iferous. Mr. Topley of the English survey then spoke of the general acceptance, by the various European surveys, of the theory of the change of sedimentary to crystalline rocks; and here the discussion of the archean rocks ended.

Members of the English survey exhibited maps colored so as to represent the solid geology; and others, of the same places showing the geology as it is actually seen upon the surface, that is, including the drift. This latter was regarded as valuable in connection with questions of water supply. Doubt was expressed, however, about the value of such surface maps save for local and temporary purposes, and it was suggested that some method be devised by which it would be possible to represent both solid and surface geology upon the same sheet.

The plan of Mr. Gilbert, of the U. S. geological survey, for a subject bibliography of North American geology, elicited some discussion. The section evidently felt a deeper interest in this paper than it was ready to express on so short a notice.

A brief account of his work upon the Jurassic mammals of America was given by Professor Marsh. Six years ago no Jurassic mammal was known; but five years ago they were found in Wyoming, and from one pocket alone from three to four hundred individuals have been taken, representing eight genera and twenty species.

Sir William Dawson spoke at some length upon the ancient land flora of the old and new world, calling attention to the striking correspondence found in countries widely separated.

Two paleontological papers by Mr. G. F. Mathews were spoken of in high terms, especially by the Canadian geologists; and the hope was expressed, that if, as had been suggested, one of the Canadian papers should be published in full by the association, the one upon the primitive Conocoryphean should be selected.

A paper by Prof. J. Milne, upon the earthquake phenomena in Japan, referred to the mechanical difficulties to be dealt with in his observations, and described a new earthquake house he has built upon large balls resting upon iron plates. Three hundred and eighty-seven earthquakes had been observed by him, eighty-seven per cent of which came from the sea.

Sir William Dawson then went over the leading facts worked out by Dr. Hall in his forthcoming geology of Palestine.

The last paper presented was by Mr. P. Hallett, and consisted of notes on Niagara Falls. For American geologists they contained nothing new.

It will be seen that nothing striking or new was presented to the section; indeed, some of the productions have been served up already a number of times and in various forms. But any thing different was hardly to be expected. The meeting was remarkable for bringing together workers in geology from every quarter of the globe. From Japan was Lyman, and a paper was read from Milne; from India were Blanford and Ball; from Australia were Blanford and Selwyn; from Africa was T. Rupert Jones; from Palestine was Professor Bauerman, and a paper was read from Hull; from Brazil was Branner; from England, Scotland, and Ireland, were the various members from those countries; from the States were Hall, Newberry, Marsh, Powell, and many others; while the Canadian workers were represented by Dawson, Selwyn, Whiteaves, and Adams.

PROCEEDINGS OF THE SECTION OF BIOLOGY.

IN opening the biological section Thursday, Aug. 28, the president of that section, Prof. H. N. Moseley, delivered an address upon the physiology of deep-sea life. Well fitted as Professor Moseley is to discuss the subject of deep-sea life, on account of his long participation in its investigation during the voyage of the Challenger, his address was not only a critical and discriminating review of some of the later results arrived at by other observers and experimenters, but was supplemented by many valuable statements and suggestions of his own.

Mr. C. Spence Bate, of Plymouth, Eng., read a paper on the geographical distribution of the macrurous Crustacea, which embodied many important notes on form, color, habits, and habitats of different genera of these animals. In allusion to points mentioned by Mr. Bate, Professor Moseley said that deep-sea forms either had very large eyes or had no eyes, and that there must be a source of light in the deep sea; that source was phosphorescence, but its light must be very dim. The question was still unanswered, whether the larvae of deep-sea crustacea were found at the surface, as are the larvae of other crustaceans, and had to descend two or three miles through the ocean to reach their feeding grounds as adults.

Prof. W. J. Sollas, of Dublin, read a long paper on the origin of fresh-water faunas. The main difficulties in the way of most marine animals becoming inhabitants of fresh water were considered under three different heads: first, the time requisite for the animals to adapt themselves to the new medium; second, the greater severity of climate experienced by animals in fresh water than in salt water; and, third, the inability of marine animals with free-swimming larval stages to enter the mouths of fresh-water streams, or to breed in flowing streams if they gained access to them. In regard to climate, it is a fact that many marine forms become fresh-water ones as we approach the tropics. But severity of the climate of fresh water is not alone sufficient to account for the absence from it of many families well represented in marine faunas. Professor Sollas had prepared an extensive table, comparing by orders and by families the animals of fresh with those of salt water, and finds as a rule, with some exceptions, which he accounts for by peculiarities of life-history, that fresh-water animals carry their ova in or about them during the earlier stages of development, or they develop by buds or statoblasts. Some marine forms have passed from the ocean into marshes, and

thence into streams; while other forms, especially during earlier geological times, owe their transfer into fresh water to the changing of marine into lacustrine areas. Professor Sollas reviewed some of the relations which the origin of certain fresh-water forms have to geological periods and changes, and considered some of the causes of modification of form and of prolongation of embryonic life of marine animals.

