

English Provincial Universities: Demand and Supply.

THE elevation of University College, Reading, to full university status has naturally led to a certain amount of speculation as to the prospects of other colleges which aim at achieving a like development. A careful survey of the demand for and supply of university education in Great Britain was included in last year's Report of the University Grants Committee, which pointed out that in spite of serious financial distress among the classes from which university students are mainly drawn, in spite of a rise in fees and in personal expenses, there were 56.9 per cent. more full-time students of both sexes at British universities and colleges than before the War. There can, the committee thought, be little doubt that the demand for university education cannot long remain stationary even at this higher level, and that it will continue to grow both in volume and intensity. The growth is, in fact, clearly traceable to causes which are likely to operate in the future with increasing force.

One may distinguish between the demand for professional or vocational education at a university—the bread-and-butter studies—and the demand for the other advantages which a university education offers, advantages associated with the ideal of a 'liberal education.' Both have been and are being stimulated by the rapid increase in the secondary school population, which has multiplied the number of young people fitted for and capable of appreciating the value of university training while creating a demand for more teachers which the universities alone can properly supply. The ever-extending applications of science to industrial purposes, the instalment by industrial concerns of private laboratories and research departments, and the development of industrial research associations, provide an ever-widening field for men and women trained in the scientific departments of universities. There is, moreover, in the world of commerce and industry a growing appreciation of the value of the university-trained mind, and the opinion gains ground "that for the direction of operations which tend every day to become more and more dependent for their success upon the understanding of a complicated network of world conditions, disciplined imagination, breadth of outlook, and mastery of general principles are the qualities needed—qualities which it is the object of a good university education to develop." Meanwhile the demand of the learned professions and the public services grows no less, and the local government authorities have begun to compete with the central government for the services of university graduates.

Partly as a result of the widening of the university area of influence, there has come about a broadening of the basis of university studies in all faculties, and this has tended to increase the number of those who would pursue at a university the ideal of a 'liberal education.'

A potent cause of growth in the *effective* demand for university education in Britain has been the generous provision by local authorities of scholarships tenable in universities. It has been estimated that this amounts to something like 300,000*l.* per annum.

So much for the demand. In discussing the question whether the supply would be able to meet it, the

committee directed attention to its statistics of students in attendance at each of the universities, and pointed out that there are few at which there is not ample scope for expansion without any danger of introducing the methods of mass production—expansion which would meet all the needs likely to arise for a good many years to come, at much less cost than would be incurred in creating new universities or raising to the university level institutions which are now below it: "We consider that a relatively small number of universities, staffed and equipped on a worthy scale, will be of more value to the nation than a larger number of universities of inferior strength."

Turning now from these general considerations to particular examples, the present position and prospects of the three university colleges at Nottingham, Southampton, and Exeter may be briefly described as follows:

UNIVERSITY COLLEGE, NOTTINGHAM.

This College was founded by the municipality of Nottingham and opened in 1881 by the Duke of Albany; it took up the Cambridge extension courses, of which Nottingham was one of the earliest centres, and the evening classes which for many years had been held at the Mechanics' Institution. From these beginnings it has developed its present work.

The College building, which houses also the Free Public Library, is situated in the centre of the city, but new buildings are in process of erection on a very fine site, three miles distant, presented by Sir Jesse Boot as part of a gift of 350,000*l.* made in 1920 to the city of Nottingham. From the gift, 110,000*l.* was allocated to the new buildings, for which Sir Jesse Boot made supplementary gifts amounting to 40,000*l.* An anonymous donor gave 100,000*l.* in 1922 as a contribution towards the establishment of an "East Midlands University," and this sum was added to the building fund, making 250,000*l.* in all. Sir Jesse Boot has since added to his benefactions; among other gifts he has provided 12,000*l.* more for the buildings and 9000*l.* for the sports ground. The present buildings in Shakespeare Street will continue to house the technical day courses and the evening classes.

