Lord Reay said that the main purpose of the Bill was to put an end to an anomaly. London had a variety of institutions in which University education was given, but which had not the power of conferring degrees; and, on the other hand, London had an examining Board unconnected with the teaching institutions. The institutions had no crown to their edifice; the University had no foundation. The object of the scheme of the last Royal Commission was to constitute a corporate body out of these scattered fragments, and recognition was given on well-defined and broad lines to University teaching wherever it existed. The aim of the Bill was not merely educational. It had a much wider bearing. What was the cause of the increased expenditure on higher education on the continent? It was the consciousness that wealth and military power were insufficient; that higher education must provide the intellectual capital which agriculture, industry, and trade required. If we were to hold our own in this race we must use the same means. A London University would not be a mere local institution; it would eventually be an Imperial institution, profiting all classes throughout the Empire. The progress of the Bill was anxiously watched by scientific men at home as well as abroad. There was, indeed, practical unanimity among all those who had the higher interests of the country at heart that failure to give London a teaching University would be nothing less than a national disgrace.

Lord Kelvin felt that the reasons already put before their lordships for accepting the Bill were overwhelmingly strong, and he only wished to intervene because he had been mentioned as one apparently partially opposed to the provisions of the Bill. As a member of Lord Cowper's Commission he joined with Sir George Stokes and Mr. Weldon in a note expressing a preference for a separate teaching University. They had some doubts as to whether or not the functions of a teaching University could practically be added to the duties so well performed by the University of London of examining for degrees and conferring degrees upon students who had not had the benefit of instruction in colleges of universities in any part of the world. They felt the gravity of the objection that might be held to establishing another university—a rival university—beside the University of London; but when it seemed, as it did then seem to them, hopeless that the University of London could be got to undertake the duty of organising and carrying on a teaching University, they felt that the paramount object of having a teaching University in London should not on that account be given it. On his own behalf, and, he believed, on behalf of his colleagues in the note, he could say they would only have been too glad to have accepted what was now proposed by this Bill. Their doubts and hesitation had been completely set aside by what had passed. Personally he thoroughly approved of the Bill. He believed that an immense addition to the usefulness of the existing colleges in London would result from the passing of the measure. It was an anomalous state of things that there was no teaching University in London. It was not only London, but the United Kingdom, and, indeed, the whole world, that would benefit by the passing of the Bill, and therefore his desire was strong and evident, not only that the Bill might pass speedily through their lordships' House, but that it would be taken up by the House of Commons and made an Act of Parliament before the close of the present Session.

The Earl of Kimberley said that some years ago he had the honour to be President of University College, and at that time there was put forward a scheme for a separate University such as Lord Kelvin thought might be the only alternative. He then felt it would be a great misfortune if there were set up two rival universities in London, and therefore, he need hardly say, how greatly he rejoiced that they had arrived at last at a point where they seemed to have in view a conjunction of teaching and examining in the University of London. He was glad to see the noble Duke had inserted in the Bill the clause that the Commissioners were to see that provision was made for securing adequately the interests of collegiate and non-collegiate students respectively. That ought to reassure those who had placed themselves in opposition to the Bill, because an impartial Statutory Commission such as the noble Duke intended to appoint would be perfectly able to see that the statutes of the University were so framed that there would be no chance of any portion of the University work being impaired by a wrong administration of its powers.

The second reading was then agreed to.

SCIENCE FOR SECONDARY SCHOOLS.

THE Reports of the United States Commissioner of Education are known to be the most valuable publications on educational statistics and methods in the English language. The Report (1892-93), just distributed, may appear to be somewhat belated, but the contents are so instructive and exhibit so many special features, that the delay of publication may be forgiven. There are two volumes, running altogether into 2153 pages, and the amount of information contained in them is marvellous. Taking the volumes in order, we find in the first elaborate tables of statistics referring to the schools of the United States, and statistics of illiteracy for each of the States and for Europe. Then follow surveys of the educational system of Belgium, the elementary schools of Great Britain, the systems of education developed in the British Colonies, the French educational system, and a most instructive chapter on developments in the teaching of geography in Central Europe. The chapter on child-study, which practically concludes Part I. of the first volume, contains a number of interesting contributions from leading American representatives of this modern movement.

