has also been a notable development of short summer-vacation courses (mainly in London) for foreign students as well as of other summer courses, to which, although not planned expressly for them, foreigners are admitted. Interchange of school teachers (for periods not exceeding one year) between England and Wales and the Dominions overseas has been organised by the League of the Empire on a large scale, and other bodies such as the Overseas Educational League and the Fellowship of the Maple Leaf, are engaged in similar enterprises.

Several European countries participate in exchanges financed by American educational endowments. The Commission for Relief in Belgium Educational Foundation of New York arranges, in concert with the Fondation Universitaire of Brussels, grants for study in American Universities to Belgian graduates and vice versa (in 1921–22, 34 and 24 respectively). The American-Scandinavian Foundation similarly allots 40 travelling fellowships, each of 1000 dollars, and the Franco-American Scholarship Exchange, administered by the American Council on Education, provides 50 scholarships for French women in American colleges, 28 for American women in French lycées and écoles normales, and 22 fellowships for American graduates in French universities.

In France the Doctorat d'Etat has been made more accessible to foreign graduates, a system of exchanges of professors has been arranged with certain American universities, and the summer-vacation courses for foreign students in vogue before the War have been re-established and extended. In 1919 a Franco-Swiss interuniversity conference took place, and in 1921 a convention was concluded, between the French and Belgian ministries of public instruction, to encourage and regulate the exchange of professors and students and to establish a permanent technical commission for the study of questions regarding the scientific, literary, artistic, and scholastic relations between the two countries.

In the same year, 1921, were formed the Netherlands Committee for International Academic Relations and the Office Central Universitaire Suisse.

The Confédération Internationale des Etudiants, formed in 1919, has contributed substantially in co-operation with its affiliated national unions, towards familiarising students with the idea of migration. The National Union of Students of England and Wales, constituted in 1922, has been very active in promoting visits by students to universities in foreign countries.

In the nineteenth century one of the most powerful influences making for migration of students was the great reputation of the German universities for profound learning and for primacy in scientific research, together with their liberal conditions of entrance. In the United States especially a German doctorate came to be looked upon as a normal culmination of the studies of an ambitious youth. The tradition was fostered by the system of exchange of professors arranged by the Prussian ministry of education with American universities. Before the War, however, a reaction had set in, due in part to the rapid development of the American graduate schools.

The League of Nations decided last year to enter the field of International Education, and a Committee on Intellectual Co-operation, having a sub-committee on Interuniversity Relations, is actively engaged in devising ways and means of stimulating movements and enterprises such as those mentioned in this article, including the establishment of an international bureau of university information.

The question of interchange of students has an economic aspect which deserves study. At the present time students from abroad constitute about eight per cent. of the full-time students in the universities and university colleges of the United Kingdom. Statistics showing the number of students from the United Kingdom in universities and colleges in all other countries are not available, but those in the United States in 1920–21 numbered 181, and those in other parts of the world are certainly very few compared with the total of more than four thousand students from abroad in the British Isles. Is the fact that our imports so largely exceed our exports to be accounted economically advantageous to us or the reverse? The fees paid by students represent, of course, only a fraction of the costs of maintenance of the institutions where they study, and in universities such as Oxford, Cambridge, London, and Edinburgh, which are frequented by students from abroad in large numbers, the additional expenditure necessitated by their attendance is probably not compensated by their fees; but there is a more important question in regard to the students who come to Great Britain to study technology. When they go back to their own countries they take with them knowledge which is used so as to make the competition of their countries' industries with our own more formidable. On the other hand, they are likely to recommend the placing of orders for stores and machinery in the country in which they have studied rather than in other countries, and if they had not come to Great Britain for their knowledge they would probably have obtained something very like it elsewhere. It may be that such students do British industries more good than harm. The matter is one on which it is desirable that further light should be, if possible, obtained.

Botanical Surveys.

THE Department of Agriculture of South Africa has recently issued two memoirs (Nos. 3 and 4) on the botanical survey of South Africa. The former, by S. Schonland, entitled "Introduction to South African Cyperaceæ," is a systematic account of a selection of the indigenous sedges, many of which play an important part in the prevention and cure of soil erosion, and a knowledge of which is essential in the study of the relations of sour and sweet veld. A description of the general structure of the vegetative organs, the inflorescence, the difficulties in the interpretation of which are discussed in some detail, the flower and the fruit, is followed by notes on all the South African genera, including representative species of each. The species are illustrated by seventy carefully drawn plates, which show the habit of the plant and enlarged details of flower and fruit, and will enable the student to identify any species included in the limits of the book. The general arrangement is the one adopted in the "Flora Capensis" by the late Mr. C. B. Clarke, to the thoroughness of whose work Dr. Schonland pays high tribute. The critical remarks included in the notes on the genera render the work of value to others than the South African student of this family.

Memoir No. 4, entitled "A Guide to Botanical Survey Work," is a series of chapters, by different experts, which will be helpful to those engaged in the South African survey. Dr. Pole Evans reiterates the organisation and aims of the survey, and describes briefly the characteristics of the two main botanical regions, the true Cape region, with a vegetation resembling in its general aspect that of the Mediterranean area, and the South African region, which

comprises the remainder of the country under review, extending northwards to include a strip of Southern Rhodesia and the southern part of Portuguese East Africa. There are also chapters on the physical features and climate, on methods of survey, with instructions to collectors and observers, and a bibliography. Dr. Marloth writes on the use of the common names of plants, which, though sometimes not trustworthy, may be very useful if accepted with care and discretion.

