than to productive scholarship,* and this condition will hardly improve until our universities can afford to appoint professors who shall lecture exclusively to the students of the graduate school.

As a whole, our museums expend too small a proportion of their resources upon the development of their more serious aims, such as the maintenance of learned libraries, the publication of research and encouragement of exploration. The great majority of our museums contribute little or nothing to the direct advancement of knowledge, either in publication of original work, or in the maintenance of lecture courses given by acknowledged masters. Moreover, the installation, arrangement and labeling of their collections, and economy in expenditure leave much to be desired. It is true that all of these deficiencies are in a measure traceable to the poor support which our museums receive from public funds, a fact which is apparent when we consider that the British Museum in 1897–98 received a public grant of about $812,000 or more than the entire public support given more recently to sixteen of our best museums whose finances we have been considering.

In European countries the state of civilization and development of culture of each nation is certainly commensurable with the development of its museums. Measured by this standard, the United States compares unfavorably with other civilized countries.

This investigation appears to show that the average well-managed museum in the United States devotes one half of its annual income to salaries and wages, one third to maintenance, installation and repairs, and only about one sixth of its income to expeditions, library, publications of research and purchase of specimens.

* An excellent exposition of the inefficiency of our universities as centers for the production of research is given by Hugo Münsterberg, 'American Traits from the Point of View of a German,' Chapter III., 'Scholarship,' 1901, Houghton Mifflin and Co.

ALFRED GOLDSBOROUGH MAYER.
MUSEUM OF THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

*MONTANA AS A FIELD FOR AN ACADEMY OF SCIENCES, ARTS AND LETTERS.**

IT seems appropriate at this meeting, the first in the history of the work of the Montana Academy of Sciences, Arts and Letters, to discuss the opportunities for work in the state, rather than to take the discussion of some problem or phase of work, tempting as the latter may be. In this day of many societies and organizations, when each line of work has its own organization, with a membership composed of those directly interested in the work fostered by the organization, it would appear that new organizations and societies should not be brought into existence without good reasons for so doing. Let us present some of the reasons for the organization of this academy.

In organization lies strength. According to the laws of physics, if a thousand separate forces act upon an object from different directions the object will move in the direction of the component of all the forces and with the force exerted by it. This component may be smaller than any single force, when the forces act against each other. Or it may be the sum of all of them when they act together. Each human being may be considered to represent a force. The sum total of progress represents the combined action of all the forces of the different units, human beings. When the work is concerted and not antagonistic, progress is rapid. When every

* Address delivered at the first meeting of the Montana Academy of Sciences, Arts and Letters, at Bozeman, Montana, December 29, 1902.

man is at war with his neighbor advancement is slow.

The strength of organization has long been recognized. The political 'machine' may not number many politicians, but its power is well known. Church organizations have for centuries been powerful agencies among men, controlling both thought and action. Capitalists organize, making many monopolies into one gigantic monopoly, and threatening the peace of the world. Nations form alliances for protection. Laborers unite as a unit to bring about reforms and better to protect themselves from abuses of employers. The wave of organization is sweeping onward with great force. Nothing to-day promises success without organization and concerted action. Proof of this is the great number of societies of various kinds, with titles expressive of their importance and work.

This banding together of human beings for mutual good is usually of two grades or degrees, *i. e.*, local and state or national. Local associations deal with affairs immediately at hand. State and national societies discuss subjects broader and more far-reaching in scope, omitting such details as refer to single localities. There is thus a double tie of strength in organization. The strength of the national or state society is measured in great part by the strength of the local associations. Each aids and supports the other.

If the foregoing is sound reasoning there is much to be expected from such an organization in the state as that proposed in the Academy of Sciences, Arts and Letters. The teachers of the state have their state association, with its various departments. With this we do not wish to interfere. The agriculturists, wool-growers, cattlemen, horticulturists, laborers of various callings, physicians and others have their local and state organizations or both, in order the more effectually to accomplish the work the individual members see should be done. By such an association an individual idea soon becomes common property. The good things are quickly sifted and are pressed by the power of the whole association instead of by the individual who first conceives them.

Most of the great achievements of the world have come about through exchange of ideas. The occasional meetings of kindred spirits for the discussion of topics in which there is mutual interest are productive of far more good and are much more effective than is usually considered. At such gatherings there is an unusual stimulus for thought. Business or professional cares are subordinated to the work of the association, and the thought and attention are directed solely to the subjects presented. A single suggestion from some paper may start a flow of ideas which may develop into work of vast importance. Often it happens that at such gatherings are found men and women so full of suggestive ideas that it is impossible for one person to operate them all. Those less fertile in originality may receive suggestions which otherwise could not possibly be obtained. This exchange of ideas is all important in such gatherings as this, and its value can not be over-estimated.

