THE METHODS OF FUNCTIONAL NEUROLOGY.

BY

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In a review of my book on the Nervous System of Vertebrates in the *American Naturalist* for November, 1907, occur some statements which require correction. Professor Parker says: "The eye and its nervous connections are put in the somatic afferent division, not because they are concerned with touch or any of the derived senses, but because in certain of the lower vertebrates the spinal nerve terminals are stimulated apparently¹ by light. The olfactory apparatus is classed under the visceral sensory division because it is concerned with the acquisition of food. The weakness of this classification is apparent from the fact that the reasoning by which the author is led to assign the olfactory apparatus to the visceral sensory division, if applied to the optic apparatus, would bring these organs under that head instead of under the somatic sensory. In a similar way the organs of taste ought not to be classed as visceral sensory organs, but as a somatic sensory mechanism, for the reason that the cutaneous sensory nerves of lower vertebrates are stimulated by sour and salt substances much as our organs of taste are." He follows these statements with severe condemnation of the book and censure of the group of neurologists which it represents, because they are following a wrong method which is bound to lead to false conclusions. Professor Parker would of course not say this if he did not believe it and think that he was doing a service to science. For this reason it is proper to make the following correction as to facts.

The reasons for the classification of the visual apparatus with the

¹ Why does Professor Parker use this word? I have simply accepted and followed his own positive statements in this matter. Professor Parker's second paper on this subject is interesting. It appeared November 1, 1905, and I was able to insert its results only in the proof sheets of the book. One of his conclusions there reads: "This sensitiveness of the vertebrate skin to light is probably a remnant of that primitive condition from which the lateral retinas were derived, etc." This is in entire accord with the extended argument contained in my paper in the *Journal of Comparative Neurology and Psychology* for May, 1905 (see p. 233).

somatic afferent division are very different from the one which he states. The optic centers were assigned to the somatic sensory division in 1902 before Professor Parker's first paper on the stimulation of cutaneous nerves by light was published (1903) and before I knew anything of this physiological fact. The reasons for the classification stated in the book are:

1. The primary optic centers form a part of the dorso-lateral column of the brain (p. 24).

2. These centers are at the same time centers for both primary and secondary fibers of touch (p. 150). Primary touch fibers reach the same region in all vertebrates including man (p. 115-116 and later work).

3. The optic tract is morphologically comparable—homologous—with the secondary tract of touch, the medial lemniscus (p. 150).

4. The retina itself is derived from the dorso-lateral zone of the embryonic brain (p. 44-45, 150).

5. The animal *responds* to light stimulation on the eye and on the spinal nerve terminals *by the same characteristic movements* (as shown by Parker) (p. 150). Throughout the book the mode of response to various types of stimulation is considered in determining functional and morphological relationships. This Professor Parker has overlooked.

Professor Parker's next statement requires correction as follows: "The olfactory apparatus is classed under the visceral sensory division because it is" primarily and chiefly "concerned with the acquisition of food," *and equally* because it has centers in the brain in common with those of taste. Does Professor Parker mean to say, as he implies, that vertebrates use their eyes primarily and chiefly "in the acquisition of food"? In fact, they use the eyes primarily and chiefly *to see their way about*. Those forms (*e. g.*, teleosts, birds) which depend chiefly on their eyes for finding food at a distance also use their eyes primarily to see their way, to avoid obstacles and enemies, etc. Furthermore, they depend upon the somatic motor mechanism for catching food as well as for locomotion. The mode of response to visual stimuli is somatic. Again, the stimulation of cutaneous nerves by sour and salt substances would *not* be ground for classing taste organs with them or for any classification at all. The mode of response must be taken into account as well as the *normal* mode of stimulation to which the structures are adapted.

Professor Parker's statements show that he has failed to understand the method of functional neurology which he condemns. Nothing is more desired on the part of functional neurologists than thoughtful criticism of their work. The author has been very much gratified by

the way this book has been received among anatomists and biologists. Of all the numerous reviews both in this country and abroad, only this one has been adverse. All the neurologists who have reviewed it have expressed their appreciation of the attempt to seek the meaning of the nervous system by unifying the results obtained from the structural, functional, and phylogenetic modes of study. Many have offered in published reviews or by letter very helpful suggestions and criticisms. It has been my purpose here only to point out the errors in Professor Parker's statements. At the proper time and place I shall endeavor to explain in a more clear and simple manner than heretofore the principles involved in the functional analysis of the nervous system.