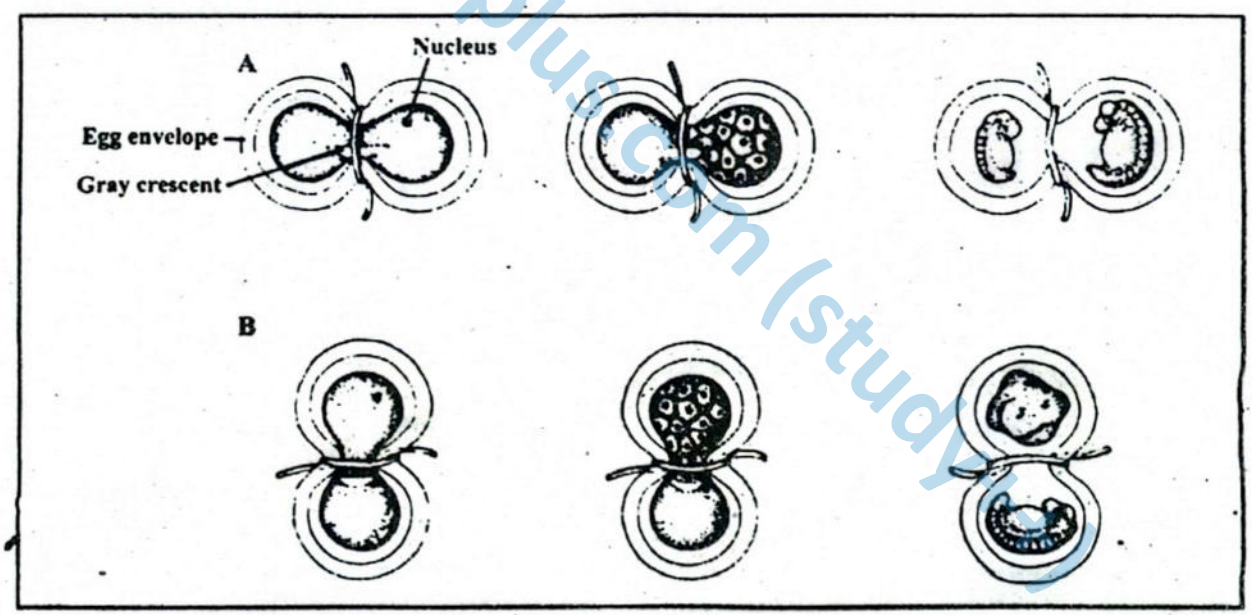
Spemann observed that cell containing nucleus sometimes develop in abnormal ball of cells. On further studies he found that development depends on the position of gray crescent. Gray crescent is the pigment free area that appears at the time of fertilization. Those halves which do not have gray crescent cannot develop further.

Conclusion of Spemann:

On the basis of experiments, Spemann made two conclusions:

(i) All cells contained same nuclear information.

(ii) In the gray crescent area, cytoplasm contains information essential for development.



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Q.8. Discuss the role of cytoplasm and nucleus in development.

Ans. Role of cytoplasm:

Cytoplasm has special component that contain different morphogenetic determinants. These determinants are responsible for cell differentiation such determinants are located in blastomeres. The fertilized egg of an ascidian contains cytoplasm of five different colours that segregate in different blastomeres.

1. Clear cytoplasm: It is responsible to produce epiderms in larval
2. Yellow cytoplasm: It gives rise to muscle cells.
3. Gray vegetal cytoplasm: It forms gut.
4. Grey equatorial cytoplasm which forms notochord and neural tube.

