

Societies' Club hope to have the pleasure of seeing you at their house in St. James'-street.

Monday the Museum of the College of Surgeons will be thrown open, and will be found well worth a visit. Mr. Rothschild has also kindly invited us to see his rich museum at Tring.

Tuesday the Duke of Bedford will show his collection of Cervidae at Woburn, and there will be excursions under the auspices of the Director of the Marine Biological Laboratory at Plymouth, and of Prof. Herdman at Port Erin.

I trust, therefore, that you will have a delightful and interesting week, and that our foreign friends will carry back with them pleasant recollections of their visit here, which may induce them to return again in some future year.

THE BRITISH ASSOCIATION.

THE preparations for the meeting in Bristol are well in hand, and by September 7 everything will be in order for the reception of visitors. It is, of course, impossible to say at present whether the meeting will be a big one, but it is expected to be, and the Executive Committee are prepared for any emergency which may arise on this score. It is not improbable, taking all things into consideration, that many will avail themselves of coming to Bristol. Owing to the distance that the meeting was held from London last year, some certainly could not spare the time for a visit to Canada, and so will take special pains to be present this year. There happen, too, to be several unusual attractions. The opening of the Cabot Tower, though not strictly speaking connected with the Association, has been fixed for Tuesday, September 6, and will no doubt influence many Canadians and other American visitors to come to Bristol. The Marquess of Dufferin will perform the ceremony, and be present at the dinner in the evening. The International Conference on Terrestrial Magnetism will also meet during the Association week, and there will also be a Biological Exhibition in the Clifton Zoological Gardens, which cannot fail to be of interest. Lastly, and by no means least, the high reputation Bristol and the neighbourhood has for objects of interest—geological, botanical, and archæological—together with the well-known beauty of the place and the hospitality of its citizens, will induce many to attend the 1898 meeting, combined with the additional attraction of a visit from part of the Channel Fleet.

The reception room will be at the Victoria Rooms in the large hall, and will contain the usual counters for obtaining tickets, &c., post office, and conveniences for writing; this latter being in the gallery, access to which is obtained by a wide staircase. The small hall will be devoted to the gentlemen's smoking room, where tea and coffee can be obtained. The room known as Alderman Daniel's, with two others, will be given over to the ladies, the rooms being suitably furnished. The local hon. treasurer and secretaries will also have their office in the Victoria Rooms.

The Directors of the Victoria Rooms Company have, in reply to a request, redecorated a large part of the building, so that the appearances are all that could be desired. Cloak room for gentlemen, typewriting rooms, telephone, and a newspaper stall are all provided.

Luncheons can be obtained at the Grammar School, hard by the Victoria Rooms, and at the premises of the late Salisbury Club, which latter building will also accommodate the press and General Committee at their meetings. Lunch can also be obtained at several restaurants near.

In the Drill Hall will be an exhibition of pictures, ancient armour, and Bristol china and other objects of interest; while the band of the Royal Horse Artillery will play there each afternoon from 4 to 6. In the event of wet weather this place will be very convenient; but wet or fine, it will form a comfortable lounge for those who do not wish to go to garden parties.

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The section rooms are well situated, and are mostly near the reception rooms, the furthest not being any considerable distance.

Section A will meet in the Lecture Theatre of the Museum, kindly lent by the Corporation; Section B in the British University College; Section C in the Hannah More Hall, Park Street; Section D in the Victoria Chapel Schoolroom; Section E in the Concert Room of the Blind Asylum; Sections F and G in the Merchant Venturers' Technical College; Section H in the Roman Catholic Schoolroom; Section K in the Fine Arts Academy.

All the Bristol and Clifton Clubs have thrown their doors open to visitors, and at the Clifton College and Corporation Baths members can have an early swim if they desire it.

The presidential address and evening lectures will be delivered in the Colston Hall; the working men's lecture in the hall of the Young Men's Christian Association, St. James Square.

