SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, JANUARY 22, 1904.

CONTENTS:

The American Association for the Advancement of Science:—

Geography in the United States, I.: PROFESSOR W. M. DAVIS 121

Some Unsolved Problems of Organic Adaptation: PROFESSOR CHARLES W. HARGITT 132

Scientific Books:—

The Honeysuckles: DR. N. L. BRITTON. *Human Anatomy in the International Catalogue of Scientific Literature:* M. 145

Scientific Journals and Articles 147

Societies and Academies:—

The San Francisco Section of the American Mathematical Society: PROFESSOR G. A. MILLER. *The Anthropological Society of Washington:* DR. WALTER HOUGH. *The Science Club of the University of Wisconsin:* VICTOR LENHER 148

Discussion and Correspondence:—

The Lunar Theory: PROFESSOR ASAPH HALL. *The Scaurs on the River Rouge:* DR. MARK S. W. JEFFERSON 150

Shorter Articles:—

Wonder Horses and Mendelism: PROFESSOR C. B. DAVENPORT. *The Inheritance of Song in Passerine Birds:* WILLIAM E. D. SCOTT. 151

The U. S. Naval Observatory 154

Scientific Notes and News 156

University and Educational News 160

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

GEOGRAPHY IN THE UNITED STATES. I.*

FOR twenty years past our section has acknowledged in its name an equal rank for geology and geography, but not one of the vice-presidential addresses during that period, or, indeed, since the foundation of the association over fifty years ago, has been concerned with the subject second named. Unless we cross off geography from the list of our responsibilities, it should certainly receive at least occasional attention; let me, therefore, depart from all precedents, and, even though geologists may form the majority in this gathering, consider the standing of geography among the sciences of the United States; how it has reached the place it now occupies, and what the prospects are for its further advance.

One measure of the place that geography occupies in this country may be made by considering the share that geographical problems have had in the proceedings of our association; here follow, therefore, the results of a brief examination of our fifty volumes of records. In the early years of the association there was no fixed division into sections. The meetings were sometimes so small that papers from various sciences were presented in general session. At least once in the early years the work of our predecessors was recorded under the general heading, 'natural history, etc.' As early as in 1851 there was a section of

* Address of the vice-president and chairman of Section E—Geology and Geography—of the American Association for the Advancement of Science, St. Louis meeting, December, 1903.

geology and physical geography, and another of ethnology and geography, but that classification did not endure. Once only, in 1853, did geography stand by itself as a sectional heading, but at many meetings physics of the globe and meteorology had places to themselves. Through the '60's and '70's geography was sometimes coupled with geology, but the latter more often stood alone or with paleontology, and it was not until the Montreal meeting of 1882 that Section E was definitely organized with the title that it now bears.

