

abundant remains of horses are found, which horses resembled altogether our own species, or perhaps are still more nearly allied to the wild ass. The same is the case in America, where the species was very abundant in the Quaternary epoch—a curious fact, as, when first discovered by Europeans, there was not a horse from one end of the vast continent to the other.

In the Pliocene and older Miocene, both of Europe and America, are found a number of horse-like animals, resembling the existing horse in the pattern and number of the teeth, but differing in other particulars, especially the structure of the limbs. They belong to the genera *Protohippus*, *Hipparion*, &c., and are the immediate predecessors of the Quaternary horses.

In these animals the bones of the fore-arm are essentially like those of the horse, but the ulna is stouter and larger, can be traced from one end to the other, and, although firmly united to the radius, was not ankylosed with it. The same is true, though to a less marked extent, of the fibula.

But the most curious change is to be found in the toes. The third toe though still by far the largest, is proportionally smaller than in the horse, and each of the splint bones bears its own proper number of phalanges; a pair of "dew-claws," like those of the reindeer, being thus formed, one on either side of the great central toe. These accessory toes, however, by no means reached the ground, and could have been of no possible use, except in progression through marshes.

The teeth are quite like those of the existing horse, as to pattern, number, presence of cement, &c.; the orbit also is complete, but there is a curious depression on the face-bones, just beneath the orbit, a rudiment of which is, however, found in some of the older horses.

On passing to the older Miocene, we find an animal, known as *Anchitherium*, which bears, in many respects, a close resemblance to *Hipparion*, but is shorter-legged, stouter-bodied, and altogether more awkward in appearance. Its skull exhibits the depression mentioned as existing in *Hipparion*, but the orbit is incomplete behind, thus deviating from the specialised structure found in the horse, and approaching nearer to an ordinary typical mammal. The same is the case with the teeth, which are short and formed roots at an early period; their pattern also is simplified, although all the essential features are still retained. The valleys between the various ridges are not filled up with cement, and the little anterior premolar of the horse has become as large as the other grinders, so that the whole forty-four teeth of the typical mammalian dentition are well developed. The diastema is still present between the canines and the anterior grinding teeth—a curious fact in relation to the theory that the corresponding space in the horse was specially constructed for the insertion of the bit; for, if the Miocene men were in the habit of riding the *Anchitherium*, they were probably able to hold on so well with their hind legs as to be in no need of a bit.

The fibula is a complete bone, though still ankylosed below to the tibia; the ulna also is far stouter and more distinct than in *Hipparion*. In both fore and hind foot the middle toe is smaller, in relation to the size of the animal, than in either the horse or the *Hipparion*, and the second and fourth toes, though still smaller than the third, are so large that they must have reached the ground in walking. Thus, it is only necessary for the second and fourth toes, and the ulna and fibula to get smaller and smaller for the limb of *Anchitherium* to be converted into that of *Hipparion*, and this again into that of the horse.

Up to the year 1870 this was all the evidence we had about the matter, except for the fact that a species of *Palæotherium* from the older Eocene was, in many respects, so horse-like, having, however, well-developed ulna and fibula, and the second and fourth toes larger even than in *Anchitherium*, that it had every appearance of

being the original stock of the horse. But within the last six years some remarkable discoveries in central and western North America, have brought to light forms which are, probably, nearer the direct line of descent than any we have hitherto known.

In the Eocene rocks of these localities, a horse-like animal has been found, with three toes, like those of *Anchitherium*, but having, in addition, a little style of bone on the outer side of the fore foot, evidently representing the fifth digit. This is the little *Orohippus*, the lowest member of the Equine series.

This evidence is conclusive as far as the fact of evolution is concerned, for it is preposterous to assume that each member of this perfect series of forms has been specially created; and if it can be proved—as the facts adduced above certainly do prove—that a complicated animal like the horse may have arisen by gradual modification of a lower and less specialised form, there is surely no reason to think that other animals have arisen in a different way.

This case, moreover, is not isolated. Every new investigation into the Tertiary mammalian fauna brings fresh evidence, tending to show how the rhinoceros, the pigs, the ruminants, have come about. Similar light is being thrown on the origin of the carnivora, and also, in a less degree, on that of all the other groups of mammals.

It may well be asked why such clear evidence should be obtainable as to the origin of mammals, while in the case of many other groups—fish, for instance—all the evidence seems to point the other way. This question cannot be satisfactorily answered at present, but the fact is probably connected with the great uniformity of conditions to which the lower animals are exposed, for it is invariably the case that the higher the position of any given animal in the scale of being, the more complex are the conditions acting on it.

