channel of the Mississippi from Cairo to its mouth may be relieved of this destroying agency; and the flood-plain valley of the Mississippi itself can be protected from the destroyer; and the channel of the river may be made far more stable, and its cross-section far more uniform, and sufficiently ample to carry the waters of the greatest floods, — all by spreading the rivers of the West over the upper valleys of the Rocky Mountains and over the arid plains. It is thus, and thus only, that the lower Mississippi can be protected; and it is thus, and only thus, that the arid lands can be redeemed. The two problems are inseparably joined. Irrigate the deserts and make them gardens and wheat-fields, and by the same process you protect the flood-plain of the Mississippi and make corn-fields and cotton-fields.

THE THIRTY-SEVENTH MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE thirty-seventh meeting of the American Association for the Advancement of Science, which was held the past week at Cleveland, O., was not as well attended as the meetings of this great association usually are; but it was nevertheless as successful, and as useful for science, as those of the preceding years. The meeting opened on Wednesday, Aug. 15, with 81 members in attendance. Before the close of the day the number swelled to 258, on Thursday to 303, and on the following day many citizens of Cleveland joined it. A very remarkable feature of this meeting was that only a few citizens of Cleveland numbered on the lists of the first three days, although they showed their interest in the proceedings of the association in other ways, — first of all, by their hospitality, which was very much appreciated by their guests; by attending the evening sessions; and by very full and well-edited reports in the local newspapers. The meeting of the association this year, though not showing as great a number of members attending as last year, and consequently a smaller increase in membership, is remarkable for the great number of eminent scientists taking part in it. The scientific departments of Washington were well represented; and the New England States, as well as all the States from New York to Arkansas and Minnesota, sent most of their prominent scientists.

The meetings were held in the Central High School. In order to bring about closer social meetings between members of the association, brief general sessions were held every morning, and the members met in the hall where these sessions were held. Social intercourse was also promoted by a very enjoyable arrangement of the local committee, who served every day a lunch to the members of the association in the High School, thus inducing them to spend the interval between the morning and afternoon sessions at the school. As the promotion of social intercourse during these meetings is of equal importance with the papers read and the discussions in the various sections, these arrangements are well worth being recorded, and greatly contributed to the success of the meeting.

The programme was similar in character to those of former meetings of the association. The meeting was called to order on Wednesday, Aug. 15, by the retiring president, Prof. S. P. Langley, who resigned the chair to the new president, Major J. W. Powell. A hearty welcome was extended to the members of the association by representatives of the city of Cleveland and of the local committee, to which the president replied, and the sections were organized in their respective halls. At the general meeting the permanent secretary reported on the financial state of the association, from which we were glad to learn that the property of the association has increased materially, and that the research fund, which consists of the contributions of life-members, amounts to more than $4,400.

In the afternoon the vice-presidents of the sections delivered their addresses. In the evening the retiring president, Professor Langley, addressed the association on the subject of the history of the theory of radiant heat, in which address he forcibly brought home the truth that the progress of science is not always on the right line, but that it is only found after many futile attempts, and frequently after long following the wrong track. Thus he proved the importance of the study of the history of science. The address was printed in the last number of *Science*.

On Tuesday a number of geologists had held a meeting, and appointed a committee to bring in a constitution and by-laws for an American geological society. The committee consisted of Prof. A. Winchell of Ann Arbor, John S. Stevenson of New York, C. H. Hitchcock of New Hampshire, Edward Orton of Ohio, and John R. Proctor of Kentucky. On Wednesday, after the organization of the section, a meeting was held, which was well attended, and it was resolved that the society should be formed on the basis proposed by the committee.

On Thursday the sections began their regular sessions, of which a report will be given next week. The important feature of this day was a lecture delivered by President G. Stanley Hall of Clark University of Worcester, Mass. It was the first time that the new psychology had been given a place on the programme of the association; and nobody was better qualified to introduce this important subject in the association than Professor Hall, who was the first to cultivate this branch of science in America. It is to be hoped that this study, now that attention has been called to it, will continue to form part of the proceedings of the association.