In those years when physics of the globe and meteorology were given sectional rank, problems concerning the ocean and the atmosphere received a good share of attention. It is curious to note, in contrast to this, how little consideration has been given to the exploration and description of the lands, that is, to the geography of the lands, in this Association for the Advancement of Science, either before or after the establishment of the double name for our section. The exploration of foreign lands, for many years a prominent subject in the meetings of the British Association, where geography has had a section to itself since 1869, has attracted hardly any notice in our gatherings; perhaps because we have been busy exploring our own domain. At the first meeting, 1848, a summary of then recent explorations, prepared by Alexander, is the only paper of its kind. Other papers treating the geography of foreign lands are so few in number that most of them may be noted here; in 1850, Squier gave an evening address on the volcanoes of Central America; in 1858 and 1860, Hayes and Wheildon discussed arctic exploration; Orton described the valley of the Amazon in 1869; in 1884 and 1898, two English visitors had papers on different parts of Asia; in 1891 and 1898, Crawford described features of Nicaragua; and in 1894 and 1895, Hubbard read papers on China, Corea and Japan. Even geological essays on foreign regions have been few; Dana, Branner, Hill, Spencer, Heilprin and Hitchcock being the chief contributors. Inattention to foreign exploration is, however, not to be fully explained by devotion to the geography of our own country, so far as the latter is measured by the pages devoted to it in our proceedings. The first meeting started well enough, with accounts of the terraces of Lake Superior by Agassiz, of the physical geography of northern Mississippi by Bolton, and of the topography of Pennsylvania and Ohio by Roberts. Again, in 1851, when physical geography was named with geology, the first subject had two essays, the distribution of animals in California, and the climate, flora and fauna of northern Ohio; and geography joined in the same year with ethnology had three rather scattering titles: a deep-sea bank near the Gulf Stream, measurement of heights by the barometer, and a geographical department in the Library of Congress; but this beginning had no worthy sequel. The many expeditions across our western territory contributed little geographic matter to our records; in 1856 Blake described the orography of the western United States, and Emory the boundary of the United States and Mexico; and the latter added in 1857 an account of the western mountain systems of North America. From that time onward there has been very little primarily of a geographical nature concerning the United States. Even the modern discussions of glacial geology in the last twenty years, profitable as they have been to the physical geographers of glaciated regions, have in very few, if any, cases been presented as contributions to geography. The new phase of the physiography of the lands is scantily represented; there have been

hardly more than accounts of Mexico by Hill, of California by Perrin Smith, of North Carolina by Cobb; it is to be noted, moreover, that these three authors are primarily geologists, not geographers. This meager showing leads one to suspect that our proceedings do not give a fair measure of geographical activity in North America.

There has been in reality a great deal of work of a geographical nature done by our people, but the proceedings of the association do not seem to have commended themselves as a place to put the work on record. Our geological surveys, state and national, have contributed numerous geographic chapters and reports of prime value; our weather bureau is in many respects the leading institution of its kind; our coast survey sets a high standard for triangulation, coast maps and tide current studies; we have held a prominent place in arctic exploration, and have taken some part in exploration elsewhere. But in spite of all this accomplishment, we have not made great contributions to the full-fledged science of geography. There are, for example, few steps toward scientific geography of greater value than good maps, but for the geographer to stop with the production of good maps is as if the botanist stopped with the collection of dried plants. The survey reports of our various states and territories contain a great fund of geographical matter, and some of the members of these surveys have carried the physical geography of the lands so far forward as to develop it into a new science, to which a name, geomorphy or geomorphogeny, has been given; yet geography has not flourished among us as a maturely developed subject. The survey reports have not, as a rule, been prepared by persons whose training and interests were primarily geographical, and very few of the geomorphogenists have carried their new science forward into a geographical relation; they have usually stopped with the physical aspects of the subject, and left the organic aspects with scanty consideration. It is as if there had been some impediment in the way of the full development of geography as a maturely organized science. There are in fact three serious impediments.

During all these years geography has suffered greatly from being traditionally a school subject in its educational relations; the subject as a whole has been almost everywhere omitted from the later years of college and university training, although certain of its component parts have received some attention in college years. Again, geography as a whole leads to no professional career outside of school-teaching; it is perhaps chiefly on that account that our colleges and universities can give little time to it. Finally, there is not to-day in this country an organized body of mature geographical experts at all comparable to the bodies of physicists or of zoologists who are organized into effective working societies; in the absence of such an organization geography suffers greatly for the lack of that aid which comes from mutual encouragement among its workers. How can we remove these impediments of low educational rank, no professional career and no professional organization?

Geography will find a place in our colleges and universities very soon after it is shown to be a subject as worthy of such a place as are the subjects whose position is already assured. Physical geography is to-day slowly winning a more respected place than it has ever had among the subjects on which examinations are set for admission to college. Commercial or economic geography is, I believe, destined to attract increasing attention from mature teachers and nearly mature students. The general geography of various parts of the world must receive more and more consid-

eration in our colleges during the century that opens with the outgrowth of our home country; and just so soon as mature teachers of mature geography can make their lectures of value to the young men of to-day, who are to be the leaders of enterprise to-morrow, place will be found for geographical courses in our higher institutions of learning. Progress in this respect is visible, though not rapid. In order to hasten progress, increased attention might well be given to so-called practical courses in geography, as well as to courses of a generally descriptive nature. The impediment of low educational rank is not permanent; it need not discourage us, for it is destined to disappear.

