system also contains an appreciable amount of micro-ions, these will be distributed between the two phases in a manner characteristic for the system under consideration.

Overbeek and Voorn[29] have emphasized the importance of this type of concept in our approach to the physical chemistry of cytoplasm, and Troshin[30] has based his theory of ionic discrimination on this type of consideration. The coacervates as described by the Dutch workers behave as regards their viscosity like Newtonian liquids. Thus, the association of macromolecules in the coacervate may be regarded as dynamic, there being both intra- and inter-molecular points of contact of the statistically kinked macromolecules.

One should differentiate sharply between the type of coacervate obtained by the association of a linear polymer, and the colloid-rich phase which may be obtained with corpuscular proteins. When this latter type of protein is obtained in the low-dispersed form, one usually obtained colloid crystals, rather than liquid coacervates. The colloid crystals will owe their stability to the presence of lateral bonds between groups of contiguous folds of the macromolecule, or between sub-units, which will counteract the tendency of the macromolecule to form the most probable shape, that of the statistically kinked macromolecule.

Such a description would seem to fit in very well with the physical chemistry of such high molecular weight compounds as the deoxyribonucleic acids[31]. It may be suggested that the ordered phase (or at least the organelles) conforms to this type of macromolecular pattern more than to the random liquid system of complex coacervation.

The ability of the ordered phase to exclude an ion by some mechanism other than membrane impermeability may be questioned. It would seem improbable that cytoplasm, which consists of 80 per cent water, would contain a sufficiently large amount of water in the 'bound' state to explain the exclusion of sodium. If, however, the cell is considered as a system of modified complex coacervates, then the partition of salts between the two partially immiscible phases would be entirely different from that obtaining in the test-tube. The ordered phase, therefore, will be a colloid-rich phase in which there is a high degree of molecular orientation and structural differentiation. The free intracellular phase, which we tentatively identify with the sarcoplasmic reticulum, will conform more to the labile, short-term pattern which is typical of coacervates.

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SCIENTISTS AND ENGINEERS IN BRITAIN*

THE second report on scientific and engineering man-power from the Committee on Scientific Man-power of the Advisory Council on Scientific Policy compares the situation in Great Britain in 1959 with that in 1956 and estimates the developments likely by 1962. Like the first report, it is based on information collected by the Ministry of Labour and National Service, this time in the first three months of 1959, covering private industry, the nationalized industries and public corporations, central and local government (excluding education and the Armed Forces) and education, but agriculture is again excluded as well as self-employed persons, persons employed by firms of consultants, and scientists and engineers working outside Great Britain. The inquiry is slightly more comprehensive than that in 1956, which excluded firms employing less than 100 workers, for it covers, besides all establishments employing 500 workers or more, a sample of those with 11–499 workers (31–499 workers in the building and contracting industry). It is estimated that the employments covered account for nearly 90 per cent of all qualified scientists and engineers in Great Britain. As in the previous report, these terms are applied to persons with one of the following qualifications: a university degree in science or engineering; the diploma in technology; an associateship of one of the higher educational institutions; graduate or corporate membership of one of the professional institutions. Technologists with specialist qualifications in branches of applied science such as textiles, rubber and plastics are again excluded, unless they qualify as defined above.

For early 1959 the report gives the total of qualified scientists as 63,200 and of engineers as 89,200; 43,600 of the grand total possessed the higher national certificate or diploma of technology only. Of the scientists, 21,200 are employed in manufacturing industry, 1,000 in industrial research associations, 3,200 in nationalized industries, 6,400 in central government and 28,700 in education; 2,000 are employed in other manufacturing industry and 400

* Scientific and Engineering Manpower in Great Britain 1959. Pp. vi+48. (Cmnd. 902.) (London: H.M. Stationery Office, 1959.) 3*s*. net.

others in teaching. For engineers the corresponding figures are: 42,400; 600; 17,000; 8,500; 3,300; 4,900; and 1,300; 4,100 qualified engineers are employed in the building and contracting industry and 6,600 by local authorities. It is estimated that 5,000 scientists and 9,600 engineers are in employment not covered by the inquiry, and 4,000 and 2,000 respectively in postgraduate research. The grand total of 173,000 represents an increase of 19·3 per cent over the 1956 figures and an increase from 6 to 7 in the number of scientists and engineers per thousand of the working population, apart from the 43,000 possessing no higher qualification than a higher national diploma or certificate.

Of this increase, 62 per cent has gone into private manufacturing industry, 13 per cent to nationalized industry, 17 per cent to education, and 8 per cent to central and local government, more than half the increase in the nationalized industries and public corporations being attributable to the Atomic Energy Authority, where the increase was 71 per cent (2,470 to 4,220), and a further increase of 42 per cent by 1962 is anticipated. Taking scientists and engineers separately, manufacturing industry has gained 53 per cent of the scientists and 69 per cent of the engineers; for nationalized industry the figures are 8 per cent and 16 per cent, respectively; for central and local government, 6 per cent and 3 per cent; and for education, 32 per cent and 6 per cent, respectively. The actual increase of 19·7 per cent or 23,600 compares with the employers' forecast of 32,500 or 27·2 per cent; for manufacturing industry the actual increase was 30·2 per cent; for research associations, 10 per cent; for nationalized industry, 18·4 per cent; for central government, 7·5 per cent; local government, 3·8 per cent; and education, 14 per cent.