At the ceremony of laying the foundation-stone of the new building on June 14, 1922, Lord Haldane suggested that a university for the East Midlands might be organised on something like the pattern which is now in operation in Wales, the university looking to the constituent colleges to develop the teaching of their own students and preserve all the records and to conduct examinations for degrees under the university's supervision. He thought it would be possible to start a university on these lines with four faculties: arts, science, engineering, and commerce. The other constituent colleges of the projected university were not named, but Leicester, Loughborough, and Derby are all within easy reach, and the colleges at those places would presumably come into the scheme.

The instruction at University College, Nottingham, is organised in faculties of arts (including education and music), economics (including commerce and law), pure science (including pharmacy), and applied science (engineering and technology, textiles and mining). A department of adult education is conducted by a whole-time professor, assisted by four staff tutors, two organising lecturers, and about thirty-five part-time tutors and lecturers. The College has shown

great enterprise in developing this department to a high degree of efficiency since the War. It makes special provision for the instruction of foreign students throughout the academic year.

Much advanced work is carried on, there having been in 1924-25 twenty-four research students in addition to students doing post-graduation work in education or in secondary training. The total number of full-time students in 1924-25 was 472, including 175 women. The distribution by faculties was: arts and economics, 204 (women 130); pure science, 204 (women 45); medicine, 6; technology, 58. Ninety-seven students were accommodated in residential halls. Part-time students numbered 734 (women 97), and there were in addition 1545 students taking courses not of a university standard, and 1867 university tutorial class three-year students.

On the score of amount of instruction provided and research work undertaken, Nottingham ranks higher than Reading. It is in provision of residential halls for its students and in finance that it falls short. A scheme for providing additional halls of residence both for men and for women has, however, been begun and has already received contributions and promises of support. The total income of the College in 1924-1925 was 59,609*l.* as against Reading's 84,159*l.*, and its income from endowments 1600*l.* as against 12,148*l.* Its grants from local authorities amounted to 14,532*l.* plus 2500*l.* set apart for scholarships, hostels, etc.; its parliamentary grants to 25,548*l.*, its tuition and examination fees to 12,878*l.*, and other income to 5051*l.*

The book value of its lands and buildings and permanent equipment is 495,888*l.*, and its endowment investments 2381*l.*. A few more bequests such as that of Mr. W. H. Revis (37,000*l.*) would enable the College, either alone or in association with others, to make out a very strong case for a university charter.

UNIVERSITY COLLEGE, SOUTHAMPTON.

The College at Southampton originated in the Hartley Institute for Technical Training, founded in 1850 and formally opened by Lord Palmerston in 1862. For thirty years its function was that of a technical college only, but in 1899 it was recognised by the Board of Education as a training college for teachers. Three years later (after investigation and report by the Treasury) the College was promoted to a place in the list of university colleges in receipt of Treasury grant. New buildings on the outskirts of the town were opened on June 20, 1914, by Lord Haldane. On the outbreak, six weeks later, of the War, the College authorities handed over the buildings to be used as a hospital, and it was not until October 1919 that the College actually took possession of its new home. The buildings are not yet completed, and a good deal of the work now being done is carried on with huts as lecture-rooms and laboratories.

The College prepares students for degree examinations of the University of London, the examinations of various professional bodies such as the Pharmaceutical Society, Institute of Chemistry, Institutions of Mechanical, Civil and Electrical Engineers, Royal Institute of British Architects, Surveyors' Institution, Law Society, etc., and for its own diplomas in engineering, commerce and economics, geography, law, music, and English (for foreign students). Its department of education for the training of teachers has a high standard of admission (London matriculation) and prepares students not only for the Board of Education's Certificate examination (conducted internally, at the College) but also for the teachers' diploma and higher diploma in pedagogy of the University of London and other advanced examina-

tions in professional subjects. An increasing number of these students take also university degree examinations. The original work of the College as a technical institution still flourishes in the shape of evening classes in arts, pure and applied science, engineering, etc. There is an old students' association with nearly two thousand members.