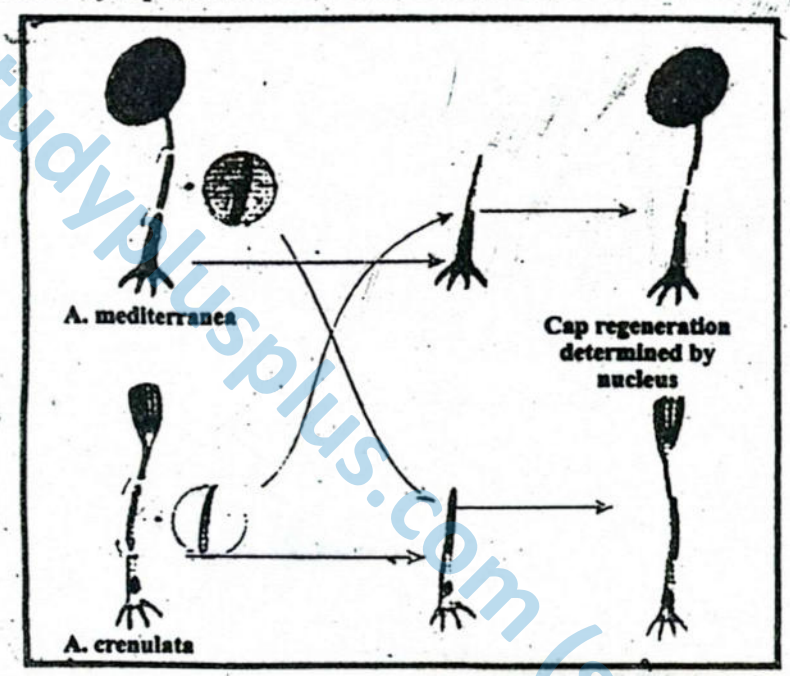

Fig. Nuclear control of cap structures in two species of *Acetabularia*.

Role of nucleus in development:

Some of the active substances are found in the nucleus. This is proved through an experiment.

Acetabularia:

It is multicellular alga. It has rhizoids which are attached to the ground from where there arises a long stalk with an umbrella shaped cap at its top. On the basis of structure two species has been identified.

1. *Acetabularia mediterranea* whose cap is regular.
2. *Acetabularia crenulata* moving irregular shaped cap. Both of have single nucleus.

Experiment:

Haremmerling performed the experiment in which he removed the caps. He found that new caps are degenerated. He cut off the nucleus containing rhizome from an alga of

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one species A miditerranea and grafted a similar piece containing the nucleus of another species A crenulata. When the cap grows it was found that new cap was like that of A crenulata. Thus nucleus lying at the base of aloja determine the structure of cap. Thus the nucleus plays a role in expressing of the genes.

Conclusion:

Nucleus contains all the genes which determine the characteristic of individual while cytoplasm plays the role of selection of genes.

Q.9. Explain the concept of differentiation with reference to different experiments.

Ans. Definition:

The cell has determinants that control the functions of cell. These determinants are equally distributed in the egg. This is called differentiation.

Experiment 1:

Spemann performed the experiment to study differentiation. He took out piece of ectoderm from frogs embryo and grew it in separated. The embryo from which ectoderm was removed cannot develop normal nervous system. Similarly the isolated piece of ectoderm cannot develop any structure through it was active and healthy.

Experiment 2:

In another experiment he separated the mesoderm underlying ectoderm and folded the flap of ectoderm to its original piece. Nervous system was not developed which proves that mesoderm stimulates the ectodermal cells to form nervous system.

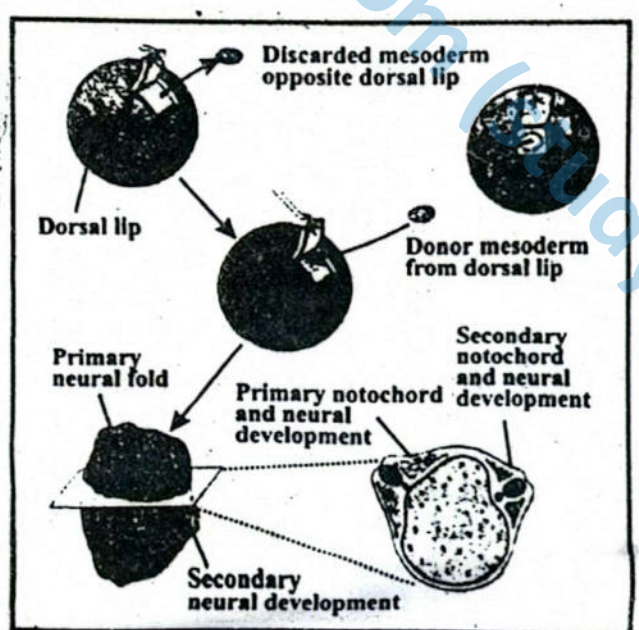

Fig. The Spemann primary organizer experiment.