Two conversazioni will be given: one by the Chairman of the Council (the Lord Bishop of Hereford), the head master of Clifton College, and Mrs. Glazebrook, at Clifton College, on September 8; the other by the local committee, in the Colston Hall on the 13th.

As well as the Cabot dinner two others will be given: the Chamber of Commerce on the 10th, the Master and Society of Merchant Venturers on the 13th; and a smoking concert will be given in honour of the President at the Merchant Venturers' Technical College on the 9th.

During the week, eight garden parties will be given to the members of the Association, several of the houses where they are to be held having most beautiful views of the Avon and Severn. As regards the usual literature that will be distributed, the handbook will not be of the bulky though excellent type of the 1875 one; it will be a more compact work, printed on thin but strong paper, and the articles, which are written by local authorities on the various subjects, as complete and full as space will permit. This work was completed more than a month ago.

The excursions guides are being framed on the lines laid down by the Manchester Committee a few years ago. Each of the eighteen excursions is printed as a separate booklet, but all are enclosed in a stout cloth cover and held by a band. The map, for only one will be given, is a new one, just published by Philip, of Liverpool, and will be coloured to show the geology of the district.

GLYPHIC AND GRAPHIC ART APPLIED TO PALEONTOLOGY.¹

THE Trustees of the American Museum of Natural History have undertaken a most useful work, in providing casts of a number of vertebrate fossils, obtained during recent years, from the Tertiary and Secondary deposits of North America, many of which can only be represented by this means in foreign museums.

But they have done even more than this; for, possessing on their staff men of artistic talent, as well as anatomical knowledge, they have set to work and produced a series of models of some of the extinct monsters of the Permian, Cretaceous and Tertiary rocks of North America, restored by Mr. Charles Knight with suggestions and criticisms by the late Prof. E. D. Cope, and by Prof. Osborn and Dr. Wortman. These models (which are on a scale suitable for a small museum or lecture-table), have been executed in plaster by Mr. Jacob Gommel. Only five are at present ready for dis-

¹ "Casts, Models, Photographs, and Restorations of Fossil Vertebrates," Department of Vertebrate Palæontology, American Museum of Natural History; Central Park, New York, U.S.A. Henry F. Osborn, Curator; J. L. Wortman and W. D. Matthew, Assistant Curators. 8vo. Pp. 24 7 illustrations).

tribution, at prices varying between ten dollars and thirty dollars each; they represent:—

Fig. 1, *Agathaumas (Triceratops) sphenocerus* (Cope), a large heavily armed herbivorous Dinosaur from the Laramie Upper Cretaceous of Western America; the length of the animal being about 25 feet.

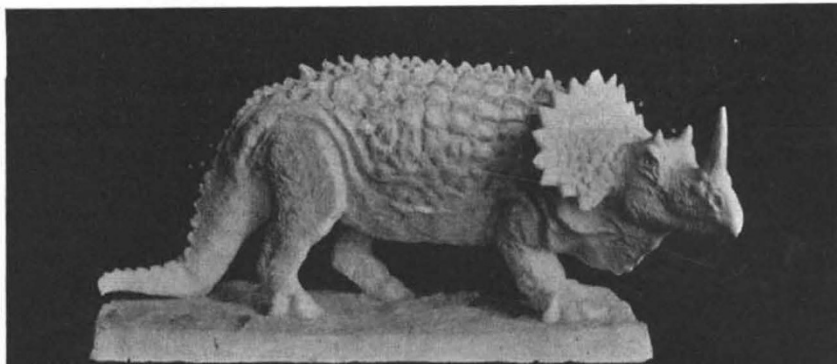
Fig. 2, *Hadrosaurus mirabilis* (Leidy), a huge Dinosaur 38 feet in length, with a head like an *Ornithomimus*, with small fore-limbs and heavy hind-limbs and tail. Like *Triceratops* it was found in the Laramie Cretaceous beds. *Hadrosaurus* was probably of amphibious habits, feeding on soft water-plants or small mud-loving organisms. Its body was covered with a thick rhinoceros-like hide, parts of which were found preserved with the skeleton in Prof. Cope's specimen.

