

6.44 ± 0.08 nuclei per cell, whereas in the mature tumour where there is a preponderance of T_2 cells, the average number of nuclei per cell is 10.1 ± 0.36.

In addition to the increased basophilia of the cytoplasm and mitotic activity of the nuclei in T cells there is hyperactivity of the nucleolus and heterochromatin. Tumour cells also show abnormal nuclear activity including endomitosis, multipolar spindles, chromosome aggregation, polyploidy, aneuploidy and micronuclei. These cytological disturbances are all characteristic of cells in animal tumours^{18,19}.

Our observations on a number of fungi serve to emphasize the desirability of undertaking further work on the nature of the changes that are produced by the action of various chemical agents. While fungal cells are not ideally suited for cytological study, there is little doubt that the comparison with the behaviour of cells in animal neoplasms represents something more than a mere analogy. Preliminary work on grafting neoplastic with normal tissue already indicates a promising field of research. Furthermore, the simplicity of organization of the fungi, together with their suitability for culture on synthetic media, should provide ample encouragement for biochemical studies.

We are very grateful to Prof. A. Haddow, of the Chester Beatty Research Institute, not only

for his advice and encouragement, but also for supplying a number of carcinogenic hydrocarbons. Our investigations, which will be described in detail elsewhere, have been made possible by a grant from the British Empire Cancer Campaign, to which we also extend our gratitude.

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EDUCATION AND PRODUCTIVITY IN UNDER-DEVELOPED AREAS

THE main theme this year of Section L (Education) of the British Association was education in the British Colonies, and, following Sir Christopher Cox's provocative presidential address, it fell to two symposia to deal in greater detail with two of the central problems involved. These were the relationship of education to productivity, and the central educational dilemma of quantity or quality. Each was the subject of a separate symposium, and Prof. F. C. Benham, of the Royal Institute of International Affairs, opened the first with a paper on "The Allocation of Resources". He pointed out how poor the British Colonies are, with an average income per head of population of only one-tenth to one-seventh of that in Britain. Like all poor countries, they are faced with a difficult choice when they have to decide whether to spend more money on education and the social services, on one hand, or on measures for economic development, on the other. Considering briefly the case for each, Prof. Benham said that many people would urge that absolute priority be given to education, for they would say that illiterates cannot play their part properly as citizens, that children's talents and personalities need to be developed, and that we need higher education to provide leaders in society and government. But in spite of this, education is only one of the claimants among the social services; there are many others, and health and housing, for example, can also make out a very strong case.

On the other hand, the arguments for giving priority to economic development are hard to resist, for unless measures are taken to raise progressively future levels of output and income, there is no escape from a low standard of living. Referring to Lord Beveridge's point that "expenditure on education is the communal investment which in the end will bring the best return", Prof. Benham emphasized

that it would be wrong to compare Britain with the Colonies in this respect, for Britain, with a population of fifty million, has a public revenue of more than ten times that of the Colonies. The latter, with a population of eighty million, have an annual income of only £50 million. Moreover, the proportion of children under fifteen years of age in Britain is only 20 per cent, whereas in the Colonies it is 40 per cent.

When a Colonial government considers how best it can use its limited resources to yield the best return, there are likely to be quite a number of projects which will give a greater and a quicker return than education. Considering the matter solely from the point of view of its yield as an investment, education might well have to take a back seat. The case for it only becomes strong when it is considered on its own merits, not as an investment but as a training for life and livelihood and as a means of character-building and raising mental stature. Even so, the Colonies are a long way from their goal, for there are three times as many children in the Colonies as in Britain, and yet only one in three receives any kind of schooling. In the educational field itself, there appear to Prof. Benham to be four outstanding priorities: an adequate flow of leaders at the university-level; teacher-training adequate both in numbers and quality; certain types of technical and vocational education; and, in some Colonies, an agricultural extension service.

Turning to the problem of finance, Prof. Benham thought there were a number of possibilities which might be considered. First, a higher proportion of public expenditure could be devoted to education; secondly, more money might be raised by taxation; thirdly, public loans for education might be raised; fourthly, more external aid might be sought; fifthly, more responsibility might be placed on local author-

ities; sixthly, certain measures could be taken to keep down costs. After briefly considering all these possibilities, however, he did not think he could draw hopeful conclusions from any of them. In spite of all efforts, the root of the difficulty lies in the poverty of Colonial people, and this being so, he thought the only real and permanent solution is to raise their real income by speeding up their economic development.