We can not live without friends. If we were cut aloof from the aid and companionship of our fellows life would be profitless. It is give and take. Some give more than they take, others take more than they give. It is certainly true that the wider one's circle of friends and acquaintances becomes the greater is the opportunity for giving and receiving ideas and suggestions, hence of receiving help and becoming a helper. Occasional fraternal gatherings widen one's circle of friends, bind closer the bonds of unity in work,

give new inspiration for work and added stimulus for greater effort.

Everywhere among educational men is heard the urgent call for investigation. Trained investigators are sought on every side. Investigation is demanded of college professors by governing boards. It is inspired in students. The investigators make the world move. They are the leaven that moves society to demand social reforms. They open new fields for commerce. Educational reforms are suggested by them. To them we look for the alleviation of diseases, for the control of pestilences. If the fabled fountain of immortal youth is ever found it will surely be through the efforts of this noble class of men. They have practically banished the curse of yellow fever in the tropics; by their efforts the Oriental fruits are grown on the opposite side of the earth; electricity has by leaps and bounds, at their magic touch, entered almost every occupation of civilized man; by their unflagging efforts the unwritten history of past ages has become common property; space has been annihilated by their inventions; the farmer, the fruit-grower, the merchant, the lawyer, the laborer, all must acknowledge the powerful influence exerted by the investigators.

Division of labor is being differentiated very rapidly during the last decade. The pressure for specialization in occupations and professions is fast driving men into one single phase of a subject for an occupation. This differentiation of occupations and division of labor will become more and more circumscribed and complex as the years go by. Each new discovery and invention multiplies the possibilities of increased work ten, twenty or a hundredfold. The specialist who by continued investigation adds new ideas and new inventions to the world's large list benefits the race by so doing, and adds luster to his name and nation. But at the same time he draws more sharply the line that marks the life work of his successors. His work is demanded. It indicates the highest degree of mental activity. It demands a fertile brain, a vivid imagination, a philosophical mind, a benevolent and humanitarian nature.

It is not to be expected that every investigator in the state should be a member of the academy, but certainly every member of the academy should be an investigator. Each person should have some one idea, or several ideas, which may demand original work, whether it be in the field of science, arts or letters. The meetings of the academy should be given up almost entirely to reports of work in progress. They should be the means of making public the work of investigation carried on by the members, and no paper should be considered too technical for presentation.

The object of the Academy is stated in Article II. of the constitution.

"The object of the academy shall be the promotion of sciences, arts and letters in the state of Montana. Among the special objects shall be the publication of the results of investigation, the formation of a library, and the promotion of a thorough scientific survey of the state."

This is a broad and liberal field for action. It may be appropriate here briefly to summarize some of the opportunities presented to the members of the academy in the state of Montana.

The state contains approximately 146,000 square miles of territory. About one third of this is agricultural land, either in cultivation or capable of being cultivated by the use of water; one third is grazing land, either too remote from water for irrigation or too uneven to permit the use of water; the remaining third is mountainous.

The state is almost three times the size of either Iowa, Wisconsin, Arkansas, Alabama, North Carolina, New York, Mississippi or Louisiana; it is 140 times the size of Rhode Island, 75 times as large as Delaware, 30 times the size of Connecticut, 20 times the size of New Jersey, 18 times the size of Massachusetts, 16 times that of Vermont, 14½ times that of Maryland, 6 times that of West Virginia and almost five times the size of Maine. Its area equals the combined areas of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey, Delaware, Maryland and West Virginia; or of Nevada with Pennsylvania thrown in; or of Virginia, West Virginia, Ohio and Kentucky. It is about 600 miles from the eastern to the western end of the state, 722 by the Northern Pacific Railroad.

The climate varies from the moist and heavily timbered belt in the west to the dry arid plains in the east; from the cold northern boundary to the mild western and southern area, with boreal regions along the mountain chains.

The scenery of the mountainous regions is sublime. Numerous lakes, flanked by towering mountains, tempt the artist who is skillful with the brush. Broad valleys with winding streams alternate with mountain ranges with untold agricultural, mineral and lumber wealth.

