the forearm movement proved slightly inferior to the more practiced finger movement, and even to the full arm movement. In this particular the full arm movement would, with practice, probably be the best of the three. But in uniformity of slant, the forearm movement was far superior to the others. There were a smoothness and grace in the tracings of this movement that were quite absent from the rest.

These analytical laboratory experiments were obtained with a high degree of agreement from a considerable number of individuals. As to the results of the suggested movement in actual writing, little more can at present be asserted than that the movement is entirely practicable. The few who have tried it are pleased with the results. The writer of this article has himself adopted it largely, and finds realized the advantages that the laboratory experiments gave reason to expect. Rapid writing is freer and more legible, showing no tendency to degenerate into the flat scrawl. Less fatigue is felt; and the muscles employed, though not so large as those of the full arm movement, are large enough to avoid the tendency to cramp. The uniformity of slant gives the page a neat appearance. The alignment is satisfactory. The possession of two movements is at times a great source of comfort. Finally, from the relative facility with which the left hand was found to acquire the various movements, as well as from the fact that the wrist movement is made by the simplest muscular coördination, it seems altogether probable that the wrist movement would possess, over the complex finger movement, the advantage of being more easily learned.

R. S. WOODWORTH.

A CENSUS OF THE FOSSIL VERTEBRATA OF NORTH AMERICA.

THE writer has been able to make such an examination of the literature appertaining to fossil vertebrates, that he feels justified in making a statement regarding the number of genera and species which are known to occur in North America north of Mexico. The writer is not aware that any one else has yet prepared a list of the species of all the groups, and apparently the paleontologists themselves have very vague ideas regarding the number of known species, outside of the groups which they are themselves studying.

It is, of course, recognized that no two men in preparing such a list would arrive at the same results, since their ideas would undoubtedly differ more or less regarding what are to be considered tenable genera and species. In determining whether or not reputed species are to be reduced to synonymy, the writer has in most cases accepted the results of the investigations of other workers, where such results have been expressed clearly and definitely; while in cases of doubt a conservative course has been followed, it being held that it will cause less confusion in nomenclature and bibliography to retain as distinct two forms which must eventually be united, than it will to unite under one name two forms which must in the end be separated.

The whole number of genera which, in the acceptation of the writer, are found in the region indicated is 1118; the whole number of species 3234. These are distributed among the large groups, as shown in table following. It is proper to note that in this list there is included a relatively small number of existing species whose remains have been found in pleistocene deposits of old lakes and of caves, accompanied by remains of other species either now extinct or having a geographical distribution different from the present. A larger proportional number of such living species is found in the group of birds than in any other, there being 33 such species.

GENERA AND SPECIES OF NORTH AMERICAN FOSSIL VERTEBRATA IN THE GROUPS NAMED.

FISHES.

Group.	Genera.	Species.
Elasmobranchii	114	537
Ichthyodorulites*	34	136
Aspidoganoidei†	3	7
Placodermi	18	43
Dipnoi	10	43
Crossopterygia	16	41
Actinopteri	102	303
Total of fishes	297	1110

BATRACHIANS.

Group.	Genera.	Species.
Stegocephali	41	88
Urodela	2	5
Anura	1	1
Total of batrachians	44	94

REPTILES.

Group.	Genera.	Species.
Cotylosauria	12	24
Chelydosauria	2	3
Anomodontia	1	1
Pelycosauria	12	29
Testudines	37	148
Ichthyosauria	5	7
Plesiosauria	14	27
Rhynchocephalia	3	9
Pterosauria	3	8
Loricata‡	17	62
Squamata§	48	126
Dinosauria	65	154
Total of reptiles	219	598

BIRDS.

Genera, 59 ; species, 102.

MAMMALS.

Group.	Genera.	Species.
Protodonta	2	2
Allotheria	13	41
Didelphia	21	44
Bruta	16	36
Sirenia	5	7
Cete	42	77
Condylarthra	9	26
Perissodactyla	43	215
Artiodactyla	75	207
Ancylopoda	3	5
Amblypoda	13	40
Dinocerea	5	33
Proboscidea	2	18
Tillodontia	3	13
Glires	40	99
Insectivora	18	22
Chiroptera	5	7
Creodonta	39	103
Carnivora	55	134
Primates	27	53
Total of mammals	436	1182

Foot-prints : Genera, 63 ; species, 147.