The study of geography is not likely soon to lead to a large, independent career, but it may be made useful in many careers, as has just been indicated. It will, however, be made particularly serviceable to a class of men that is now of small but of increasing numbers, namely, those who travel about the world, seeking fortune, entertainment or novelty. With the present rapid increase of wealth among us, this class is destined to grow, and while it may never be large, it may soon be important, and its members need careful cultivation; and at the same time the teachers of this class, and of other classes with whom geography becomes important, will win a respected career for themselves. The impediment arising from the lack of a large professional career will, therefore, have no great importance when the many relations of geography to other subjects are recognized.

The third impediment to the maturing of geography is the most easily overcome even if at present the most serious, for its removal depends only on the action of geographers themselves, and not on the action of higher bodies, such as executive officers, trustees and so on, or on the action of lower bodies, such as students. The absence of a society of mature geographical experts is the fault of the experts themselves. No greater assistance to the development of mature scientific geography lies within our reach than the establishment of a geographical society which shall take rank with the Geological Society of America, for example, as a society of experts, in which membership shall be open only to those whose interests are primarily geographical and whose capacity has been proved by published original work in a distinctly geographical field. In order to determine whether such a society can now be organized, I propose to consider the classes of persons in the community from which the members of the society could be recruited.

There are at least four classes of geographical associates, as they may be called, from which mature geographical experts might be drawn. First and in largest number is the class consisting of the teachers of geography in our schools. It is true that our school-teachers, as a rule, devote themselves to immature geography; that is, to only so much of the whole content of the subject as can be understood by minors, indeed by children. But, on the other hand, one who is acquainted with recent educational progress can not fail to recognize the notable advance made in the last ten years alone in the preparation for and in the performance of geographical teaching. There are in the secondary schools to-day a number of teachers who are competent to make original, mature geographical exploration of their home country, and some of them have actually traveled east and west with the object of making geographical studies. There are several teachers' geography clubs, and the leading members of these clubs are thoughtful workers. I am sure that a significant number of ac-

ceptable members of an expert geographical society would be found in this class.

The second class of geographical associates includes the observers of the national and state weather services, who have chiefly to do with that important branch of geography comprehended under climatology; these observers are gathering a great crop of facts, not always very accurately determined or very widely applied as far as the observers in the state services are concerned; yet from among the thousands of persons thus employed there will now and then come forth the original worker whose contribution will fully entitle him to expert rank; when his published studies are seen to be of a thoroughly geographical character and of a mature grade, they would warrant his admission to a society of geographical experts.

Third comes the class made up from the members of various governmental bureaus, state and national, whose work is of a more or less geographical character; for example, topographers and hydrographers, geologists and biologists, ethnologists and statisticians; this class being as a whole of much higher scientific standing than the two classes already mentioned. It may happen that many persons thus classified have a first interest in the strictly geographical side of their studies, although faithful work in the organization to which they belong associates them with other sciences. I should expect the greatest part of the membership in a society of geographical experts to be drawn from this class.

It may be noted that the absence of a body of mature geographers, as well organized and as scientifically productive as are the workers in various other sciences, is explained by some as an inherent characteristic of geography, necessitated by the great diversity of its methods and its interests. The diversity is already an embarrassment, it is claimed, even in school years; and it afterwards compels the separation of the branches of this highly composite subject, at best but loosely coherent, into a number of specialities, each of which is so much more closely allied to other sciences than to the other branches of geography, that those workers whose union would constitute a body of mature geographical experts are found scattered among other unions, geological, botanical, zoological, ethnological, economical and historical. The claim that the disunion of geographical experts is necessary does not seem to me well founded. May we not, indeed, prove that there is no such disunion by pointing to the fourth class of geographical associates, concerning whom my silence thus far may perhaps have awakened your curiosity, namely, the members of our various geographical societies?

