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## Local Problems in Science

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PROCEEDINGS  
OF THE  
Iowa Academy of Sciences,  
FOR  
1888.

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The annual session for 1888 convened in the Hall of the Young Men's Christian Association, Des Moines, Iowa, on September 5th, with a full attendance of the recognized membership present. After the formal induction into the office of president of the president-elect, Prof. Herbert Osborn, of the Iowa Agricultural College, the Academy listened to the following annual address:

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**LOCAL PROBLEMS IN SCIENCE.**

BY PRESIDENT HERBERT OSBORN.

It may be said, with truth, that science knows no boundaries of geography, politics, sect or race. That if there is to her credit, any characteristic of permanence, it is that of universality. But admitting this cosmopolitan, universal characteristic, we may agree that in every country, State and community, there are scientific questions of special local importance and interest, questions which, while entering into the science of the world, having their relationship of dependence upon, and of support to, allied questions the world over, are still so local in their nature that only local interest is the warrant for their special investigation.

I deem it unnecessary therefore to offer any apology for

asking your attention to a brief outline of certain scientific problems whose solution has special relation to the State of Iowa.

My paper naturally assumes the form of a brief review of the scientific work in the State, the progress that has been made in certain lines and the hasty mention of such as force themselves on your attention for the future.

The prosecution of scientific investigation in the State has not, as a rule, been assisted by organized societies or institutions to the extent seen in sister States, but such as have existed should, perhaps, receive first mention.

The first of such organizations to operate in the State was a government exploring party and scientific work apparently began when Thomas Say, as a member of Long's expedition to the Northwest Territory in 1819-20, collected and subsequently described many forms of life occurring in the State. His descriptions are to be found in the reports of the expedition and in the publications of the Philadelphia Academy.

The geological survey of Wisconsin, Iowa and Minnesota in 1848-52 appears to have been the first careful investigation into the geological formations of the State, followed, shortly after, in 1855-9, by the first State geological survey under Professor James Hall.

The second State geological survey was organized in the spring of 1866 and placed in charge of Dr. C. A. White. This survey was continued till 1869 and reports printed in 1870.

The Davenport Academy of Natural Sciences was organized in 1867 and has since 1876 published proceedings which contain many valuable papers upon the geology, natural history, etc, of the State of Iowa, more especially the portion adjacent to Davenport.

The Iowa Academy of Sciences, the only State Society, previous to our own, devoted strictly to the sciences and embracing especially the scientific problems of the State, was organ-

ized in 1875, and after having been the means of encouraging investigation in many portions of the State unfortunately died in 1884. Its brief published record of proceedings contains titles and abstracts of many valuable papers, many of which were published in full in various scientific journals.

Other scientific organizations have existed here and there over the State, but none publish regular proceedings and it is difficult to arrive at any opinion as to the extent or character of their work.

Mention should be made, however, of the Iowa Assembly of the Agassiz Association, which is one of the most prosperous in the country, and from which we look for devoted scientific workers in the immediate future.

In the transactions of the Iowa State Horticultural Society and the State Agricultural Society there may be found occasional papers upon the botany, ornithology, entomology and geology of the State. Most of these were prepared with special reference to their relations to horticulture and agriculture, but many contain contributions to the scientific literature of the State not elsewhere accessible.

In the biennial reports and the bulletins of the Iowa Agricultural College may be found papers on the meteorology and natural history of the State.

The State Weather Service, organized as a volunteer service by Dr. G. Hinrichs in 1875, has since 1878 received financial assistance from the State and the published reports of the service contain records of observation at many stations throughout the State.

These have been the principal channels of publication for essentially local scientific contributions and almost the only ones not dependent upon individual enterprise.

Students of anthropology have found in Iowa some extremely interesting fields for study, and the work in this branch which has centered mainly in the Davenport Academy

has resulted in bringing to light many valuable facts. Some of the discoveries there made have been of so great importance in affecting the views of leading anthropologists as to have been the source of severe contention. There still exists an opportunity in the Indian tribes on the reservation in Tama County to study some of the details of Indian life, but I am not aware that the opportunity has been improved by any Iowa anthropologist. Possibly these Indians have mingled too much with civilization around them to furnish much of value concerning their former mode of life, and it may be that the tribes are already too well known to need further study.