Total of all groups : Genera, 1118 ; species, 3234.

*Mostly, at least, defensive spines of elasmobranchs.

† This name, proposed by Dr. Gill, in 1876, antedates Cope's *Ostracodermi* and *Ostracophori*.

‡ Crocodiles and their allies.

§ Mosasaurs, lizards and snakes.

Of the classes of the list presented above, the birds are conspicuous because of the small number of species represented, the 102 contrasting strongly with the approximately 1100 species now inhabiting North America. It seems not unlikely that the habit possessed by birds of living in the open air and the tendency of their bodies to float for a long time after death have insured their destruction. Doubtless many of the smaller reptiles and mammals have been preserved because they met death in their burrows. A floating bird would be devoured by large fishes and reptiles.

The list of the reptiles is a large one, the two largest orders being those of the turtles and the dinosaurs. The latter owe their preservation mainly to their great size. The turtles are likely to become buried in deposits, because they are mostly inhabitants of the water, they readily sink when dead, and they are not easily devoured.

The mammals present a formidable array. One-half of the groups in the list are extinct, either wholly or from this continent. Those which have here living representatives show many more fossil than living species, excepting the bats, the rodents and the insectivores. The last two groups, being composed mostly of small species, have

probably not yet received their share of the attention of collectors. Of rodents there are now living in North America over 300 species, of bats about 40 species, and of insectivores about 40 species.

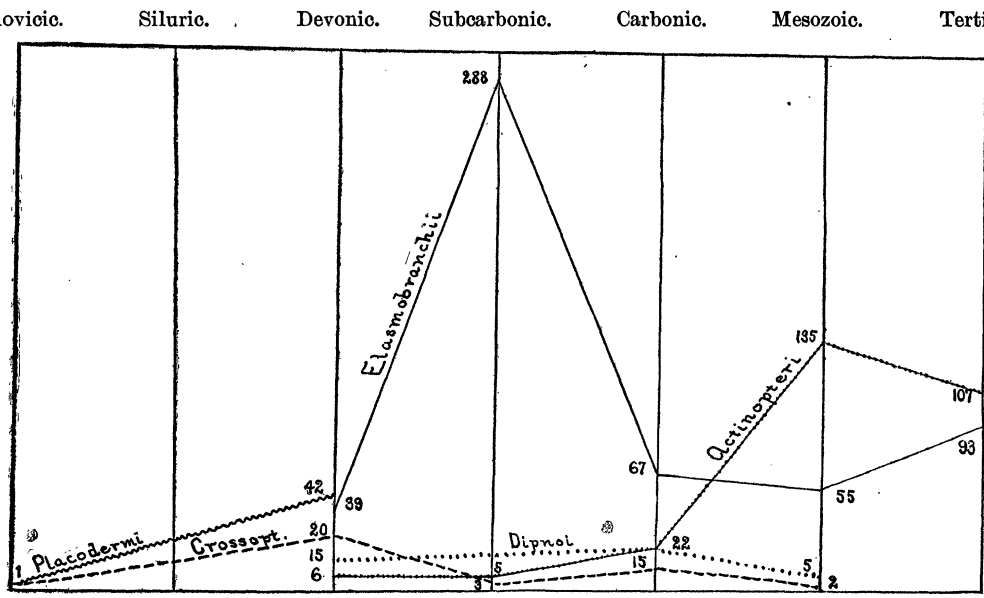

Diagram showing the distribution of North American fossil fishes.

