

22 (2545)

An experimental study of the origin of the meninges.

By SAMUEL C. HARVEY, M. D., and HAROLD S. BURR, Ph.D.

[*From the Departments of Surgery and Anatomy, Yale University, New Haven, Conn.*]

As a result of experimental work concerning the healing of the meninges following injury, it was found by one of us (S. C. H),¹ that the dura in the presence of an intact lepto meninx heals without adhesion to the underlying membrane. This is brought about, not by the ingrowth of mesothelium from the surrounding normal dura, but by the direct transformation of mesenchymal cells into mesothelium which comes to lie against the uninjured and impervious lepto-meninx.

On the other hand,² when the lepto-meninx is injured with the overlying dura remaining undamaged, an analogous healing without adhesions does not take place. The lining mesothelium of the dura disappears and this membrane enters intimately into the reparative process in the subjacent lepto-meninx, the final result being dense adhesions. This seems to indicate some fundamental histogenetic difference between these two structures.

Harrison³ has shown by experimental methods that the nerve sheath cells are derived from the neural crest. Inasmuch as these cells are analogous to the lepto-meninx in their relationship to the nerve structures which they surround, it seemed possible that this membrane was likewise derived from the neural crest while the dura probably developed from the mesenchyme.

An examination of pig and chick embryos at and previous to the time of the outgrowth of the nerve root fibers from the neural tube, confirmed this belief.

It seemed possible to verify this supposition by experimentation. This work was carried out by the transplantation of sections of the neural tube of the amblystoma with and without neural crest cells. If the lepto-meninx develops from neural crest cells, then transplanting a portion of the neural tube free

¹ Sayad, William Y., and Harvey, Samuel, *Annals of Surgery*, 1923, xxxvii, 129.

² Lear, Maxwell and Harvey, Samuel, *Annals of Surgery*, in press.

³ Harrison, Ross G., *Am. J. Anat.*, 1906, v, 121.

from such cells should lead to the growth of neural tissues surrounded only by dura, while such transplantation carrying with it nerve crest cells should lead to the formation of both the dura and the lepto-meninges about the neural transplant. Such experiments were carried out in the Spring of 1924, with the following results.

The first series was that in which the mid-brain, optic vesicle and the adjacent neural crest cells were transplanted into the region lying just anterior to the limb. The result of the procedure was that the transplanted neural tissue was completely invested by lepto-meninges and dura.

The second series involved the transplantation of a portion of the cerebral hemisphere into the same region, after careful removal of neural crest cells. Examination of the result showed the growth of neural tissue with no lepto-meninges, it being surrounded only by an incompletely formed dura.

These experiments indicate then that there is a definite histogenetic difference between the dura and the lepto-meninges, and that the latter has the same origin as that of the neural sheath cells, namely, the cells of the neural crest, while the former is probably developed from mesenchyme.