Professor Hall gave a brief review of the scope of experimental psychology. He dwelt on the researches made in the study of psychologic physiology, and on the functions of brain and nerves; he mentioned the methods of psychophysic inquiries, and the important bearing of ethnological studies upon psychologic questions. He concluded his sketch, which was listened to with the greatest attention, with a reference to the study of hypnotism, which is one of the most promising fields of psychic research.

On Friday evening Major J. W. Powell delivered a lecture on 'Competition as a Factor in Human Progress.' In his forcible and graphic way, the lecturer gave the results of his study of the history of civilization and of human progress, which is based on his views as an ethnologist. He compared the evolution of society to that of animals and plants, and showed that the term 'survival of the fittest' does not apply in the same way in sociology and in biology.

Saturday was devoted to an excursion to Put-in-Bay, one of the islands in the western extremity of Lake Erie. The day was very pleasantly spent, the weather being fine. The remarkable glacial striæ of Kelley's Island were visited on this trip.

SCIENTIFIC NEWS IN WASHINGTON.

The Latest Public-School Statistics: Some Interesting Figures and Comparisons of School Population, Enrolment, and Attendance. — Plastering Wines in France: a Searching Investigation by the French Academy of Medicine: Adverse Report.

School Attendance in the United States.

THE annual report of the United States commissioner of education for 1886–87 is now going through the press at the Government Printing-Office, but copies of the volume will not probably be ready for distribution until next winter. The report of Commissioner Dawson, besides giving the usual statements of the organization and administration of his office, is supplemented with an explanation of his plan to publish in a series of monographs a history of education in the United States, and an account of his visit to Alaska, with suggestions as to the education of the people of that far-off Territory.

The commissioner's statement is followed by twenty-two chapters, which, in addition to presenting the usual statistics, digests of State school reports, etc., treat of the training of teachers, kindergartens, secondary instruction, superior instruction, professional instruction, manual and industrial training, education of special classes, libraries in the United States, and many other important educational subjects, and a chapter of papers on important educational topics by men of recognized authority on the subjects upon which they write.

In addition to the usual statistical tables accompanying the report, Commissioner Dawson has directed the preparation of several new and quite important ones, and the addition of new columns to some of the old ones. This work has been done by Mr. F. E.

Upton, of the Bureau of Education, who has added some notes of explanation. These treat of many important and interesting subjects, and will be referred to again in future numbers of *Science*. Some of the more striking facts in regard to school-census population and attendance are given here.

"Although the school-census populations," says Mr. Upton in one of his notes, "may not be compared with each other, nor aggregated, on account of their heterogeneity, the percentage of increase of these populations may, if we assume that the population between any two limits of age in any State increases in the same ratio as that between any other two limits (i.e., that the proportion of the population of any given age remains constant in each State), — an assumption that may be made as regards the increase of a few years within very narrow limits of error. It is on this assumption that the percentage of increase or decrease of school-census population has been aggregated by geographical divisions."

The geographical divisions are as follows: North Atlantic division, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania; South Atlantic division, Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida; south central division, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas, Arkansas; north central division, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Dakota, Nebraska, Kansas; western division, Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Washington, Oregon, California.

"The largest percentage [in school-census population] is found, as might be expected, in the western division, which contains the newer States and Territories, and where a small absolute increase sometimes causes a large relative one. In the five States and Territories of that division that furnish the necessary data, the average increase per cent of the school-census population is found to be 5.68, which would cause it to double in about twelve and a half years. The next largest rate of growth of school-census population is found in the South. The percentage of increase in the South Atlantic division (based on two States only) is 3.21.