On the succeeding days a few papers upon the geographical distribution of animals were presented. Dr. G. E. Dobson pointed out that many of the most characteristic species of the chiropterous fauna of Australia have their nearest allies not in the Oriental but in the Ethiopian region, and instanced the presence of species of certain genera of bats in Madagascar and Australia which were poorly or not at all represented in India. We are therefore obliged, for this and other reasons, to suppose, that, at a comparatively recent period, a chain of islands connected Madagascar with Australia; the islands being sufficiently far apart to prevent the distribution of terrestrial mammals, yet near enough to permit the occasional passage of flying species. Later, a temporary connection of a similar kind probably extended between Madagascar and India. Treating geographical distribution of animals in a less general manner, was a paper by Mr. Howard Saunders on the geographical distribution of the Laridae (the gulls and terns), with special reference to Canadian species.

As to the distribution of plants, Professor Asa Gray, in his remarks on the characteristic features of North-American vegetation, called attention to the resemblances and the differences between the flora of North America and that of Europe, and to the causes of these resemblances and differences. The similarity of the trees of the Atlantic border to those of Europe was alluded to, and its cause discussed; and mention was made of the pleasure which the European botanist would experience in finding, in the new world, plants growing wild which are cultivated in the gardens of Europe. Among these are species of Rhododendron, Cypripedium, and Coreopsis. Turning to the differences between the flora of Europe and America, the wealth of species of trees and shrubs in the latter country was illustrated by numerical comparisons of the species of oaks and of many other trees in Canada with those found in England. Besides the far more numerous kinds of leguminous trees, and the remarkable wealth in species of Compositae which is noticeable in America, there are many tropical plants which extend northward into the United States. Such are various trees, and Sarracenia, Passiflora, Tillandsia, and numerous other herbaceous plants. After discussion of the part which the ice of the glacial period played in the distribution of plants over Europe and North America, Professor Gray reviewed the characteristics of the flora of the middle and western portions of North America. This paper was one of the few which the general committee voted to print in full in its proceedings.

Remotely connected as it is with the question of the distribution of trees in the United States, attention may be called to the Jesup collection in the New-York museum of natural history, which was briefly described in a paper by Prof. A. S. Bickmore. This collection, besides illustrating the wood, bark, leaves, and other parts of the trees of the United States, by dried specimens or by figures, inside the museum, is supplemented by having the trees about the museum numbered to correspond with the specimens, so that immediate reference can be made to the museum by any one who wishes to learn more about a tree seen in the park.

On the question of the affinities of different groups of animals, as shown by their anatomy or development, several papers of importance were read; but of the greatest value was the announcement made in a brief telegram from Professor Liversedge, in Australia, announcing that Mr. W. H. Caldwell, who is in Australia in order to study the development of some of the curious animals found there, had discovered that the Monotremata are oviparous, and that the egg is meroblastic. No statement was given in the telegram as to whether the facts were determined as regards Ornithorhynchus or Echidna; but the main points of interest are the discovery of the oviparous habits of a mammal, and the meroblastic development of its egg, as in reptiles, since the eggs of mammals are regularly holoblastic. This shows that we must turn to the reptiles for the ancestors of the mammals.

Prof. O. C. Marsh read a paper on the classification and affinities of dinosaurian reptiles. It was replete with facts derived from the large amount of material which has been accumulated within the last half-dozen years. Three orders were recognizable in the herbivorous, and one order in the carnivorous dinosaurs. In the carnivorous groups we have forms with greatly enlarged pelvis, and animals that sat down. One of them which was found the past year, Ceratosaurus, exhibits new characters for a dinosaur. The vertebrae are smooth in front and concave behind. The pelvis is made up of three coössified bones, as it is in birds, and not of separate bones as in Archaeopteryx and in other dinosaurs. Ceratosaurus also agreed with adult birds in having the three metatarsal bones coössified. The dinosaurs are thus shown to be very closely related to birds; and, in answer to a question, Professor Marsh called attention to the correspondence between the double sternum of larger dinosaurs and the ossification of the sternum from two centres in young birds.