The great advance made of late years in all studies pertaining to the past inhabitants of this continent render the further investigation of prehistoric remains in this State not only more interesting and significant, but must render the prosecution of such work and the interpretation of results more easy, certain and reliable.

The desire to know all we can of the past inhabitants of the soil we occupy has in it more than idle curiosity. The fact that nations were born, developed to their fullest powers, grew old and died, and were replaced by others to follow the same cycle on this the soil where we have established in their place a higher civilization, should lead us to look well to all weak points in our social and political structure. The history of the Aborigines of America may have its place in our education as well as the histories of the dynasties of the Old World.

In the line of zoology, while there has never been official support or workers numerous, such progress has been made as may furnish ready foundation for the work of coming students. As elsewhere, and from the nature of the case, more is known of the local *fauna* in our State among the vertebrates than in the lower groups of animals. The mammals

are much the same as those of the adjoining States, but occupying the border land between the valley and the plain their distribution presents many interesting questions. The species now extinct or doomed to extinction by the invading presence of man have need of an historian, and his work can not be begun too soon.

The first attention given to the birds of the State was probably about the year 1820, by Thomas Say, though to what extent his collections were made strictly within our borders it is difficult to determine. Doubtless the famous Audubon in his many travels through the Mississippi Valley touched more than once upon our soil, and collected here some of the material for his famous drawings and descriptions. I do not recall, however, his statement of any localities now recognizable as within the State.

In 1868 Prof. J. A. Allen<sup>1</sup> published notes on Iowa birds, giving a list of many species occurring in the State. To this list Prof. H. W. Parker, of Iowa College at Grinnell, made a considerable addition in a note in the *American Naturalist*,<sup>2</sup> entitled, "Iowa Birds"; and in the report of the State geological survey under Dr. White, Prof. Allen presents a much more complete catalogue. Recently, Dr. H. S. Williams and Mr. C. R. Keyes have conjointly made an exhaustive study of the State bird *fauna*, and it is probable that but few species remain to be added to their catalogue.

Prof. F. E. L. Beal, Charles Aldrich, Prof. H. W. Parker, Mr. F. M. Tripp and others have contributed to our knowledge of local bird *fauna* within the State, breeding habits, migration, etc.

While little may be left to do upon the *avian fauna* of the State at large, much may be done concerning local distribution as to valley, hill, forest or prairie, breeding grounds and time of appearance and disappearance of migratory spe-

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1—Mem. Bost. Soc. Nat. Hist. Vol. I, p. IV.

2—*American Naturalist*, Vol. V., p. 168.

Especially is there the question so absorbing both economically and scientifically, as to their food, habits and the precise relation of each species to other branches of the organic world, all of which vary more or less with locality, and hence demand study in all parts of the State. The new division of ornithology and mammalogy in the United States Department of Agriculture furnishes opportunity for any disposed to assist in these problems to render contributions which may have far more than local value. Isolated observations, published in connection with many others on the same subject from different localities, become of far greater significance and value.

I am not aware of any record of the reptiles, batrachians or fishes, which pretends to represent the *fauna* of the State in these classes, and in the latter classes especially there is opportunity for rich returning to the investigator. A beginning has been made by Profs. Jordan and Meek who, a few years since, collected in some of the streams of Southern Iowa and published a list of species collected in Iowa, in the Proceedings of the National Museum. The economic aspects of the fishes are probably not fully appreciated by the people of the State, but are recognized to the extent of an official fish commissioner. A better knowledge of the breeding habits and food supply and enemies of the food fishes common to our streams and lakes would doubtless be of great advantage in assisting their multiplication, and alongside of attempts to introduce food fishes from abroad (and it seems to me more important than them) there should be an intelligent effort to further the production of the best species native to the State.

Of the invertebrates, no group can equal the insects, both in scientific and economic importance. Contributions in this branch have been made by Hoffmeister, Parker, Bessey, Putnam, Witter, Walton and the writer, with others whose names not now in mind may deserve equal mention.

Much of the work done has very naturally been upon the histories of species, and frequently with reference to the vast economic relations they assume. While there is much of complexity in their study, and the beginner soon becomes appalled at the multiplicity of forms observed in his own locality, there is much to whet his interest and repay his efforts in study. Collections are easily made, and with a little attention to important details for their preservation might form useful and permanent adjuncts to education in every school district.

No faunal list in this group approximating completeness has been published, and for the present is out of the question.

