individual of all those contained in the plate. It would be interesting to know what effect on the composite its absence would produce. This element of what we may perhaps call prepotency is most likely to disturb these composite delineations; for, though in itself a very interesting phenomenon, it seems to be somewhat of an obstacle in this use of the new art. With this great contribution of Galton well in hand, we may at length hope that we shall be able to enter upon the study of that unexplored realm of the human face, and physiognomy become a tolerably exact science. Some such process as this seems to offer the only chance of obtaining valuable generalizations in this field of inquiry.

The citizens' committee of Montreal, formed to arrange for the entertainment of the British association last summer, has every reason to be congratulated on the success of its enterprise. Not only was the meeting a marked success in every point in which the citizens' committee had power to contribute to it, but the report presented at its final meeting a fortnight ago showed with what care it had employed the funds intrusted to it. Parliament granted $20,000 toward passage-money to the British members; and this was so carefully expended and accounted for, that there remains a considerable sum (about $2,600) to cover in to the treasury, — a new experience for a parliamentary grant of this sort. The Dominion government further voted $5,000 for general expenses, the corporation of Montreal an equal sum, and the citizens subscribed $4,580.97. This, too, has been managed with such care, that, apart from the expenses of the meeting, the committee is able to publish an edition of fifteen hundred copies, largely for gratuitous circulation, of a volume of economic papers, and then have on hand a surplus of $1,500. This the committee recommended should be given to McGill college in recognition of, and partial compensation for, its liberality in placing the building and grounds of the university at the disposal of the association. This was voted with the understanding that it should be used in some special way, such as for prizes or scholarships, to commemorate the meeting of the British association in Montreal. The success of the work of the committee was believed to be largely due to the excellent judgment and unwearied service of Mr. D. A. P. Watt and Lieut.-Col. Crawford, to the former of whom his associates presented a pleasing memento.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The ontogeny and phylogeny of the hypoglossal nerve.

It cannot be otherwise than gratifying when two investigators, travelling along entirely distinct paths, unknown to each other, find themselves suddenly brought face to face upon the same stand-point. Haeckel's dictum, that the ontogeny of any form is a brief recapitulation of its phylogeny, is continually receiving confirmation, and, taking into consideration cenogenetic modifications, may be accepted as a dogma. If, then, a theory as to the past history of any form or organ which has been deduced from embryological data is also to be deduced (and that, too, independently) from comparative anatomical studies of adult forms, there are strong reasons for its acceptance.

A case of this kind has occurred quite recently. Since van Wijhe's interesting and important observations on the mesoderm segments of the elasmobranchs, the view that the hypoglossal nerve has been derived by a separation of fibres from the ventral roots of the vagus has very generally been accepted. In a paper very shortly to appear in the 'Studies from the biological laboratory of the Johns Hopkins university,' an entirely different view will be supported.

From a comparative study of the origin and distribution of the anterior cervical nerves in the various orders of the class Pisces, I have been led to the conclusion that the post-occipital nerves, as they may be termed, of Amia and other ganoid forms, are comparable to the anterior cervical nerves of the elasmobranchs, and in the teleosts and marsipobranchs have passed backwards, and become incorporated with the first spinal nerve. The apparent first spinal, therefore, represents three nerves. In the urodelous Amphibia, one finds, however, an arrangement more similar to what obtains in the elasmobranchs, there being in the anterior spinal region three distinct nerves, whose combined distribution resembles very closely that of the first spinal nerve of the teleosts, and may therefore be considered its equivalent. In the Anura there is a reduction in the number, the first nerve disappearing, or fusing with the second, so that two nerves here fulfil the function of the original three. In all these ichthyopsidan forms there is no true hypoglossal, this nerve making its appearance in the Sauropsida. From its distribution, it is apparently homologous with the three anterior spinal nerves of the urodelous Amphibia. As

a result of these comparisons, it may be concluded that the hypoglossal nerve of the Sauropsida and Mammalia is not a separation from the anterior roots of the vagus, but *is formed by the coalescence of a number — probably three — of anterior spinal nerves.*

Since the completion of my manuscript, the last number of the *Archiv für anatomie und physiologie* has been received; and therein is a paper by Professor Froriep of Tübingen, dealing, among other things, with this very point as to the origin and morphological relations of the hypoglossal. His observations were carried on by means of sections through very young sheep and cow embryos; and he was able to perceive that the hypoglossal at an early stage consisted of three distinct parts, which eventually unite; the union occurring first near the origin of the nerve, and proceeding centrifugally. To emphasize the similarity between Froriep's results based on embryological data, and my own deduced from anatomical facts, it will be well to quote a sentence from his paper. In summing up, he says, "The hypoglossus is formed by the union of a number of segmental spinal nerves, each of which is composed of two roots, — a ventral and a dorsal, — exactly like spinal nerves." J. PLAYFAIR MCMURRICH.

