and *Dryobates pubescens medianus* were stated to intergrade along the western side of tide water in the region named, and the range of *medianus* was extended from South Carolina to this section.

Vernon Bailey spoke of 'Sleepy Grass and its Effects on Horses,' stating that this grass grew luxuriantly in some sections of the California Sierras. Horses eating this grass were rendered very drowsy for several days, and it was reported that in some instances they were temporarily too sleepy for use. The effects gradually wore off, and it was said that horses or cattle having eaten this grass would not do so a second time.

F. V. Coville described 'The Use of Sagebrush among the Klamath Indians of Oregon' and illustrated by experiment the manner in which it was employed to make fire by friction. The reason that sagebush was particularly adapted for this purpose was due to the fact that the rings of growth were not of uniform texture, some being soft, others hard. Owing to this the end of a piece of this wood did not wear smooth, but remained rough, causing continued friction, and eventually producing enough heat to light the very dry bark employed in place of tinder.

O. F. Cook presented a paper on 'The Function of Latex in the Central American Rubber Tree,' presenting incidentally much information as to the habits of the tree and the production of rubber. It was stated that, while the tree throve in moist climates, this was not favorable to the yield of rubber, which was greatest after a dry season, and lack of acquaintance with this fact led to the attempt to cultivate rubber trees in unsuitable localities. From observation of this and plants with similar sap it was inferred that an important function of the latex was to check evaporation.

F. A. LUCAS.

THE RESEARCH CLUB OF THE UNIVERSITY OF MICHIGAN.

THE Club met on the evening of November 19 and listened to papers by Professors John A. Fairlie and S. L. Bigelow.

Dr. Fairlie discussed the Ohio situation in the relation of legislative enactments for municipal government; and Dr. Bigelow spoke on 'The Passage of a Direct Current through an Electrolyte when the Electromotive Force Applied is Small.' The speaker stated that every attempt to determine Le Blanc's decomposition points shows that small currents pass before such a point is reached. Attempts to account for these currents by means of polarization phenomena, including the idea of electric 'double layers,' by Nernst's osmotic theory, and by Helmholtz's 'convection currents,' were shown to be unsatisfactory. A new theory was suggested: that a gas (hydrogen or oxygen) on dissolving becomes differentiated to a certain extent into molecules with plus charges and molecules with minus charges which then act as carriers of electrical energy. Facts already known and new experimental evidence were adduced in favor of this view. It was further proposed to apply Thompson's corpuscular theory to solutions, a justification for this being found in the close analogies known to exist between substances in dilute solution and in the gaseous condition, and Thompson's theory was considered preferable to the theory of electrons as stated by Nernst. It was pointed out that this theory would account for the currents passing at low voltage, and possibly for conduction in solutions whose boiling and freezing points fail to indicate corresponding dissociation. It was expressly stated that this new idea does not conflict with the dissociation theory, but rather serves to support it, offering a plausible explanation of some apparent exceptions.

The article will appear in the December number of the *Journal of Physical Chemistry*.

FREDERICK C. NEWCOMBE,
*Secretary*.

## DISCUSSION AND CORRESPONDENCE.

### THE CARNEGIE INSTITUTION.

TO THE EDITOR OF SCIENCE: Munificent as is the endowment of the Carnegie Institution, it is safe to assume that most of the good things proposed for science in the official plans will be enjoyed only by future generations; important results can be attained on the probable income, but not results in many directions. It may be, too, that some of the

proposals lie near to the founder's heart, enough of them to exhaust most of the available resources. One thus feels some hesitancy in making suggestions, for fear the trustees are committed in piety to all they can 'broadly and liberally' carry forward.

But there is one possible group of enterprises of no little importance, that has received little direct mention. There are, namely, a number of scientific undertakings, some highly interesting in theory, some vitally useful in practice, and many both the one and the other, that can hardly be entered into by university teachers, and can be entered into by other scientists only under great disadvantages. At least this is true under present conditions, and will continue to be true until some broadly founded and liberally managed institution shows, by successful example, how such things should be done.