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Q.10. What do you mean by embryonic induction?

Ans. DEFINITION:

The capacity of some cells to evoke a specific development response in others is called embryonic induction. Various experiments were performed by Hans Spemann and Hilde Mangold in 1924.

Experiment:

They took two embryos of salamander at gastrula stage and remove a piece of dorsal lip from one embryo and transplanted it on ventral and lateral positions of another salamander gastrula. It developed notochord and somites. It also induce second embryo, to form neural tube and complete nervous system was formed where blastopore lip was placed. The developing embryo had both grafted tissue and induced lost tissue. Later on it was found that only cells from dorsal lip of blastopore were capable of inducing complete embryo. This area corresponds to presumptive areas of notochord somites and prechordal plate.

Primary Induction:

The tissue which is capable of inducing development of secondary embryo in host is called primary induction and dorsal lip area is called primary organizer.

Q.11. Explain the process of aging.

Ans. DEFINITION:

The negative physiological changes in our body is called aging.

Effects:

Aging shows the following affects on the body individual.

1. Loss of hair pigment in hair leaving behind while hairs.
2. Development of small pigmented areas in the skin of face and arms.
3. Dryness and wrinkling of skin.
4. Loss of agility.
5. The weight is increased due to deposition of fats.
6. The eyesight usually become weak and create problem of forgetfulness.
7. General weakness and decreased immunity exists.
8. Degeneration of organs and tissues may also take place e.g. in joints arthritis arises from degeneration of cartilage.
9. Degeneration and disappearance of the elastic tissues in the tunica media of blood vessel results in arteriosclerosis.
10. Blood clotting in coronary arteries may occur.

Causes:

The actual causes of aging are unknown but following points are noteworthy.

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(1) Limited mitosis:

One of the reason of aging process may be that cells of the tissues have finite number of mitotic divisions and hence the cells may have reached their finite number by the time a tissue or an organ is fully grown.

For example in old age nervous system has very few nerve cells left which leads to destruction of mental activity and memory.

(2) Spontaneous mutation:

The degeneration of tissues and loss of cells can be caused by spontaneous mutations.

(3) Changes in intracellular substances:

During the process of aging intracellular substance get changed e.g., collagen acquires increased cross linkage in its protein molecules elastic tissues lose their elasticity. There is also hardening and loss of resilience in dense connective tissues and cartilage.

Slowing the process:

This process can be slowed down by use of better food and improving life condition e.g. regular meals and exercise adequate sleep, avoiding from smoking and maintaining the balanced weight.

Gerontology

The study of aging is called gerontology.

According to this study number of old people are expected to rise. In the next half century the number of people over age 75 will rise from present 8 million to 14.5 million and number of over age 80 will rise from 5 million to 12 million.

The human life span is judged to be maximum of 120-125 years. The present goal of gerontology is not to increase life span but to increase health span.

Q.12. Define regeneration. Discuss regeneration in different animals.

Ans. DEFINITION:

The ability to regain or recover the lost or injured part of the body is called regeneration.

Regeneration in different animals:

Sponges

The animals of phylum porifera have very simple body so the power of regeneration is very great in them. They can easily replace the part lost during injury. Moreover piece left is capable of forming into a complete sponge. Sponges take a lot of time for regeneration from months to many years.

Lobster:

The pincer claw of the lobster has the ability of regeneration. As it lost new cla regenerates.

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Starfish:

Starfish has very high power of regeneration. The arms of the starfish have great capability of regeneration. If starfish breaks off portions of their arms into pieces then each piece can develop into new starfish.