There are at the present time between five and seven thousand such persons in the United States, but in the absence of any standard of geographical knowledge from the requirements for membership, these societies can not, I regret to say, be taken as evidence that there is a common bond by which experts in all branches of geography are held together. None of our geographical societies is composed solely of experts, and none of them is held together by purely geographical bonds. While we must not overlook the excellent work that our geographical societies have done, neither must we overlook the fact that in making no sufficient attempt to require geographical expertness as a condition for membership, there is a very important work that the societies have left undone. They have truly enough cultivated a general interest in subjects of a more or less geographical nature, but they have failed to develop geography as a mature science. Indeed, it may be cogently

maintained that the absence of any standard of geographical knowledge as a condition for society membership has worked as seriously against the development of mature scientific geography as has the general abandonment of geographical teaching to the secondary schools. Large membership seems to be essential to the maintenance of good libraries in handsome society buildings, and it is certainly helpful in the collection of funds with which journals may be published and with which exploring expeditions may be equipped and sent out. I should regret to see the membership in a single existing geographical society decreased, but I regret also that there is no geographical society of the same rank as the American Mathematical Society, the American Physical Society or many others in which number of members is secondary to expert quality of members. Large numbers of untrained persons are not found necessary to the maintenance of vigorous societies in which these other sciences are productively cultivated, and it is, therefore, reasonable to believe that large numbers would not be essential to the formation of a geographical society of high standing. Indeed, it can hardly be doubted that the acceptance of a low standard for membership in our geographical societies has had much to do with the prevailing indifference regarding the development of a high standard for the qualification of geographical experts.

Not only may any respectable person obtain membership in any of our geographical societies, however ignorant he may be of geography, but various kinds of societies are ranked as geographical, even though their object may be geographical in a very small degree. This is indicated by a list of geographical societies recently published, in which is included a small travelers' club lately organized in one corner of our country. The object of this club is simply 'the encouragement of intelligent travel and exploration.' Interest in rather than accomplishment of exploration and travel suffice to recommend a candidate, otherwise qualified, for membership. The object of travel is nowhere stated to be geographical. As a matter of fact, travel for the sake of art, archeology, language, history, astronomy, geology and botany, for discovery, or even only for sport and adventure, as well as for strictly geographical objects, is encouraged by this young organization, which is really nothing more than its name claims it to be: a travelers' club. The same list of geographical societies includes several clubs of excursionists, outing-takers or mountain climbers, among whom, as a matter of fact, geography attracts hardly more interest than botany. These societies are doing an excellent work in taking their members outdoors, sometimes on walks near home, sometimes farther away to a hotel in the country, sometimes to a camp among the mountains. The chief result of such outings is an increased enjoyment and appreciation of the landscape, of natural scenery and of everything that enters into it; but this excellent result is by no means exclusively, perhaps not even largely, geographic in its quality.

One might question whether geographic rank was really accorded to these clubs by general assent, if their recognition in the group of geographical societies were expressed only by an individual opinion in the list referred to; but this is not the case. In preparation for the meeting of the International Geographical Congress, to be held in this country next summer, delegates to the committee of management have been invited from the Appalachian Mountain Club, in one corner of the country, and from the Mazamas in another. The delegates appointed by these clubs are, as might have been expected, men compe-

