(Schneider, 1902) are "Fett enthaltende Granula", while "Lipochondrien" (Ries, 1933 ; I. Fischer, 1937) is a "Synonym mit Lipochondren", but also possibly identical with Hirsch's "Praesubstanzen der Golgi-Systeme". It may be asked what all these names, mostly new, have to do with the inner reticulum of Golgi in the nerve cell ? The answer to this is an easy one—nothing whatever. The Golgi apparatus is a canalicular system which can be seen quite clearly in the living cells of the extirpated sympathetic ganglion of the mouse. No phase-contrast microscope is necessary ; the ordinary light microscope is sufficient. Nor does the neurone fixed with formalin or osmic acid differ morphologically from the living one. A paper on this subject is being published by T. Moussa in one of the Wistar Journals. So permanent is the complicated and characteristic canalicular system of the human sympathetic ganglion cell (extirpated for hypertension) that it is impossible to destroy it by any current fixation or imbedding method. We are not sure what happens to it in tissue cultures of living sympathetic ganglia[10].

In Fig. 5 is a sympathetic ganglion cell from a half-grown mammal showing the Golgi apparatus (*EFI*) at the dendrite end, and the beginning of senility pigment at the axon end of the nucleus (*BC*). As the animal ages, the senility pigment granules collect into a compact group, well known to all students of histology. Moussa and I are of the opinion that these granules originate in the Golgi apparatus (*FI*) and move around to their definitive position in the neurone[10]. Furthermore, I now believe that these so-called senility pigment granules are, or contain, some form of neurosecretion. Their separation and biological test is being attempted. They are deeply stainable in neutral red, vitally, and serve as markers of the canalicular system in which they originate.

It will now be clear that it is not considered that the oil droplets of the liver and the so-called senility pigment granules of the vertebrate neurone are similar. In neither case do they constitute the Golgi apparatus, nor are they themselves homologous structures. These statements show how widely I differ from the views of Palade and Claude, as interpreted by J. R. Baker and Geoffrey H. Bourne.

There is just one point which is important, and stating it now may save further discussion. In his recent writing, J. R. Baker stresses the importance of examination of living cells as well as those fixed and stained. I agree fully with him in this. That is why in the British Isles, in the past, the great bulk of studies of the cytoplasm of living cells has been made by my students. It should be understood, however, that recent studies with the phase-contrast microscope merely confirm the views of Strangeways and Canti[11] on the relative values of various fixing mixtures. Osmic-containing fixatives without acetic acid or alcohol give an almost perfect fixation of the cell. Dalton used the chrome-osmium method of Nassonow–Kolatchew.

[1] Palade and Claude, *J. Morph.*, **85** (1949).
[2] Dalton, *Anat. Rec.*, **58** (1933–34).
[3] De Robertis, *Rev. Soc. Argentina Biol.*, **14** (1938).
[4] Baker, J. R., *Quart. J. Mic. Sci.*, **85** (1944).
[5] Owen Thomas, *Quart. J. Mic. Sci.*, **89** (1948).
[6] Gatenby, Moussa and Dosekun, *La Cellule*, **53** (1949).
[7] Ciaccio, *Anat. Anz.*, **35** (1910).
[8] Schneider, "Lehrbuch der Histologie" (Jena, 1902).
[9] Hirsch, "Form- und Stoffwechsel de Golgi-Körper" (Gebrüder Borntraeger, Berlin, 1939).
[10] Murray and Stout, *Amer. J. Anat.*, **80** (1947).
[11] Strangeways and Canti, *Quart. J. Mic. Sci.*, **71** (1927–28).

TECHNOLOGICAL EDUCATION IN GREAT BRITAIN

THE case for the founding in Great Britain of one or more entirely new institutions broadly similar to the Massachusetts Institute of Technology or to the Eidgenössiche Technische Hochschule, Zurich, has of late been made in Parliament, in the technical and the serious lay Press, and in the deliberations and pronouncements of educational and scientific societies. It is a case which has not suffered from a lack of distinguished exponents, and it was therefore particularly stimulating to hear a vigorous and powerful statement of the opposing view from Lord Eustace Percy, whose attachment to the interests and needs of higher technological education is unquestionable. He was addressing the Education Group of the Institute of Physics at its meeting on October 25 ; many of his audience might dissent from his views, but none would have been uninfluenced by his profound and yet scintillating expression of them.

What, asked Lord Eustace, is the serious argument for a new university of technology ? It is not that existing universities would be swamped by technological students if they were to attempt to meet the full needs of industry, since such students represent only 13 per cent of the total university student body, even though the number of technological degrees granted has more than doubled since 1938 ; nor does it stem from the mere impulse to imitate the United States or Switzerland. "No, the serious argument for a new technological university is, I take it, the one which has been advanced by certain eminent scientists : that the bias of scientific studies in the universities is towards pure research and that studies pursued with that bias cannot be expected to develop the practical interests and the executive qualities of mind which are proper to technologists. Now, the first thing to be noted about this argument is that it does not contemplate any greater specialization in technological training at the undergraduate stage. On the contrary, it is usually accompanied (with a strange lack of logic) by a demand that such training should be based, at that stage, on a much wider and deeper study of the fundamental sciences than at present. The expulsion of technologists from existing universities will, therefore, have to be accompanied by a no less wholesale exodus of professors of pure science. Nor, at any rate on the analogy of M.I.T., is there much question of a change in methods of teaching within the university institution, such as the substitution of factory-scale equipment for small laboratory units. In other words, the argument does not seem to contemplate any change in curriculum, but only the creation, in the new Technological University, of that most intangible thing in education : a different atmosphere."