The Report of the Canadian Arctic Expedition 1913–18 (vol. v., Botany, part B) by Theo. Holm ("Contributions to the Morphology, Synonymy, and Geographical Distribution of Arctic Plants") contains some interesting notes on the methods of growth and reproduction, manner of hibernation and other characteristics, of many of the species collected by the expedition. Certain biological types are absent from the polar regions; there are no climbers, no saprophytes, and no true parasites. Pedicularis alone represents the partial parasites. The great majority of the herbs are perennial. The chapter on geographical distribution contains a table showing the general distribution of the species collected, which indicates that the vegetation of the north coast of America is composed of types from various parts of the northern hemisphere of both worlds, and bears out the view that the present arctic flora consists to a great extent of remnants of the alpine floras of the tertiary period. These alpine floras were principally those of the European Alps, Altai and Baikal, the Rocky Mountains, and perhaps also Caucasus and Scandinavia.

Memoir 126, issued by the Canadian Department of Mines ("A Botanical Exploration of the North Shore of the Gulf of St. Lawrence," by Harold St. John), includes an annotated list of all the flowering plants and ferns recorded from this area, in all 622 species, and some discussion of the soil-relations of the various ecological plant groups. A comparison of the habitats of 103 species along the north shore of the gulf and in other regions, especially Europe, indicates an agreement the more surprising considering that the data have been gathered by many botanists at widely separated places and times. Mr. St. John also gives an account of botanical exploration in the same area previous to his own visit in 1915.

"A Flora of the Shetlands," by Dr. G. C. Druce, forms a supplement to the recently issued report of the Botanical Society and Exchange Club for 1921. The total land surface of the islands, which number more than a hundred, is rather more than that of the Faroes, but the hills are lower and lack the marked alpine element found in the flora of the Faroes. The population of the islands since the glacial period has been explained alternatively by the existence of a land-bridge and immigration by means of birds, ocean-currents, and wind. The latter view would seem the more probable. There are practically no endemic species, and many species found in the islands are extremely local. The flowering plants and ferns number about 500 species, 59 of which have probably been introduced by man. Dr. Druce remarks on the size and brilliancy of some of the flowers, and suggests the feeble intensity of sunlight as a cause; clouds are absent from the sky only on a few days in the year, and mists are very frequent. There are few Lepidoptera; many plants are self-pollinated, and others never ripen seed. The flora approximates most closely to that of the Faroes, and is distinctly poorer than that of the Orkneys.

The Gas Industry and Coal Conservation.

THE annual coal output of Great Britain is about 300 million tons, of which approximately 20 million tons are carbonised annually in gasworks for the production of towns' gas. The reserves of British coal within 4000 feet of the surface were estimated in 1915 at 197,000 million tons. In something like 600 years the coal measures of this country will be probably exhausted, and what then? The world's scramble for oil to-day indicates that a coal age will certainly not be succeeded by an oil age. Possibly we shall have learnt to tap atomic sources of energy, or perhaps the earth's internal heat may be available to us, after the manner suggested by Sir Charles Parsons.

There are those who hold that how posterity will provide itself with supplies of energy is posterity's own concern and need cause us no uneasiness; the gas industry takes a wider view. Its processes are continually being examined with a view to effecting greater conservation of coal. In a Report to the Institution of Gas Engineers in 1919, by Sir Dugald Clerk, Profs. Cobb and Smithells, it is shown that the thermal efficiency of the process of carbonisation of coal achieved to-day in the United Kingdom is from 70 to 80 per cent., and that debiting gas with the whole of the thermal losses of the process and allowing for transmission and other losses, at least 45 per cent. of the heat of the coal carbonised is delivered to the consumer as inflammable gas. This is a high figure, but it can be considerably improved upon if the heat content of the coke produced, amounting to more than 10 cwt. per ton of coal carbonised, is made available to the consumer by the conversion of the coke into gas. The Gas Regulation Act, 1920, had this point among others in view when it conferred upon individual gas undertakings freedom to declare the calorific value of the gas each would supply. As there appears to be considerable confusion of thought on this matter, perhaps it were as well if we explained briefly the nature of the component mixtures constituting towns' gas.

> "We see all sights from Pole to Pole,
> And glance and nod and bustle by,
> And never once possess our soul,
> Before we die."

Blue water gas is produced from coke by passing air and steam alternately over an incandescent bed of this fuel. Its calorific value is about 300 B.Th.U. per cubic foot, and its composition is approximately represented by CO_2, 4·5 per cent.; CO, 43 per cent.; H_2, 48 per cent.; methane, 0·5 per cent., and nitrogen, 4 per cent. Sometimes this gas is mixed direct with coal gas in a towns' gas supply, a customary proportion being 80 per cent. of coal gas and 20 per cent. of water gas, the percentage of carbon monoxide in the resulting mixture being approximately 14 per cent. and the resulting calorific value about 500 B.Th.U. per cubic foot. More commonly, however, carburetted water gas, produced by enriching blue water gas with gaseous hydrocarbons derived by "cracking" various oils at high temperatures, is used for this purpose. The carbon monoxide content of carburetted water gas is on the average about 27 per cent., and, when admixed to the extent of about 20 per cent. with straight coal gas, a mixture containing approximately 11 per cent of carbon monoxide results. Straight coal gas produced by the high temperature distillation of coal has a calorific value of about 560 B.Th.U. per cubic foot and contains about 7 per cent. of carbon monoxide.