In 1925-26 the number of full-time students was 316, including 157 women. The number resident in college hostels was 192 (women 94). Two-thirds of the full-time students (82 men and 131 women) were working in the Faculty of Arts; 86 were students of pure science; 17 were engineering students. Part-time students numbered 294, including 28 women. In addition, there were 253 students taking courses not of a university standard and 112 students attending university tutorial (three-year) classes. The book value of lands and buildings as at July 31, 1925, was 64,591*l.*, and endowment investments amounted to 12,347*l.* The total income of the year 1924-25 was 31,962*l.*, derived from: parliamentary grants (15,139*l.*, increased in 1925-26 by 4000*l.*), local authorities' grants (9236*l.*), tuition and examination fees (6094*l.*), endowments (644*l.*), and other sources (849*l.*). Student expenses have been kept low, and it is claimed that a university education may be acquired at Southampton at an inclusive cost of 105*l.* a year.

Although the College is able at present to pay its way, further expansion and improvement are dependent on the success of efforts now being made to raise additional funds. In May 1925 an appeal was launched for 500,000*l.* for the endowment of chairs and the provision of additional buildings, with the view of eventually obtaining a charter for a projected "University of Wessex." Geographically, Southampton would seem to be the most appropriate centre for university education for East Dorset, South Hants, the Isle of Wight and Channel Islands, and West Sussex. The towns of Poole, Bournemouth, Salisbury, Portsmouth, Winchester, and Chichester are all within easy distance. In 1925-26, 119 out of the total number (316) of full-time students lived at home, and 72 others came from homes within a radius of thirty miles, whilst 125 came from beyond that radius.

The case for a University of Wessex rests partly on the regional demand, present and prospective, for regional facilities for university education, and partly on the incidental and indirect benefits likely to accrue to the inhabitants of the region in consequence of having a university in their midst. It may be anticipated, therefore, that Southampton will, like Nottingham, largely develop its university extension activities and its commercial and technological departments. Southampton being within such easy reach of French ports, a university with a strong faculty of commerce would attract many students from France. The engineering department of the College is at present a small one, but its efficiency is proved by the fact that the students when they leave college readily obtain employment, and some of them have already risen to very considerable distinction. Were money forthcoming, this department would be capable of important developments, especially in the study of marine and aeronautical engineering, for which Southampton offers excellent opportunities.

UNIVERSITY COLLEGE, EXETER.

The University College of the south-west of England, Exeter, formerly known as the Royal Albert Memorial College, originated in 1865, when memorial buildings consisting of a museum, a library, and adjuncts for the study of art, science, and literature were erected. With the co-operation of the Local Lectures Syndicate of the University of Cambridge, the work of the

institution was re-modelled and co-ordinated in 1893, when the first principal was appointed, but it was not until 1901 that the educational work was organised for development on the lines of a university college with the provision of a curriculum for the external examinations of the University of London.

The College was placed upon the list of university institutions in receipt of grant from H.M. Treasury as from August 1, 1922, when it was incorporated under its present name as a company limited by guarantee, and the college buildings and halls of residence were transferred to it by the Exeter City Council. From that time its progress has been rapid, the number of degree students in the four years ending 1924-25 having been 96, 139, 187, and 211 respectively. The total number of full-time students in 1924-25 was 332, of whom 221 were in the teachers' training department. Residential halls provide accommodation for 134 women and 110 men students. Part-time students numbered 38 and occasional students 40. There are departments of biology, chemistry, classics, education, English, geography, history and economics, law, pure and applied mathematics, modern languages, music, philosophy, physics, and extra-mural studies. The total income was 29,067*l.*, including parliamentary grants 12,317*l.*, grants from local education authorities 10,384*l.*, tuition and examination fees 5040*l.*, income from endowment 674*l.*, and from other sources 1112*l.* The book value of its land, buildings, and permanent equipment is 81,433*l.*, and its endowment investments 11,603*l.*

