is the shoal channel which separates the South Shetlands from Cape Horn, which is a region of great snowfall. Therefore should the antarctic ice gain sufficient thickness to rest on the bottom of this shallow sea it would move into the Cape Horn channel and eventually close it. The ice growth would not be entirely from the southern continent, but also from lands in the region of Cape Horn. Thus the antarctic continent and South America would be connected by an isthmus of ice, and consequently the independent circulation of the Southern Ocean arrested. Hence it will be seen that the westerly winds, instead of blowing the surface waters of the Southern Ocean constantly around the globe, as they are known to do to-day, would instead blow the surface waters away from the easterly side of the ice-formed isthmus, which would cause a low sea-level along its Atlantic side, and this low sea-level would attract the tropical waters from their high level against Brazil well into the southern seas, and so wash the antarctic continent to the eastward of the South Shetlands.

The tropical waters thus attracted southward would be cooler than the tropical waters of to-day, owing to the great extension of cold in the southern latitudes. Still they would begin the slow process of raising the temperature of the Southern Ocean, and would in time melt the ice in all southern lands. Not only the Brazil currents would penetrate the southern seas, as we have shown, but also the waters from the high level of the tropical Indian Ocean which now pass down the Mozambique Channel would reach a much higher latitude than now.

The ice-made isthmus uniting South America to the antarctic continent would, on account of its location, be the last body of ice to melt from the southern hemisphere, it being situated to the windward of the tropical currents and also in a region where the fall of snow is great; yet it would eventually melt away, and the independent circulation of the Southern Ocean again be established. But it would require a long time for ice-sheets to again form on southern lands, because of the lack of icebergs to cool the southern waters. Still, their temperature would gradually lower with the exclusion of the tropical waters, and consequently ice would slowly gather on the antarctic lands.

The above theory thus briefly presented to account for the climatic changes of the high southern latitudes is in full accord with the simple workings of nature as carried on to-day; and it is probable that the formation of continents and oceans, as well as the earth's motions in its path around the sun, have met with little change since the cold era iced the lands of the high latitudes.

At an early age, previous to the appearance of frigid periods, the ocean waters of the high latitudes probably did not possess an independent circulation sufficient to lower the temperature so that glaciers could form. This may have been owing to the shallow sea-bottom south of Cape Horn having been above the surface of the water, the channel having since been formed by a comparatively small change in the ocean's level. For, while considering this subject, it is well to keep in mind that whenever the western continent extended to the antarctic circle it prevented the independent circulation of the Southern Ocean waters, consequently during such times ice periods could not have occurred in the southern hemisphere.

It will be noticed that according to the views given above, the several theories which have been published to account for great climatic changes neglect to set forth the only efficacious methods through which nature works for conveying and withdrawing tropical heat sufficient to cause temperate and frigid periods in the high latitudes. While lack of space forbids an explanation of the causes which would perfect an ice period in the northern hemisphere, I will say that it could be mainly brought about through the independent circulation of the arctic waters, which now largely prevent the tropical waters of the North Atlantic from entering the arctic seas, thus causing the accumulation of ice sheets on Greenland. But before a northern ice period can be perfected, it seems that it will need to co-operate with a cold period in the southern hemisphere; and in order to have the ice of a northern frigid period melt away, it would require the assistance of a mild climate in the high southern latitudes.

C. A. M. TABER.

Wakefield, Mass., Aug. 14.

BOOK-REVIEWS.

The Journal of the College of Science, Imperial University of Japan. Vol. IV., Part I.

THIS volume forms a fitting complement to the numbers already issued, and indicates the advanced position of the college and the high standing of its teachers and special students. If any thing would commend an institution to the generous attention of the government it is the admirable work which has been embodied in the various memoirs of the series. The present number opens with a memoir by Professor K. Mitsukuri on the "Fœtal Membranes of Chelonia." It is one of a series on the embryology of *Reptilia*. The first one, in which Mr. Ishikawa was joint author, was on the germinal layers of Chelonia. The fœtal membranes of *Reptilia* have been supposed to bear a close resemblance to those of birds. Mr. Mitsukuri has found many notable features which have, hitherto, been overlooked, and these appeared so remarkable that he has made them the subject of his memoir. Ten beautiful plates accompany the text.

Mr. Kamakichi Kishinouye gives the results of his researches on the "Development of the Araneina," illustrated by four plates. The material for study was obtained on the grounds of the university, and this included *Lycosa*, *Agalina*, and other genera of spiders. His method of treating the eggs is given in full, and will be found of great value to the student. His discussion of the formation of the pulmonary lamellæ or lung-book is very interesting. He thinks it probable that the lung-book was derived from the gills of some aquatic arthropodous animal, such as Limulus, comparing it with the lamellar branchia of Limulus sunk beneath the body surface. He shows that an invagination of the first abdominal appendage gives rise to the lung-book, and a similar invagination at the base of the second gives rise to a tube—abortive trachea. Many other interesting points are developed or sustained in this memoir.

