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Universities as Centres of Chemical Research.

THE advancement of natural knowledge is the major, if not the exclusive, aim of all purely scientific societies, and to this aim they adhere as a rule very strictly. In recent times, however, events have happened which have led to a wider view being taken of the functions of science, and hence we discern an increasing tendency for presidential addresses to wander from the narrower paths of esoteric learning and to linger awhile in the more spacious avenues that lead not only to increased knowledge, but also to improved social welfare. Progress is determined by the interplay of many factors, intellectual as well as moral and physical, and leaders in the pursuit of new knowledge can do much towards its realisation if they possess their share of the tribal conscience and have the necessary courage to speak out.

Of the many problems that touch both science and social welfare, that of research is one of the most fundamental, and in selecting this topic for his presidential address to the Chemical Society, as well as for his skill in handling it, Prof. W. P. Wynne deserves our thanks and congratulations. In this address¹ he reconsiders in the light of recent happenings the observations and conclusions expressed by Prof. R. Meldola when he spoke from the chair in 1907. In the opinion of the latter the output of research work was not "representative of the productive capacity of the nation," and the "enormous submergence of research talent" then existing was due mainly to the few openings offered by industry, the low salaries paid to junior university teachers, and to poverty compelling promising students to leave the university immediately after graduation. The one bright spot in the somewhat dismal scene was the existence of scholarship schemes associated with the Royal Commissioners of the Exhibition of 1851, the Salters' Company and the Carnegie Trust, through which men of approved ability were enabled to carry on original work after finishing their college training.

Prof. Wynne's diagnosis of the present situation agrees in the main with that of his predecessor: both indicate that lack of sufficient funds is responsible for most of our present-day defects and deficiencies. In two tables Prof. Wynne presents statistics relating to the output and distribution of chemical research in the British Isles during the three sexennial periods 1901-6, 1908-13, and 1919-24. The original chemical memoirs published in the leading chemical journals and in the Proceedings of the Royal Society, and emanating from higher educational institutions, numbered 865, 1271, and 1464 in the respective periods.

¹ Journal of the Chemical Society, vol. 127, April.

To these totals the Universities of Oxford, Cambridge, and Manchester, together with the Imperial College (Royal College of Science and C.T.C.), contributed, collectively, 33·8, 36·5, and 34·8 per cent., the London colleges, modern English universities, and Welsh, Scottish and Irish universities, 57·8, 53·2, and 56·1 per cent., whilst the technical colleges accounted for only 8·4, 10·3, and 9·1 per cent. The persistent comparative sterility of the technical institutions is ascribed to the unenlightened outlook of the governing bodies concerned; and the approximate uniformity in the number of contributions from each of the three groups is regarded as accidental.

Interesting as the detailed figures given in the printed address undoubtedly are, their significance must not be overestimated. In the first place, it may be doubted whether numbers of papers published can afford an unambiguous index of research activity. The criticism is often heard that modern workers are far too prone to publish small instalments (scraps!) of work at frequent intervals, rather than to wait until their investigations have attained a reasonable degree of completeness. Publication of original research has become an almost indispensable condition of promotion in the academic sphere, and hence the young worker seeking notoriety and quick promotion may publish half-a-dozen small contributions in the same interval of time when a classical worker of the old school might have published only one. Secondly, the statistical method used by Prof. Wynne takes no cognizance of quality, and quantity without quality is of no greater moment in science than in art or morals. Whilst, therefore, we may agree that Prof. Wynne's figures warrant the conclusion that there has been a steady increase in the volume of chemical research—though not to the extent implied by the figures—there is nothing to indicate that there has been any corresponding increase in value. *The statistical method* very often breaks down when applied to things of the spirit.

In not repeating or endorsing his predecessor's opinion concerning the output of work being incommensurate with the productive capacity, Prof. Wynne takes a wise course, because the question of productive capacity in the intellectual sphere must be very largely a matter of conjecture, and unless we have some fairly accurate means of measuring, it must be wrong to predicate any quantitative relationship between output and capacity to produce. The belief may, however, be justified that, following the extension of educational facilities in our secondary schools, due to the enactment of the Fisher proposals, capacity for research is being increasingly developed, or rather, that those gifted with it are not being overlooked to the same extent as formerly. Unfortunately, secondary education shares

with university education the same handicap of lacking adequate financial resources, and therefore until better times arrive, both have to cut their coat strictly according to their cloth, compromise, and postpone enterprises of great pith and moment.

Prof. Wynne recalls that the university colleges passed their early lives in poverty, so that their administrators came to judge the success and the needs of departments by the number of students working in them, and to regard all departments as of equal value and importance; and these views still persist. The relatively high cost of maintaining laboratories remains an added handicap to scientific departments, and it is suggested that in allocating grants, more consideration should be given to the number of post-graduates engaged in research, and to the number of hours actually spent in teaching. Science demonstrators and assistants have to spend long hours in the laboratory, and therefore they should be given more free time for their own work. Since, however, the universal call for economy rules out any increases in staff, it is of fundamental importance to inquire whether greater efficiency could not be secured by abandoning the present policy of allowing each university to attempt to excel in many branches of pure and applied science, and by substituting therefor more localisation and greater concentration of effort.

