1. A posterior root, the ganglion of which is stationary in position and is connected with both splanchnic and somatic afferent nerves.

2. An anterior root, the ganglion of which is vagrant, and is connected with the efferent small-fibred splanchnic nerves.

Also it is not a fundamental characteristic of a spinal nerve that the anterior root should necessarily pass free from the spinal ganglion, for it is clear that both anterior and posterior roots may pass into the same stationary ganglionic mass if the whole or part of the efferent ganglion has not travelled away from the parent mass. This passage of the fibres of the anterior as well as of the posterior roots into the spinal ganglion is common enough in the lower animals, and is a peculiarity of the first two cervical nerves in such an animal as the dog. If, then, the cranial nerves are formed on the same plan as the spinal, their efferent roots ought to be divisible into a large-fibred non-ganglionated portion and a small-fibred ganglionated portion, the ganglia of which may be vagrant in character, while their afferent roots should possess stationary ganglia near their exits from the brain; also the centres of origin for the different sets of nerve fibres, *i.e.* for the splanchnic and somatic nerves, ought to be the direct continuation of the corresponding centres of origin in the spinal cord. Such I find to be the case; if we leave out of consideration the nerves of special sense, viz. the optic, olfactory, and auditory nerves, the remaining cranial nerves are found to divide themselves into two groups—

(1) A foremost group of nerves, which in man are entirely efferent, viz. third, fourth, motor part of fifth, sixth, and seventh nerves.

(2) A hindmost group of nerves of mixed character, viz. ninth, tenth, eleventh, and twelfth nerves, and the sensory part of fifth.

The nerves of the first group resemble the spinal nerves as far as their anterior roots are concerned, for they are composed of large-fibred non-ganglionated motor nerves and small-fibred splanchnic efferent nerves, which possess vagrant ganglia, such as the ganglion oculomotorii, the ganglion geniculatum, &c.

They resemble spinal nerves also as far as their posterior roots are concerned, for they have formed upon them a ganglion at their exit from the brain corresponding strictly to the stationary posterior root ganglion of a spinal nerve. One great difference, however, exists between their posterior roots and those of a spinal nerve, for neither the nerve fibres nor the ganglion cells of these roots are any longer functional; they exist simply in the roots of this group of cranial nerves in man, and other warm-blooded animals, as the phylogenetically degenerated remnants of what were in ages long since past doubtless functional ganglia and functional nerve fibres.

This foremost group of cranial nerves, then, is built up on precisely the same plan as the spinal nerves; the apparent difference being due to the fact that the afferent roots with their ganglia have degenerated.

The hindmost group of cranial nerves is also composed of the same constituents as the spinal nerves, and their different components arise from centres of origin in the medulla oblongata and in the cervical region of the spinal cord which are directly continuous with the corresponding groups of nerve cells in other parts of the spinal cord. Here, however, the deviation from the spinal nerve type which has taken place consists not in the suppression of any particular component, but in the scattering of the various components, so that none of the nerves of this group form in themselves complete segmental nerves, but rather the whole of them taken together form a broken up group of segmental nerves which are capable of being rearranged not only into afferent and efferent but also into splanchnic and somatic divisions of precisely the same character as in a group of spinal nerves.

I conclude therefore that both these two great groups of cranial nerves are built up on the same plan as the spinal nerves, not only with respect to the structure, function, and distribution of their nerve fibres, but also as far as the arrangement of the centres of origin of those nerve fibres in the central nervous system is concerned; and I think it probable that the reason for the deviation of the cranial nerves from the spinal nerve type is bound up with the changes which occurred at the time when a large portion of the fibres of the foremost group of cranial nerves lost their functional activity. I imagine that in the long past history of the vertebrate animal some extensive tract in connection with the foremost part of the nervous system has become useless and disappeared, and in consequence the nerves supplying those parts have degenerated. In this phylogenetic degeneration the whole of the splanchnic and somatic afferent nerves of that region were involved, and probably also some of the efferent nerve fibres, with the result that certain only of the motor elements have remained functional. In the further history of the vertebrate, the parts which have replaced those which became useless have received their nerve supply from tracts of the central nervous system situated behind this foremost group of nerves; in consequence of which the component parts of that hindermost group have become more or less separated from each other. The extent of the area involved is especially well seen when the sensory nerves of this area, both somatic and splanchnic, are considered; for we see not only that the sensory part of the trigeminal, representing the somatic sensory elements, and the sensory part of the vagus, representing the splanchnic sensory elements, are derived from their respective ascending roots, *i.e.* arise in connection with a series of nerve segments extending well into the cervical region, but also that the peripheral distributions of these two nerves are very extensive. Without speculating further at present upon the nature of the change which has disturbed the orderly arrangement of the cranial nerves, enough has been said to prove that the cranial nerves considered in this article are built up on the same plan as the spinal nerves. Further it is worthy of notice that just as the division into somatic and splanchnic has thrown great light upon the conception of the manner in which a segmental nerve is formed, so also it lends aid to the consideration of the segmentation of structures other than the nervous, for we find that two distinct segmentations exist in the body which do not necessarily run parallel to each other: the one, a segmentation which may be fitly called splanchnic, and is represented by the orderly arrangement of visceral and branchial clefts; and the other, a somatic segmentation, characterized by the formation of somites, *i.e.* of vertebræ and somatic muscles arranged also in orderly sequence.

The splanchnic segmentation is most conspicuous in the cranial region, the somatic segmentation in the spinal region, and it is most advisable to remember that a valid comparison between cranial and spinal segments can only be made when like is compared with like, for it by no means follows that the somatic and splanchnic segmentations have proceeded on identical lines; consequently, in comparing cranial with spinal nerves, we must compare structures of the same kind, and seeing that the spinal nerves are arranged according to somatic segments so also must the cranial nerves be arranged in accordance with their relation to the somatic muscles of the head, and not in relation to the branchial and visceral clefts.

It is not advisable in this article to enter upon any discussion as to the number of segments supplied by the cranial nerves, or to speculate upon the nature of the changes which have taken place in the past history of the vertebrate animal, whereby the present distribution of the cranial nerves has been brought about. I desire only to put as shortly as possible before the readers of NATURE the general results of my recent investigations into the structure of the cranial and spinal nerves.

W. H. GASKELL.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. T. C. Fitzpatrick, of Christ's College, has been appointed an Assistant Demonstrator of Physics.

Prof. H. M. Ward, M.A., of Christ's College, has been appointed Examiner in Botany in the place of Prof. Bayley Balfour.

Dr. R. D. Roberts has been appointed an Elector to the Harkness Scholarship.

The name of Mr. Adami, the new Demonstrator of Pathology, was misprinted Adams in our last issue.

SCIENTIFIC SERIALS.

Bulletin de l'Académie Royale de Belgique, February.—Researches on the colloidal state, by C. Winssinger. This is the first part of a memoir describing a series of experiments undertaken to determine the various conditions of the colloidal state—that is, of the state assumed under certain circumstances by bodies generally insoluble in water. For the present the author confines himself to describing the mode of preparation and the chief properties of the colloidal substances. All the