The animals which are included under the general name of fishes furnish such interesting results that an attempt is made to furnish a graphic illustration of the time distribution of the principal groups. In examining this we are at once struck with the enormous development of the elasmobranchs during the Subcarbonic period. Furthermore, from the elasmobranchs presented in the illustration have been excluded the ichthyodorulites, the great majority of which are undoubtedly the defensive spines of shark-like animals. The distribution of the species of these is as follows: Siluric, 2; Devonic, 27; Subcarbonic, 83; Carbonic, including the Permic, 22. Had these been included, the Subcarbonic peak would have been uplifted by an amount equal to two-thirds its present height, while the elevations of the Devonic and Carbonic would not have been greatly increased. The occurrence of so many defensive spines in the Subcarbonic, when such a variety of elasmobranchs is indicated by teeth, is a pretty plain suggestion that in very many cases a genus founded on a spine is identical with some other genus based on teeth; for it is not probable that many of the ichthyodorulite-bearing fishes were toothless. After the Subcarbonic period the elasmobranch line descends rapidly in the Carbonic, slowly in the Mesozoic, and rises slightly in the Tertiary. At the present day there are recognized only about 86 species of elasmobranchs living along the whole American coast, north of Mexico.

Although the ichthyodorulites have been excluded from the elasmobranch species in the illustration, the line has been extended to the Siluric, because of the occurrence of *Onchus* in it.

In like manner the line representing the Placodermi and the Crossopterygia have

been prolonged backward to the Ordovicic, in consideration of Mr. C. D. Walcott's genera *Astraspis* and *Eriptychius*.

In contrast with the elasmobranchs the actinopterous fishes, which entered on their career as 'a feeble folk' in the Devonic, seem hardly to have held their own during the Subcarbonic. Their numbers increased slowly during the Carbonic, the feri then expanded rapidly during the Mesozoic. The slight fall in the number of known species during the Tertiary does not probably indicate an actual reduction in the number of species that then lived. In the waters of the region here contemplated there are now living probably at least 1500 species of this group of fishes.

O. P. Hay.

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*THE INTERNATIONAL ASSOCIATION OF ACADEMIES.**

For several years past there has existed an Association or Cartell of the Academies of Sciences of Munich and Vienna, and of the Royal Societies of Sciences of Göttingen and Leipzig, which has met yearly to discuss matters of common interest, and the combined action of these bodies has in several ways been fruitful of results. Representatives of the Royal Society of London attended the meeting held last year at Göttingen, as well as that which took place the previous year at Leipzig, chiefly with the object of discussing the project of an international catalogue of scientific literature which the Society has been engaged in promoting.

When the invitation was conveyed to the Royal Society of London to send representatives to the Göttingen meeting, it was intimated that the Cartell would be glad to learn the views of the Society as to the possibility of its joining the Association. The delegates appointed from London were instructed to state that the Royal Society would be disposed to join, provided that the organization were so extended as to assume a truly international character. This suggestion was not only accepted in principle at Göttingen, but it was agreed that the Royal Society of London should be requested to take the steps, if thought desirable, to ascertain how far the establishment of such an international association would commend itself to the leading scientific bodies of other countries.

The Royal Society of Sciences of Berlin, although not included in the Cartell, has for several years past been represented at its meetings. When the Royal Society of London had ascertained that the project was likely to find favor, it was agreed that the Royal Society and the Berlin Academy should together issue an invitation to the Academy of Sciences, Paris, the Imperial Academy of Sciences, St. Petersburg, the Reale Accademia dei Lincei, Rome, the National Academy, Washington, as well as to the bodies included in the Cartell, requesting them to send delegates to a conference to be held in Wiesbaden on the 10th and 11th of October.

At the conference, excepting the Reale Accademia dei Lincei, which was unable to send delegates, although in full sympathy with the movement, all the bodies invited were represented—the Berlin Academy by Messrs. Auwers, Virchow, and Diels; the Göttingen Society by Messrs. Ehlers and Leo; the Leipzig Society by Messrs. Windisch and Wislicenus; the Royal Society by Messrs. Rücker, Armstrong, and Schuster; the Munich Academy by Messrs. von Zittel, Dyck and von Sicherer; the Paris Academy by Messrs. Darboux and Moissan; the St. Petersburg Academy by Messrs. Famintzine and Salemann; the Washington Academy by Messrs. Newcomb, Remsen, and Bowditch; and the Vienna Academy by Messrs. Mussafia, von Lang, Lieben, and Gomperz.

*From the London *Times*.