Fig. 3, *Megalosaurus?* (*Lalaps*, *Dryptosaurus*), *aquilunguis* (Cope). A carnivorous type of Dinosaur, about 15 feet in length, 8 feet of which was represented by its tail; light and agile in form, and armed with powerful teeth and claws. The disproportionately long hind-limbs and heavy tail remind one of the kangaroo, which it may also have resembled in its mode of progression, by leaps instead of walking or running. It probably used its powerful hind feet armed with heavy claws in attacking its enemies. The jumping powers, as represented in the model of two fighting *Lalaps*, was suggested by Prof. Cope. *Lalaps* was first described by Cope from the Cretaceous beds of New Jersey. The name (*Lalaps*) being preoccupied, Prof. Marsh substituted that of *Dryptosaurus*; but in order to avoid the use of this name, it is here suggested to place it in Buckland's genus *Megalosaurus*!

Fig. 4, *Nanosaurus claviger* (Cope) is from the Permian beds of Texas, and is a highly-specialised form belonging to the primitive reptilian order *Pelycosauria* of Cope, and to the sub-order *Rhynchocephalia*, "beak-headed" reptiles. As to the precise object of the extraordinary rigid fin-like crest upon the back, it is not easy to conjecture. Prof. Cope humorously suggested that it might have been used as a sail. Again, it might have assisted the creature in swimming, or was perhaps only ornamental.

It was supported upon enormously elongated ladder like processes of the dorsal vertebræ, a structure probably unique amongst the Reptilia or even amongst Vertebrates.

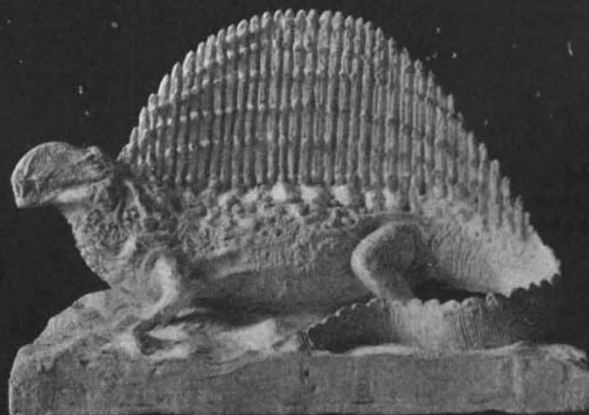
The last model is that of *Cervalces americanus*, a Pleistocene form of the American elk, which was of the same size and proportions as the living moose, but



No. 1. *Agathaumas sphenocerus* Cope.



No. 2. *Hadrosaurus mirabilis* Leidy.



No. 4. *Nanosaurus claviger* Cope.

had horns almost as large as those of the extinct gigantic Irish deer, expanded in three planes of growth nearly at right angles to each other. The model is based upon

a remarkably perfect skeleton found in New Jersey, and mounted in the Princeton University Museum. Prof. Scott, who described it in 1885, suggested that it possessed characters intermediate between those of the deer and moose.