Nearly 70 per cent of the net gain for manufacturing industry in scientists and engineers is concentrated in electrical engineering, chemicals and allied trades, other plant and machinery and aircraft. As regards private manufacturing industry as a whole, the proportion of qualified scientists and engineers to the total number of persons employed rose from 8 to 11 per thousand. In most industries the percentage engaged on research and development showed little change compared with 1956. In the shipbuilding, ship-repairing and marine engineering group it increased from 9 to 20 per cent, and in the railway equipment industry from 5 to 23 per cent; but in the aircraft industry there was a substantial increase in the proportion of scientists and engineers engaged on work other than research and development. In manufacturing industry as a whole, 41·2 per cent of scientists and engineers were engaged on research and development compared with 44·5 per cent in 1956; in electronics the figure was 66 per cent; for precision instruments, 60 per cent; for aircraft, 54 per cent; for heavy electrical engineering, 53 per cent; and man-made fibres, 51 per cent. Establishments with staffs of 500 or more employed 69 per cent of the scientists and engineers in this sector, but only 46 per cent of all persons engaged in manufacturing industry; for scientists the figure is 64 per cent, and for engineers 71 per cent, and 68 per cent of these scientists and 80 per cent of the engineers were engaged on research and development. For establishments employing more than 100 workers a proportionately smaller increase in the number of engineers and scientists employed was expected during the next three years compared with 1956–59.

The industrial research associations which in 1956 employed nearly 1,400 scientists and engineers hope to employ 1,800 by 1962—an increase of 17 per cent in the next three years; whereas the nationalized industries hope to employ 24,900, an increase of 20 per cent on the 20,700 employed in 1959, and of 18 per cent on 1956. For the Gas Council and the Area Gas Boards, the increase was 17 per cent; for the National Coal Board, 15 per cent; and for the Electricity Authorities, 2·5 per cent; but the latter employed an appreciably higher proportion of qualified scientists and engineers (30 per thousand) than the average for manufacturing industry or for the other public corporations except the Atomic Energy Authority (123 per thousand). Whereas for all other public corporations only 8 per cent of scientists and engineers on average were employed on research and development, for the Atomic Energy Authority the figure was 63 per cent, and for the Airways Corporation 33 per cent. By 1962 the Electricity Authorities look for a further increase of 35 per cent in the number of scientists and engineers, and the British Transport Commission for a 29 per cent increase.

Whereas in 1956 the departments of central government expected to increase their total of scientists and engineers from 13,800 to 15,800 by 1959, the increase was only 7·5 per cent, mainly because the expected 11 per cent increase in the defence departments did not occur, the number employed remaining at 7,600. It is estimated that about 20,000 scientists and engineers, including those serving in the Armed Forces, were employed on defence work at the beginning of 1959, about half of whom were engaged on research and development, and accounting for about 25 per cent of all scientists and engineers engaged on research and development in industry and government research establishments compared with 40 per cent three years ago. The fall in the proportion in the aircraft industry engaged on research and the smallness of the increase in qualified personnel in the electrical engineering industry may be due to cuts in defence contracts.

The civil departments employ nearly 4,600 scientists and engineers, or about 30 per cent of the total employed by the central government. An increase from 2,350 to 2,700 in the number employed by the research councils between 1956 and 1959 reflects principally the planned expansion in the Department of Scientific and Industrial Research under the five-year plan initiated in 1954, and the 12 per cent increase forecast by the civil departments by 1963 includes a 16 per cent increase for the research departments, covering provision for the second five-year plan for the Department of Scientific and Industrial Research, which calls for a 6 per cent a year increase in its professionally qualified staff. In the same period, the defence departments anticipate a reduction in the total number of scientists and engineers to 7,450 as the net result of a 6 per cent increase in scientists and a 6 per cent decrease in engineers.

Of the 6,700 scientists and engineers employed by local authorities in 1956, about 80 per cent were civil and structural engineers. In 1959 the total was more than 6,950, but 1,150 immediate vacancies are reported and an increase of 25 per cent is hoped for by 1962. The increase among civil and structural engineers in 1959 was 11 per cent, but the number of mechanical engineers fell from 660 to 370.

The current scientific man-power position in education is discussed elsewhere (see p. 1971 of this issue), and apart from noting that some universities consider that their competitive position has improved in the past two years, it should suffice here to refer to the forecasts of requirements for teachers from 1959 until 1962 given in the report. For the universities an increase of 1,275, or 30 per cent, to 5,450 is forecast; for technical and teacher training colleges the corresponding figures are 1,620 (24 per cent) and 8,480; and for the schools 3,675 (16 per cent) and 26,290. The forecast of requirements for university teachers by 1962 assumes that two-thirds of the increased numbers of students reaching the universities by 1962 will read pure science or technology. It is also expected that by 1962 about 5,000 scientists and 2,500 engineers will be engaged on postgraduate work in the universities, compared with 4,000 and 2,000, respectively, in 1959.

