In this instrument the alternations in brightness at any point in the field when the slide is moved are beats due to the Doppler effect just as truly as are those heard in the second form of Koenig's experiment.

ALBERT B. PORTER.

CHICAGO,
January 14, 1905.

NOTE ON THE BROAD WHITE FISH.

IN the *Proceedings* of the American Philosophical Society of Philadelphia, XLIII., 1904, p. 451, plates VIII. and IX., I have wrongly identified the broad white fish, or *Coregonus kennicotti* Jordan and Gilbert, as the humpback, or *Coregonus nelsonii* Bean. My error was due largely to lack of material, ignorance of the species from autopsy, and the fact, as I have since discovered, that *C. nelsonii* does not always exhibit the well-developed hump like that of the type. Possibly when the Siberian forms are carefully studied the nomenclatures of these fishes will be more stable.

HENRY W. FOWLER.

ACADEMY OF NATURAL SCIENCES,
PHILADELPHIA, February 5, 1905.

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*RECENT ZOOPALEONTOLOGY.**

DURING the past thirteen years great advances have been made in our knowledge of the ancient mammalian life of North America, especially through the explorations in the Rocky Mountain region carried on by the Carnegie, Field Columbian and American Natural History Museums. The long Tertiary period has been clearly subdivided into a series of stages and substages. This enables paleontologists to record more accurately than ever before the time of arrival and departure of the larger and smaller quadrupeds from North and South America, Asia, Europe, Africa, and to determine more precisely when the connection of North and South America was interrupted by a gulf flowing between the Atlantic and Pacific Oceans, and when the connection was again made by the elevation of the Isthmus of Panama; this demonstrates also that a very much closer connection existed between the animal life of Europe and of North America through continuous intermigration over the broad land area now submerged beneath the Behring Straits. A series of six world maps prepared by Dr. W. D. Matthew clearly exhibit this submergence and emergence of the isthmuses between these great continents.

Of especial interest is the recent discovery by the Geological Survey of Egypt that the whole race of mastodons and elephants originated in Africa, entered Europe in the middle of the Tertiary and soon afterward found their way into North America and somewhat later into South America. We have now been able to fix very positively the date of actual arrival of these animals in North America. It appears probable that successive waves of migrations of European and Asiatic species of elephants and mammoths came to this country. In the meantime there survived here from one of the earliest African migrants the eastern American forest mastodon which lived until comparatively recent times.

The theory of multiple races or polyphyletic evolution not only of elephants but of horses, rhinoceroses, camels and titanotheres appears to be clearly established through these recent discoveries. It was formerly believed, for example, that the modern horse had a single line of ancestors extending back into the Eocene period; now it appears that in North America there were always four to six entirely different varieties of the horse family living contemporaneously, including slow-moving, forest-living horses with broader feet, and very swift plains-living horses with narrow feet fashioned more like the deer. Intermediate between these arose the variety which survived and gave rise to the true modern horse. Furthermore, it appears that the modern horses separated from the asses and zebras at a much more remote period than has been generally supposed, and we are now endeavoring to ascertain accurately when this separation occurred.

The same discovery of multiple races has been made among the rhinoceroses. In Eu-

* Abstract of a lecture delivered by Professor Osborn before the Society of Naturalists at the Philadelphia meeting.

rope and in North America instead of forming a single line of evolution there were at least seven or eight nearly contemporary but distinct lines of rhinoceros succession, some of which can be traced back as far as the base of the middle Tertiary. The truly American rhinoceroses which appear to have branched out into several water-living, forest-living and plains-living types, were reinforced by the sudden appearance of the extremely short-limbed rhinoceroses which had evolved in Europe and came over to this country simultaneously with the earliest elephants or mastodons.

Another remarkable feature of this law of multiple evolution is that even where these varieties have evolved quite separately and independently, they still have inherited from remote common ancestors certain tendencies or potentialities of evolution which were latent but not expressed in the ancestral forms but which find a more or less simultaneous expression in the derived forms. Thus, among the rhinoceroses and titanotheres the rudiments of horns begin to appear more or less simultaneously in several of these multiple independent races or varieties, indicating a hereditary predisposition toward the development of certain organs quite unsuspected in the earlier evolutionary writings of Lamarck and Darwin. This predisposition to evolve certain structures tends to establish the idea that the laws of development are not controlled *solely* by the survival of the fittest as according to the original Darwinian theory, nor by the inherited effects of use and disuse as according to the Lamack-Spencer theory, but represent the budding out or expression of certain innate or inherited ancestral tendencies.

Among the greatest surprises in recent discovery has been the finding of armadillo-like edentates in the Rocky Mountain region near Ft. Bridger, Wyo., from rocks of the lower Tertiary period. These armadillos certainly bore a leathery if not a bony shield. Some ossicles indicating the presence of the bony shield are reported to be present in the collections of the Yale Museum; the remains thus far found by the American Museum exploring parties show a provision for the shield in the structure of the backbone but do not exhibit the bony elements of the shield itself.

Almost equally surprising results of ten years' exploration are the tracing back of the dog family into the Lower Eocene, of the saber-tooth tiger family into the Middle Eocene, of the camel family into the Upper Eocene, of the hedge-hogs (now extinct in this country) into the Lower Oligocene, of the raccoons into the Lower Miocene. The camel family, like the horses and the rhinoceroses, branched out into a great many varieties, short- and long-limbed, most remarkable among the latter being the giraffe-camel (*Alticamelus*), which, although a true camel, was closely similar in build to the giraffe. With these discoveries the names of Scott, Wortman and Matthew are honorably associated.

It has long been known that the deer, bear, moose, the oxen and sheep families did not appear in this country until very late in geological times, shortly before the Ice Age.

Among the many difficult and still unsolved problems is the cause of the total extinction of the horse in North and South America while it survived and multiplied in Europe, Asia and Africa. Just before the time of the extinction of the horse, America exhibited the greatest beauty and variety in the development of this family. As studied by Gidley, there were horses exceeding in size the enormous Percherons of to-day and there were also varieties smaller than the most diminutive Shetlands. Yet with all this wide range of variation all became extinct.

The elephants also exhibited three great varieties, the true mammoth (*E. primigenius*) to the north, the Columbian elephant in the central states, and the gigantic Imperial mammoth to the south, forms shown to be quite distinct by Lucas and undoubtedly adapted to various kinds of climate; yet all died out with the great wave of death which swept off the camels, horses and the giant South American sloths, just before or during the first advance of the Glacial period. H. F. O.

SCIENTIFIC NOTES AND NEWS.

The senate of the University of Edinburgh has voted to confer its honorary doctorate of