The second part of the first volume is devoted entirely to reports which were called forth on the occasion of the World's Columbian Exposition. Among these reports are detailed criticisms of American educational methods, by eminent French and German educationists. There is a survey of medical instruction in the United States, as presented in the reports of two French Commissioners appointed to make a special study of the subject, and an English version of a report on American technological schools, prepared by Prof. Riedler, of the Royal Polytechnicum at Charlottenberg. The remainder of the first volume is taken up with papers read at the Library Congress held during the Columbian Exposition, and notes on the educational exhibits.

The second volume contains the third and fourth parts of the Report. Prof. Hinsdale contributes to it a series of rare documents illustrative of American educational history, and there is incorporated in it the report of the Committee of Ten, appointed to take up the important subject of courses of instruction in secondary schools, and papers relating thereto. The chief interest for us in the volume lies in this valuable educational document.

The Committee, which was appointed by the National Council of Education, organised conferences of leading teachers of the principal subjects which enter into the programmes of secondary schools in the United States. Each of nine subjects was considered and reported upon by a conference consisting of ten members, who were selected on account of their scholarship and experience. Among the subjects discussed were four concerned with groups of sciences; viz. (1) mathematics; (2) physics, astronomy, and chemistry; (3) natural history (biology, including botany, zoology, and physiology); (4) geography (physical geography, geology, and meteorology). As a result of the conferences, a great number and variety of important changes in the scope and method of science teaching were recommended. All the conferences on scientific subjects agreed that laboratory work by the pupils was the best means of instruction, and dwelt upon the great utility of the genuine laboratory note-book; and they all declared that teachers of science in schools need at least as thorough a special training as teachers of languages or mathematics receive.

The most important recommendations made by the scientific conferences are summarised in the following pages. But all who are interested in scientific education should read the entire reports, for each is so full of suggestions and recommendations, that it is impossible to present adequate abstracts of them.

On one very important question of general policy, which affects the preparation of all school programmes, the Committee of ten, and all the conferences organised by it, were absolutely unanimous. Among the questions suggested for discussion in each conference was—"Should the subject be treated differently for pupils who are going to college, for those who are going to a scientific school, and for those who, presumably, are going to neither?" This question was answered unanimously in the negative by all the conferences; so that we have the fact that nearly one hundred eminent teachers agree that every subject which is taught at all in a secondary school should be taught in the same way and to the same extent to every pupil so long as he pursues it, no matter what the probable destination of the pupil may be, or at what point his education is to cease.

MATHEMATICS.

The form of the report of the conference on mathematics differs somewhat from that of the other reports. This report is subdivided under five headings: (1) General conclusions; (2) the teaching of arithmetic; (3) the teaching of concrete geometry; (4) the teaching of algebra; (5) the teaching of formal or demonstrative geometry.

The first general conclusion of the conference was arrived at unanimously. The conference consisted of one Government official and university professor, five professors of mathematics in as many colleges, one principal of a high school, two teachers of mathematics in endowed schools, and one proprietor of a private school for boys. The professional experience of these gentlemen and their several fields of work were various, and they came from widely separated parts of America; yet they were unanimously of opinion "that a radical change in the teaching of arithmetic was necessary." They recommend "that the course in arithmetic be at once abridged and enriched; abridged by omitting entirely those subjects which perplex and exhaust the pupil without affording any really valuable mental discipline, and enriched by a greater number of exercises in simple calculation, and in the solution of concrete problems." They specify in detail the subjects which they think should be curtailed or entirely omitted, and they give in their special report on the teaching of arithmetic a full statement of the reasons on which their conclusion is based. They map out a course in arithmetic which, in their judgment, should begin about the age of six years, and be completed at about the thirteenth year of age.