I refer to broad, complex, and, in many instances, very practical problems, whose solution depends in each case on the accumulation and skilled synthesis and re-synthesis of data falling within the fields of a number of different sciences. It is true that all sciences are compelled in these days to poach on their neighbors' preserves. But in some cases the facts must be sought, not mainly in one domain, and only exceptionally in others, but about equally in a number of different scientific domains, and they can be properly gathered from each domain and digested only by men of special aptitude and training. For an investigation of this type there is need of a force of workers, each skilled in a particular science, and all organized and cooperating for a common end, a condition that does not exist in universities, and exists only rarely and to a limited extent in other scientific foundations. Such organized bodies of men are needed to deal with the problems of temperance, of crime, of marriage and divorce, of pauperism, etc., and also to deal with the broader problems of ethics, within whose scope all these problems and many more are included. They are also needed by anthropology, in the broadest sense of the word, by sociology—which will probably never be a science till the need is supplied—and, finally, by metaphysics, to which the same remark applies.

The greatest defect of science is probably lack of organization, and until the defect is remedied, large investigations cannot be successfully undertaken. Its realm is no doubt minutely subdivided, like, say, the land of France, so that each worker enthusiastically farms his own little patch. But specialization is only one factor in organization, not the whole of it. Mutual aid, cooperation among workers is the other indispensable factor, and of that little is to be found among scientific men. The amount of highly trained brain substance that is used up in activities that merely call for the intelligence of a clerk, or even of a machine, is simply appalling. Little more than a dozen investigators at our universities have a clerk or stenographer, and I know of none who has at his disposal specialists in other scientific departments. Each attends to all his needs, from blacking his boots and writing with his hand, to gathering all his facts, with the aid of a few advanced students in the most favored cases, and thinking out his conclusions. Professor Münsterberg is right in asking larger salaries for scientific workers, though their portion in this respect is not intolerable. But their acute financial need is not private, but official; they need money to put into their work and make it truly efficient; to pay for labor-saving devices, to buy equipment, to hire clerks, to employ well-trained specialists as assistants. Science is organized as industry was during the later Middle Ages, when each smith hammered at his own forge, and every other worker labored alone, or with a few apprentices, at his workshop. It should be organized, at least for attack on the larger problems, as industry is to-day, where one organization, by the aid of many devices and of all necessary experts, begins with the raw material and ends with the finished product. Naturally, scientific organization will have its own problems, and it can not hope for a long time to be by any means as complete as industrial organizations, but a beginning should be made as soon, and under as favorable conditions, as possible. It is about as

reasonable to ask our scientists to-day to solve large problems, as it would be to furnish Mr. Schwab a coal and an iron mine, and ask him and a few miners to turn out a steel rail or a Baldwin locomotive.

If the Carnegie Institution would thoroughly organize bodies of workers in a few fields too large and complex for our present resources and methods, and furnish them with adequate supplies of all kinds, it would avoid duplication, and would, I venture to believe, set an inspiring example to our present scientific institutions, and attain reliable and relatively complete results of high value. And assuredly an institution founded by one of the foremost organizers of industry could do no better for science than to aid in its organization.

S. E. MEZES.

UNIVERSITY OF TEXAS.

TO THE EDITOR OF SCIENCE: With the accumulation of valuable papers from men of science in regard to the disbursement of the fund of the Carnegie Institution so as best to advance human knowledge, it has occurred to me that, as these papers have all been written by teachers or authors, it might not be out of place for a collector of facts (who has helped increase our knowledge of the extinct life of the earth during thirty-five years spent in the fossil fields of the West) to make a few remarks on this interesting topic, even though the years of early manhood were spent in the field and not the university. From long experience I can testify to the difficult life-work of a collector in America, when he gives all that he has to the advancement of pure science, and can well appreciate the remark of Professor E. D. Cope when he said to me several years ago: 'After us there will be more demand for our wares.' Though I have fared better than some collectors, and have usually received credit for my discoveries, yet it has grieved me that I had to send a large number of my most valuable collections of Permian and Cretaceous vertebrates to Munich, for lack of proper support and encouragement at home. And though the words of commendation from such a noted authority as Dr. von Zittel are very pleasant to receive, when he writes me my collections from Kansas and Texas are the best in Europe, and that they will be an everlasting memorial to my name, I am an American, and it has hurt me to see treasures that are of greater value than anything man's fingers or brains have created leave our shores forever. Now, as thirty-five years have been devoted to the advancement of historical geology with little hopes of ever receiving financial considerations for my life-work, and, judging the future by the past, many more of my fossils will cross the Atlantic, as did a fine skeleton of a Kansas mosasaur I sent the British Museum last month, I want to ask that the Carnegie Institution take measures, if it lies in their power, to stop this fearful drain on our natural resources and retain in American institutions the wonderfully preserved records of the Almighty in the rocks of America. I have little doubt but that specimens have left our country that can never be duplicated. I remember that the only fine specimen I ever found of a Cretaceous shark, about twenty-five feet long, now rests in Munich. Owing to the cartilaginous nature of the bones it is rare indeed to find the whole column preserved.