The net increase in the forecast of requirements for technical colleges, teacher training colleges and schools includes about 1,000 current vacancies, nearly half of which are in Scotland, and it is admitted that the figure for England and Wales greatly underestimates the number of additional teachers needed to restore 1953 staffing standards. To reduce the size of swollen classes might require a further 4,000–5,000 science teachers.

The figures for various categories of scientists employed in 1959 (with the percentage increase on 1956 in brackets) are as follow: 6,400 biologists (25·5), 24,300 chemists (16·3), 800 geologists (– 11·1), 13,000 mathematicians (12·1), 13,600 physicists (28·3) and 2,700 other scientists (28·6). For engineers the figures are: metallurgists, 3,600 (12·5); chemical engineers, 1,900 (26·7); civil engineers, 13,700 (7·0); electrical engineers, 20,000 (12·4); mining engineers, 4,600 (21·1); mechanical engineers, 34,000 (25·9); engineers in teaching, 3,300 (37·5). The following figures give the forecast of additional numbers required by 1962 (percentage increase on 1959 in brackets): biologists, 1,200 (17·6); chemists, 5,400 (20·5); geologists, 200 (25·0); mathematicians, 2,700 (19·6); physicists, 3,300 (20·2); other scientists, 200 (16·7); metallurgists, 1,300 (35·1); chemical engineers, 700 (35·0); civil and structural engineers, 3,300 (22·9); electrical engineers, 6,000 (27·9); mining engineers, 200 (4·3); mechanical and other engineers, 8,700 (23·8); engineers in teaching, 1,200 (26·1). The figures take no account of the demands abroad for scientists and engineers trained in Great Britain.

For 1962 a grand total of 87,100 scientists and 124,600 engineers is forecast by the inquiry, of whom 76,200 scientists and 110,800 engineers are required in fields covered by the inquiry and 5,000 scientists and 2,500 engineers in postgraduate research. Moreover, it is assumed that 6,000 scientists and 8,400 engineers will be needed to replace wastage from death, retirement, etc. Against this, an output of 51,650 scientists and engineers is forecast for the period 1959–62, of whom only about 47,500 will be available for employment in Great Britain compared with anticipated requirements of 53,100. About 60 per cent of the total will be university graduates (28,800), holders of the diploma in technology (900) or associates of one of Scotland's central institutions (750); the remaining 21,200 will be admitted to professional institutions on the evidence of other qualifications. By 1962 the annual output is expected to reach about 19,000 compared with 15,000 in 1958, and of the net 47,500 available for employment in Britain, 19,200 will be scientists and 28,300 engineers. Of the 5,674 scientists qualifying for the first time in 1958, 494 did so in biological sciences, 1,296 in chemistry, 167 in geology, 496 in mathematics, 755 in physics, 599 in general science, and 1,357 by pass degrees. Of the 9,326 engineers, 333 qualified in aeronautical, 325 in chemical, 1,047 in civil and structural, 1,658 in electrical, 734 in marine, 2,748 in mechanical, 504 in mining and metallurgy, 432 in production, 225 in municipal, 146 in naval architecture, and 1,087 in general engineering, etc.

NEWS and VIEWS

Australian Commonwealth Scientific and Industrial Research Organization Executive

THE appointment has been announced of two new members to the Executive of the Australian Commonwealth Scientific and Industrial Research Organization. This follows the passing last month of an amendment to the Science and Industry Research Act, enlarging the Organization's Executive. The new full-time members will be Mr. C. S. Christian, chief of the Organization's Division of Land Research and Regional Survey, and Prof. L. G. H. Huxley, Elder professor of physics in the University of Adelaide.

Mr. C. S. Christian

MR. CHRISTIAN has been associated with the Commonwealth Scientific and Industrial Research Organization ever since his graduation from Gatton College and the University of Queensland. In 1931 he studied genetics at the University of Minnesota, and in 1933 he held an appointment under Sir Ronald Fisher at Rothamsted Experimental Station. On his return to Australia, he undertook wheat and plant breeding research with the Commonwealth Scientific and Industrial Research Organization in Canberra and in Queensland. In 1946, following a request from the North Australian Development Committee, Mr. Christian organized the North Australia Regional Survey, which has since become the Commonwealth Scientific and Industrial Research Organization's Division of Land Research and Regional Survey. In 1955, Mr. Christian was invited by Unesco to advise in Syria on the establishment of a resources survey unit, and similarly in 1958 he went to India to plan a Central Arid Zone Research Unit. He is the Australian delegate to the International Rice Commission and president of Section K (Agriculture) of the Australian and New Zealand Association for the Advancement of Science. He has been president of the Queensland and A.C.T. branches of the Australian Institute of Agricultural Science.

Prof. L. G. H. Huxley

PROF. HUXLEY was educated at Hutchins School in Hobart, and at the University of Tasmania. He was the Tasmanian Rhodes Scholar in 1923, and went to New College, Oxford, in 1925, to read honours