

its refractive power. For the second liquid Mr. Ahrens has succeeded in finding in the paraffin series a white oil which is a suitable material in its mechanical as well as in its optical properties. It has not, however, the same mean refractive index as methyl salicylate, so therefore, for a direct-vision prism, the end faces cannot be square to the principal axis of the transmitted light. Their obliquity, however, is not great—not more than  $15^\circ$  if the refracting angle of the middle prismatic cell is from  $120^\circ$  to  $125^\circ$ . The dispersion of these prisms is very good, and there is much less absorption of the blue end of the spectrum than is usually found with a bisulphide or flint-glass prism. The writer, in a rough comparison of one of the Ahrens biliquid prisms with a Wernicke prism and a  $60^\circ$  bisulphide prism, found the following angular dispersions between



Ahrens's Biliquid Direct-vision Prism.

the C and F hydrogen lines:—bisulphide of carbon prism,  $3^\circ 27'$ ; Wernicke prism,  $3^\circ 6'$ ; Ahrens prism,  $3^\circ 12'$ .

If direct-vision is not desired, a prism of high dispersion can be made on the same biliquid plan by constructing a glass cell with the end faces at about  $30^\circ$  to the line of sight, and with internal oblique partitions at from  $20^\circ$  to  $24^\circ$  to the line of sight, dividing the whole into three prismatic chambers, the two outer of which are filled with methyl salicylate and the middle one with the white oil. This prism has marked superiority over a flint-glass prism of equal size. It must not, of course, be forgotten that all liquid prisms are unsuitable for fine definition of the spectral lines owing to the change of refractive index in the liquid when the temperature rises.

The biliquid prism is being put on the market by Mr. Pillscher.

#### THE REFORM OF MATHEMATICAL AND SCIENCE TEACHING IN GERMANY.<sup>1</sup>

THE revolt against formal culture which characterised mathematical instruction has within the last decade produced a large bibliography in English, French, and German, and inspired systematic inquiry into possible and needful reform. The movement has been assisted in Germany by an extension of the privileges of the *Gymnasium* to the *Realgymnasium* and the *Oberrealschule*, which in time may share the prestige of the *Gymnasium* and win for the exact sciences a place *ebenbürtig* with the classics.

When the *Reformschulen* were founded to provide a common foundation for all pupils in nine-class schools between the ages of nine and twelve, engineers were pronouncedly favourable, thinking that the exact sciences would benefit, and that an *Einheitsmittelschule* (secondary school with uniform curriculum) was in sight. But they were doubly disappointed; the classics have benefited, and the *Einheitsmittelschule* is condemned for systematic perfection.

Reform of mathematical and science teaching depends closely on the inexorable demands of civilisation, and for the understanding of modern culture a proper grasp of the meaning of a function is considered indispensable. On this account it is proposed to include analytical geometry and the calculus in the work of the nine-class schools. As no more time can be allotted to mathematics, any relief must come from further pruning of the syllabus. Hence elementary mathematics must be relieved of its lumber, the desire to achieve systematic perfection must be left unfulfilled, pedantic thoroughness must be killed by ridicule, and the exclusively deductive form abandoned, more value being attached to intuition than to a cunning use of the syllogism. Though mathematicians attack the isolation of their subject, they do not advocate *Fachbildung* (professional studies) in secondary schools. Pro-

<sup>1</sup> Abstract of paper read at the meeting of the Edinburgh Mathematical Society on November 11 by Mr. A. J. Pressland.

fessional bodies have always protested against it, and the protest has been taken to indicate the attitude of Trade Unions also. Nevertheless, German universities are trying to give the teacher an acquaintance with practical applications and arrange courses in applied mathematics or recognise attendance at technical high schools. The courses include descriptive geometry, mathematical methods of technical mechanics, surveying, life assurance, and laboratory work.

The introduction of practical work in the teaching of physics is urgently needed. It is provided in the best Prussian schools and in South Germany, notably at Munich, it forms part of the primary syllabus during the last two years. A statistical inquiry showed that 75 per cent., at least, of Prussian secondary schools desired facilities for experimental work, whilst only about thirty possessed them.

The minimum amount of time demanded is seven hours per week for science—physics, chemistry, biology, and geography—and four for mathematics. If proposals for introducing specialisation in the last three years are entertained, further hours may fall to the lot of the exact sciences.

The reintroduction of biology, which disappeared in 1879 as a result of the writings of Darwin and Haeckel, is being advocated as a training of the powers of observation, in which the German freshman is said to be woefully deficient, and as an exercise in the use of the microscope. Geography comprises economic geology, *Erkunde*, and astronomy, as well as commercial products. To bring it into organic connection with mathematics, courses of lectures on the interconnection of mathematics are being projected.