Not only should all the valuable fossils remain in our country, but the fossil hunter of the future should have better material returns for his labor than has been my lot. Professor Edward Orton once wrote me that the work of collecting was a pleasant avocation, but as yet would not do as a vocation. I have often thought he was right when I have had to struggle for means to keep at work so I could continue through life to add to the store of historical facts. This state of affairs should cease in the United States, and the Carnegie Institution could do no better with the fund left in their charge in advancing science than first to retain in American institutions the extinct fossils that make up the ancient life histories of the earth. And second to properly reimburse men who will give their lives, if necessary, to accumulate facts in paleontology, and prepare them for scientific study. I hold it as self-evident that there can be no advancement of the sci-

ence without the collections; that if they are made men will come to study and describe them. Thousands of pages of paleontological literature are worthless because paleontologists have attempted to restore animals they never saw from a few broken bones of the skeletons —a thing that is absolutely impossible. So also is it burdened with species after species described from fragments, when perfect specimens are found, many of them resolved into one. Such work is worse than labor lost. Nature makes no mistakes and a perfect specimen is of more value than many books describing poor or imperfect material.

Charles H. Sternberg.

Lawrence, Kansas,
November 6, 1902.

That the Carnegie Institution should, above all, accomplish work not being done elsewhere is the one proposition in this symposium which has not met with disagreement. The establishment of a vivarium for experimental evolution meets this requirement. It is no longer necessary to urge the value of such an institution. I shall only try to show why work in experimental evolution has been retarded and how a well-equipped and well-supported vivarium will make possible great development in this direction.

There is not lacking ability, interest or desire to do this kind or work. It is the lack of facilities which prevents effort. The resources of the agricultural experiment stations are not available, because they are restricted to economic problems. Experiments in evolution are beyond the means of the unassisted worker for the following reasons:

1. *Expense.*—A barn, a greenhouse and a large and adequately protected garden are required. Moreover, the collection of material would sometimes require the expense of traveling.

2. *Time.*—Every-day year-around attention is impossible for most college teachers, who are generally absent from time to time for lectures, meetings and vacations, and who cannot afford to employ a reliable and skilled assistant to carry on the routine work in their absence.

3. *Permanence.*—Such experiments often need to be continued through many years, some even indefinitely. This is very difficult in a university where such work would most likely be attempted, because it would be by the energy of but one man who might at any time be called to another position.

One must further consider that effort in such a vivarium must be vastly more productive than equal effort from individual investigators, for the following reasons:

1. *Division of Labor.*—Since much of the labor involved is of a routine nature which can be carried on by a skilled gardener or attendant, the results will be of greater value because experiments involving numbers can be carried out on a large scale and more problems can be undertaken.

2. *Superiority of Equipment.*—The equipment would be of the best, thus insuring more and better results. Accidents resulting from improvised or inadequate apparatus or arrangements have spoiled many experiments; witness the work upon breeding insect larvæ.

Let us hope that the Carnegie Institution will seize the opportunity of aiding in putting evolution at last on an inductive basis.

Roswell H. Johnson.

One respect in which German chemists have an important advantage over most Americans is that many of them work with the aid of private assistants. These assistants are usually thoroughly trained men who have already taken the doctor's degree. They have no duties as instructors or otherwise in connection with teaching.

In a few cases American chemists having independent means have employed men to aid them in their researches, but, with very rare exceptions, colleges or universities have not used their funds for such a purpose. If private assistants were furnished, who should work exclusively in carrying out experimental researches under the direction of some of those chemists who have already done good, independent work, large results would, undoubtedly, be obtained. It is difficult to see how in any other way so much could be accomplished toward furthering chemical research.

W. A. Noyes.