These figures do not suggest that the College is likely to qualify soon for full university status, but it might conceivably join with the Technical Schools, Plymouth, the Seale-Hayne Agricultural College, Newton Abbot, and the Camborne School of Mines, to form a federal university. An important scheme for co-operation with the Technical Schools, Plymouth, has been worked out providing for degree and diploma

courses in civil, electrical, marine, and mechanical engineering and in commerce at Plymouth, and the extension of the law teaching and extra-mural work already carried on there by the College. An appeal was launched in October 1925 for 100,000*l.* for the equipment and endowment.

UNIVERSITY COLLEGE, HULL.

The plans for the proposed University College for Hull, for which the Right Hon. T. R. Ferens gave 250,000*l.*, provide for an organisation somewhat similar in scope to that of University College, Southampton, with the addition of a department of agriculture and, eventually, departments of shipbuilding and applied chemistry of the oil, colour, gas, and spirit industries.

Lest the account already given of the policy of the University Grants Committee in regard to proposals for establishing new universities should be misunderstood, it must be added that the Committee is careful to point out that its "view of what is prudent at one particular stage of our history betokens no lack of sympathy with the general desire for a wider avenue to university education, or with the ambitions of certain large and populous cities to rival the more fortunate communities which already possess universities of their own." The Committee hopes that "as returning prosperity enables the schemes of local education authorities under the Education Act to be carried into effect, the local colleges will play an increasingly distinguished part in the higher education of the people, and will steadily raise the level of national knowledge and culture. It may well be that some of these will, in course of time, establish a claim to university rank and receive charters as independent universities."

Fluctuations in the Abundance of a Species considered Mathematically.¹

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A CONSIDERATION of biological associations, or of the mutual interactions between two or more species associated together, has led me to certain mathematical results which may be set forth as follows.

The first case I have considered is that of two associated species, of which one, finding sufficient food in its environment, would multiply indefinitely when left to itself, while the other would perish for lack of nourishment if left alone; but the second feeds upon the first, and so the two species can co-exist together.

The proportional rate of increase of the eaten species diminishes as the number of individuals of the eating species increases, while the augmentation of the eating species increases with the increase of the number of individuals of the eaten species. Having determined the laws of this increase and diminution, it is possible to establish two differential equations of the first order, non-linear, which can be integrated. The integrals reveal the fact that the numbers of individuals of the two species are periodic functions of the time, with equal periods but with different phases, so that each species goes through a cycle relative to the other during a period, a process which may be called the

'fluctuation of the two species.' Figs. 1 and 2 give representations of different possible cycles, corresponding to different initial values of the number of individuals of the two species: ordinates representing the eating, and abscissæ the eaten species.

The co-ordinates of a point on a cycle are the concurrent values of the numbers of individuals of the two species, those of the central point Ω being the mean values; and the following laws have been deduced from integration of the differential equations which represent the fluctuation:

I. The fluctuation of the two species is periodic, the period depending only on the coefficients of increase and of destruction of the two species, and on the initial numbers of the individuals of the two species.

II. The average numbers of the two species tend to constant values, whatever the initial numbers may have been, so long as the coefficients of increase or of destruction of the two species and also the coefficients of protection and attack remain constant. (Laws I. and II. are illustrated in Fig. 2.)

III. If we try to destroy individuals of both species uniformly and proportionately to their number, the average number of individuals of the eaten species grows and the average number of the eating species diminishes (see Fig. 1). But increased protection of

¹ V. Volterra.—Variazioni e fluttuazioni del numero di individui in specie animali conviventi.—*Memorie della R. Accademia dei Lincei* (Cl. di Sci. Fis. etc.), ser. 6, vol. ii. fasc. 3, 85 pp., 1926.