# HD 15: PLACODES

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## READING ASSIGNMENT

Larsen 3rd Edition Chapter 12, Part 2. pp.379-389; Part 3. pp.390-396; Chapter 13. pp.430-432

## SUMMARY

A series of ectodermal thickenings or placodes develop in the cephalic region at the periphery of the neural plate. Placodes are central to the development of the cephalic sensory systems in vertebrates and are among the innovations that appeared in the early evolution of vertebrates. There are placodes for the three organs of special sense: olfactory, optic (lens) and otic placodes, and (epibranchial) placodes that give rise to the distal cells of the sensory ganglia of cranial nerves (V,) VII, IX and X. Placodes (with the possible exception of the olfactory placodes) form under the influence of surrounding cranial tissues. They do not appear to require the presence of neural crest. The development of the organs of special sense is described briefly.

## LEARNING OBJECTIVES

You should be able to

a. Give a definition of placodes and describe their evolutionary significance.
b. Name the different types of placodes, their locations in the developing embryo and their developmental fates.
c. Discuss the early development of the placodes and some of the possible factors that feature in their development.
d. Describe the contributions by trigeminal and epibranchial placodes, and by neural crest cells to the ganglia of cranial nerves V, VII, IX, X.
e. Describe the development of olfactory epithelium, specifically the origin of the olfactory placodal cells, the differentiation of sensory neurons, and the stages in the development of the olfactory nerve (CN I).
f. Describe the development of the eye, specifically the origin and derivatives of the optic vesicle, and of the lens vesicle; the differentiation of the cells in the mature retina and the development of the optic nerve (CN II).
g. Describe the development of the structures of the inner ear, specifically the derivatives of the ventral and dorsal components of the otic vesicle, the development of the cochlear duct and of the semicircular canals, and the development of the statoacoustic ganglion and nerve (CN VIII).

**GLOSSARY:**

**Choroidal fissure**: A groove on the ventral surface of the optic stalk. In it runs the hyaloid artery.
**Epibranchial placodes:** Located close to the dorsal ends of the 1st, 2nd, 3rd, and 4th pharyngeal grooves. They will give rise to the distal cell population of the trigeminal ganglion (V), geniculate ganglion (VII), petrosal ganglion (IX), nodose ganglion (X).
**Hyaloid artery:** This artery is a terminal branch of the ophthalmic artery and is located in the choroidal fissure.The artery will develop into the central artery of the retina.
**Hypobranchial placodes:** Located close to the ventral ends of the 2nd and 3rd pharyngeal grooves. To date they have been found only in frogs. Their role is unknown.
**Lens vesicle:** A hollow structure formed by the invagination of the optic placode.
**Olfactory placode:** Gives rise to the sensory receptor cells of the olfactory and vomeronasal epithelia of the nose.
**Ophthalmic trigeminal placode:** Located in an intermediate position**-** between the otic placode and the epibranchial placodes. This is the ophthalmic component of the future trigeminal ganglion.
**Optic cup:** Develops when the distal face of the optic vesicle forms a depression (optic fissure) transforming it into a goblet-shaped structure. The hollow lens vesicle sits in the depression of the optic cup. The inner layer of the optic cup becomes the neural retina, while the outer layer becomes the pigment retina.
**Optic placode:** Invaginates and gives rise first to a lens vesicle and subsequently to the lens of the eye.
**Optic stalk**: The structure by which the optic vesicle remains attached to the forebrain.
**Optic vesicle:** An evagination that expands from the wall of the forebrain towards the optic placode.
**Otic pit:** formed as the result of invagination of the otic placode during the 4th week, still open to the ectodermal surface.
**Otic placode:** The only remaining placode of the dorsolateral series. Will give rise to the membranous labyrinth of the inner ear and the statoacoustic ganglion of cranial nerve VIII.
**Otic vesicle:** Invagination of the otic placode during the 4th week results in the development of an open otic pit and subsequently in a closed otic vesicle.
**Placodes:** Localized thickened areas of specialized ectoderm that originate from ectoderm at the border between the neural plate/neural crest and the future epidermis in the cephalic region. These structures are essential for the development of sensory components of the peripheral nervous system in vertebrates.