20h. 34m. 37s. + 11° 18′·5, respectively, the following magnitudes have been observed for the newly discovered variable :—

Date, 1902.		Magnitude.
September	4	9·6
,,	6	9·6
,,	24	9·8
,,	25	9·8
October	7	10·2

EDUCATION AT THE BRITISH ASSOCIATION.

THOUGH the youngest offspring of the British Association, the Section of Educational Science has developed so rapidly that its growth in strength and influence is being watched with interest not unmixed with anxiety by several of the older sections. Most of the meetings devoted to the discussion of educational topics were largely attended this year, and all of them have been reported in detail, thus showing that science in education and education in science appeal to a wide public. The Section provides a platform on which it is possible, not only to state the place science should occupy in the curricula of school and college, but also to describe the character of the instruction which should be given, and to construct an organic educational science out of the disjointed body of opinion. It is easy to see that, rightly directed, the work of the Section may have an important influence in determining lines of progress in education ; and the success so far achieved justifies faith in the promise of the future.

One characteristic of the proceedings of the Section is especially noteworthy. Instead of accepting a variety of papers on diverse disconnected subjects, each meeting has been devoted to the discussion of a specific matter introduced by one or two papers. Attention has thus been concentrated upon definite points, and it has been possible to obtain the expression of competent opinion around them. Imperfections of scope and method have been pointed out, difficulties described and reforms advocated with a breadth of view and maturity of experience which command the attention of the educational world.

As an instance of the effect of the work of the Section, mention may be made of the discussion on the scope and teaching of elementary mathematics, opened last year by Prof. Perry, which led to the appointment of a committee with Prof. Forsyth as chairman. In the report presented by this committee, several desirable reforms were indicated, all of them of a kind capable of adoption by teachers and examiners. The committee considers that different methods of teaching mathematics might be adopted for different classes of students, and corresponding types of examination should be used. Emphasis is laid upon the recommendation that the teaching of demonstrative geometry should be preceded by the teaching of practical and experimental geometry, together with a considerable amount of accurate drawing and measurement. In demonstrative geometry, no single book should be placed in a position of authority, nor should there be a single syllabus in control of all examinations. It is recommended that some association of arithmetic and algebra with geometry is desirable in all cases where this may be found possible. Examining bodies are advised that no candidate should be allowed to pass unless he gives evidence of some power to deal with questions not included in the text-book adopted. With regard to arithmetic and algebra, regret is expressed that the decimal system of weights and measures has not been adopted in this country. Graphical methods should be used wherever possible, and tables of simple functions should be introduced as soon as the student is capable of understanding the general nature of the functions tabulated.

In opening the discussion on points arising from this report, Mr. A. W. Siddons described the recommendations of the Mathematical Association Committee, of which he is honorary secretary. Like the British Association Committee, that of the Mathematical Association recommends that a first introduction to geometry, and to each new branch of geometry, should be experimental with the use of instruments and numerical measurements and calculations. So far as deductive geometry is concerned, Mr. Siddons pointed out that there seem to be four alternatives :—(1) To have no one syllabus placed in the position of authority; (2) to replace Euclid by *one* standard syllabus; (3) to modify Euclid by omission and readjustment; (4) to retain Euclid in its present form.

The Mathematical Association Committee has recommended the adoption of a modified Euclid ; it is considered that the time is not yet ripe for the proposal of a standard to be adopted finally in place of Euclid. The modifications proposed include :—(1) The omission of some propositions which do not help on the course or which should be regarded as axiomatic ; (2) improved methods of proving other propositions, including the use of hypothetical constructions ; (3) the addition of a few propositions ; (4) the adoption of Playfair's axiom and the "limit" definition of a tangent ; (5) the use of angles greater than two right angles ; (6) that the exact treatment of incommensurables be regarded as a branch of higher mathematics.

The discussion upon the two reports was distinguished this year by the fact that mathematical masters from several public and other large schools were present and took part in it. It is evident from the opinions expressed that reforms in the directions advocated by the two committees would be welcomed by many teachers.

