Differentiation of Quail Hensen's Node in Chick Coelomic Cavity[1]

It has been known for a long time that the part of chick blastoderm which contains Hensen's node, when isolated and grown in suitable conditions, will differentiate into various tissues[2,3]. VEINI and HARA[4] have recently shown with homoplastic transplantations that Hensen's node in the coelomic cavity of an older embryo will give rise to neural structures, notochord, cartilage, muscle, different parts of the digestive tract, pancreas, and, less frequently, to glands like thyroid, parathyroid and thymus. Since quail cells can be readily distinguished from chick cells by LE DOUARIN's marker[5–7] (a DNA-containing nucleolus which is seen as a red spot in Feulgen-stained quail cell nuclei), it seemed interesting to find out whether quail Hensen's node would show similar differentiation tendencies in chick coelomic cavity.

Squares of 0.2×0.2 mm containing the Hensen's node and similar squares immediately posterior to them (postnodal pieces) were removed from young Japanese quail embryos at stages which correspond to HAMBURGER and HAMILTON chick embryo stages $3–3^1/_2$ (half-grown primitive streak) and 4 (full primitive streak). The pieces were inserted into the coelomic cavities of White Leghorn chick embryos which had been incubated for 60 h, using the method described by HARA[8,9]. After 8–12 days the grafts eventually found in the embryos were fixed in Zenker's fluid, sectioned, stained with Feulgen and Rossenbeck's method and examined histologically. A graft was found in 24 cases out of a total of 38 surviving embryos; the size, shape and attachment of the graft varied considerably.

The results of the histological analysis are shown in the Table. It shows that no marked difference was found between grafts of different stages. However, the differentiation of node and postnodal from the same blastoderm was often similar. Endodermal differentiations were the most frequent ones, consisting of respiratory and/or digestive epithelium (oesophagus, crop, stomach, gut) and digestive glands, often in great masses. Sometimes the accompanying connective tissue and muscle layers were derived only from the host, sometimes from the grafted quail tissue. In some cases, quail connective tissue and muscle was found even outside the digestive tube, as well as quail cartilage, sometimes together with chick cartilage. A thyroid with quail epithelium and chick connective tissue appeared twice, and once what seemed to be a quail notochord. Chick lymphatic tissue with more or less abundant quail cells was not rare. Quail nervous tissue (with chick blood vessels) was found in some cases, but only once in any great amount; in that case even pigment cells were found, which had migrated even into host feathers. Except in lymphatic tissue, complete mixtures of cells of the two species were rare, although areas of chick connective tissue and muscle could gradually change into areas of corresponding quail cells.

The frequencies of various quail tissues in the grafts

	Stage 4		Stage $3–3^1/_2$	
	HN (8)	PN (8)	HN (5)	PN (3)
Nervous tissue	4	2	1	–
Pigment cells	1	–	–	–
Thyroid epithelium	1	1	–	–
Digestive epithelium	7	3	5	2
Digestive tube (all layers)	2	4	1	1
Connective tissue (other than digestive tract)	2	3	1	1
Muscle (other than digestive tract)	1	3	1	1
Cartilage	3	3	1	1
Lymphatic tissue	2	4	3	1
Notochord	–	–	1	–

HN, Hensen's node; PN, postnodal piece.

The results indicate that the quail Hensen's node and the part of primitive streak immediately behind it can realize various developmental potencies in chick coelomic cavity, and that the overall differentiation pattern is not basically different from that of the chick Hensen's node. They also show that, in coelomic grafting, the host tissue may have an active part in the formation of the graft, being able to differentiate, at least into muscle, connective tissue and cartilage.

Summary. Quail Hensen's nodes were cultured in the chick coelomic cavity. They differentiated into various tissues, intimately mixing with host cells, which in many cases formed the supporting mesoderm of graft epithelial or nervous tissue.

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