The conference next recommend that a course of instruction in concrete geometry with numerous exercises be introduced into the grammar schools, and that this instruction should, during the earlier years, be given in connection with drawing. They recommend that the study of systematic algebra should be begun at the age of fourteen; but that, in connection with the study of arithmetic, the pupils should earlier be made familiar with algebraic expressions and symbols, including the method of solving simple equations. "The conference believe that the study of demonstrative geometry should begin at the end of the first year's study of algebra, and be carried on by the side of algebra for the next two years, occupying about two hours and a half a week." They are also of opinion "that if the introductory course in concrete geometry has been well taught, both plane and solid geometry can be mastered at this time." Most of the improvements in teaching arithmetic which the conference suggest "can be summed up under the two heads of giving the teacher a more concrete form, and paying more attention to facility and correctness in work. The concrete system should not be confined to principles, but be extended to practical applications in measuring and in physics."

In regard to the teaching of concrete geometry, the conference urge that while the student's geometrical education should begin in the kindergarten, or at the latest in the primary school, systematic instruction in concrete or experimental geometry should begin at about the age of ten for the average student, and should occupy about one school hour a week for at least three years. From the outset of this course, the pupil should be required to express himself verbally as well as by drawing and modelling. He should learn to estimate by the eye, and to measure with some degree of accuracy lengths, angular magnitudes, and areas; to make accurate plans from his own measurements and estimates; and to make models of simple geometrical solids. The whole work in concrete geometry will connect itself on the one side with the work in arithmetic, and on the other with elementary instruction in physics. With the study of arithmetic is therefore to be intimately associated the study of algebraic signs and forms, of concrete geometry, and of elementary physics. Here is a striking instance of the interlacing of subjects which seems so desirable to every one of the conferences.

Under the head of teaching algebra, the conference set forth in detail the method of familiarising the pupil with the use of algebraic language during the study of arithmetic. This part of the report also deals clearly with the question of the time required for the thorough mastery of algebra through quadratic equations. The report on the teaching of demonstrative geometry is a clear and concise statement of the best method of teaching this subject. It insists on the importance of elegance and finish in geometrical demonstration, for the reason that the discipline for which geometrical demonstration is to be chiefly prized is a discipline in complete, exact, and logical statement. If slovenliness of expression, or awkwardness of form is tolerated, this admirable discipline is lost. The conference therefore recommend an abundance of oral exercises in geometry—for which there is no proper substitute—and the rejection of all demonstrations which are not exact and formally perfect. Indeed, throughout all the teaching of mathematics the conference deem it important that great stress be laid by the teacher on accuracy of statement and elegance of form as well as on clear and rigorous reasoning. Another very important recommendation in this part of the report is to be found in the following passage: "As soon as the student has acquired the art of rigorous demonstration, his work should cease to be merely receptive. He should begin to devise constructions and demonstrations for himself. Geometry can not be mastered by reading the demonstrations of a text-book, and while there is no branch of elementary mathematics in which purely receptive work, if continued too long, may lose its interest more completely, there is also none in which independent work can be made more attractive and stimulating." These observations are entirely in accordance with the recent practice of some colleges in setting admission examination papers in geometry which demand of the candidates some capacity to solve new problems, or rather to make new application of familiar principles.

PHYSICS, CHEMISTRY, AND ASTRONOMY.

The members of this conference were urgent that the study of simple natural phenomena be introduced into elementary schools, and it was the sense of the conference that at least one period a day from the first year of the primary school should be given to such study. Apparently the conference entertained the opinion that the present teachers in elementary schools are ill prepared to teach children how to observe simple natural phenomena; for their second recommendation was that special science teachers or superintendents be appointed to instruct the teachers of elementary schools in the methods of teaching natural phenomena. The conference were clearly of opinion that from the beginning this study should be pursued by the pupil chiefly, though not exclusively, by means of experiments and by practice in the use of simple instruments for making physical measurements. The report dwells repeatedly on the importance of the study of things and phenomena by direct contact. It emphasises the necessity of a large proportion of laboratory work in the study of physics and chemistry, and advocates the keeping of laboratory note-books by the pupils, and the use of such note-books as part of the test for admission to college. At the same time the report points out that laboratory work must be conjoined with the study of a text-book and with attendance at lectures or demonstrations, and that intelligent direction by a good teacher is as necessary in a laboratory as it is in the ordinary recitation or lecture room.