tent to act with the others in organizing the congress for us, but the same result would have been attained if delegates had been asked from the various geological, botanical, zoological and historical societies, for all these societies contain among their members persons of a certain amount of geographical knowledge and of a sufficient executive ability. The same would be true had delegates been invited from the Boone and Crocket Club, a choice organization of sportsmen, for all such clubs have men of undoubted ability in the way of organization among their members, and are largely concerned with matters of geographical location and distribution in their activities. Nevertheless, neither the sporting nor the outing clubs are essentially or characteristically geographical in their objects. Do not, however, understand me to object to the acceptance of delegates from the above-named clubs as members of the committee on management of the International Geographical Congress. I approve of the plan heartily; for in the absence of geographical societies in many parts of our country there was no other plan so appropriate. The matter is mentioned here only to show the straits to which geographers are reduced in attempting to give a national welcome to an international geographical congress; the difficulty, so far as it is a difficulty, arises from the absence among us of a body of mature geographical experts, united in an advanced acquaintance with some large part of a well-defined science. This condition of things seems to me unsatisfactory. The absence of a strong society of geographical experts indicates an insufficient attention to scientific geography, and I, therefore, now turn to consider the direction in which serious efforts may be most profitably made toward a better condition of things. Let it be understood, however, that no quick-acting remedy is possible, for the reason that many of those concerned with the problem—namely, the advance of scientific geography—do not seem to recognize that the existing state of things needs a remedy. It is, therefore, only as a change of heart—a scientific change of the geographic heart—makes itself felt that much can be accomplished toward the development of scientific geography, and such a change is notoriously of slow accomplishment. Progress is apparent, however, and from progress we may gather encouragement. In what direction, then, shall our further efforts be turned?

Let me urge, in the first place, that close scrutiny should be given to things that are properly called geographical, with the object of determining the essential content of geographical science and of excluding from our responsibility everything that is not essentially geographic. Only in this way can we clear the ground for the cultivation of really geographical problems in geographical education and in geographical societies. This scrutiny should be exercised all along the line: in the preparation of text-books, in the training of teachers, in the study of experts, and in the conduct of any geographical society that attempts to take a really scientific position. The essential content of geographical science is so large that the successful cultivation of the whole of it demands all the energies of many experts. Those who are earnestly engaged in cultivating geography proper should treat non-geographic problems in the same way that a careful farmer would treat blades of grass in his cornfield: he would treat them as weeds and cut them out, for however useful grass is in its own place, its growth in the cornfield will weaken the growth of the corn. So in the field of geographical study, there is no room for both geography and history, geography and geology, geography and astronomy. Geography will never gain the

disciplinary quality that is so profitable in other subjects until it is as jealously guarded from the intrusion of irrelevant items as is physics or geometry or Latin. Indeed, the analogy of the blades of grass in the cornfield is hardly strong enough. It is well known that Ritter, the originator of the causal notion in geography, and, therefore, the greatest benefactor of geography in the nineteenth century, was so hospitable in his treatment of history that his pupils grew up in large number to be historians, and his own subject was in a way lost sight of by many of his students who became professors of geography, so-called, in the German universities, until Peschel revolted and turned attention again to the essential features of geography proper.

Close scrutiny of what is commonly called geography will certainly be beneficial in bringing forward the essence of the subject and in regulating irrelevant topics to the background; but it is not to be expected that any precise agreement will soon be reached as to what constitutes geography, strictly interpreted. Opinions on the subject, gathered from different parts of the country, even if gathered from persons entitled to speak with what is called 'authority,' would probably differ as widely as did the nomenclatures of the leading physiographic divisions of North America as proposed in a symposium a few years ago; but if careful consideration and free discussion are given to the subject, unity of opinion will in due time be approached as closely as is desirable.