Mathematical ideas can be obtained by means of Froebel's boxes of geometrical solids and simple plane figures, but the school work after the kindergarten is not usually conducted on the same sound and systematic plan. An address on the subjects to be taught as science in schools and the order in which they should be taken, given by Dr. C. W. Kimmins, indicated desirable directions of study. Dr. Kimmins pointed out that the great reforms which have taken place in recent years in the teaching of science in schools have been due in large measure to the British Association report on the teaching of chemistry. Similar reports are needed on the teaching of other subjects suitable for instruction in schools, and it is hoped that the committee appointed on the teaching of botany will be of value in this connection.

Dr. Kimmins suggested that the interval between the kindergarten (pupils five to eight years of age) and the experimental science course should be utilised for suitable nature-study teaching. During this interval, thorough instruction should be given in practical mathematics, including the mensuration which is generally taken as part of the experimental science course. This should be given in the time devoted to mathematics, not science. Finally, it was considered that the subjects requiring special attention are the teaching of natural history and botany, and the correlation of science and art teaching.

When experimental science is introduced into schools, the best course of practical instruction to follow is one based upon heuristic principles, such as that which has been introduced into Irish national schools. Mr. W. Mayhowe Heller, who has organised the work, described the methods and results of the scheme. The Commissioners of National Education, in taking steps to introduce practical instruction into their schools, are attempting to do the work accomplished in the towns of England and Scotland by local educational enterprise. In elementary science, the typical course for boys and girls is based on the 1889 recommendation of the British Association Committee. Teachers attending training courses have to perform all experiments of the course themselves. Free equipment grants of apparatus for manual instruction and elementary science are given to necessitous schools. Very few schools at present have laboratories, but at the same time a great deal of individual experimenting can be accomplished. Object lessons are allowed as a substitute for a systematic course of instruction in experimental science, but these must attempt to achieve the same results as the science lesson, viz. accurate habits in observation, work, description and reasoning. Practical instruction of this kind is of the highest importance to Ireland ; for upon its successful introduction into the national schools depends the future of technical instruction.

The position of science in Irish intermediate schools was brought before the Section in two papers, one by Mr. R. M. Jones, head-master of the Royal Academical Institution, and another by Mr. T. P. Gill, secretary of the Department of Agriculture and Technical Instruction. Mr. Jones gave a survey of the working of the new scheme of intermediate education and indicated the probable tendency of developments. Practical work in physics and chemistry has been introduced into intermediate schools, the scheme followed being that of the Department of Agriculture and Technical Instruction. The result is that laboratories in which simple measurements and weighings can be conveniently carried on have been provided in many

schools, and the work done in them is of a most inspiring character both to teacher and pupil.

The science programme for the Irish intermediate or secondary schools was dealt with by Mr. Gill, who though by training and inclination a humanist, expressed his complete satisfaction with the aims and scope of the scheme. 'The programme was introduced for three reasons, which Mr. Gill expressed as follows:—

"First, because we believe that science has a part as well as letters in the science of general education—(remember, I am speaking now only of the science part of the programme, and only of the secondary schools)—and, secondly, because the teaching of experimental science according to this programme involves a method now commonly called the heuristic method, which we believe has a great educational value and may be applied to the advantage of the study of other subjects as well as science. The third reason is the special value of science in connection with technical instruction."

Mr. Gill confessed that in admitting the claim of science in general education, and standing as its champion, he did so as a convert, and one who has been brought to that realisation of the power and value of science which is forced upon every modern man. "Scientific physics," he remarked, "which have now their recognised place in public instruction, are admittedly no more difficult to learn or to teach than Latin or Greek, and in our Irish public schools at the present time I venture to say Latin and Greek are not so well taught as our experimental science, with all the great drawbacks and the difficulties which have beset us in the endeavour to provide teaching power. The secondary school which has to do with the future leaders, the industrial and intellectual leaders of the country, would hardly be true to its function as a preserver of the equipoise of general knowledge, would hardly be a living institution informed by the spirit of the age, if it failed to take notice in its curriculum of the place science occupies to-day in the mental and material life of society."

Dr. W. J. M. Starkie, Resident Commissioner of National Education in Ireland, created a sensation among Irish educationists by a paper in which he criticised the recent reforms of primary and secondary education, undertaken with a view to their co-ordination. He condemned the managerial control of national schools in Ireland, and pleaded for that which every civilised country in Europe has long since attained—a single local authority for education outside of technical schools and universities. Nothing can be done, however, until educated and independent laymen come forward in sufficient numbers to make their influence felt on such authorities.