The great utility of the laboratory note-book is emphatically stated. To the objection that the kind of instruction described requires much time and effort on the part of the teacher, the conference reply that to give good instruction in the sciences requires of the teacher more work than to give good instruction in mathematics or the languages; and that the sooner this fact is recognised by those who have the management of schools the better for all concerned. The science teacher must regularly spend much time in collecting materials, preparing experiments, and keeping collections in order, and this indispensable labour should be allowed for in programmes and salaries. As regards the means of testing the progress of the pupils in physics and chemistry, the conference were unanimously of opinion that a laboratory examination should always be combined with an oral or written examination, neither test taken singly being sufficient. There was a difference of opinion in the conference on the question whether physics should precede chemistry, or chemistry physics. The logical order would place physics first; but all the members of the conference but one advised that chemistry be put first for practical reasons which are stated in the majority report. A sub-committee of the conference has prepared lists of experiments in physics and chemistry for the use of secondary schools, not, of course, as a prescription, but only as a suggestion, and a somewhat precise indication of the topics which the conference had in mind, and of the limits of the instruction.

NATURAL HISTORY.

The conference on natural history unanimously agreed that the study of botany and zoology ought to be introduced into the primary schools at the very beginning of the school course, and be pursued steadily, with not less than two periods a week,

throughout the whole course below the high school. In the next place, they agreed that in these early lessons in natural science no text-book should be used; but that the study should constantly be associated with the study of literature, language, and drawing. It was their opinion that the study of physiology should be postponed to the later years of the high school course; but that in the high school, some branch of natural history proper should be pursued every day throughout at least one year. Like the report on physics, chemistry, and astronomy, the report on natural history emphasises the absolute necessity of laboratory work by the pupils on plants and animals, and would have careful drawing insisted on from the beginning of the instruction.

As the laboratory note-book is recommended by the conference on physics, so the conference on natural history recommends that the pupils should be made to express themselves clearly and exactly in words, or by drawings, in describing the objects which they observe; and they believe that this practice will be found a valuable aid in training the pupils in the art of expression. They agree with the conference on physics, chemistry, and astronomy that science examinations should include both a written and a laboratory test, and that the laboratory note-books of the pupils should be produced at the examination. The recommendations of this conference are therefore very similar to those of the physical conference, so far as methods go; but there are appended to the general report of the conference on natural history sub-reports which describe the proper topics, the best order of topics, and the right methods of instruction in botany for schools below the high school, and for the high school itself, and in zoology for the secondary schools. Inasmuch as both the subject-matter and the methods of instruction in natural history are much less familiar to ordinary school teachers than the matter and the methods in the languages and mathematics, the conference believed that descriptive details were necessary in order to give a clear view of the intentions of the conference. In another sub-report the conference give their reasons for recommending the postponement to the latest possible time of the study of physiology and hygiene. Like the sixth conference, the conference on natural history protest that no person should be regarded as qualified to teach natural science who has not had special training for this work—a preparation at least as thorough as that of their fellow teachers of mathematics and the languages.

GEOGRAPHY.

Considering that geography has been a subject of recognised value in elementary schools for many generations, and that a considerable portion of the whole school-time of children has long been devoted to a study called by this name, it is somewhat startling to find that the report of the conference on geography deals with more novelties than any other report, exhibits more dissatisfaction with prevailing methods, and makes, on the whole, the most revolutionary suggestions.