It is not, however, to be expected that there should be, as yet, an answer to every difficulty, for we are only just beginning the study of biological facts from the evolutionary point of view. Still, when we look back twenty years to the publication of the "Origin of Species," we are filled with astonishment at the progress of our knowledge, and especially at the immense strides it has made in the region of palæontological research. The accurate information obtained in this department of science has put the fact of evolution beyond a doubt; formerly, the great reproach to the theory was, that no support was lent to it by the geological history of living things; now, whatever happens, the fact remains that the hypothesis is founded on the firm basis of palæontological evidence.

#### THE LOAN COLLECTION CONFERENCES

CONSIDERABLE progress has been made in the arrangements for holding conferences in connection with the approaching Loan Collection of Scientific Apparatus at South Kensington.

In the Section of Mechanics, which includes Pure and Applied Mathematics and Measurement, the conferences will be held on May 17, 22, and 25, and the following gentlemen have promised to give addresses or to take part:—

Dr. Siemens, F.R.S., general address with special reference to Measurement.

Mr. F. J. Bramwell, F.R.S., on Prime Movers.

Mr. Barnaby, Director of Naval Construction to the Admiralty.—Naval Architecture.

Mr. W. Froude, M.A., F.R.S.—Fluid Resistance.

M. Tresca, Sous-Directeur du Conservatoire des Arts et Métiers, Paris.—Flow of Solids.

M. le General Morin, Directeur du Conservatoire des Arts et Métiers, Paris.—Ventilation of Public Buildings.

Sir Joseph Whitworth, Bart., F.R.S.—Linear Measurement.

Prof. Goodeve, M.A.—Solid Measurement.

Prof. Kennedy, C.E.—Kinematics.

Mr. W. Hackney.—Furnaces.

Prof. Sir W. Thomson, LL.D., F.R.S.—Electrical Measurement.

Mr. Westmacott.—Hydraulic Transmission.

Prof. Tilser (Bohemian Polytechnic Institute, Prague).

—His new Method of Descriptive Geometry.

In the Section of Physics (including Astronomy), the following arrangements have been made provisionally :—

May 16.—Address by the President, Mr. Spottiswoode ; Mr. Norman Lockyer, Capt. Abney, and Mr. Huggins—Spectroscopy ; Prof. Clifton—Interference ; Professors Adams and Stokes, and Mr. Spottiswoode—Polarisation ; Mr. Sorby, or Dr. Royston Pigott—Microscopes ; M. Becquerel and Prof. Stokes—Fluorescence ; Sir W. Thomson—Electrometers.

May 19.—Prof. Tyndall—Reflection of Sound ; Prof. Adams—Wheatstone's Researches ; Prof. Guthrie—Heat ; Mr. De la Rue—Astronomical Photography ; and M. Leverrier.

May 24.—Prof. Clerk-Maxwell, Prof. Andrews, and M. Tresca—Molecular Construction of Matter ; Mr. De la Rue—Electric Batteries ; Prof. Carey Foster—Galvanometers ; Baron Ferdinand von Wrangel—Voltsmeters ; M. Viandel—Gramme's Machine ; and M. Helmholtz.

The conferences in Chemistry will be held on the 18th and 23rd May, and the following communications have been promised :—

Address by the Chairman, Dr. Frankland, F.R.S., generally on the objects exhibited in this section, and specially on the instruments used for the investigation of gases.

Dr. J. H. Gilbert, F.R.S., on some points in connection with vegetation.

Mr. Donkin, Demonstrator of Chemistry in the Oxford Museum, on Sir B. Brodie's apparatus used in the investigation of ozone.

M. Fremy, Membre de l'Institut de France, on the preservation of animal food.

Prof. Roscoe, F.R.S., on Vanadium and its compounds.

Prof. Guthrie, F.R.S., on Cryohydrates.

The conferences in Biology will be held on May 26 and 29, and will relate chiefly to the following subjects, viz. :—

(1) The methods of measurement and registration which are applicable to the vital phenomena of plants, animals, and man ; (2) the methods and instruments employed in physiological optics and acoustics ; and (3) the modes of preparing the tissues of plants and animals for microscopical examination. Explanations of apparatus and instruments will be given by the President, Professors Donders, Hering, Marey, Crum Brown, M. Foster, Flower, M'Kendrick, Thielton Dyer, Messrs. Liebreich, Pritchard, Mosso, Gaskell, and others.