Prof. C. E. Bessey published a preliminary list of the *Orthoptera* of Iowa in 1877.<sup>3</sup> Mr. J. Duncan Putnam published lists of the *Lepidoptera* and *Coleoptera* for Davenport, and also lists of *Coleoptera* collected at Monticello and Frederick.<sup>4</sup> Miss Alice Walton has given a lists of *Lepidoptera* for Muscatine<sup>4</sup> including mostly *Macro-lepidoptera*.<sup>5</sup> The writer has presented lists of *Rhopalocera Sphingidæ* and *Odonata* for the central part of the State to the Iowa Academy of Sciences, and at the last meeting of this association a preliminary list of the *Hemiptera* of the State. Also in connection with Mr. H. F. Wickham, of Iowa City, the fragment of a catalogue of the *Coleoptera* of the State.

Entomologically we occupy interesting territory, since in our fauna we have a mingling not of eastern with western forms, but of southern and northern. Many southern species find their northern limit within the borders of the State, and similarly northern species reach their southern boundary here. Moreover, we have frequent evidence of the partial innovation of southern forms—species which, apparently, reaching us as stragglers are able some seasons to fix them-

3—Seventh Biennial Report of the Iowa Agricultural College, 1877, p. 205-10.

4—Proc. Dav. Acad. Nat. Sci., Vol. I, 1875, p. 169-177.

5—Proc. Dav. Acad. Nat. Sci., Vol. II, p. 141-2.



selves and for a few generations, at least, to live and multiply.

Aside from the questions of native species and of the distribution in the State, there is work for any number of investigators upon the life-histories and habits of our native insects. There are hundreds, nay, I doubt not, thousands of insects, native to the State, concerning whose life history we know the merest fragment or nothing whatsoever. Of those which have been studied the ones best known seem to present the greatest number of problems open for further study.

In the *Crustacea* we have a wealth of material which no Iowan has as yet seen fit to mine. While doubtless our *fauna* agrees closely with that of Illinois or Minnesota, where this group has been studied more thoroughly, it would be both interesting and useful for some student to give the group his attention so far as to determine to what extent they are identical.

The *mollusks* of the State are receiving the attention of our worthy secretary, Prof. R. E. Call, and have been studied also by Profs. Pratt, Witter, Pilsbry, Shimek and others. We have as yet no complete faunal list, though the list by Prof. Pratt<sup>6</sup> and Prof. Call<sup>7</sup> given for certain localities cover pretty well the fauna of the State in the groups treated.

The economic relations they bear to aquatic life and to higher animals as the intermediate hosts for numerous parasites renders them important objects to study.

Of worms we know comparatively little. A few parasitic species and the universal earth worm (which means several genera and species) have been studied, but much remains to be done. Darwin (in his admirable memoir on the Earth-worm) has shown us plainly the great importance of this apparently insignificant animal, and other forms await

6—Proc. Dav. Acad. Nat. Sci., Vol. I., p. 165-57.

7—Bull. Des Moines Sci., Vol. I., No. 1, p. 5-67.

future Darwins to show their relations to the economy of nature.

Our streams, ponds, ditches and swamps, like those of other States, swarm with the minute forms of life whose size renders them unnoticed, but whose existence is as full of incident as that of higher forms. I know of no attempt as yet to even enumerate the common forms found in the State. They are everywhere abundant, and to every possessor of a fairly good microscope offer a most delightful field of research.

Of such aquatic forms the *Crustacea* have already been mentioned. Prof. F. E. L. Beal has contributed notes on the *Tardigrada*. Of *Hydrozoa* we have, so far as yet known, but one or two forms though it is probable that others may occur. Of sponges a few of the fresh water species have been determined by Mr. Edward Potts, of Philadelphia, from specimens sent from Ames and recorded in his Monograph of fresh water sponges.<sup>8</sup> Of the *Protozoa* there are innumerable forms but so far as known except the description of one species by Prof. C. C. Nutting,<sup>9</sup> of Iowa City, no attempt at a systematic study of them has been made.

The flora of Iowa is to be congratulated on the fact that it has received the attention of some of the most eminent botanists of the day. Parry, Bessey, Arthur, Halsted, Holway, McBride and many others have contributed to a knowledge of our native plants.