As a contribution toward this collection of opinions, let me state my own view: the essential in geography is a relation between the elements of terrestrial environment and the items of organic response; this being only a modernized extension of Ritter's view. Everything that involves such a relationship is to that extent geographic. Anything in which such a relationship is wanting is to that extent not geographic. The location of a manufacturing village at a point where a stream affords water-power is an example of the kind of relation that is meant, and if this example is accepted, then the reasonable principle of continuity will guide us to include under geography every other example in which the way that organic forms have of doing things is conditioned by their inorganic environment. The organic part of geography must not be limited to man, because the time is now past when man is studied altogether apart from the other forms of life on the earth. The colonies of ants on our western deserts, with their burrows, their hills, their roads and their threshing floors, exhibit responses to elements of environment found in soil and climate as clearly as a manufacturing village exhibits a response to water-power. The different coloration of the dorsal and ventral parts of fish is a response to the external illumination of our non-luminous earth. The word *arrive* is a persistent memorial of the importance long ago attached to a successful crossing of the shore line that separates sea and land. It is not significant whether the relation and the elements that enter into it are of easy or difficult understanding, nor whether they are what we call important or unimportant, familiar or unfamiliar. The essential quality of geography is that it involves relations of things organic and inorganic; and the entire content of geography would include all such relations. A large library would be required to hold a full statement of so broad a subject, but elementary text-books of geography may be made by selecting from the whole content such relations as are elementary, and serviceable handbooks may be made by selecting such relations as seem important from their frequency or their significance. The essen-

tial throughout would, however, still be a relation of earth and life, practically as Ritter phrased it when he took the important step of introducing the causal notion as a geographical principle.

Thus defined, geography has two chief divisions. Everything about the earth or any inorganic part of it, considered as an element of the environment by which the organic inhabitants are conditioned, belongs under physical geography or physiography.* Every item in which the organic inhabitants of the earth—plant, animal or man—show a response to the elements of environment, belongs under organic geography. Geography proper involves a consideration of relations in which the things that belong under its two divisions are involved.

The validity of these propositions may be illustrated by a concrete case. The location and growth of Memphis, Helena and Vicksburg are manifestly dependent on the places where the Mississippi River swings against the bluffs of the uplands on the east and west of its flood plain. The mere existence and location of the cities, stated independently of their controlling environment, are empirical items of the organic part of geography, and these items fail to become truly geographic as long as they are stated without reference to their cause. The mere course of the Mississippi, independent of the organic consequences which it controls, is an empirical element of the inorganic part of geography, but it fails to become truly geographic as long as it is treated alone. The two kinds of facts must be combined in order to gain the real geographic flavor. Geography is, therefore, not simply a description of places; it is not simply an account of the earth *and* of its inhabitants, each described independent of the other; it involves a relation of some element of physical geography to some item of organic geography, and nothing from which this relation is absent possesses the essential quality of geographical discipline. The location of a cape or of a city is an elementary fact which may be built up with other facts into a relation of full geographic meaning; but taken alone, it has about the same rank in geography that spelling has in language. A map has about the same place in geography that a dictionary has in literature. The mean annual temperature of a given station, and the occurrence of a certain plant in a certain locality, are facts of kinds that must enter extensively into the relationships with which geography deals; but these facts, standing alone, are wanting in the essential quality of mature geographical science. Not only so; many facts of these kinds may, when treated in other relations, enter into other sciences; for it is not so much the thing that is studied as the relation in which it is studied that determines the science to which it belongs. I, therefore, emphasize again the broad general principle that mature scientific geography is essentially concerned with the relations among its inorganic and organic elements; among the elements of physical and of organic geography, or, as might be said more briefly, among the elements of physiography and of ——. Let me confess to the most indulgent part of this audience that I have invented a one-word name for the organic part of geography, and have found it useful in thinking and writing and teaching; but inasmuch as the ten, or at the outside twelve, new words that I have introduced as technical terms into the growing subject of physiography have given me with some geological critics the reputation of being reckless in regard to terminology, it will be the part of prudence not to mention the new name for

* It should be noted that the British definition of physiography gives it a much wider meaning than is here indicated.

organic geography here, where my audience probably consists for the most part of geologists.