For the old-established scholarship schemes for post-graduate research work Prof. Wynne has nothing but praise; the figures he gives show that far more scholarships are awarded for chemistry than for any other science. The Beit Memorial Fellowship and the Ramsay Memorial Fellowship Trusts have increased considerably the sums available for this work, whilst the Department of Scientific and Industrial Research, by giving maintenance grants for training in research methods, "has done a service to science and the country so great as to be almost incredible in the light of pre-War neglect." Its annual expenditure since 1920 in grants for research training in branches having industrial applications has been between 40,000*l.* and 50,000*l.*

The institution of the Ph.D. degree for research work was a war-time measure, originating in the desire to attract to our universities students from the Overseas Dominions and foreign countries who formerly would have studied in Germany. It was recognised at the outset that success of the scheme for such a degree would depend mainly upon the expenditure of large public funds to improve the equipment of our laboratories and to provide increased amenities for the students; such expenditure has, unfortunately, not been found possible. A serious blemish in the regulations for this degree is the non-provision of travelling scholarships for home students, as the

value to them of change of environment is very great. Since there is no immediate prospect that this defect will be remedied, Prof. Wynne suggests (1) that the Department of Scientific and Industrial Research should only renew its grants after the first year to students who migrate to another institution; (2) that the grants be renewable for a third year; and (3) that during the two years' absence from home the maintenance grant be increased.

Despite the acute and prolonged depression in trade, there has been a distinct change in outlook with regard to the employment of trained research chemists in industry, and for this the institution of research associations by the Department of Scientific and Industrial Research is largely responsible. Manufacturers, however, still complain of the inefficiency, from the works point of view, of the university-trained man; but, asks Prof. Wynne: Are the universities entirely to blame? What opportunities do industrial firms offer him for testing his vocation while there is yet time for him to make another choice? Is it not possible to allow selected students to spend some part of each long vacation in the works, not necessarily in the laboratory, but under foremen on the plant? The common objections relating to the violation of secrecy and interference with routine have been successfully overcome in Sheffield, where the presence of intending graduates is welcomed in the steel-works during the long vacation. There seems no valid reason why the example of Sheffield firms should not be followed in other centres and in other industries.

Finally, Prof. Wynne appeals to the Association of British Chemical Manufacturers to assist and co-operate with the universities in such matters. He recalls the fact that the Chemical Society took a leading part in launching the Association, but he did not mention, as he might have done, that the conferences of the chemical societies which led to its foundation were convened to consider the best methods, not only for promoting co-operation among chemical manufacturers, but also co-operation "between them and the teachers in universities, colleges, and technical schools." The Association has admittedly done good work for the manufacturers, and in support of Prof. Wynne we venture to express the hope that it will add to its laurels by working with and assisting institutions of higher education. As Prof. Wynne says, "University and industry—theory and practice—obviously must collaborate if the chemical industry of this country is to make headway in face of present difficulties"; indeed, without the co-operation of the universities, the industry can neither hope to prosper in times of acute international competition, nor fulfil its patriotic obligations in times of international strife.

National Art in the Stone Age.

Urgeschichte der bildenden Kunst in Europa, von den Anfängen bis um 500 vor Christi. Von Moritz Hoernes. Dritte Auflage, durchgesehen und ergänzt von Oswald Menghin. Pp. xix + 864. (Wien: Kunstverlag Anton Schroll und Co., 1925.) 30 gold marks.

ALTHOUGH written history begins in Europe two thousand years later than in Egypt or Mesopotamia, the archæological record is nowhere longer or more continuous. Art is more the object of the archæologist than the philologist; and in this domain Europe is exceptionally rich. The men of the Old Stone Age decorated bones or cave walls with marvellous drawings which recall to life an extinct fauna. But the naturalism of palæolithic art passed away with the advent of more modern climatic conditions; in France and Spain, the centres of quaternary art, only conventionalised and æsthetically worthless survivals are to be found on the walls of Copper Age cave-shelters and dolmens. Only in the extreme north did a naturalistic art, stylistically if not genetically akin to that of the cave-men, persist throughout the New Stone Age among backward food-gathering tribes. From that period, which saw the establishment of food-producing economy, no artistic products have elsewhere come down to us save geometrically decorated vases and rude clay figurines.

The same geometric character pervades continental art in the Bronze and early Iron Ages. But in the Ægean in the seventeenth century B.C., a new and deliberate naturalism arose under the shadows of the Cretan palaces, only to fall a prey to conventionalism and eventually to become geometric in the "Greek Middle Ages," as Hoernes happily describes the Late Mycænæan and Dipylon periods. The final revival of naturalism begins in the city-states of archaic Greece, and Etruria, then among the Celts of La Tène, and finally among the Teutons in the first centuries of our era. Hoernes saw in these transformations the reflection, not of racial, but of economic and social changes. The primitive naturalism was proper to the parasitic life of hunters. Geometric styles correspond to the symbiotic economy of peasants, and in the permanence of their designs betray the prominent part played by women in the new industries. A synthesis of the foregoing moments in a class-society wherein a "parasitic" layer of rulers, priests, and warriors has been superimposed upon the peasantry evokes the conscious naturalism of Middle Minoan Crete or La Tène. With these masterly generalisations the Viennese professor summed up abstractly the artistic evolution of our continent.

In presenting the evidence on which these conclusions