As regards English schools, Dr. J. H. Gladstone read the report of the committee on the teaching of science subjects in elementary schools; but the changes which have been caused by the introduction of the Block grant in place of the former examination grants have made it difficult to arrive at definite information as to the number of pupils receiving instruction in science. It is felt that the time has now arrived for a general survey of the progress made since the committee was appointed in 1879, and such a statement will, it is hoped, be presented to the Association next year.

Before any subject can be taught with success, the health of the pupil and the training of the teacher have to be considered. A preliminary report of the committee on the conditions of health essential to the carrying on of the work of instruction in schools was presented by Prof. C. S. Sherrington, F.R.S. Attention has so far been directed to the following points:—The periods of day appropriate for different studies, the length of lessons, and periods of study suitable for children of different ages; anthropometrical and physiological observation forms in use in various schools with a view to preparing a typical form for general use; anthropometrical and physiological observations recorded in different schools for a series of years on the same children; investigations into the causes of defective eyesight in school children and a definition of the conditions necessary for preserving the sight; the practical knowledge of hygiene possessed by school teachers. Much interesting information has been collected and tabulated, and it is hoped that when the final report is presented next year some action will be taken upon its recommendation.

Given pupils in a condition to study with profit, it is desirable that the teachers should be trained to direct their mental activities. In a paper on the preliminary training of teachers, with special reference to women, Miss L. E. Walter described the various avenues to qualification as teachers in elementary schools, and suggested some practicable improvements in the courses of study pursued between the ages of about fourteen and eighteen years. She condemned the excessive book-work which must be done by pupil teachers who desire to pass their examinations, especially when scientific subjects are concerned. It was urged that in every pupil teachers' school or centre the students should be taught (1) how to read books with permanent profit; (2) how to increase their knowledge practically by simple experiments as distinct from book-work.

In the course of a brilliant address, Prof. H. L. Withers pointed out that the problem of the training of teachers is essentially different in a primary and secondary school. In the former a considerable, though incomplete, system has been in existence for the best part of a century, while in the latter the provision made is still so defective that at least in the case of boys' schools it may be said that we have everything to do from the beginning. For the primary teacher large Government grants are given, while nothing is as yet allowed for the secondary. Primary schools are fairly homogeneous. Secondary schools display a great multiplicity of types, social and educational, day and boarding. The problem in the two cases was, therefore, treated separately by Prof. Withers. As regards the latter, it was remarked that the multiplicity of types is so great that anything like a single stereotype system of training would be futile. The secondary schools themselves must take a large share in framing an elastic variety of systems, and the training provided must be consistent with all that is best and strongest in our existing tradition. Analogy with other professions suggests that a combination between the great schools and the Universities is essential for the institution of a complete system of professional training. Though in several respects the position of men as regards training is quite distinct from that of women, yet for the purposes of both who desire to obtain their professional training at universities, each university should, for the future, be equipped with a department of education as effective as its departments of law and medicine. As much as possible should be done to refer students to the principles of mental, moral and physical science, upon which the theory and practice of education must ultimately be based.

In secondary schools a knowledge of educational principles is not regarded as of much importance, and young men go to them to teach without having received any training. In the course of time some of them became good schoolmasters, gaining experience at the expense of their pupils. In such cases the school has the same relation to the teacher as the workshop to the engineer, but there is little doubt that the master and the engineer should receive some practical training before undertaking professional duties. Prof. Perry's presidential address on the training of engineers was discussed at a joint meeting with the Section of Engineering. Among the points brought forward in the course of the discussion were, that it would be an advantage if students of engineering could spend five months each year in a workshop and five months in a technical college; that preliminary training in habits of observation and accuracy was of the greatest value; that teachers should be kept in close touch with the practice of their profession, and their laboratories should be equipped with modern tools and machinery; and that we have little to learn from Germany in the matter of education or of turning out work, but much to learn as regards financial ability and the science of commerce.