"The total public-school enrolment of the United States, as made up from the latest data received and supplemented by estimates in two cases (Arkansas and Montana), is 11,805,660. The yearly increase for the United States cannot be accurately determined, as ten States and Territories do not furnish the necessary data. Assuming, however, that the States and Territories so lacking have made the same progress as the others in the same divisions, the yearly increase would be 305,772, or at the rate of 2.66 per cent per annum. In only five States (New Hampshire, Vermont, South Carolina, Ohio, and Nevada) and one Territory (Arizona) has the enrolment decreased. The largest relative decrease (5.37 per cent) is found in New Hampshire. Dakota furnishes the largest per cent of increase (11.70 per cent), followed by Indiana with 9.20 per cent. The large development of the school-registration of Indiana is a notable circumstance, when compared with the nearly stationary condition of the contiguous States, Ohio and Illinois.

"In the proportion of children enrolled in the public schools, the North Central States are far in the lead, having 121 pupils in the public schools for every 100 children six to fourteen years of age. That this should be a matter of congratulation, considering the relatively low density of population of those States, has already been noted.

"Notwithstanding the tremendous strides that have been made in the development of the school systems of the Southern States during the past ten years, they are still far behind the Northern States in regard to the proportion of children enrolled in the public schools. In the South Atlantic States only 89, and in the South Central States only 79, children out of every 100, six to fourteen years of age, are enrolled as pupils in the public schools. This results in a great degree from the excessive proportion of children to grown persons met with in the Southern States: for, if we compare the proportion of total population enrolled, the disparity which appears to the prejudice of the Southern States almost disappears, and in one case is quite reversed; i.e., the proportion of total population enrolled is actually greater in the two southern divisions (being 19.06 and 17.49 in the cases referred to) than it is in the western division (16.86). No account is taken here of the duration of attendance at school, but only of the circumstance that the pupils were on the school registers. If the element of time is taken into consideration, the South appears much more at disadvantage. The great advantage which the Northern States possess is the much larger number of tax-payers in proportion to the number of children to be educated. Even if the relative wealth of the North and the South were equal, which is far from being the case, each tax-payer of the former section would have a far less burden to bear in the work of getting all the schoolable children within the schools.

"According to the most recent returns, the number of pupils daily attending the public schools of the United States while they are in session, is, on an average, 7,571,416. As in the case of enrolment, it is not possible to determine the exact yearly increase; but a very fair approximation places it at 218,500, or at the yearly rate of 2.89 per cent. The greatest increase in average attendance is observable in the South. In both of the southern divisions it is not only remarkably large, but it is to be noted that it exceeds the increase of enrolment: in other words, not only more pupils are going to school there, but the attendance of those who do go is more regular. This is an evidence of increased appreciation of public schools not to be overlooked. Florida shows the greatest growth of average attendance; viz., 13.94 per cent. In the District of Columbia, Virginia, and Georgia, the growth is also exceedingly noteworthy. Indiana stands in the same relation to the States on her east and west borders as in the case of enrolment. The average attendance has decreased in six States, so far as reported, — New Hampshire, Vermont, Rhode Island, Connecticut, New York, and South Carolina. The greatest decrease (3.64 per cent) took place in New Hampshire." This may be partially explained by the fact that the private-school enrolment has increased 3.57 per cent in Vermont, 5.13 in Connecticut, and 4.12 in New York. These figures may be considered as establishing conclusively the fact that the private schools are gaining on the public schools in the States mentioned, and the presumption that they are so doing in the neighboring States.

"The rate of increase of average attendance for the United States (2.89 per cent) exceeds slightly the rate of increase of enrolment (2.66 per cent) as estimated. This indicates a greater regularity of attendance for the country at large. The average attendance for the United States is 64.13: that is, for every 100 pupils enrolled during the school-year, 64 have attended daily, on an average, during the sessions of the schools; or, looking at the matter in another light, each pupil enrolled was present, on an average, 64 out of every 100 days his school was in session.