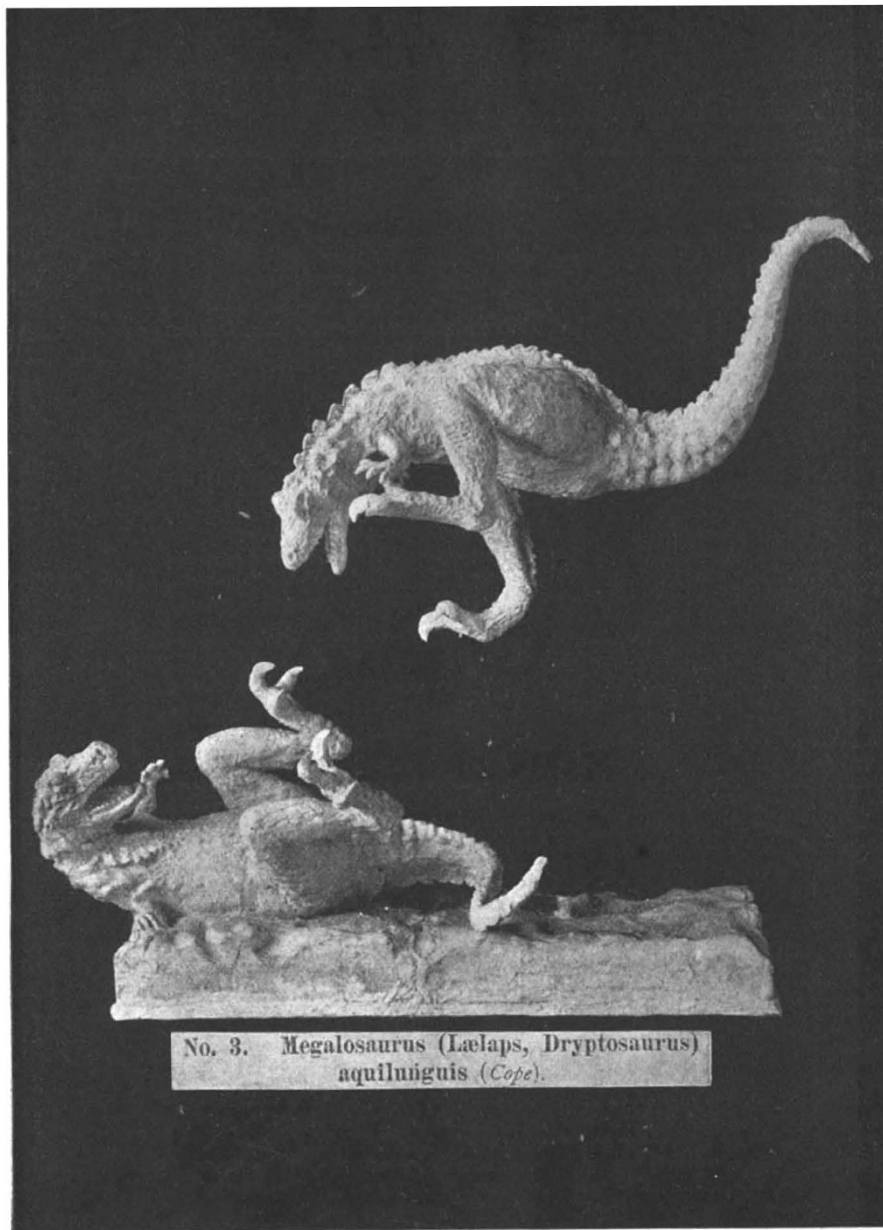
The other casts executed embrace the fore and hind foot of *Coryphodon radians*; the fore-foot of *Palaeosyops paludosus*, the front of skull and lower jaw of *Diplacodon*

enlargements from the original negatives, size 18 inches x 22 inches).

These excellent pictures, of which a number may be seen mounted and exhibited in the galleries of the British Museum (Natural History), Cromwell Road, London, consist (1) of photographs of eleven mounted skeletons of rare fossil mammals, as *Metamynodon*, *Titanotherium*, *Hyrachyus*, *Patriofelis*, *Protohippus*, *Hoplophoneus*, *Palaeosyops*, *Phenacodus*, *Coryphodon*, *Teleoceras*, and *Acera-therium*; and (2) photographic restorations, of the same size as the skeletons, depicting the animals clothed in their flesh, and represented in different attitudes according to their known habits and surroundings.