Language is an important factor in determining commercial developments. It is therefore worth while to consider Sir Frederick Bramwell's suggestion that the great commercial nations—the United States, Germany, France and England—should each adopt a common language to be learnt in addition to their own, in order to facilitate intercommunication and save the trouble of learning several languages for business purposes. Italian was suggested as a suitable language for the purpose, because it is easy of acquirement, founded upon a classic basis, and could be adopted without arousing feelings of jealousy among the nations accepting it. Latin was also suggested as a suitable common language, as it was in mediæval times.

Many people believe that English will in the course of time become the language of commerce, but if this is to be realised more attention must be paid to the teaching of our mother tongue in schools than is usually the case. Mr. P. J. Hartog dealt with this subject in a paper which led to a good discussion. He held that a mastery of our language is as necessary for the so-called practical uses of the leaders in war, diplomacy, science and commerce as for the historian and the philosopher. Though

on the grounds of utility English ought to be given an important place in the school curriculum, it is one of the most neglected subjects. The result is that few boys leaving school are able to write a good letter, and many adults are unable to describe things or events in precise terms. On this account many misleading statements are made which might have been avoided. Mr. Hartog pleaded for the rational and systematic teaching of the mother tongue in our schools. By neglecting this subject the teacher is deprived of a very powerful instrument of education. Prof. G. M. Minchin gave, in a paper, a number of examples of the misuse of common English words and expressions, among them being split infinitives, *without* instead of *unless*, misplaced *shall* and *will*, and many others which should be avoided by all who desire to use words in their correct sense and place, and preserve our language from barbarisms.

Other subjects were considered during the meetings of the Section, but limitations of space will not permit descriptions of them, or of the many valuable points brought forward by speakers in the discussions. It was evident from what was read and said that a large amount of material of interest to men of science and practical teachers is available, so the Section is likely to be even more active in the future than it has been during its two years of existence. R. A. G.

BOTANY AT THE BRITISH ASSOCIATION.

THE semi-popular lecture was given on Monday, September 15, by Prof. F. W. Oliver, on ancient and modern seeds. The lecturer gave a clear and interesting description, illustrated with lantern slides, of the gradual evolution of the seed, and dealt with some of the more interesting questions concerning the morphology of various seed structures.

On Friday, September 12, the botanists paid a visit to the Belfast Botanic Gardens, and under the guidance of the able curator, Mr. McKimm, inspected the extremely interesting fernery which has recently been constructed. On Tuesday afternoon, the Rev. C. H. Waddell, the indefatigable local secretary of Section K, conducted a botanical excursion to Colin Glen. After an interesting ramble, the members were entertained to tea by Mr. and Mrs. Kidd, whose kindness was much appreciated.

Much interest was taken in a collection of characteristic Australian plants, exhibited by Mr. Thomas Steel during the meeting.

Prof. I. Bayley Balfour, F.R.S., exhibited and described specimens of the various forms of *Erica tetralix* found in Connemara. Mr. James Stirling, Government Geologist of Victoria, in a paper on the flora of the Australian Alps, dealt with the origin and distribution of the mixed types of plants now growing on the highest altitudes over south-east Australia, and their correlation with other Alpine and the Tertiary floras of the region.

Mr. R. Lloyd Praeger read a paper on the composition of the flora of the north-east of Ireland. This area includes the counties of Down and Antrim, and the flora numbers 820 species of flowering plants and vascular cryptogams, the total flora of Ireland being reckoned at 1020 species. There is in the local flora an almost complete representation of British type plants. English type plants are rather poorly represented. Scottish type plants reach in Antrim their maximum for Ireland; in Down they are somewhat fewer. Of Highland type species there is a fair representation; Antrim, though of less elevation, contains more Alpine plants than Down. Germanic plants are extremely few in Ireland. In Atlantic type plants, Down and Antrim are comparatively rich.

Mr. Herbert Wright (Ceylon) contributed a paper on foliar periodicity in Ceylon, in which he showed that some trees undergo complete defoliation twice per year; others exhibit incremental foliar activity several times per year, in addition to a complete annual renewal. The irregularity of foliar periodicity is very pronounced. There is not a month when all the trees are in full leaf.