Matters are still in an indefinite position, but there are indications that the Cambridge Congress of 1912 will mark the beginning of a new era. It is to be hoped, for our sakes, that the results of this congress can be laid before the Consultative Committee of the Board of Education to be recommended for adoption throughout the Empire.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

**BIRMINGHAM.**—Mr. John Dale has been awarded the Walter Myers studentship for a further period of one year, having proved himself a student of exceptional merit. An award of the same studentship for the present year has been made to Mr. Cranston Walker. The value of the studentship is 150*l.* per annum, and it must be used for research in pathology or clinical medicine at some German university. Mr. Dale, the first holder, is working at Hamburg, and Mr. Cranston Walker is at the University of Freiburg, in Baden. The holder must possess a degree in science in addition to degrees in medicine and surgery.

**CAMBRIDGE.**—An election to an Isaac Newton studentship will be held in the Lent term, 1911. It will be the duty of the student to devote himself during the tenure of his studentship to study or research in some branch of astronomy or of physical optics, according to a course proposed by himself and approved by the electors. The student's course of study or research must be pursued at Cambridge. The studentship will be tenable for the term of three years from April 15, 1911. The emolument of the student will be 200*l.* per annum. Candidates for the studentship are invited to send in their applications to the Vice-Chancellor between January 16 and 26, 1911, together with testimonials and such other evidence as to their qualifications and their proposed course of study or research as they may think fit.

Mr. A. E. Shipley, F.R.S., master of Christ's College, has been nominated by the general board of studies as a member of the board of electors to the professorship of zoology and comparative anatomy in succession to the late Mr. J. W. Clark; and Prof. W. J. Pope, F.R.S., has been nominated by the council of the Senate a member of the board of electors to the Allen scholarship.

**OXFORD.**—On November 22 another stage was reached in the discussion of the changes proposed by the Hebdomadal Council at the instance of the Chancellor of

the University. The preamble of a statute providing that Greek should no longer be a compulsory subject in Responsions was promulgated in Congregation, and on a division was rejected by 188 to 152. The form of statute was introduced on behalf of council by Mr. Matheson and opposed by Dr. James, president of St. John's College, and formerly headmaster of Rugby. Sir W. Anson warden of All Souls', though not opposed to making Greek optional in certain cases, spoke against the proposal in its present form, a course which was also taken, on similar grounds, by Dr. Gilbert Murray, regius professor of Greek, and Mr. J. W. Mackail, professor of poetry. Mr. Cookson advocated the passing of the statute, and Prof. J. A. Smith argued on the same side. Mr. E. M. Walker opposed it. There is no doubt that the rejection of the preamble, which involves the loss of the statute, was largely due to the objection taken by Prof. Murray and the "moderate" party to the particular way in which the proposal had been framed. Rightly or wrongly, it was considered that no proper opportunity had been allowed for a fair discussion of possible limitations and alternatives, and the majority shrank from a measure that appeared to them unnecessarily drastic. Though for the present excluded by the vote of Congregation from the programme of university reform, it is not likely that the Greek question will be allowed to rest. But it must be remembered that, even if presented in a form acceptable to Congregation, the measure of relief has still to run the gauntlet of Convocation before becoming part of the statute law of the University.

It is announced that an Imperial Conference on Education is to be held in London next year, probably in April. The conference is, it is said, to take place at the invitation of the Imperial Government, and is to be regarded as an outcome of the congress held in 1907 under the auspices of the League of the Empire. Delegates are expected from Canada, Australia, New Zealand, South Africa, India, and the Crown Colonies.

THE U.S. General Education Board, says *Science*, has made conditional appropriations amounting to 145,000*l.*, distributed as follows:—Baylor University, Waco, Tex., 40,000*l.*; Trinity College, Durham, N.C., 30,000*l.*; University of Chattanooga, Tenn., 30,000*l.*; Meredith College, Raleigh, N.C., 10,000*l.*; Wesleyan Female College, Macon, Ga., 20,000*l.*; and Amherst College, Amherst, Mass., 15,000*l.* From the same source we learn that Wooster University has received 20,000*l.* from Mrs. J. S. Kennedy, of New York.