There can be no just complaint of narrowness in a science that has charge of all the relations among the elements of terrestrial environment and the items of organic response. Indeed, the criticism usually made upon the subject thus defined is, as has already been pointed out, that it is too broad, too vaguely limited and too much concerned with all sorts of things to have sufficient unity and coherence for a real science. Some persons, indeed, object that geography has no right to existence as a separate science; that it is chiefly a compound of parts of other sciences; but if it be defined as concerned with the relationships that have been just specified, these objections have little force. It is true, indeed, that the things with which geography must deal are dealt with in other sciences as well, but this is also the case with astronomy, physics, chemistry, geology, botany, zoology, history, economics. * * * There is no subject of study whose facts are independent of all other subjects; not only are the same things studied under different sciences, but every science employs some of the methods and results of other sciences. The individuality of a science depends not on its having to do with things that are cared for by no other science, or on its employing methods that are used in no other science, but on its studying these things and employing these methods in order to gain its own well-defined object. Chemistry, for example, is concerned with the study of material substances in relation to their constitution, but it constantly and most properly employs physical and mathematical methods in reaching its ends. Botanists and zoologists are much interested in the chemical composition and physical action of plants and animals, because the facts of composition and action enter so largely into the understanding of plants and animals considered as living beings. Overlappings of the kind thus indicated are common enough, and geography, as well as other sciences, exhibits them in abundance. It may be that geography has a greater amount of overlapping than any other science; but no valid objection to its content can be made on that ground; the maximum of overlapping must occur in one science or another—there can be no discredit to the science on that account. Geography has to do with rocks whose origin is studied in geology; with the currents of the atmosphere, whose processes exemplify general laws that are studied in physics; with plants and animals, whose forms and manner of growth are the first care of the botanist and zoologist; and with man, whose actions recorded in order of time occupy the historian; but the particular point of view from which the geographer studies all these things makes them as much his own property as they are the property of any one else.

In view of what has been said, let me return to the close scrutiny that I have urged as to what should be admitted within the walls of a geographical society. We will suppose the geography of Pennsylvania is under discussion; as a result there must be some mention of the occurrence of coal, because coal, now an element of inorganic environment, exerts a control over the distribution and the industries of the population of Pennsylvania. But the coal of Pennsylvania might be treated with equal appropriateness by a geologist, if its origin, its deformation and its erosion were considered as local elements in the history of the earth; by a chemist, if its composition were the first object of attention; by a botanist, if the ancient plants that produced the now inorganic coal-beds were studied. Furthermore, it

would be eminently proper for the geologist to make some mention of the present uses to which coal is put; or for the chemist and the botanist to tell something of the geological date when coal was formed, if by so doing the attention of the hearer could be better gained and held, and if the problem at issue could thereby be made clearer and more serviceable. So the geographer is warranted in touching upon the composition, the origin, the exploitation of the Pennsylvania coal-beds, if by so doing he makes a more forcible presentation of his own problem; but if he weakens the presentation of his own problem by the introduction of these unessential facts, still more if he presents these unessential facts as his prime interest, he goes too far. The point of all this is that students in many different sciences may have to consider in common certain aspects of the problems presented by the coal of Pennsylvania; but that each student should consider Pennsylvania coal in the way that best serves his own subject. The scrutiny that I have urged would, therefore, be directed chiefly to excluding from consideration under geography the non-geographic relations of the many things that various sciences have to study in common, and to bringing forward in geography all the problems that are involved in the relations of the earth and its inhabitants. The things involved in the relations of earth and life are the common property of many sciences, but the relations belong essentially to geography. It would be easy to point out topics in text-books and treatises, in the pages of geographical journals and in lectures before geographical societies, that would not fall under any division of geography as here defined. In many such cases, however, the topics might without difficulty have been given a sufficiently geographical turn, had it been so desired or intended; the topics might have been presented from the geographical point of view, so as to emphasize the essential quality of geographical study, had there been a conscious wish to this end. But in other cases, the subjects presented belong so clearly elsewhere, or are treated so completely from some other than a geographical point of view, as to fall quite outside of geography; for example, a recent number of one of our geographical journals contained an excellent full-page plate and a half page of text on the 'Skull of the Imperial Mammoth,' with brief description of its size and anatomy, but with nothing more nearly approaching geographical treatment than the statement that the specimen came from 'the sands of western Texas.' In all such cases it is open to question whether close scrutiny as to inclusion and exclusion has been given, and while the policy pursued by many geographical societies of generously accepting for their journals many sorts of interesting articles has something to commend it in the way of pleasing a mixed constituency, it is, nevertheless, open to the objection of not sufficiently advancing the more scientific aspects of geography. Blades of grass and mammoth skulls are very good things, if crops of hay and collections of fossils are to be gathered; but they are in the way of the growth of the best corn and of the publication of the best geographical journals. Let no one suppose, however, that the audiences in geographical lecture halls or the readers of geographical journals need suffer under the scrutiny that is here urged regarding lectures and articles. There is, even under the strictest scrutiny, an abundance of varied and interesting matter of a strictly geographical nature; few, if any, sciences are richer than geography in matter of general interest. There is, indeed, some reason for thinking that the real obstacle in the way of applying close scrutiny in the way here recom-