The hardy pioneer, the vanishing redman, the scenic beauty of the state, the undeveloped natural history resources and the remarkable geological beds offer a rich field for the novelist, the ethnologist, the historian or the scientist. The number to undertake the work is small. The field is large. There is a wide range for selection. Within a decade the work will be much more circumscribed. It should be a part of the mission of the academy to call the attention of the people of the state and of the world at large to the marvelous resources of the state, and to aid in their development.

Permit me to suggest a few ways in which the academy may be of value in the state.

One of the most necessary lines of work to be accomplished, and in time the first to be undertaken, is to discover what is present in the state. It is impossible to begin work without knowing what the work is about. To determine the distribution of shells necessitates the preliminary work of collecting and identifying species. To discuss vertical range of vegetation on mountains or horizontal range on the plains demands a large amount of hard work in digging, drying, transporting, and mounting numerous collections of specimens, as also their identification.

In this connection it may be stated that there are many important localities in the state to which the collector has not yet made a visit. It may, therefore, reasonably be expected that many of the first scientific papers in natural history and geology will be lists of collected material from limited localities. These are specially desirable and are of prime importance. In geology we may reasonably expect descriptions of mountains showing special structure, discussions of river and lake beds, reports on rocks and minerals, with lists and descriptions of new fossils. We may certainly expect from time to time that those gifted in photography may present slides illustrating the natural scenery, and it is certainly in reason to expect from time to time exhibits of work with the brush, whether they be of topography or natural history matters little.

The academy should pick up the younger individuals and put them to work. It is to them we must look for recruits. They need help. There are in every locality

many persons who are anxious to carry on some work involving original study. It should be fostered in every individual. There are few people who do not in early life have a love for nature. Unfortunately for the large number, this natural tendency to inquire into nature's secrets is smothered by the many other forms of mental activity in which they must engage. This natural tendency, if properly directed and stimulated, may be the beginning of more important studies in science, or art. Our state is young. It is no discredit to say the work of science and art within its borders is not extensive, indeed, is small. But the opportunity is here and all that is necessary is to mass the forces, bring in all those with a desire for work and give them encouragement, and work to a common end.

The academy should seek avenues for advertising the scientific, artistic and literary opportunities presented by the state. There should be no selfish motives in any work undertaken. With a state as large as this there is abundant room for a large number of skilled workers. What the state needs is men of money and men of brains. The former for the establishment of those industries necessary to develop the state, the latter to seek out new lines of development. Tens of thousands might come in, and still the field would scarcely be touched. This end may be accomplished by articles in the daily and weekly press. Rarely is an intelligent article relative to the state refused by the brethren of the newspaper fraternity. Those more gifted may prepare articles for the more pretentious magazines. Pictures of local artists should be purchased and, if possible, distributed. Books and magazines should be purchased. It is not a very encouraging sign to see so excellent a local publication as the *Rocky Mountain Magazine* die for lack of support. There are many ways in which the state may be advertised, and each individual must use his own judgment as to the best means at his disposal.

The academy should devise means for disseminating the knowledge presented by members at the regular meetings in the papers and discussions.

The earlier history of the California academy is worth recording. During its first years it commanded but little attention. Record of its business and abstracts of papers were given to the public through the medium of the daily press. Now the academy is one of the strongest in the United States, and its publications are of a high order and quite numerous. The publications of the Montana Academy should be issued by the state as state documents. The means of the academy will be limited for some years. If the state's material resources are developed by members of the academy the people of the state should be willing to bear their proportion of the expense, since the work of investigation is gratuitous. If papers in pure science, arts or letters are presented, these should be printed on the ground that all such work is for the advancement of human knowledge. The work of the one preparing the paper is much greater than that necessitated by each taxpayer for its dissemination. The distinction between the practical and theoretical can not be drawn. The theoretical often becomes practical, and neither can do without the other. All papers of importance, therefore, should be printed. With proper safeguards, the publication of the transactions of the academy should be an honor to the state and of great value to its citizens. I suggest that this academy recommend to the legislature the enactment of a law for the printing of the transactions of the academy as state documents.

The academy should foster the organization of a state geological and natural history survey. There is no reason why such a survey should not be begun in the state at an early date. The state is in a prosperous condition. Its prosperity is increasing annually. The portion of the state covered by the United States Geological Survey is very small and does not include much of the work which a state survey would no doubt cover. The work of the state survey should, so far as possible, be carried on conjointly with that of the United States survey. The expense at first need not be great. With a moderate beginning, increased annually as the state prospers, the survey could do a very great service in working out the resources of the state. No doubt but that much of the preliminary work could be done without salaried men and with nothing more than the payment of field expenses by the state. The results of the field workers should be printed as state documents. The survey should be under a governing board free from politics, consisting of men representing the various state institutions, the state scientific organizations and the governor. Every member of the academy should use his influence to have such a survey inaugurated. If the question is properly agitated the survey is likely to be organized.