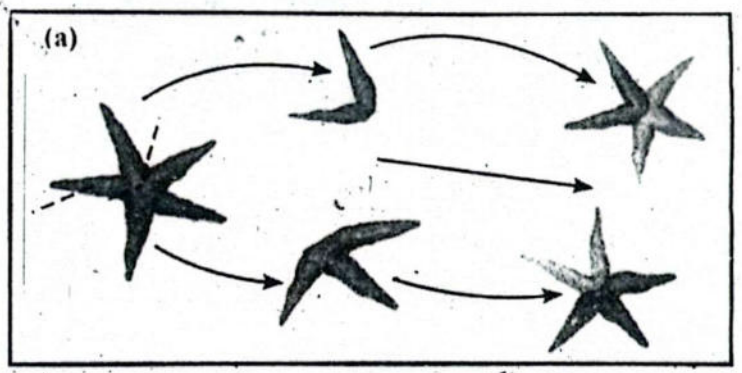

Fig. Regeneration in (a) Start fish

Earthworm:

The head of the earthworm if removed can regenerate new one.

Amphibians:

Amphibians can regenerate their limbs and tail in larval condition. Salamander can regenerate their limbs throughout their life more rapidly when young and small.

Lizards:

At the time of danger or due to some other reasons lizards can easily discard their tails but can regenerate it again.

Man:

In man healing of fracture and repair of skin wound are other examples of regeneration.

Processes involved in regeneration:

For regeneration of any organ or part of body, same embryological processes take place as in the formation of embryo. These processes are retention of undifferentiated cells and differentiation of cells.

Differentiation of cells:

(i) Planaria has very unspecialized cells called *neoblasts* which are always present in the body of adult. When any part in missed those neoblasts migrate towards that site of amputation and differentiate into special cells.

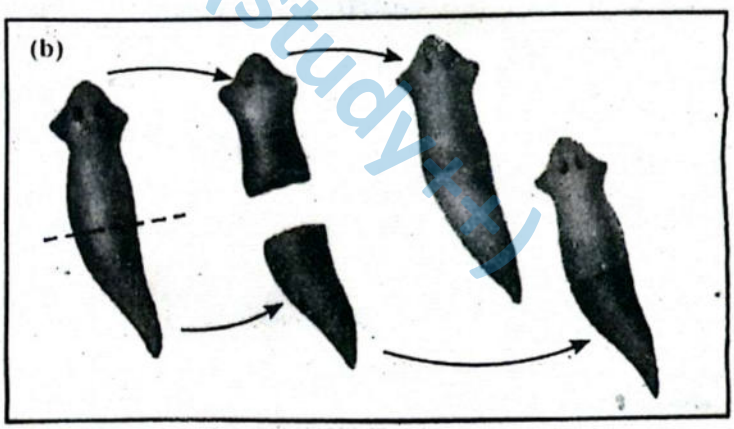

Fig. Regeneration in (b) *Planaria*

(ii) In salamanders or newts some specialized tissue cell types in the stump of an amputated limb apparently differentiate (become less specialized) and then proceed to differentiate into same and different types of cells.

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Regeneration in Plants

In plants regeneration is the basis of plant propagation. Almost any part or even very small fragments of plant e.g., piece of stem or leaf or single tissue cell can develop into full plant. A part of the stem with few leaves may be taken from many kinds of plants and when planted in soil form a complete plant.

Q.13. What do you mean by abnormal development? What are the factors which are involved in this development?

Ans. Abnormal development:

Due to some unfavorable conditions some parts of the body cannot develop normally. This is called abnormal development. The branch which deals with these abnormal developments and causes are called teratology.

Factors involved in this process:

Anything which interferes with the normal process of development cause abnormal. These abnormalities are:

1. Inherited from parents.
2. Due to chromosomes and genes.
3. Due to environmental factors.
4. Due to some metabolic defect.

1. Inherited from parents:

A defective or abnormal gene is passed from the parents to their off springs. This defective gene may by present on autosomes sex chromosomes e.g. haemophilia is a defect in sex chromosomes which is suffered by man only. The appearance of abnormality also depends whether defective gene is dominant or recessive, homozygous or heterozygous.

2. Chromosomal abnormalities:

These abnormalities takes place in sex chromosomes and arise during gamete formation and gamete unite to form zygote or chromosome is either missing or extra. These abnormalities are called syndrome. There are three types of syndrome:

(i) Kline felter syndrome of (XXY) condition.