In the department of plant physiology, Prof. J. C. Bose, of Calcutta, gave an interesting demonstration, illustrated by experiments, on the response of plants to stimulation (*vide Journ.* Linn. Soc., xxxv., 1902). Mrs. D. H. Scott gave an account of the movements of the flower-buds and flowers of *Sparmannia africana* up to the time of the setting of the fruit. At first the buds hang all in one plane; each bud has a joint on the stalk, which is much swollen below the flower. The buds rise one by one from the drooping position to the horizontal; then make a sharp curve inwards, and just before flowering the bud hangs down in an exactly vertical position. The flowers open during sunlight at a temperature not below 60° F. (15°·5 C.), so that on a cold day perhaps only one flower and on a hot day three or four may be open at the same time. The flowers reopen for several days; during this time they gradually take up a vertical position, pollen often being formed for five or six days. Then, if fertilised by bees, the flower-stalk falls again into the horizontal position, from which it rises again as the fruit ripens. Mr. Barnard and Prof. Allan Macfadyen, in a paper on luminous bacteria, stated that these organisms require particular and exact conditions in order to exhibit their luminous properties. They must have a suitable nutrient soil containing such proportions of salts as shall render the medium isotonic. A supply of free oxygen is essential; in the absence of oxygen the organisms live, but are non-luminous. The luminosity appears to be due to the vital processes of the cell, and an exposure to the temperature of liquid air does not destroy it. Prof. Macfadyen and Mr. Rowland also contributed a paper on the suspension of life at low temperatures, in which they showed that ten hours' exposure to the temperature of liquid hydrogen (about − 252° C.) had no appreciable effect on the vitality of the various organisms (bacteria and yeast) tested. Miss Gabrielle L. C. Matthaei (Cambridge) described experiments on the effect of temperature on carbon dioxide assimilation in the leaves of the cherry laurel. The lowest temperature at which assimilation could be detected was − 6° C. This is the first well-established case of assimilation below 0° C. For temperatures between −6° C. and 33° C. it was found that assimilation is affected in exactly the same way as is respiration. Provided the illumination is sufficient, the assimilation increases with the temperature. Dr. Henry H. Dixon (Dublin) gave an account of some experiments made to determine the resistance of seeds to high temperatures. The maximum temperature to which the various seeds were exposed and still retained their germinating power varied from 90° C. to 121° C. The president communicated a paper by himself and Mr. H. Jackson on the germination of fatty seeds. In the case of Ricinus, the reserves consist mainly of oil and aleurone, hardly a trace of carbohydrate being present. In germination, the oil diminishes and both cane sugar and glucose make their appearance, accompanied by the formation of lecithin, a fatty body which contains nitrogen and phosphorus.

Several important papers on fossil plants were read. Miss Margaret Benson described the seed-like fructification of *Miadesmia membranacea*, Bertrand. The foliage leaf bears a ligule in a longitudinal groove with thickened base and sides. In the sporophylls, the sporangia are inserted singly in the proximal end of the groove, and are large and pedicellate. In the megasporophyll, the sides of the groove are completely coherent above the sporange, and thus form a velum. The wall of the megasporange is composed of several layers of isodiametric cells, and encloses a single thin-walled megaspore or embryo sac. The microsporange has no velum, and the wall is formed of a palisade layer. Miss Benson also described the structure of some sporangia found associated with petioles and other fragments of *Lyginodendron oldhamium*. Mr. Lomax described two specimens obtained from Dulesgate, which show that Lyginodendron had a branching stem; also that the branch was given off in the one case between two leaf-stalks and in close proximity to several roots. The position of the roots shows that they must have been aërial roots, and not, as generally accepted, basal or confined to the basal regions of the stem. Mr. Lomax also read a paper on the occurrence of nodular concretions (coal balls) in the Lower Coal-measures. These bodies consist of a quantity of fragments of short pieces of stems, &c., some with the cortex, some without, some split in fragments, and so on. From an examination of these nodules it appears that, at least in this case, these plant remains have not grown on the spot where we now find them, and the author comes to the conclusion that the various portions of plants have been carried into their present position after being broken in fragments, and before petrification, or they have been carried from a parent bed after petrification. In a paper on sporangiophores as a clue to affinities among Pteridophyta, Dr. D. H. Scott, F.R.S., pointed out that some years ago he suggested the probability of an homology between the ventral sporangiophores of Sphenophyllum or Cheirostrobus and the similarly placed synangia of