They are taken from a series of large water-colour drawings executed by Mr. Charles Knight, the animal painter, with the object of increasing the popular interest in these extinct animals, and to give a fuller and truer idea of their anatomy and external form than is afforded by the skeleton alone. The position of all the joints and angles of the feet and limbs is true to life, being governed by the skeleton itself. The lips, nostrils, and gape of the mouth are determined by comparison of the length of the nasals, size of the interior nares, character and position of the teeth, with similar parts in the remotely-related living forms. The eyes are carefully located and proportioned. Up to this point the animal is a fairly correct representation of the original. On the other hand the shape of the ears, the colour and epidermic characters of hair and hide are largely imaginative, except in so far as they are suggested by relationship to modern allies, as of *Protorohippus* to the horse, or of *Acera-therium*, *Metamynodon*, and *Hyracodon* to the rhinoceros. (The price of these photographs is fixed at four dollars each).

These restorations include



No. 3. *Megalosaurus* (*Laelaps*, *Dryptosaurus*) *aquilunguis* (Cope).

emarginatus; the lower jaw of *Dromatherium sylvestre*, described by Emmons from the Trias of North Carolina in 1854; the lower jaw of *Microconodon tenuirostris*; and the brain-casts of *Periptychus rhabdodon*, and of *Pantolambda*.

Interesting as are these casts, we venture to think that the most valuable work achieved by Mr. Osborn is the production of the fine series of photographs (bromide

Patriofelis, an aquatic Middle Eocene carnivore with broad flat plantigrade feet with spreading toes, well adapted for swimming. He was not, perhaps, as expert a swimmer as the seals are now, but was sufficiently active in the water to capture turtles.

This is, perhaps, the least original and successful of the restorations, being modelled somewhat too closely upon the existing otter.

The second restoration is that of the little four-toed Lower Eocene horse (*Protorohippus venticolus*). This animal in life was about four hands or sixteen inches in height at the withers. The mane is left upright; the forequarters and neck are striped. The body is, perhaps, too large for such very slender and graceful legs.

The third restoration is based on a study of the mounted skeleton of the *Aceratherium*, a hornless form of rhinoceros from the Upper Oligocene formation.

The next picture represents the six-horned *Protoceras*, a Tertiary ruminant from South Dakota, not unlike the North American prong-horn antelope, with soft snout and fleshy upper lip as in the modern saiga.

Metanynodon, an aquatic hornless rhinoceros from the same deposits, affords the subject for a fifth cartoon. The giant pig (*Elotherium*), from South Dakota lake deposits, forms a sixth illustration. The head in the male is of enormous size, but the chest is small and the limbs are extremely tall and stilted. The great projecting flanges below the cheeks, for the attachment of the masseter muscles, presented peculiar difficulties to the artist to represent correctly.

Another striking group is that of the Titanotheres, a huge horned pachyderm, of which the male, female and young are depicted. There is no doubt that the females were smaller, and possessed imperfectly-developed horns and narrow zygomatic arches; the males had a pair of extremely long recurved horns, placed transversely on the nasals. In the general structure of the skull, as well as in its dentition, *Titanotherium* (except in the peculiar position of the horns) suggests the modern rhinoceros.

The most striking of these large early Tertiary mammals is undoubtedly the *Uintatherium*, of which Mr. Knight has made an excellent picture. There are quite a number of species of this huge many-horned ungulate, for which the sub-order Dinocerata was proposed by Prof. O. C. Marsh, and on which that author founded an admirable

quarto monograph in 1884. Like many American forms it enjoys several generic names, as *Dinoceras*, *Tinoceras*, and *Uintatherium*; the last, being that proposed by Prof. Leidy in 1872, has no doubt the strongest claim to priority.

Three pairs of bony, rounded horn-like protuberances mark the skull; the tusks, which are large, are thought to have been used to draw the branches and leaves of shrubs into the mouth; the skeleton at once suggests that of the elephant, and presupposes a similar hide. A papier maché (life-size) restoration of the skeleton of *Uintatherium* (*Tinoceras*) *ingens*, presented by Prof. O. C. Marsh, in addition to Mr. Knight's restoration of *U. cornutum*, grace the Natural History Museum in Cromwell Road.