The first contribution which has come to my notice is an elaborate list of species by Dr. C. C. Parry, published in the Report of the Geological Survey of the Northwest. The list enumerates above eight hundred species, a large part of which are credited to Iowa.

Messrs. Haupt and Nagel have listed the flowering plants of Davenport.<sup>10</sup>

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8—Proc. Phil. Acad. Nat. Sci., 1887, p. 157-279.

9—Amer. Nat. Vol. XXII., p. 13.

10—Proc. Dav. Acad. Nat. Sci., Vol. I., p. 153-164.

Of the higher forms—especially the flowering plants—the catalogues by Prof. J. C. Arthur in the proceedings of the Davenport Academy may be taken as fairly complete for the State, but in the lower groups—to judge by the number of recent additions—the list is but begun, while their relations to agriculture call for careful study. Even for the better known part of the flora there is work for local collectors in determining the richness of their localities, in fixing the boundaries of species, or recording the progress of invading forms.

Among the lower forms, whose presence is of so much importance as sources of disease to both animals and plants, we have our full quota, and, while many of these are of equal importance elsewhere, there is every reason to push their investigation on Iowa soil. The mildews, rusts and blights as well as the hosts of bacterial forms present us with an array of problems so vital to the well-being of the community that it is not strange we should find investigations in progress on all hands. It is to be hoped that the State of Iowa shall produce its full share of investigators and reap as rich rewards as other States in the harvest of discoveries that have but begun. In this branch of study we have the contributions by Prof. C. E. Bessey, also numerous papers by Dr. J. C. Arthur, Dr. B. D. Halsted, Prof. T. H. McBride, Dr. C. M. Hobby and others.

I have already mentioned briefly the existence of the various geological surveys of the State. The first organized under the general government as the Northwest survey, and embracing Wisconsin, Iowa and Minnesota. So far as Iowa was concerned it must be considered as but a partial reconnaissance, and scarcely more than touched upon the geological problems in the State which are of most vital interest to her people and the science. It went far enough, however, to locate in general the different geological areas

of the State, limited to some extent the coal area and described in a general way the rich sources of agricultural wealth, sources which have since been so abundantly utilized. Its reports contain also valuable papers upon the paleontology and botany of the State, and many chemical analyses of rocks, soils, fossil bones, etc.

The first State survey, organized when only a narrow border of the eastern portion had been settled, naturally directed all its efforts to that portion of the State, and as a consequence many of the most interesting and important portions of the State, geologically, were not even visited. The investigation of the lead region of Dubuque by Prof. Whitney was, however, so exhaustive and accurate that Dr. White considered it unnecessary in the following survey to give it any attention. In addition to this, the survey did a great deal to make known the fossils of the older strata in the State and lay a foundation for further geological work.

This survey was, however, brought to a sudden close, and in a way that has ever since left discredit upon the legislature that permitted it. The director was left without funds for the prosecution of his work when but partially finished, a portion of his salary unpaid, and the State even refused to reimburse him for money he had advanced to pay his assistants and prepare plates for his reports.

The second survey, under State support, endeavored to operate more particularly in the portions of the State not previously examined, but in order to give a correct outline of the geology of the State as a whole and fill gaps in the previous survey, had necessarily to re-examine much of the ground already traversed. This second survey had scarcely completed a general reconnaissance of the State when it too was brought to a sudden termination; not, however, with so much of discredit in the manner of its termination.

In view of the circumstance of its preparation we must consider this report upon this survey as a most valuable con-

tribution to the geology of the State. The formations were mapped with approximate accuracy, and in the location of the coal areas alone there has doubtless been a saving of vast sums of money to the State in prevention of useless prospecting for coal in portions of the State where coal could not possibly occur. Prof. W. J. McGee gives in the Tenth Census Report an excellent review of the quarries and quarry products of the State.

Of individual workers in geology we have had many of whom we may feel proud, and the contributions to this subject by Profs. Todd, Calvin, McGee, Call, Barris, Wachsmith and others\* have added much to our knowledge.

Of especial interest and importance have been the studies of recent deposits, drift, loess, etc., by Profs. McGee, Call and Todd, which, owing to the paramount importance of agriculture in our State, are of direct interest to the people of every portion of the State.

But how much remains to be studied in this direction? The recent discoveries and great advances in utilization of oil and gas render of absorbing interest all the geological formations where these may possibly occur. Their careful examination would be of great service to the people of the State, and might be the means of saving thousands of dollars by preventing useless prospecting.

