aquatic and amphibious mammalia (otters, seals, whales, etc.), and others detrimental to fish. As if this were not sufficiently catholic, division 40 is a trap to catch any interests not already retained. It is defined as follows, under the head 'scientific investigation:' physico-chemical investigation into those qualities of salt and fresh water which affect aquatic animals; investigation of the bottom of the sea and of lakes, shown by samples; aquatic plants in relation to fishing, etc.; researches into the aquatic fauna (animals of the several classes preserved in alcohol, or prepared, etc.); apparatus and implements used in such researches.

Ten of the twenty-three subjects announced for the essays are purely biological, and many of the others can be handled only by scientific investigators.

The fisheries exhibitions of to-day are therefore more than their names would seem to indicate. Perhaps they might more appropriately be called hydrological exhibitions. Their scope has increased as they have become more popular. The first, held at Amsterdam in 1861, was much less ambitious. Others followed at Bergen, Norway (1865), Arcachon, France (1866), Bologne (1866), The Hague (1867), Aarhuus, Denmark (1867), Vienna (1867), Gothenburg, Sweden (1867), Havre (1868), Naples (1871), Berlin, London (1878); and in Berlin, in 1880, the climax was apparently reached in a display, which, for extent and completeness, no one supposed would ever be surpassed. Great Britain has since had exhibitions at Edinburgh, Norwich, and Tynemouth; and attention of the whole nation is now concentrated upon the exhibition which is to be opened by the Queen on the 12th. It is generally admitted that it is the most important exhibition held here since the Great exhibition of 1851. Twenty-five nations and colonies are represented. In the catalogues and in the announcements the place of honor is given to the United States; and the officers do not hesitate to admit that the success of the affair was largely assured by the prompt and liberal action of our government, — action which may be regarded as, in part, an acknowledgment of the very generous manner in which England participated in our own exhibition in Philadelphia in 1876.

South Kensington, May 1. G. BROWN GOODE.

THE WEDGE-PHOTOMETER.

THIS instrument has been attracting considerable attention during the last year, and has been especially studied by Professor Pritchard of Oxford and Professor Pickering of Harvard, to each of whom we owe a form of the instrument. It depends for its efficiency on the accurate observation of the time of extinction of the light of a star; and as it is evident that the various sources of error in photometric work — moonlight, the state of the atmosphere, the condition of the eyes of the observer, the position of observation, whether that of comfort or constraint — would affect a faint point of light near extinguishment more than they would the brighter lights used in other photometric methods, any contribution to the question of the accuracy to be expected from the wedge-photometer may be of interest.

The instrument employed by me is of the form suggested by Professor Pickering. It was made by Mr. J. Grunow of New York, and seems to be very good work. It consists of a wedge of London smoke glass an inch square, and about a twentieth of an inch thick at its blunt edge, a large low-power positive eye-piece, and a special adapter, and is a very convenient photometer to use. The color of the wedge is deep enough to give one magnitude of the ordinary scale of the brighter stars for each five seconds in the time of extinction at the equator.

For the study of the accuracy of observation with this instrument, I selected the Durchmusterung star 22°.2164, of which Argelander puts the magnitude at 5.3. In observation I took alternate observations on this, and the star to be compared with it, until I had five for each star, which I called a set of observations. By this method I made the conditions of observation as nearly as possible the same for the two stars, and thus the difference in their time of extinction nearly free from error.

My comparisons were made chiefly with the star Durchmusterung 22°.2163 of the catalogued magnitude 8.8. Between April 2 and April 29 I made twenty-eight sets of observations on the two stars. The difference in their time of extinction varied from 19.1 seconds to 21.6 seconds; approximating, however, pretty closely to the mean 20.6 seconds, of which the probable error was ±0.09 in seconds, equivalent to ±0.015 in magnitudes. The mean error of a single set of observations is ±0.68 seconds, or ±0.12 magnitudes. A series of four sets of comparisons of star 21°.2156 gave a mean error of ±0.68, and a probable error of ±0.23; and a series of five sets with 21°.2156 gave ±0.83 and ±0.24, in both cases in seconds.