"Regularity of attendance is greatest in the western division (66.51), and least in the South Atlantic division (62.79), but it is nearly uniform in the different sections of the country; more so, perhaps, than any other single item which admits of statistical record. When the individual States are considered, a greater inequality is observed. In Maine and Arizona the regularity of attendance is 82.79 and 84.26 respectively, while in Minnesota it drops to 49.17. It is possible, however, as in other instances, that this inequality may be due in some measure to inaccuracy or incompleteness in the school reports, or a lack of uniformity in the methods used. This regularity of attendance is far from being as high as is to be desired. Compulsory attendance laws do not seem to affect it to any appreciable extent, as it is somewhat higher in the South Central States, where there are no compulsory laws, than in the North Central States. It will probably depend for improvement upon a growing appreciation of the benefits of a public-school education.

"Such as it is now, however, it is far in advance of any former period, and the progress it has made in the last semi-decade is especially noteworthy. The tendency suggested by the figures is unmistakable. They show conclusively the steady growth of a sentiment in favor of popular education, — a growth not confined to any one part of the country, but extending throughout its length and breadth. This remark will be seen to possess greater force when it is considered that there has been an increase in the proportion of children enrolled as pupils, as well as an increase in the proportion of the number enrolled who attend regularly."

The Plastering of Wine.

The latest of the United States consular reports published by the State department contains a report by Walter T. Griffin, commercial agent, upon the plastering of wines. Since the great reduction in the amount of wines manufactured in the Bordeaux and Burgundy districts, the inferior wines of the central departments of France are being substituted for them, and recourse is had to chemical addition for the purpose of increasing their market-value. So important is this matter considered, that the question whether the plastering of wine is injurious to public health or not is now being discussed by the Academy of Medicine at Paris.

The plastering of wine consists in adding sulphate of lime after the first fermentation, or while the wine is in the vat; it is also mixed with the grape-must. The general rule is to put in five hundred grams of the plaster to the hectolitre of wine, but the greater number of wine-makers throw in the lime without weighing. The advantages said to be gained by the use of sulphate of lime are, that fermentation is greatly increased, is more rapid and complete, the color is brighter and more permanent, and the wine will keep for a much longer period. The objections are, that the addition of sulphate of lime causes chemical changes that render the wine injurious to health. The reasons given are these: wine, in its normal condition, contains a certain amount of bi-tartrate of potash, which, when brought in contact with sulphate of lime, forms an acid sulphate of potash, and there is precipitated an insoluble bi-tartrate of lime, varying according to its degree of alcohol, the wine dissolving a portion of the sulphate of lime.

Natural wine contains, at a maximum, about half a gram of sulphate of potash per litre. This quantity is increased from five to ten fold by the action of the lime, and at the same time the proportion of the bi-tartrate of potash diminishes to such a degree that it may be said that the lime substitutes for this salt the acid sulphate of potash. Finally, in wine treated with lime, sulphuric acid is found in a free state, also the sulphate of magnesia. There are three parties to the contest, — the proprietors and wine-merchants, who increase their profits by the plastering of the wine; the hygienists, who have always insisted upon the injurious effects of the practice; and the chemists, who have never given a final decision. The present discussion in the Academy of Medicine is the outgrowth of advice asked by the government of it and of the hygienic committees. A report of the progress thus far made in its inquiry by the academy has been made by M. Marty, who was designated to prepare it.

The paper is largely historical, and only a brief notice of that part of it will be made here. The hygienic committee, in 1856, reported in favor of plastering. The following year numerous evil consequences resulted from the plastered wines at St. Affrique, in the department of Aveyron. The doctors state that those who drank of this wine had an unquenchable thirst (cephalalgy) and an insupportable dryness of the throat. These are only the superficial symptoms and lesions that plastered wines produce in the organism. About the same time the Chamber of Commerce employed a committee of chemists to inquire into the matter, and they sustained the opinion given by the hygienic committee. In 1858 M. Poggiale, after new researches, found in the ashes of plastered wines an almost entire absence of bi-tartrate of potash, and an entirely abnormal proportion of sulphate of potash. He concluded that the practice of plastering had better be abandoned, as he considered it injurious to health. The *conseils generaux* entered into the lists after the decision given by the court at Roanne, which was against plastered wine. They demanded a new scientific inquiry. For a second time the hygienic committee, in spite of a spirited protestation from Michel Levy, declared in favor of plastering. M. Buignet and M. Bussy re-analyzed the plastered wine by a new process, and found free sulphuric acid, which was formed by the action of bi-tartrate of potash and sulphate of lime. The result was a compromise by the chemists, who considered that plastering might be done with moderation. In 1879 this question was brought for a third time before the committee, who did not admit the harmlessness of plastering, but said that two grams per litre were not dangerous.