The Conferences in Physical Geography, Geology, Mineralogy, and Meteorology will be held on May 30, and June 1 and 2, and the following gentlemen have promised to take part :—

Mr. John Evans, F.R.S., general address on the objects exhibited in the section. In Meteorology, Prof. Roscoe, Mr. T. Stevenson, Mr. R. H. Scott, Mr. G. J. Symons, Dr. Mann, and Mr. Galloway. In Geography, Major Anderson, Lieut. Cameron, Mr. Clements Markham, Col. Walker, Professeur Forel, Prof. Wyville Thomson, and Mr. Francis Galton. In Geology and Mining, M. Daubrée, Prof. Ramsay, Mr. Rance, Baron Von Ettinghausen, and Mr. Topley. In Mineralogy, &c., M. des Cloiseaux, and the Rev. N. Brady.

#### NOTES

THE Eighth Annual Report of the Geological and Geographical Survey of the Territories, under the direction of Prof. F. V. Hayden, has just been issued from the U.S. Government

Printing Office. It is a report of progress of the explorations, mainly in Colorado, for the year 1874, and contains twelve articles in 500 octavo pages, and eighty-eight illustrations, including maps and sections. It commences with an introductory letter to the Secretary of the Interior, under whose auspices the survey is conducted, which contains a general account of the organisation of the various field divisions, and the progress of the work. Following this is the part devoted to geology, mineralogy, and mining industry, containing the reports of Prof. Hayden, Wm. H. Holmes, Dr. A. C. Peale, Dr. F. M. Endlich, and Samuel Aughey, Ph.D. Dr. Hayden's report is devoted to the special geology of the eastern part of the Rocky Mountains in Colorado, the Arkansas Valley, and portions of the Elk Mountains. The report of Wm. H. Holmes is devoted to the geology of the north-western portion of the Elk Mountains. The report of Dr. A. C. Peale gives the general and special features of the district assigned to the middle division of the survey, viz., the country lying between the Grand and Gunnison rivers west of the 107th meridian. Dr. F. M. Endlich reports on the San Juan country, giving chapters on the metamorphic, volcanic, and sedimentary areas and mines of the region. All these reports are abundantly illustrated with woodcuts, sections, and geological maps. Dr. Samuel Aughey has an interesting and practical report on the superficial deposits in Nebraska. The second paper is devoted to palæontology, and contains papers on the flora of the lignitic formations of North America, by Mr. Leo Lesquereux. A large number of new fossil plants are described and illustrated in eight plates. Following the palæontology is the report of Mr. W. H. Jackson on the ancient ruins of South-western Colorado. Eight plates of the cliff-houses, cave-dwellings, and other ruins of the Mancos, McElmo, and Hovenweep rivers accompany the report. Following Mr. Jackson's interesting report is an article on the zoological work for 1874. It contains descriptions and figures of several new species in conchology. The last division of the volume comprises the portion devoted to topography and geography, containing the following reports :—Mr. Henry Gannett's on the middle district, Mr. S. B. Ladd's on the northern district, and Mr. A. D. Wilson's and Franklin Rhoda's on the San Juan or southern district. These reports give the general topographical features of the areas surveyed, the means of communication and elevations of principal points. A complete table of contents and exhaustive indexes accompany the report. There is a general index of systematic names.

ORDERS have been given by the French Minister of Public Works for entering into a contract for the construction of the large refractor, whose length will be seventeen metres. A sum of 210,000 francs is to be paid to M. Eichers when the work is completed. The huge instrument is to be delivered two years hence. It will not be placed under a movable shade like the great reflector, but a cupola of requisite dimensions is to be constructed. All these arrangements have already been devised by M. Leverrier.

In a lecture on the Geographical Distribution of Birds, the first of a course delivered by Mr. R. B. Sharpe, on the 2nd inst., at the St. John's Wood Assembly Rooms, the lecturer exhibited, by the oxycalcium light, a large series of maps of the world, about fifty in number, each coloured in that part only where the bird he was speaking of is distributed. A carefully-painted slide of the bird, from the pencil of Mr. Keulemans, was also introduced with the description of the plumage of each species, and in association with the map of its distribution.

A PLAGUE of Field Voles (*Arvicolica agrestis*) has recently visited some of the pastoral farms of Upper Teviotdale and the adjoining districts, which has led to the appointment of a committee of the Farmers' Club of the Locality for the purpose of