The coal formations merit further investigation, and peat bogs, quarries, gypsum and other mineral deposits, with a host of minor subjects, in one part of the State or another, await scientific examination. The location of areas where artesian wells are liable to be secured would also be of great service, and even an approximate outline of such areas, possible from a knowledge of the character and slope of the geological strata in given localities might save large sums

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\* Since the above was penned we have been pleased to note the appearance of several papers on Iowa geology, from Mr. Clement L. Webster and Mr. C. R. Keyes, in *The American Geologist* and *American Naturalist*.

expended in boring for artesian wells in places where such wells cannot be expected.

Our State, with others in its latitude, has undergone the interesting phenomenon of glaciation, and every student of geology must have become absorbed in the problems presented, the exact outline of the moraines, the depth of the drift, the nature and origin of the detritus, the course of glacial and pre-glacial streams, and a host of other questions which repeat themselves in every neighborhood of the State, offer abundant opportunity for the local student of geology, and every contribution to the subject, no matter how local it may appear, helps to swell our knowledge of the ground on which we live.

Erratic boulders greet us on every hand, like sphinxes, each burdened with unanswered questions. Whence came they? How did they come, where and how were they formed? What their composition, their structure, their history? Surely, these questions cannot be answered alike for all we see. While some we may consider as for the present, at least, apparently settled, what we know must certainly be far less than that which is unknown. In elucidation of these the chemist, the physicist, and the geologist have all a part with test tube, crucible, microscope and a host of other appliances.

Closely intermingled with the geological problems of the State are certain lines of investigation in physics and chemistry.

The physical conditions connected with the formation of our soils and various geological deposits, while many of them universal in their nature, have all a local interest and many may be studied to excellent advantage at various parts in the State. The causes and conditions incident to glaciation, the phenomena of erosion and sedimentation which have so much to do with the present condition of our surface soils have all a physical explanation to be applied in individual localities.

Here, too, we may consider those physical conditions of the atmosphere whose changes have so much of vital concern for the organisms which exist upon the earth's surface.

The subject of meteorology has received a considerable amount of attention in the State. It will be, of course, impossible to mention all the parties who have contributed to this subject, either as individual observers or as reporters for some of the organized weather services. Records by Prof. Parvin were begun at Muscatine in 1859, and his record for 1850-6 is published in the First Geological Report. The United States Signal Service has had a number of stations in the State since its first organization, some of which have been volunteer and others supported by the service. The records have, for the most part, only appeared in the reports of the service, but for the station at Ames and conducted by Profs. Macomber and Hainer summaries of the more important observations have been published in the College Biennial reports.

The State Weather Service already mentioned, organized and directed by Dr. Gustavus Hinrichs, receives reports from some fifty volunteer observers scattered over the State, and the published records contain extensive tabulations of their reports.

Inasmuch as this service receives direct support from the State and the expense of publication is borne by the State, people naturally look for some return in the way of assistance in meeting the idiosyncracies of the "weather".

It is perhaps too much to expect that people in general will appreciate a mere record of the weather which is past, no matter what its scientific value or interest may be, nor will many appreciate the claim that long series of observations are still necessary as a basis for useful forecasts. The farmer gathering his crops, the merchant with perishable articles on hand, the man in any calling whose work or whose pursuit

of pleasure is affected by the condition of the weather is far more interested in what the conditions will be in the twenty-four to forty-eight hours ahead of him than he can be in the weather of six months or a year in the past.

The occasional wail which is heard when the weather forecaster makes a mistake affecting any large area is in itself strong evidence that the predictions of the Signal Service are consulted daily by thousands of interested people, and that to a certain extent, at least, they base their plans for the day on such predictions. Such could not be the case if the service did not in the majority of cases prove useful by giving accurate predictions.

I believe that both science and the public welfare would be benefitted if there could be a proper connection between the State and Government services. The Signal Service spends annually large sums of money in supporting observers and distributing predictions by telegraph in our State. In so far as the State Service duplicates such work, there is loss of effort and money. The observations taken at different hours and under different instructions, are not readily compared for lack of uniformity.

I would not be understood as depreciating the work of our State Service or favoring any reduction of its resources but as suggesting merely the effort to so combine the work now carried on in entirely independent ways as to secure records capable of exact comparison, and distribute the greatest amount of valuable information to the people of the State.