These observations were made under various conditions with no more than usual care, and probably represent fairly the accuracy easily attainable. With further practice the errors could probably be reduced. In general, my observations seem to show that single sets of observations by this wedge-photometer are trustworthy to one or two tenths of a magnitude. If so, there is much that can be done by it; and as the simplicity, convenience, and inexpensiveness of the instrument are such as to recommend it, similar instruments could properly be a part of the outfit of every observatory.

The above errors are correct on the supposition that none of the stars examined were variable; and I found no evidence that they were. In the case of another star, however, either the star was variable, or the errors made were much larger than in the other cases, though the observations were made at about the same time. The star in question is 22°.2162. The average difference between it and 22°.2164 is 25.1 seconds for twenty-three sets; but the individual sets range from 28.0 seconds on the 15th, at 13h. sidereal time, to 22.3 seconds on the 19th, at 12h. The mean error of a single set is 1.34 seconds, and the probable error of the mean, ±0.58 second. As I believed I could trace with the eye a change in the brightness of the star, I think we have in this case a variable, with a range of about one magnitude, rather than observations much less accurate than others taken at the same time. M. W. HARRINGTON.

NOTES UPON THE FOETAL MEMBRANES OF THE OPOSSUM AND OTHER MARSUPIALS.

I RECENTLY had the good fortune to receive from Mr. Robert Speir of South Orange, N.J., a female opossum which had been captured within a few days after impregnation. I was thus enabled to make very satisfactory observations upon the foetal membranes, about which there has been so much uncertainty for many years. These embryos were in an early stage of growth, and, although they plainly showed very novel and unexpected features, no positive conclusions could be reached as to their later development. At this point a correspondence with Professor Wilder of Cornell resulted in his very generously sending me a quantity of marsupial material which he had procured from Australia. Among this material was a nearly perfect foetus in a late stage of development. An examination of this fully confirmed the observations upon the opossum embryos, and showed the relations of the foetal membranes at a later period. More recently Professor Chapman, of the Jefferson medical college, has kindly allowed a thorough examination of a valuable kangaroo foetus in his possession, which he has described in the proceedings of the Philadelphia academy for 1881. This foetus was in a stage intermediate between that represented by the opossum embryos and that of the foetus sent me by Professor Wilder: it showed the same features as the other specimens in an intermediate stage of growth.

In all these specimens the membranes are arranged very much as those of a kangaroo foetus which Professor Owen described in 1833. The peculiarity of the foetal membranes of this animal, which has ever since been used as a basis of classification distinguishing the marsupials from the higher mammals, is, that the allantois never attains a very great size, so that nothing like an allantoic placenta is formed; and the function of absorbing the maternal nutrition, during the short period of intra-uterine life, has always been considered to have devolved entirely upon the yolk-sac. Professor Owen, in the older of the specimens which he examined, found that the membranes were arranged as follows:[1] the foetus was enveloped in a large subzonal membrane, with folds fitting into uterine furrows, but *not adhering to the uterus, and without villi;* the embryo was enveloped in an amnion reflected over the stalk of the yolk-sac. This sac was large and vascular, and was connected with the foetal vascular system by a vitelline artery and two veins. There was a small allantois supplied by two allantoic arteries and one vein: it was quite free, and not attached to the subzonal membrane. The area of attachment of the yolk-sac to the inner surface of the subzonal membrane formed a disk bounded by the sinus terminalis, or circular venous trunk. When spread out, therefore, the yolk-sac formed the figure of a cone, of which the apex was the umbilical cord, and the base the sinus terminalis.

These valuable observations were confirmed by Professor Chapman in his paper referred to above. They are accurate so far as they go; but they leave us in doubt as to the real relations which exist between the foetus and the mother, inasmuch as they give no clew to the manner in which the embryo is nourished during its intra-uterine life, — a period of about

[1] This description is largely taken from Balfour's Comparative embryology, vol. ii. p. 199.