Johns Hopkins university, Baltimore, Md.

The Wisconsin bill relating to the instruction of deaf-mutes.

In *Science* (vol. v. p. 324) you state, that, until the present year, no special provision had been made in Wisconsin for the education of deaf-mutes. This is a mistake. The Wisconsin institution at Delavan, one of the best in the country, has been in successful operation since 1852, and two private schools are also in existence. The returns of the recent census, however, have shown that a large number of the deaf children of Wisconsin are growing up in ignorance, and that existing provisions for their instruction are inadequate. The bill that has just passed the Wisconsin legislature is an attempt to remedy the evil by a change in the policy of the state towards her deaf and dumb. The new plan may be tersely described as the policy of *decentralization*. The old policy of *centralization* — that is, the policy of collecting into one school all the deaf-mutes of a state — has everywhere failed to bring under instruction a large proportion of the deaf-mutes of school age. For example: there were in the United States in 1880, according to the last census, 15,059 deaf-mutes of school age (six to twenty years); while the total number of deaf-mutes returned as then in the institutions and schools of America was only 5,393, and many of these were beyond the school age. A similar result is obtained when we examine the statistics of each state taken separately.

Parents have a natural reluctance to part with their deaf children, who, more than others, require home care and attention. But education in an institution involves separation from home. Some parents will not part with their children excepting on compulsion; others delay the separation until the most impressionable period of life has been passed; and still others deprive their children of education on account of the value of their labor at home.

The nearer the school can be brought to the home of a deaf child, the less likelihood is there that he will escape instruction. The promoters of the Wisconsin bill believe that in many of the incorporated cities and villages of that state the deaf children could, with limited state aid, be educated in the localities where they reside; and that, if day-schools were established wherever possible, the institution at Delavan would be able to accommodate all who could not attend a day-school.

The bill grants state aid to any incorporated city or village supporting a school for deaf-mutes, to the extent of a hundred dollars per annum for every pupil instructed. The state appropriation alone will probably be sufficient to provide a teacher for a school of four or five deaf children; but even a school containing only one deaf child, which, of course, would have to be supported mainly from local sources, may, by complying with the provisions of the bill, receive state aid to the amount of a hundred dollars per annum.

Under such a law, there should be no excuse for lack of instruction. Public opinion will probably compel the education of deaf-mutes: for, if allowed to grow up without instruction, they very easily become dangerous members of society; while, if educated, they become good citizens, amenable to the laws of society, and sources of wealth to the state. If only as a measure of economy, the Wisconsin bill demands consideration; for the average per capita cost of the education of a deaf child in an American institution exceeds two hundred and twenty-three dollars, whereas the cost to the state, on the Wisconsin plan, is limited to a hundred dollars.

But other considerations are of still greater importance. It certainly seems reasonable to expect that the Wisconsin plan, consisting of a central institution and a large number of small day-schools scattered throughout the state, will bring under instruction a larger percentage of the deaf children of school age than would be possible on the institution plan alone. Instruction can also be commenced in the day-schools at an earlier age than heretofore; so that many pupils could receive preparatory instruction in a day-school before entering the institution, and thus be enabled to receive from the institution a higher and better education than they could otherwise hope to obtain.

ALEXANDER GRAHAM BELL.

Washington, D.C., April 27.

A complete fibula in an adult living carinate-bird.

The only known bird with a complete fibula is the Jurassic Archaeopteryx (Marsh, Dames). The fibula of all birds is complete during the early life of the embryo. I find in an adult Pandion carolinensis of Prof. O. C. Marsh's collection an entire fibula, but with the distal end of it not in front of the tibia, as in Archaeopteryx (Marsh). It would be interesting to examine the embryos of this bird; and I will be very much obliged to anybody who can send me any of them. DR. G. BAUR.

Yale-college museum, New Haven, Conn., April 24.

Digestion experiments.

I have read with some surprise the comments by Dr. E. Lewis Sturtevant in *Science*, April 24, upon my article on 'Errors in digestion experiments,' inasmuch as I had no intention, in that article, of asserting or implying any thing whatever in regard to other experiments of that character in this country. The purpose of the article was to call attention to the