The academy should aid in the protection of those relics of the past which are of common value and interest to the people of the state. I refer to the preservation of the forests, fish and game, and of historic places and objects. The sentiment for game and fish protection in the state is small. I make this statement after careful deliberation and several years of close study of the question. There is a *desire* for game protection, but little *sentiment*. The minimum penalty is usually imposed on the offender, and not infrequently the penalty is less than the amount specified by law. The members of the academy should be radiating centers from which sentiment emanates for game and fish protection. They should have a keen eye open for the senseless persons who ruthlessly slaughter song birds in the vicinity of cities or towns. There are in the state many places of historic interest. The members of the academy should be on the alert for such and should use diligent effort to have them preserved. Historic relics grow more valuable with age.

There is need for the academy to lend some assistance toward getting more and better work done in the sciences in the schools of the state. The natural and physical sciences are more inadequately presented in the high schools of the state than other subjects. The condition is much better than it was a few years ago, due in large measure to the adoption of a state course of study, in which a year of chemistry was first required and later a year of biology. The natural growth of cities has demanded better facilities and more extended curricula, another factor in the development. But there is much room yet for improvement. I do not know of a school in the state that has manual training as a part of its work.* Drawing is not required in the high school. The laboratories are confined chiefly to chemistry and physics, although microscopes are being added in several places. The members of this association should lend their influence in the different cities to having better scientific equipment, to the introduction of manual training and to the employment of teachers specially fitted for special work, after the most approved scientific and pedagogical methods.

* Since writing the above I am informed that manual training has been introduced into the Glendive schools.

Each member of the academy should engage in some work which promises fruitful results, and which will in a measure bring recognition for the work. No individual should be satisfied in his present condition. Each person should strive to add something to the world's store of knowledge.

If an organism should cease to make effort when the fatigue point is reached, there could be little advancement in power or progress. If the inhabitants of the world should cease to press in search of the unknown, progress would cease. We can not remain in a fixed condition. We must press forward or fall backward. The masses of mankind are carried forward by the efforts of the few. The greatest triumphs of the century soon become the common property of the people. With the rapid increase of knowledge and the present great differentiation of labor one must seek a limited field and drive some subject hard and increasingly. Membership in this academy indicates a desire to carry on progressive work. The coming annual meetings will give the results of the individual efforts.

In this brief sketch I have but hinted at some of the reasons for the existence of this organization, and have suggested some of the ways in which, as it appears to me, the academy may do good in the state. There are many others yet unrecounted. But if I have encouraged the members to greater individual effort and have led them to feel they are not alone, although a hundred miles from those in sympathy with the work, I shall be satisfied. Montana is not yet out of touch of pioneers. The old hunter and trapper has almost disappeared. The population is fast becoming stable. The pioneers are now those first to take up the work incident to the development of the educational and esthetic life of the people. For the accomplishment of this end the Academy of Sciences, Arts and Letters takes its place with other organizations. Its life and work will represent the activity of the members which shall make up the organization. May it have a long and useful life.

MORTON J. ELROD.

UNIVERSITY OF MONTANA.

SCIENTIFIC BOOKS.

A Manual of Zoology. By RICHARD HERTWIG. From the fifth German edition. Translated and edited by J. S. KINGSLEY. New York, Henry Holt & Co. 1902. 8vo. Pp. 704.

An English translation of the whole of this valuable manual has been needed, though we had from Dr. Field a good translation of the first or general part. Professor Kingsley has now added a translation of the second, the whole volume well rounding out the series of superior text-books of zoology now at the service of the student and teacher. With two such text-books as Parker and Haswell's 'Zoology,' and the one before us, the zoologist of the present day is fortunate.

Although we are not sure but that, for the student or beginner, the general principles of modern zoology should follow the description of the types or of the principal groups, it is safe to say that the student will nowhere find such a valuable, concise, comprehensive and reliable statement of the general subject as in this volume. It comprises not only a history of the science in nearly all its phases, but the philosophy of zoology, a subject now very much needed for students who are perhaps too early led to specialize. One might wish that the matter of geographical distribution could have been edited with reference to that of North and South America, and that more space could have been given to ecology or bionomics. But the subject covers so broad a field, and on the whole is treated in so equable a manner, that this may seem a superfluous criticism.

In the history of the evolution theory the statement is made that 'Lamarck, in accordance with the then prevailing conceptions,