(ii) Turner syndrome (XO) where one sex chromosome is missing.

(iii) Down's syndrome (XYY) where an extra sex chromosome is present which leads to tallness, aggressiveness, metabolic defect etc.

3. Environmental factors:

A name teratogenic action is given to those environmental factors which cause abnormal development. These are:

(i) Ionizing ova or spermatozoan and leads to mutations.

(ii) *Nutritional* deficiencies like deficiency of vitamins and trace elements.

(iii) Toxins and drugs which are so effective that even if ingested by mother can create problems in foetus.

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4. Metabolic defects:

These defects lead to structural deviations from normal. When various body organs are formed, sometimes one organ or its part is missing or it is repeated which may result into a abnormal organs or body parts e.g. in microcephaly individual in born with small skull. Individuals with cleft palate have their upper lip folded or individual has produced harelip.

SOLVED EXERCISE

Q.1. Fill in the blank with appropriate words.

(i) The influence of notochordal cells on the ectodermal cells to become nervous system was called _____ .

(ii) _____ is a condition in which individuals have small skull.

(iii) Growth is accompanied by two factors.

(a) By increase in _____ (b) increase in _____

(iv) _____ are the regions where growth is initiated by the proliferation of cells.

Ans. **(i)** Embryonic induction

(ii) Microcephaly

(iii) (a) number of cells (b) size of cells

(iv) Meristem

Q.2 Write whether the statement is 'true' or 'false' and write the correct statement if it is false.

(i) **Primary growth leads to increase in length, while secondary growth leads to increase in width.** **True**

(ii) **The plants in which flowering is not at all effected by the day length are called day neutral plants.** **True**

(iii) **The somatic mesoderm soon splits in the middle to form two layers** **False**

(a) Outer parietal layer **(b) Inner visceral layer**

True : The side plate mesoderm soon splits in the middle to form these layers.

(iv) **In the clear cytoplasm area, cytoplasm contains information essential for development.** **False**

True: In the clear cytoplasm area, cytoplasm contains information essential for production of larval epidermis.

(v) **The phase of cell movement and rearrangement is called cleavage.** **False**

True: The phase of cell movement and rearrangement is called gastrulation.

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Q.3 Each question has four options. Encircle the correct answer.

(i) Growth rate is influenced by

(a) hormones (b) water
(c) vitamins (d) all a, b, c

(ii) Neurula is the stage is which embryo has.

(a) blastocoele (b) neural tube
(c) the germ layers (d) archenterons

(iii) The mesodermal cells do not invaginate but migrate medially and caudally from both sides and create a midline thickening called

(a) Henson's node (b) primitive streak
(c) epiblast (d) hypoblast

(iv) The negative physiological changes in our body are called

(a) degeneration (b) abnormalities
(c) aging (d) regeneration

Ans.

(i) (d) **(ii)** (b)
(iii) (b) **(iv)** (c)

Q.4 Short Questions

(i) What is organizer and inducer substance?

Ans. The organ which is capable of inducing development of secondary embryo in host is called organizer and inducer substance.

(ii) What is differentiation?

Ans. Differentiation is the formation of specialized tissues.

(iii) Define embryonic induction.

Ans. The capacity of some cells to evoke a specific development response in others is called embryonic induction.

(iv) Differentiate between growth and development.

Ans. Growth and development

Growth is the permanent and irreversible increase in size that occurs as an organism matures. On the other hand, the progressive changes which are undergone before an organism becomes adult, constitute embryonic **development.**

(v) What is meristem?

Ans. The group of cells (called growing points) which are capable of division are called meristem.

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Q.5 Extensive Questions

(i) What is aging? How will you explain this process?

Ans. Please see Q. No. 11

(ii) What is regeneration? Why it is so effective in some animals and mining in others?

Ans. Please see Q. No. 12

(iii) Describe in detail the developmental processes of chick.

Ans. Please see Q. No. 6

(vi) What is growth, discuss different phases and condition for growth?

Ans. Please see Q. No. 1, 2, 3

(vi) What is development, describe the principles of development in detail?

Ans. Please see Q. No. 5

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