In all of the various geological surveys a prominent place was given to chemical determinations of the different rocks belonging to various formations, and in a general way we have information upon this subject for the most important strata. The survey by Owens seems to have confined its work in this line to the Lake Superior region. In the survey under Prof. Hall much attention to the subject was given and the



report by Prof. C. D. Whitney contains many analyses of rocks and minerals. In the second survey the report on chemistry, from Prof. Rush Emery shows a great amount of work upon the rocks, minerals, waters and coal of the State.

Aside from this, however, no little work has been done in the way of analyses of water from the various streams and other water supplies of the State, largely through the efforts of the State Board of Health. Messrs. Pope, Robbins, Shearer, Bennett, Andrews, Herrick and others have done much in this line, and while in many cases these analyses have not been published in any form accessible to the scientific world, I believe that a careful collection and comparative statement of all that could be brought together would furnish an exceedingly valuable and interesting document.

Aside from the economic question of water supply for cities and towns, and omitting the question of mere organic contamination, such analyses must furnish a hint, at least, as to the mineral constituents of the soils from which the water is collected, and especially in the case of mineral springs or artesian wells some information as to the character of the deeper geological deposits, of their respective areas.

Chemical analyses upon rocks, coals, fossils, etc., throw light upon the conditions of their formation and though repeated for every locality in the State where a certain geological formation occurs each one would have its especial value in comparison with the others as determining difference in condition during formation at such various localities. Moreover the immense changes in chemical composition between contiguous strata of different formations and even in different strata of the same geological age indicate some striking change of physical conditions in the waters from which such rocks were precipitated, changes which we may never be able to discover but which must apparently be approached from the chemical standpoint and for which very complete series of determinations for related rocks must be essential.

The chemistry of plants and animals is a subject as yet but slightly worked, and one of growing importance. While it cannot be considered as local in its nature, the question as to how much of variation in composition is possible, and to what extent such variation is influenced by climatic and other physical conditions, is one which can only be determined by local investigations. Not only the organisms themselves but the product of organic activity and organic decay and dissolution are rich with unsolved problems.

The principal means at present existing for the illustration of the fauna, flora, geology and mineralogy of the State are connected with educational institutions. The State University, Agricultural College, Iowa College at Grinnell, Cornell College at Mt. Vernon, and possibly some others possess collections of some extent. In all of these, however, and necessarily from the educational standpoint, it will be found that much space is given to foreign animals, and that our local fauna is meagerly represented. In none of them is there anything like a comprehensive exhibit of the State fauna. The State University is rich in mammals from the Hornaday collection, and will doubtless have a good representation of the mammalian fauna of the State. The Agricultural College has a fairly complete series of the birds of the State, either mounted or in skins, also considerable collections of reptiles and insects.

The museum of the Davenport Academy has a more local object, and its museum is especially rich in anthropology. It will be seen that in no place in the State is there a collection especially devoted to exhibiting the resources of the State.

For the purpose of bringing such material together and making it available for purposes of knowledge, we have great need of a State collection which may be said to have for its special purpose the illustrations of the natural history of the

State. Until provided with such State cabinet or Laboratory of natural history, Iowa will be behind her sister States in means for presenting to her citizens in concrete form a knowledge of her wealth in animal and vegetable life, in fossils, rocks, minerals, ores and soils, with all the other stores of geologic wealth, a knowledge of which has just begun. Such a cabinet and laboratory should have for its scope the illustration by properly mounted specimens of all the mammals that are resident in the State, or that have been known to occupy its territory in past time. The bison, the cayote, the deer, bear and panther thus brought out in the midst of our civilization would furnish us striking pictures of the rapid progress our State has seen, and these with the relics of their human contemporary, who occupied but did not possess, who inhabited but did not develop, who existed but did not *live*, whose history is but one of gluttony or starvation, warfare or animal enjoyment, all these so grouped as to teach their lesson of possibilities in human progress and attainment might well occupy an important position in the metropolis and political center of our wealthy State, a place where the thousands who annually travel in quest of pleasure or instruction, might be both entertained and instructed.

But not dwelling upon these forms which are past, such a collection would embrace, too, those living species that in one way or another force themselves on our attention. Some vitally affect the wealth of the State, and a collection illustrating their habits, open to the State at large, would be an object lesson that could but leave an impress on those who visited it.