mended is the difficulty of obtaining high-grade material presented in an essentially geographical form. Inasmuch as this difficulty arises from the relative inattention to geography as a mature science, it is the business of geographical societies to remove the difficulty.

W. M. Davis.

Harvard University.

(*To be concluded.*)

*SOME UNSOLVED PROBLEMS OF ORGANIC ADAPTATION.**

With the advent of the 'Origin of Species' became current the naturalistic interpretation of organic nature, epitomized in such phrases as 'natural selection,' 'survival of the fittest,' etc. So rapid and general was the acceptance of this conception as a working hypothesis that in thirty years, or within a single generation, Wallace made bold to claim for it universal recognition in the well known and oft-quoted declaration, 'He (Darwin) did his work so well that descent with modification is now universally accepted as the order of nature in the organic world.'

As a general statement of the fact of evolution, as the phrase may be literally interpreted, it may, after fifteen additional years of intense biological activity, be as vigorously claimed and as readily conceded. If, however, it be so interpreted as to include the full content of Darwinism and the all-sufficiency of natural selection as the prime factor, with its details of endless adaptations to environment, whether physical or physiological, it need hardly be said that consent would be far less general or prompt.

Moreover, with the highly metaphysical and speculative deductions which, under the caption of 'Neo-Darwinism,' or, more plainly, 'Weismannism,' which have boldly assumed the omnipotence and all-sufficiency of natural selection to account for the least and last detail of organic differentiation or constancy, widespread doubt and open protest are too common to elicit surprise or comment.

It need hardly be pointed out at this late day, though it is more or less persistently ignored, that primitive Darwinism, while essaying to explain the origin of *species*, and emphasizing the importance of natural selection as a means in the process, did not in the least presume to account for the origin of *variation* and *adaptation*, which were recognized as fundamental and prerequisite in affording conditions without which natural selection must be hopelessly impotent. Nor, moreover, should it be overlooked that while recognizing the inseparable correlation of the factors just mentioned and their essential utility either to the individual or species in the majority of cases, Darwin was free to concede and frank in declaring the efficiency of many other factors in the intricate and complicated problems of organic evolution.

The recent impulse which has come to biologic progress by experimental methods, and the remarkable results which have been attained thereby, may without exaggeration be said to have raised anew many an earlier doubt as well as brought to light problems apparently beyond the scope of the older explanations. It may not, therefore, be an extravagant assumption to announce the entire question of organic adaptations as open for reconsideration, in the light of which no apology will be necessary for directing attention to certain phases of the subject upon the present occasion.

Among the many problems which recent investigations and conclusions have brought into better perspective as well as sharper definition, and which might profitably be discussed, the limits of a single address preclude any very wide range of

* Address of the vice-president and chairman of Section F, Zoology, St. Louis meeting, 1903.