As has been stated in these columns, a Congress of the Universities of the Empire is to be held in London in 1912. On November 19 a meeting was held at the University of London, at which the Vice-Chancellors and other representatives of the universities of the United Kingdom were present for the purpose primarily of drawing up a paper of subjects for discussion at the congress. The subjects fell under the following heads:—(1) university organisation; (2) universities in their relation to teachers and undergraduate students; (3) universities in their relation to post-graduate and research work; (4) universities in their relation to schools and to other agencies for higher education. The draft agenda paper is to be sent at once to the various universities in the colonies and in India for comments and suggestions. The representatives of the Home universities will meet again early next summer to consider any representations made by the Colonial and Indian universities, and to select speakers to introduce the different topics to be discussed at the congress. It has been decided to hold the congress during the first week of July, 1912. We are glad to know that most of the universities throughout the Empire have accepted already the invitation to take part in what should prove an important and historic gathering. The secretary of the congress is Dr. R. D. Roberts, who may be addressed at the Congress Office, University of London, South Kensington, London, S.W.

LAST April Sir Henry Roscoe, F.R.S., as chairman of the Appeal Committee, made a public appeal for 70,000*l.* for providing new chemical laboratories at University College, London, including the purchase of the proposed

site in Gower Place. The death of King Edward led to the postponement of the Mansion House meeting arranged, and this necessity gave a check to the work of the committee. Sir Henry Roscoe has now made a second urgent appeal, which has two objects: the first is to raise a sum of 25,000*l.* for the acquisition of the proposed site, the second to raise 45,000*l.* to erect the laboratories. The sum of 25,000*l.* must be raised before December 25 next if the Senate of the University is to be in a position to exercise the option which it holds to purchase the site. Towards this sum the committee has collected more than 9000*l.*, leaving a balance of 16,000*l.* to be raised forthwith. The appeal is addressed especially to all those who realise the national importance of scientific research and its bearing upon the commercial prosperity of the country, to Londoners who desire to see university teaching in London developed in accordance with the needs of the nation, and also to the friends and admirers of Sir William Ramsay, the professor of general and inorganic chemistry at University College, to assist in this attempt to provide new chemical laboratories by gifts which will insure the acquisition of the site. It is earnestly to be hoped that the comparatively small sum of 16,000*l.* will be forthcoming before Christmas Day, so that the site adjoining the college, and eminently suitable for the proposed laboratories, may be secured. It may be pointed out that the number of students of chemistry at University College has increased greatly in recent years, and that the accommodation available has long been inadequate. The present laboratories were built in 1871, and to keep pace with modern requirements and to compete on something like equal terms with Continental universities a new building is required with up-to-date conveniences both for teaching and research. Donations should be addressed to Sir Henry E. Roscoe, F.R.S., at University College, Gower Street, London.

#### SOCIETIES AND ACADEMIES.

##### LONDON.

**Royal Society, November 17.**—Sir Archibald Geikie, K.C.B., president, followed by Mr. A. B. Kempe, vice-president, in the chair.—Harold **Wager**: The effect of gravity upon the movements and aggregation of *Euglena viridis*, Ehrb., and other micro-organisms. *Euglena viridis* and some other micro-organisms, when placed in shallow vessels or narrow tubes in the dark, become aggregated into peculiar network-like patterns or more or less well-defined groups. In a narrow tube, placed horizontally in the dark, the aggregation takes the form of a series of groups which look like green bands crossing the tube from one side to the other. Each group shows a constant cyclic up and down movement, the denser central region moving downwards under the influence of gravity, and a lighter peripheral area consisting of organisms moving upwards, mainly by their own activity. The aggregation depends upon the number of organisms present, their activity, and the depth of the vessel in which they are contained, and may persist with its regular cyclic movements for several days. The downward movement appears to be a purely mechanical one, dependent upon the specific gravity of the organism, and is not due to a stimulus which evokes a physiological response, as in geotropism or geotaxis. The upward movement is, on the other hand, due partly to the activity of the organisms themselves, partly, no doubt, to the upward currents set up in the liquid by the friction of the downward-moving stream. The upward movement of *Euglena* is more or less vertical, and appears to be controlled, so far as the orientation of its elongate body is concerned, by the action of gravity. The aggregation resembles the cohesion figures produced when fine sediments are allowed, under certain conditions, to settle down slowly in a liquid, and are probably brought about much in the same way. The movements of certain micro-organisms are apparently controlled, therefore, in a purely mechanical fashion by gravity, combined with cohesive forces, and this is of advantage to species which, like *Euglena*, are often found in large numbers in a confined space, in that it prevents their accumulation in such dense masses as would be likely to interfere with their assimilatory and respiratory functions.—Miss Jean **White**: The