

TOPIC: EMBRYONIC INDUCTION AND CONCEPT OF ORGANIZER

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Types of inductors:

On the basis of various experimental evidences Lehmon (1945) said that specific regionality of induction effects present in the dorsal lip of the blastopore. He further said that the roof of the archenteron definitely possess specific induction activities for the differentiation of head and trunk regions. On the basis of the regional specificity he classified the inductors into three groups. They are:

Archenocephalic inductor: Due to induction effect of this inductor partial head, fore-brain, eye, nasal cavities are formed.

Deuterencephalic inductor: By its induction effect posterior portion of the head, ear cavities etc. are formed. As arechenocephalic and deuterencephalic inductors induce the formation of different parts in the head region so they together are known as cephalic or head inductors.

Spino-caudal inductor: Their inductive influence leads to the formation of spinal cord and different structures of the tail region.

CONCEPT OF ORGANIZER

The effect of embryonic interaction or organizer is a morphogenetic effect by which one organic tissue transmits a chemical substance that influences other embryonic part to produce a structure that otherwise could not come into existence. The embryonic tissue which exerts such an influence is called an inductor and the chemical substance secreted by an inductor is known as evocators. The tissue on which evocator works and the tissue responses is known as responsive tissue. The action of the indicator through evocator is known as induction action or organizer action. This process of induction influences greatly the protein synthesis mechanism of responsive tissues as a result of which definite structure forming cells become very active.

Spemann's experiment (1924): A German embryologist Hans Spemann and his student Hilde Mangold (1924) performed transplantation experiment on a newt *Triturus*

crystatus, an Urodela of class Amphibia. Spemann grafted a piece taken from the dorsal lip of early gastrula of Rana sp. to the lateral lip region of the early gastrula of Triturus cristatus. The embryo of Rana sp. is donor and the embryo of Triturus is the host. They observed that the cells of the grafted piece enter into the gastrula and form notochord and somites. In this embryo its own dorsal lip of blastopore forms neural groove, notochord, mesoderm etc. Similarly the grafted tissue influences to form notochord, neural groove and mesoderm. That is in the same embryo double set of notochord, nerve cord and mesoderm are produced. In this case donor tissue has secreted some chemical substances which has induced to form neural groove, notochord etc. in the host embryo. The donor tissue had pigments and the induced neural groove has also coloured pigments. After the completion of the gastrulation they observed that a larva has developed with two heads. One head is due to normal development and the other head production has been induced by donor tissue.

They examined the larva under the microscope and found that notochord, renal tubules, gut etc. have been formed by the tissue of the host embryo as a secondary

set. If the donor tissue would not have been grafted such secondary structures would not develop. From this experiment they concluded that dorsal lip of the donor had influenced greatly the tissue and thus has brought about change in the host tissue development. If it is not the fact then how a head had developed in the abdomen of the host. This secondary head formation is due to induction effect of donor tissue. This process of influencing other tissue was termed as induction by Spemann and the tissue that induced the tissue was known as the inductor or organizer.

Primary organizer:

Spemann continued his grafting experiments taking tissues from different zones of the gastrula and observed that except dorsal lip of the early gastrula other zone of tissue can not create any induction effect but when dorsal lip is grafted a complete embryo is formed. He named the dorsal lip as organizer as this dorsal lip organizes the developmental process of the embryo. According to him this dorsal lip induces to form neural tube and the neural tube then induces to form the eyes. The dorsal lip is composed of chorda-mesoderm and as it primarily acts as inducer so he named the dorsal lip or chordamesoderm as primary organizers.

2. Secondary, tertiary and quaternary organizers:

As the gastrulation proceeds due to primary organizer's induction primary organs begin to form and the early stages of organ development are known as organ rudiments. These organ rudiments themselves may act as organizer and then they are known as secondary organizer. Tissues formed by the action of secondary organizer may in turn induce further development. Then they are known as tertiary organizer. These successive stages of organizer activities start from the primary organizer.

How these organizers act in succession can clearly be understood from the examples of the development of eye in amphibian, chick etc. First of all due to induction effect of the primary organizer forebrain and within the forebrain eye forming cells are produced. These cells push out as a vesicle outside the forebrain. These vesicles are known as optic vesicle. This vesicle grows through the lateral mesenchyme and reaches the epidermis.

As soon as the vesicle comes in contact with the epidermis the outer layer of the vesicle invaginates to form a double layered optic cup. The inner layer of the optic cup is formed of sensory cells and the outer layer is

formed of pigmented cells. They two together form the retina. The chemical substances secreted by the optic cup induce to form the lens between the optic cup and the epidermis. The peculiar thing is that if the optic vesicle is prevented from coming in contact with the epidermis there will be no lens formation. So the optic cup acts as secondary organizer. Similarly lens and retina together induce to form cornea so lens and retina together act as tertiary organizer and so on.

3.6 SUMMARY

In embryology, **cleavage** is the division of cells in the early embryo. The zygotes of many species undergo rapid cell cycles with no significant growth, producing a cluster of cells the same size as the original zygote. The different cells derived from cleavage are called blastomeres and form a compact mass called the morula. Cleavage ends with the formation of the blastula.

Depending mostly on the amount of yolk in the egg, the cleavage can be **holoblastic** (total or entire cleavage) or **meroblastic** (partial cleavage). The pole of the egg with

the highest concentration of yolk is referred to as the vegetal pole while the opposite is referred to as the animal pole.

Cleavage differs from other forms of cell division in that it increases the number of cells without increasing the mass. This means that with each successive subdivision, the ratio of nuclear to cytoplasmic material increases.