The birds and mammals should be so arranged as to illustrate their habits and their relations to each and to other organisms and to the agriculture, horticulture, etc., of the State, the native insects in their multitudinous phases of existence, with other objects in like completeness. Such an enterprise may

seem fanciful and visionary, but we need only to look to other States to see such work in progress. It would need time and perpetual aid from the State to keep it in progress when established, but compared with the importance of the matter to the State the outlay need be but insignificant. With it might be combined such scientific work in the State as a geological survey, and the investigation of the zoological, entomological and botanical problems of the State.

Many of the problems here mentioned are of such strictly local interest that we cannot expect scientific men or societies from without the State to engage upon them. Being connected with the sources of wealth in the State, of vital economic interest to the State at large, it would seem that no argument would be necessary to show the propriety of the State's assisting in their study. From the very nature of the case their full solution is impossible, and cannot be expected from private enterprise or even from community, town or county effort. The sources of wealth they affect are vital to the people of every section of the State, and as all would be benefitted all should bear part in support.

A geological survey of the State, for instance, can never be hoped for from private enterprise, though many scientific men have by their individual and unpaid efforts brought to light many facts of value to the State at large. Such a survey would not be confined in its direct assistance to the mining interests of the State, the study of regions likely to produce coal, oil and gas, or the quarries scattered here and there. Even if it was the benefit from fuller development of these resources must accrue to people throughout the State as well as to the immediate operators of such industries.

But the geology of the State of Iowa cannot but be occupied in large part with the more recent formations. The loess and the drift, the alluvial deposits along our streams, in short, the formation and character of all our surface soils

with their special aptitudes for agriculture. In these lie the great wealth of our State, richer than the silver sprinkled hills of the Rockies or the golden threaded quartz of California; more precious than the diamond strewn fields of Africa. The prairie soil of this fair State is rich in all that brings comfort and enjoyment to an honest, earnest people in quest of the means for self-improvement. Rich because it furnishes a never-failing mine of wealth. Its treasures are not exhausted with a single turning of the earth, but will remain a perpetual source of revenue to any people who will intelligently conserve and protect it.

It may be noted that I have not referred to the science of political economy, psychology, etc., but this is not because I underrate in any degree their importance in human progress and attainment. From their nature they are both local and universal, but it would prolong this address too much to give them any adequate consideration.

Problems of social life are being studied on every hand, and it may perhaps not be stating it too strongly to say that their results can be of great value only as they proceed upon the scientific method. The relations of individuals, communities, States and nations are not to be adjusted by the bombast of the politician or the mere oratory of the statesman. A scientific analysis of the conditions, complete as they may be, and accurate appreciation of cause and effect, are necessary in the study of these as well as biological or geological problems, and the best statesman is he whose talent and training enable him to follow the method of the scientist.

In the founding of this Society which meets now on the first anniversary, we have recognized the existence of problems in our State demanding scientific investigation. We have recognized, too, the well known principle of advantage in organized effort, the added stimulus and benefit accruing to associated work. We find the field broad and the work in

waiting great. We find our numbers small and frequently broken into by removals of our members to more remunerative or attractive fields of labor. We find much that might discourage, but we may look with profit to what has been here accomplished under conditions possibly more discouraging than ours.

We should strive to make our work enduring, so that those who follow will not need to repeat what we have done. We should strive for that perfection of result that may challenge the inspection and criticism of the world of science. We should hold our science as above any comparison with the wages which may be paid for scientific work, scientific opinion or support to any theory as beyond the reach of contamination with money.

The laws of Nature do not change, and he who gives a wrong expression to them knowingly subverts the very foundation of scientific progress, for the progress of science is the progress of truth.

The following papers were also read and are here given in abstract:

### ON THE METAMORPHOSIS OF A SPECIES OF ALEYRODES.

BY PRESIDENT HERBERT OSBORN.

(Abstract.)

A species of *Aleyrodes* occurring on *Pestuca* was studied at time of emergence of *imagines* and presented the following points. The pupal scale is oval, slightly convex and marked above with four dusky spots. Within the scale may be seen, at the earliest stage noted, only a granular mass without distinction of head or other parts; later eyes become conspicuous, head distinct from body and the *prothoracic* and abdominal segments extend in flattened lobes to the margin of the

\* More papers by C. P. Keyes, see footnote, Part II