To these we may add the restoration of *Hyracodon*, a small running form of rhinoceros of as light a build as a modern zebra, but lacking its grace of head.

The tenth restoration is that of a large carnivore *Mesonyx*, which, from the blunted condition of its teeth,

suggests that the animal was omnivorous in diet, and that it might have lived partly upon turtles or decaying animal food. The body is represented as large and the legs very short, and therefore not well adapted for the pursuit of living prey.

Palaeosyops, a Middle Eocene Titanotheres resembling the tapir in habits, with an elongated prehensile upper lip and slender fore-feet, is believed to have inhabited the low marshy lands, feeding entirely upon the softer kinds of leaves and grasses, since its teeth are unadapted to hard vegetable food.

The last restoration is that of the *Mastodon*, which, being so much akin to the elephants of to-day, affords little scope for the imagination in depicting him as a living animal.

The feet are larger and more projecting than in the existing species of elephants, the limbs are relatively shorter, and the head has the low flat skull of the African rather than the high prominent forehead of the Indian elephant.

We cannot fail to congratulate Prof. Osborn on the work upon which he is engaged, and to express the hope that many more of these restorations may be evolved from the fertile invention of the artist, tempered by the careful and chastening influence of the comparative anatomists of the American Museum of Natural History, New York.

JOHN A. R. NEWLANDS.

WE regret to have to record the death of Mr. John Newlands, as a consequence of an attack of influenza, at the comparatively early age of sixty-one. While probably no subject in the whole range of theoretical chemistry has received a greater amount of attention than the numerical relations among the atomic weights of the elements, few among the younger generations of chemists are acquainted with the circumstances attending the establishment of the remarkable generalisation usually known as the "Periodic Law." The contemporaries of Newlands, however, and all who have taken the trouble to look into the literature of the subject, know that it was he who discovered the fundamental relation embodied in this so-called law, and that he clearly expressed the connection between atomic weight and properties about five years before any publication of their views either by Mendeléef or Lothar Meyer. Fortunately the facts stand out from the records clearly enough, but it is difficult now, after a lapse of more than thirty years, to explain the indifference of the chemical world to an observation so remarkable as that to which Newlands drew attention first in the *Chemical News*, August 1864, again more fully in the same journal, August 1865, and a third time more emphatically in a communication to the Chemical Society, March 9, 1866. For many years previously the subject had been, so to speak, in the air. Numerous papers by Dumas, Gladstone, and latterly by Odling, had appeared in which various arrangements of the atomic weights had been adopted, but none of a comprehensive kind; yet when a scheme which consisted not of a number of isolated groups, but which supplied a system covering the whole of the known elements, was brought forward, all that the Chemical Society could do was to reject it with ridicule and contempt, and to decline to print a word of the new doctrine in the then scanty pages of its *Journal*. The unsettled state of opinion in reference to the numerical values of many atomic weights can be the only excuse for what seems like stupidity and prejudice, for Newlands' arrangement required the adoption of the atomic weights standardised as recommended by Cannizzaro in 1864-66, and these values were still unknown to, or ignored by many chemists. Newlands called his scheme the "Law of Octaves," and he showed

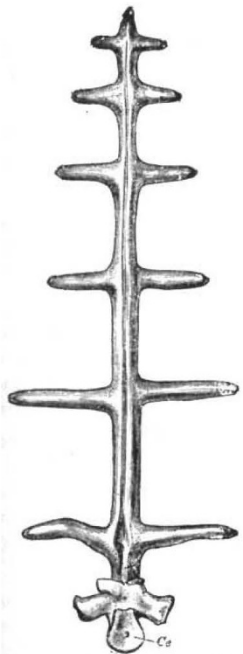


FIG. 5.—Anterior view of a single dorsal vertebra of *Nanosaurus claviger* (nat. size), Cope. Permian, Texas (Ce, centrum).