

These experiments indicate that, whereas training walls in the upper estuary would be injurious, owing to the resulting accretion, training walls in the lower estuary would improve the depth of the outlet channel; and that such training walls, combined with dredging, offer the best prospect of forming a direct stable, and deepened channel across the bar.

II. "On outlying Nerve-cells in the Mammalian Spinal Cord."

By CH. S. SHERRINGTON, M.A., M.B., &c. Communicated by Professor M. FOSTER, Sec. R.S. Received January 30, 1890.

(Abstract.)

Gaskell has shown* that in the cord of the alligator scattered nerve-cells are to be seen at the periphery of the lateral column. Although nerve-cells appear to be absent from that position in the spinal cord of Mammalia as represented by the rabbit, cat, dog, calf, monkey, and man, yet there are in these animals isolated nerve-cells present in the white matter of the cord, not only in the deeper portions of the lateral column, but in the anterior and posterior columns as well.

In the anterior columns occasional nerve-cells, of the multipolar kind, lie among those fibre-bundles which pass between the deeper mesial border of the anterior horn and the anterior commissure at the base of the anterior fissure. They, in the instances observed, are smaller than the large cells characteristic of the anterior horn, and lie with two of the processes directed parallel with the horizontal transverse fibres among which they are placed. Such cells have been observed in the human cord and in the cord of the dog and bonnet monkey.

In the lateral column, of the spinal cord of man and the other animals named above, it is common to find outlying members of the group of small cells of the lateral horn, Clarke's tractus intermedio-lateralis, situated in the white matter, distinctly beyond the limits of the grey. Some outlying cells here are placed at a great distance from the grey. These are all probably to be considered members of the intermedio-lateral group. Their similarity to those cells in form and size is striking. They are generally placed upon, or at least in close connexion with, the fine connective-tissue septa which pass across the white matter. It is probable that the cells are connected with the medullated nerve-fibres running along these septa. The cells are fusiform, with the longer axis parallel to the direction of the nerve-fibres running in the septa.

In the part of the lateral column adjacent to the lateral reticular

* 'Proceedings of the Physiological Society,' 1885.

formation numerous nerve-cells are to be found among the interlacing bands of nerve-fibres. These are often fusiform, but in many cases multipolar; they are for the most part small, but occasional large individuals can be found; the latter would appear always to be multipolar. Where the lateral column comes into contact with the lateral limb of the substantia gelatinosa of the caput cornu posterioris ganglion-cells can frequently be seen in it. The larger axis of these cells is parallel to the outline of the caput cornu. They seem to exist most numerous in regions, such as the lumbo-sacral, in which medullated fibres, probably posterior root-fibres, sweep through the deeper part of the lateral column round the lateral limb of the gelatinosa as if to reach the base of the posterior horn.

In the posterior columns outlying nerve-cells are also to be found, especially in the human cord. In these columns the cells appear to be outstanding members of the posterior vesicular group of Clarke. They are best seen in the upper lumbar and lower dorsal regions. They are large, measuring in some instances $70\ \mu$ across. In appearance they closely resemble the cells of Clarke's column. They are nearly always of broadly ovate shape. They appear always to lie on or in close relation to those horizontal bundles of nerve-fibres which curve in a ventro-lateral direction from the depth of the extero-posterior column into the grey matter in the neighbourhood of the posterior vesicular group. The longer axis of the cell is placed parallel to the nerve-fibres it lies upon or among. Where a process from the bipolar cell-body can be followed, it disappears in a direction which is that of the surrounding nerve-fibres. The cell would seem in the majority of cases to lie with its length in a plane at right angles to the long axis of the cord. Frequently the cells lie close to the grey substance of Clarke's column, but in some specimens they occupy positions far removed from the grey matter; they may even lie near the periphery of the extero-posterior column.

The chief interest attaching to nerve-cells lying in the white matter of the spinal cord is that they may be supposed to be connected with the nerve-fibres among which they are, and that from that fact some knowledge may be gained as to the anatomy of themselves, and of the group of which they may be outlying individuals, or of the fibre-bundles containing them.

With regard to the cells existing among fibres passing to the white commissure of the cord, it is legitimate to consider their presence as evidence in favour of the view that some of the cells of the median portion of the ventral grey horn are directly connected with medullated fibres passing to or from the opposite half of the cord by way of the anterior commissure.

The cells in the lateral column outside the lateral horn may be taken to point to the connection of the intermedio-lateral group of

Clarke with the nerve-fibres which radiate in bundles from the grey matter of that region into the lateral column, and to show that some of the fibres with which these are related pass out transversely well into that area which is occupied almost exclusively (man) by fibres of the crossed pyramidal tract. Concerning some of the outlying cells in the more dorsal portion of the lateral column, the same inferences may be drawn; and some of them would seem to be connected with fibres of the posterior roots that curve round the lateral aspect of the caput cornu posterioris. Of the outlying cells in the posterior column, if they are outlying members of Clarke's group, the relations which they suggest for that group are—

i. That the group is connected *directly* with certain of the median fibres of the posterior spinal roots, namely, those which after an upward course in Burdach's column plunge into the grey matter of the base of the posterior horn.

ii. That some at least of the cells of that group are interpolated, more or less immediately, into the course of medullated nerve-fibres of large calibre.

The question naturally arises, May not these cells in the posterior column of the Mammalian cord represent the bipolar cells discovered by Freud,* in the cord of *Petromyzon Planeri*, to be in direct communication with fibres of the posterior roots? If so may Clarke's column be considered a portion of the ganglion of the posterior spinal nerve-root which has been retained in the interior of the spinal cord in the thoracic and certain other regions?

III. "On the Germination of the Seed of the Castor-oil Plant (*Ricinus communis*).” By J. R. GREEN, M.A., B.Sc., F.L.S., Professor of Botany to the Pharmaceutical Society of Great Britain. Communicated by Professor M. FOSTER, Sec. R.S. Received January 29, 1890.

(Abstract.)

The older views of the transformations of the reserve products of this plant, as advanced by Sachs and other writers, took account only of the oil present in the cells, and were briefly, that it undergoes by oxidation a conversion into carbohydrate, the idea of this change being chiefly based on the observation that as the oil disappears from the endosperm during germination, starch appears in various parts of the embryo. Later writers have suggested the existence of a ferment, splitting up the fat into glycerine and fatty acid, and the further transformation of the latter into the starch.

* Freud, 'Vienna Sitzungsberichte,' January, 1877.