Mr. Oka has a memoir on a new species of fresh-water polyzoa, *Pectinatella gelatinosa*. His methods of preparation will be found valuable to students of this group. His allusions to the views of Hyatt and Morse as to the anterior region of the polypidæ refer to views uttered over twenty-five years ago, when the polyzoa and brachiopods, with the tunicates, were supposed to be molluscan. These views are antiquated, and have long since been abandoned by the authors in question. Circulation is showed by Oka to be by ciliary action. He confirms Verworn in showing ciliary action on the external wall of the alimentary canal. Important observations are made on a pair of excretory organs which are ciliated and communicate with the epigastric cavity by wide openings. Their external openings have not been found, but the relation these bear to the segmental organs of brachiopods and worms seems unquestionable. An exhaustive discussion is given to the development of the statoblast, and the longitudinal sections depicted are of great value. The memoir is a solid contribution to the literature of this interesting group of animals. Four plates illustrate the details of anatomy and development.

Mr. Seitaro Goto has a memoir, with three plates, on a new form of Diplozoon, to which he gives the specific name of "nipponicum." He gives reasons for separating it from the single species known as paradoxum. The curious creature is described in detail, and interesting points are added to what has already been known.

A new species of hymenomycetous fungus injurious to the mulberry tree, illustrated by four plates, is described by Mr. Nobujiro Tanaka, with a discussion of this fungus, which has caused much destruction of the mulberry tree in Japan.

Notes on the irritability of the stigma, by Mr. Miyoshi, are illustrated by two plates. The author shows conclusively that this irritability, as Hermann Müller first suggested, has to do with the cross-fertilization of the flower, and is not for protection against wind and rain. Irritability is excited by an insect or a bristle, and not by a drop of water or by blowing against it.

Notes on the development of the suprarenal bodies in the mouse, with two plates, are by Mr. Masamaro Inaba. In this paper is discussed the mode of origin of the two substances which go to make up the suprarenal bodies. He comes to the conclusion that

the cortical cells are derived from the peritoneal epithelium, as stated by Janosik; and the medullary substance from the sympathetic elements, as described by Professor Mitsukuri.

In these various memoirs the authors express their indebtedness to Professors Mitsukuri, Iijima, and Yatabe for aid and advice. The plates are marvels of beautiful lithography, and the drawings are made with that skill and accuracy which characterize all their work.

Taxidermy and Zoölogical Collecting. By WILLIAM T. HORNADAY. New York, Scribner. 8°. $2.50.

WHO the author of this work is, is certainly well known to most of the readers of *Science*. For years he has been connected with the National Museum as the chief taxidermist, and for a long time previously he was the taxidermist of a prominent natural science establishment. So it is with regret that we learn that Mr. Hornaday is to retire entirely from taxidermy forever. But associated with the chief author of the book was Dr. W. J. Holland, who supplied the chapters on collecting and preserving insects.

The considerable popular interest in zoölogy, and the great numbers of young naturalists coming forward, give reason to suppose that the book will meet with a considerable demand, especially as there is no other book of equal scope available.

The author urges on those who care for the preservation of specimens of many forms of animal life that they must be up and doing. It is already too late to collect wild specimens of the American bison, California elephant seal, West Indian seal, great auk, and Labrador duck. Very soon it will be impossible to find walrus, manatee, fur seal, prong-horn antelope, elk, moose, mountain sheep, and mountain goat. Then ducks are being rapidly exterminated for market, and numerous birds for the sake of fashion.

The first part of the book is on collecting and preserving. This is by no means an unimportant part of the whole, occupying nearly one hundred pages, and covers every part of the work of collecting zoological specimens, even to birds' eggs and nests.

Taxidermy is treated in the second part, which occupies one hundred and fifty pages. This opens with an account of the worker's laboratory, and closes with hints as to the most effective ways of "making up" the finished specimen, for they must resort to paint as well as some other faded beauties.

There are then a number of pages devoted to the making of plaster casts. This makes the third part of the book, which is followed by the part (IV.) devoted to osteology, or at least so much of it as can be applied in the collecting and mounting of skeletons.

The closing chapters are on insect collecting, by Dr. Holland. The book is liberally illustrated, credit being given by the author to Mr. Frederick A. Lucas for much assistance in this feature.

AMONG THE PUBLISHERS.

THE *Chautauquan* for September presents the following among other articles in its table of contents. "Russia and the Russians," by Mrs. C. R. Corson (illustrated); "The American Association for the Advancement of Science," by Marcus Benjamin; "What