It is obvious, on even a cursory reading of the majority and minority reports, that geography means for all the members of this conference something entirely different from the term "geography" as generally used in school programmes. Their definition of the word makes it embrace not only a description of the surface of the earth, but also the elements of botany, zoology, astronomy, and meteorology, as well as many considerations pertaining to commerce, government, and ethnology. "The physical environment of man" expresses as well as any single phrase can the conference's conception of the principal subject which they wish to have taught. No one can read the reports without perceiving that the advanced instruction in geography which the conference conceive to be desirable and feasible in high schools cannot be given until the pupils have mastered many of the elementary facts of botany, zoology, geometry, and physics. It is noteworthy also that this conference dealt avowedly and unreservedly with the whole range of instruction in primary and secondary schools. They did not pretend to treat chiefly instruction in secondary schools, and incidentally instruction in the lower schools; but, on the contrary, grasped at once the whole problem, and described the topics, methods, and apparatus appropriate to the entire course of twelve years. They recognised that complete descriptions would be necessary in all three branches of the subject—topics, methods, and equipment; and they have given these descriptions with an amplitude and force which leave little to be desired.

More distinctly than any other conference, they recognised that they were presenting an ideal course which could not be carried into effect everywhere or immediately. Indeed, at several points they frankly state that the means of carrying out their recommendations are not at present readily accessible, and they exhibit the same anxiety which is felt by several other conferences about training teachers for the kind of work which the conference believe to be desirable. After the full and interesting descriptions of the relations and divisions of geographical science, as the conference define it, the most important sections of their report relate to the methods and means of presenting the subject in schools, and to the right order in developing it. The methods which they advocate require not only better equipped teachers, but better means of illustrating geographical facts in the schoolroom, such as charts, maps, globes, photographs, models, lantern slides, and lanterns. Like all the other conferences on scientific subjects, the ninth conference dwell on the importance of forming from the start good habits of observing correctly and stating accurately the facts observed. They also wish that the instruction in geography may be connected with the instruction in drawing, history, and English. They believe that meteorology may be taught as an observational study in the earliest years of the grammar school, the scholars being even then made familiar with the use of the thermometer, the wind vane, and the rain gauge; and that it may be carried much further in the high school years, after physics has been studied, so that the pupils may then attain a general understanding of topographical maps, of pressure and wind charts, of isothermal charts, and of such complicated subjects as weather prediction, rainfall and the distribution of rain, storms, and the seasonal variations of the atmosphere.

Their conception of physiography is a very comprehensive one. In short, they recommend a study of physical geography which would embrace in its scope the elements of half a dozen natural sciences, and would bind together in one sheaf the various gleanings which the pupils would have gathered from widely separated fields. There can be no doubt that the study would be interesting, informing, and developing, or that it would be difficult and in every sense substantial.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

PROF. G. B. MATHEWS has resigned the chair of Mathematics in the University College of North Wales, in order to be able to devote more time to study and research.

THE Executive Committee of the City and Guilds of London Institute have appointed Mr. W. E. Dalby, since 1891 University Demonstrator of Mechanism and Applied Mechanics at Cambridge, to the Professorship of Mechanics and Applied Mathematics at the Institute's Technical College, Finsbury, rendered vacant by the resignation of Prof. Perry.

Science reports the dedication, at the University of Vermont, of two new buildings—Converse Hall, a dormitory presented to the University by John H. Converse at a cost of £25,000; and a science building presented by Dr. Edward H. Williams, which, with its equipment, will cost about £40,000. The dormitory was formally presented to the University by Mr. Converse; and the science building, in the absence of Dr. Williams, by his son, Prof. Edward H. Williams, jun., of Lehigh University. On the front of the latter building are three medallions with the heads of Agassiz, Henry, and Prof. Marsh. The building contains ample accommodation for the departments of physics, chemistry, biology, electrical engineering, and metallurgy.

EARL SPENCER, in distributing the prizes on Monday to the successful pupils at Northampton School, spoke of the absolute necessity of a sound primary education for a sound secondary technical and even University education. In Japan, and in Canada, too, he found that both secondary and University education were secured to the people. The fact that England should be behind was rather curious, and he took it that a great deal of it was due to the old grammar schools and the dislike of Parliament, with these schools existing, to create a national system of secondary education in England. That more secondary and University education was required was illustrated by the fact that, while Germany, with a population of 45,000,000, had 24,000 people using her Universities, England, with 30,000,000, had only 5500 at the University.