But, claimed Lord Eustace, "in the past, our whole university tradition, in contrast to the university traditions of the Continent, has been one of preparation for executive responsibilities". If, therefore, university science graduates are to-day fit only for research laboratories, "it is the pure sciences which should emigrate to create new universities in their own cloistered image". "If our university tradition is in danger of decay, it is in the universities that it must be repaired and restored ; industry . . . will not thank us for a policy which leaves the pure scientist to be trained in the academic atmosphere

of university honours schools, while removing the applied scientist to the more bracing climate of a technological institute."

In Lord Eustace's view, the problem of adequately developing the system of technological education in Great Britain can best be solved by carrying out experiments in existing institutions and by making an accurate appreciation of the present assets—the technical colleges and universities. Concerning the technical colleges, he said that he is now convinced (and regretted that this was not said in the report which commonly bears his name) that the necessary development and experiment cannot be hoped for so long as colleges are owned and administered by local education authorities. "A college of technology may be a State institution, like the Scottish central colleges, or it may be an independent institution like an English university college; but it cannot be administered by a municipal committee. And, in fact, the recommendations of the Percy Committee have fallen flat owing to the obstinate reluctance of the Ministry of Education and the local education authorities to do anything so 'undemocratic' as to select one institution from among others for special development, or to allow an independent governing body to spend the money of the ratepayers. So long as this continues, it is hardly too much to say that half our assets for experiment and development in higher technological education are immobilized in a blocked account."

Concerning universities, Lord Eustace claimed that many of the English provincial and the Scottish universities are achieving a natural integration of all the sciences with a bent towards their application, that such integration is the life-blood of all technologists and that existing institutions seeking such an ideal must offer more favourable ground for further experiment than any new institution serving an ill-defined ideal of segregation. Finally, many of the difficulties in the way of better technological education arise from the organization of the national industries and, in particular, from the short academic life of the engineer compared with that of any other industrial scientific worker, a fact mainly due to the apprenticeship requirements of the engineering industry and the membership conditions of some professional institutions.

The discussion on Lord Eustace's address was opened by Lord Cherwell, who felt that the universities cannot cope with the type and extent of development in technical education which is urgently needed. He quoted the technical university of Aix-la-Chappelle, which has numerous professors, full, part-time or extraordinary, giving only two or three lectures a week, and which is run at very high cost. A similar institution in Great Britain would cost about a quarter of a million pounds a year to run, and would therefore be economically feasible only if it catered for two or three thousand students. Such numbers of technological students cannot be envisaged in any existing university institution except the Imperial College of Science and Technology, London. In the past fifty years, Great Britain has lost to the United States and the Continent of Europe the great lead in technology which she had in the nineteenth century, and it is becoming increasingly difficult for British industry to compete in world markets. It is essential to provide much greater numbers of technologists.

Among other speakers, Dr. P. Dunsheath, who did not agree with Lord Cherwell's pessimistic view of the technological position, pleaded for engineers with a broad education and for facilities for men from industry to go back to college for further courses, supported by grants sufficient to maintain a family adequately.

Replying to the discussion, Lord Eustace Percy referred to the dangers of drawing analogies from the German system. It should be remembered, he said, that the German university has traditionally been almost an arts college, and that the technical university took the place of the science departments of British universities. Also, great caution should be used in drawing conclusions from the numbers of 'professors' in an institution—the significance of the title in different countries differs greatly.

N. CLARKE

MECHANIZING AFRICAN AGRICULTURE*

MR. J. W. Y. HIGGS, lecturer in agricultural machinery in the University of Reading, Mr. R. K. Kerkham, of the Department of Agriculture, Uganda, and Mr. J. R. Raeburn, reader in economics in the London School of Economics, have prepared a report as a result of a survey of African agricultural methods. They conform to their terms of reference in representing the mechanization of African agriculture as a matter for careful study and experiment. They note that data are not yet available on which to base reliable comparisons of mechanized with native systems of agriculture. For this reason the discussion impartially records both obstacles and opportunities, in statements resembling the red and green lights that permit a motorist to make his way through dense traffic.

Among the 'red lights' are the following: It is considered that savanna type of country offers the best prospects for mechanization of farming, but estimates for such an area near railhead in Northern Nigeria indicate that mechanization should be restricted to preparing the land. Even so, it is thought that farm families would not gain much by accepting mechanization, since it would be unwise to expect mechanical cultivation to produce any major increase in yields per acre. It seems that to some tenants the advantages of mechanization would be almost inconsiderable. The substitution of tractors, etc., for native labour is substitution of costly for cheap factors of production. Moreover, mechanization would make production costs less flexible. Mechanical clearing of bush is expensive and very frequently uneconomic: hand labour should clear bush whenever possible. The authors state that in many areas provision of water supplies, clinics, schools and roads should have higher priority than mechanical cultivation.

On the other hand, 'green lights' are as follows: It is noted that over most of the savannas, where possibilities of mechanization are greatest, Africans are caught in a vicious circle of malnutrition and disease, resulting in a low capacity for work. Mechanization must be one of the principal means of raising real incomes and securing better nutrition. A reasonable estimate of the labour required to open

* Colonial Office: Colonial Advisory Council of Agriculture, Animal Health and Forestry. Publication No. 1: Report of a Survey of Problems in the Mechanization of Native Agriculture in Tropical African Colonies. Pp. ix+124+16 plates. (London: H.M. Stationery Office, 1950.) 4s. 6d. net.