Prof. A. Milnes Marshall showed, in a paper on the mutual relation of the recent groups of echinoderms, that Carpenter was correct in regarding the central capsule with its radiating axial cords in Comatula as the central nervous system, while the subepithelial bands, which Ludwig and others have regarded to be the true nervous system, are, in reality, nervous in character, but of subordinate importance. Professor Marshall has proved these points by a series of conclusive experiments, which he conducted at Naples upon the living animals. In regard to the homologues of the parts of the nervous system of

crinoids in other echinoderms, Professor Marshall says, "I consider that in crinoids the subepithelial bands most certainly are homologous with the radial or ambulacral nerves of a star-fish; and I consider that they represent a part of a continuous nerve-sheath which has retained permanently its primitive continuity with the epidermis. The axial cords, some of the branches of which can be traced into extremely close proximity with the subepithelial bands, I regard as portions of the antambulacral nerve-sheath which, like the radial cords of echinids, ophiurids, and holothurids, have lost the primitive position, and shifted into or through the dermis."

Mr. William Bateson, in a paper read by the secretary, upon the presence in the Enteropneusta of a structure comparable with the notochord of the Chordata, made some interesting comparisons in regard to the relative positions of the nervous system the digestive tract, and the supposed notochord in Balanoglossus and in vertebrates. He added further comparisons between this animal and the vertebrates, and between its larva 'Tornaria' and the larvae of echinoderms.

Among anatomical papers containing facts which have a less general bearing on theories of animal relationship may be mentioned, as of especial interest or importance, the following: Professor Moseley described the position and minute structure, as determined from sections, of the eyes and other sense organs in the shells of the Chitonidae. The same gentleman showed that the arrangement of the feathers in groups of three each in the dodo had a close connection with the filoplumae, or thread-feathers, one of which is found at each side of the feathers of birds of the dove-family, near which the dodo is placed. Earlier in the development of the doves' feathers, the filiplumae are larger, relative to the size of the other feathers; and this condition resembles still more the condition found in the dodo. Prof. R. Ramsey Wright described the histological structure of certain sensory organs of the skin of the horned-pout (Amiurus), and discussed the function of the air-bladder in the same fish, and the relation of its air-bladder to the auditory apparatus. Prof. J. Struthers, of Aberdeen, described the rudimentary hind limb of the hump-backed whale (Megaptera longimana), and compared its thigh-bone with the same bone in other cetaceans. In a hump-backed whale forty feet long; the thigh-bone was entirely cartilaginous, being on one side four inches, and on the other five and a half inches long.

As a contribution to our knowledge of curious habits of plants, Prof. H. N. Moseley communicated some observations on the trapping of young fish by Utricularia vulgaris, a water-weed. After sketching and describing the bladders of this plant, which have been known for a long time to capture small crustacea, the speaker said that it had been lately discovered that these bladders also entrap young fishes. The fish, usually caught by the tail, is often, on account of its struggling, gradually drawn almost entirely into the bladder.

At the beginning of the session on Friday the 29th, reports of several committees were presented, among them that on the Naples zoölogical station. In this report, after mention of the various undertakings of the station, and of the work accomplished by Mr. A. G. Bourne and by Prof. A. Milnes Marshall, the two late occupants of the British association table at the station, the committee recommended that the association renew its grant for the table, and increase the amount paid to a hundred pounds (instead of eighty and ninety pounds as in previous years). This recommendation was adopted by the association.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Trenton natural-history society.

Aug. 12. — Dr. C. C. Abbott continued his remarks on the life-history of Scaphiopus solitarius, the spade-footed hermit-toad. The adult toads appeared in April, when they presumably did not deposit eggs, and in June, on the 26th of which month eggs were laid. These hatched by July 3, and six days later the tadpoles showed small hind-legs. In thirty-one days after laying the eggs, the young resembled the adults in all except size, and, when placed on wet sand, at once buried themselves. Before leaving the water, they tend to prey upon each other. —— Dr. A. C. Stokes remarked in reference to a captive Tarantula arenicola, that, having been deprived of building-materials, she erected a wall of earth and small pebbles, and on July 8 formed an irregular dome over the burrow, leaving a central opening, which she closed with web. July 28 she destroyed the dome, and emerged with her abdomen thickly covered with young spiders. Although the latter were presumably only ten days old, they were becoming venturesome. They swarmed over the mother; but, when trespassing on her face, they were swept off by a stroke of her leg, and allowed to run back to her body. Occasionally they climbed up the tube, and wandered about the surface. Formerly the mother was very timid, retreating into the burrow when the observer arrived at a point twelve feet from the entrance; but, after the young appeared, she permitted the observer to approach and move about at pleasure. She also accepted food from the hand. She took a fly, and remained at the surface sucking its juices. The fly was removed from her mandibles by forceps, and a black ant offered; but it was thrown away as she throws away the excavated earth. A full account of the habits of this spider will be found in *Science*, iv. 114.