M. Marty, in his report just published, settles the question from a hygienic view. He reports upon several experiments which have been made to show the harmlessness of wine plastered to 4°. All these experiments fail for want of precision or exactness in their method. It is an incontestable fact that plastered wines have occasioned functional troubles and organic injuries. All familiar with medical science know that a solution of acid sulphate of potash, in which sulphuric acid is in a free state, acts as a purgative, and a caustic in certain cases. In regard to the abolition of plastering, the hygienic committee are not unanimous in their decision. It is the opinion that a moderate plastering is necessary for the utilization, preservation, and transportation of a certain class of the poorer grades of wine, whose loss would be a disastrous thing for the wine-growers. But producers and merchants are warned, that, if they should continue the practice, the proportion of acid sulphate should not exceed two grams per litre. This proportion is sufficient to obtain the commercial advantages for which the lime is used. In conclusion, M. Marty examines and refutes certain arguments recently produced in favor of plastering. He recognizes the fact that the conditions of the non-combination of the neutral sulphate and the acid sulphate of potash are not well known, but says we have a law of nature that will guide the hygienists in the study of this question; viz., that natural wines never contain more than $\frac{65}{100}$ of a gram of the sulphate of potash per litre. The hygienists, on their side, do not ignore the fact that this is the maximum dose, and if it is surpassed it will certainly injure public health. In conclusion, the academy gave it as its unanimous opinion that plastering wine was a custom detrimental to health, and petitions that the law of 1880 be rigorously enforced.

MOTIONS OF THE SOLAR SYSTEM.[1]

NO other hypothesis has been suggested which offers such direct and complete answers to most of the questions which relate to the origin, structure, and unity of the universe, as Newton's law of gravity. It is but natural, therefore, that the majority of the problems which arise in regard to the motions of the solar system should have their origin in an effort to confirm that law.

The first attempt to apply Newton's law to all the motions of the solar system was made by Laplace. When, however, Lindenau and Bouvard undertook to compute their tables of the motions of the planets, a complete revision of Laplace's theory was found necessary. So enormous is the labor involved, that there exists, besides those mentioned, only one other complete set of theories and tables of the motions of the principal planets, — that of Leverrier. Leverrier's tables of the inner planets are now nearly thirty years old. His tables of the outer planets are much later, having employed his attention almost to the day of his death. His tables of Jupiter and Saturn were published in 1876, and those of Uranus and Neptune in the year following. Newcomb's tables of Neptune were published in 1865; those of Uranus, in 1874. Hill's theory of Jupiter and Saturn, which has for years occupied his attention, has at last been completed, and he is now engaged in preparing tables therefrom. These are intended to form a part of a complete series of tables of the principal planets now being prepared under the direction of Professor Newcomb at Washington. Another such series is also being prepared by Professor Gyldén at Stockholm.

The values of the co-efficients of the terms of short period in the motions of the principal planets are now pretty well known; and the same might be said of the secular variations, were it not for the difference between theory and observation which exists in regard to the motion of the perihelion of Mercury, which was discovered by Leverrier, and has been confirmed by Newcomb, in a discussion of the observations of the transits of Mercury, extending over a period of more than two centuries. The cause of this difference still remains unknown. The completion and comparison with observations of the new theory of the four inner planets, now being prepared under the direction of Professor Newcomb, will be awaited with interest, with the hope that it may throw new light on this interesting subject.

The only recent original tables of the moon's motions are those

[1] Abstract of an address before the Section of Mathematics and Astronomy of the American Association for the Advancement of Science, at Cleveland, O., Aug. 15–22, 1888, by Ormond Stone, vice-president of the section.