One of Prof. Benham's priorities was then taken up by Mr. J. C. Jones, director of education of the Regent Street Polytechnic, London, who dealt with the question of "Right Perspectives in Technical Education". Mr. Jones briefly outlined the facilities which already exist for technical education at its higher levels in the Colonies, and expressed it as his personal conviction that a good, general education is essential as a background at whatever level technological education is to be undertaken. This is of even greater importance in the Colonies than in Britain, principally because of two factors—the lack there of a mechanistic background, and the stigma which attaches to manual work. A basic solution to the problems raised by these factors is a greater introduction and emphasis upon educational handicrafts at an early age in the primary school and their continuance into all forms of secondary education. Mr. Jones then went on to describe the facilities which exist in many territories for other than higher technical education and declared that, because of the existence already in most Colonies of a nucleus of technical training facilities, he sees the possibility of a simultaneous development in technical education of both long-term and short-term policies. The former must be directed to a universal system of general education in which some provision is made for pre-vocational training at a relatively early age. The second stage must be the creation of alternative forms of secondary education providing for academic and technical streams. Industry, also, must play its part by the general introduction of apprenticeship schemes wherever conditions permit. Short-term planning, he thought, must be concerned to meet a developing situation in which the increasing demands of industry have to be set against a decreasing expatriate staff. In conclusion, Mr. Jones summarized his beliefs by saying, first, that the system of technical education as applied to under-developed areas can only succeed in so far as it is organically linked to, and continues the work of, the system of general education; secondly, that a system of technical education so applied must relate its work to the whole range of industrial need and not merely to its higher levels; thirdly, that development in technical education must always represent a compromise between long- and short-term policies, one logically conceived in the light of foreseeable economic expansion, and the other concerned primarily to meet the current need. He thought we had good reason to be proud of our past record in effecting the economic, as well as the political, independence of the Colonies.

For many years there has been criticism of the effects of Western schooling in rural, under-developed areas overseas. It has been called bookish and literary and is said to produce a dislike for agriculture, a flight from the land, a distaste for manual labour and a desire to secure black-coated employment. These and other criticisms of Western schooling were discussed by Mr. P. C. C. Evans, of the University of London Institute of Education, in a paper entitled

"Western Schooling and Rural Productivity". He attempted to show that, on the whole, these charges against Western schooling are ill-founded, and that it is the humanistic spirit inherent in Western civilization which creates dissatisfaction with the low standard of living associated with the land in the Colonies. This dissatisfaction is not altogether a bad thing, for it leads to new patterns of economic endeavour which in the end will lead to increased productivity. Mr. Evans pointed out how in the past the power of the school to change society in the tropics, whether for better or for worse, has been greatly exaggerated, and that this has brought much criticism upon it for effects which are, in reality, due to the whole Western contact. Even so, in order that the standard of living may be raised, and the basic values of Western civilization find fuller expression, it is necessary that schooling at all levels should be permeated with a rural idiom, which will direct pupils' endeavours, by means of a pragmatic, problem-solving approach, to deal with the urgent problems of community living.

Perhaps the most arresting, and certainly one of the most interesting, talks of the whole symposium was that given by Mr. R. K. A. Gardiner, recently director of the Gold Coast Department of Community Development, who spoke on "Fundamental Education and Economic Development". Perhaps unconsciously, all the speakers so far had appeared to give what could have been described as a European point of view; but Mr. Gardiner, an African, showed how, in some respects, our perspectives need adjustment. He referred, for example, to Prof. Benham's insistence on the scarcity of material resources, and then pointed out that the Colonies have one rich resource which is rarely given full credit—the people themselves. Their free labour, self-sacrifice and goodwill are assets of great importance in promoting improved living, and the means of tapping these is through community development. How successful the Gold Coast Department of Community Development had been in this Mr. Gardiner illustrated in a number of striking examples. Five hundred cacao-tree sprayers had been bought by the Agricultural Department to fight swollen-shoot disease; but cocoa-farmers would not buy them. The Department anticipated that it would take about five years to sell them all. It enlisted the help of the Community Development Department, and after a short campaign by the latter all the sprayers were sold in a couple of months. Again, an important road estimated to cost a very considerable sum to build had already been half-built, with the help of voluntary labour and savings, for only £100,000. But Mr. Gardiner reminded his audience that in dealing with people it must be remembered that they are not malleable material, but human beings who matter. His eloquence and simple sincerity made a fitting conclusion to a most interesting symposium.

The task of the next symposium was to discuss "The Central Educational Dilemma in Underdeveloped Territories: Quality or Quantity", and Mr. E. W. Woodhead, chief education officer for Kent, opened it with a paper entitled "The Problem of Priorities". He pointed out how the administrator in such countries will be unlikely to have at his disposal adequate resources in money, staff or materials. Again, people on the verge of self-government see priorities differently from those a long way from it. As self-government approaches, so a desire for Utopia within a limited period grows up. A new

sense of urgency arises, marked by a new relationship between government and people and often an unwillingness to recognize stubborn facts of inadequate resources, insufficiently trained staff and limited experience. Unless the administrator recognizes and accepts these new attitudes, it may not be possible to moderate harmful effects and gradually to establish worthwhile standards. The approach to self-government is reflected also in the changing aims and emphasis in education, which now comes to be regarded as one of the keys to self-government and to a sense of equality with Western powers. Such aims must for a time dominate the educational scene, though other aims must not, in the process, be forgotten. For no country, said Mr. Woodhead, can reach nationhood without the development of a public morality, co-operative attitudes in its citizens and a willingness to accept responsibility. These personal aims need to be retained alongside the demand for greater knowledge and improved skills.

The growth of an education service in the Colonies, continued Mr. Woodhead, seems to pass through a number of fairly clearly defined stages. First, it provides an escape for the few from reality and the hardness of life. Then comes a mass demand for education, associated with the introduction of cash-crops or the growth of industry. This is a stage dangerous for standards, and needs to be passed through as quickly as possible. Then comes the third stage, one dominated by a political emphasis and a demand for universal primary education and the development of secondary schools. For each of these stages there must clearly be different priorities in the educationist's mind. The administrator's problem now is to ensure as wise action as possible at each stage, though, in any case, he will find his plans affected by many factors beyond his control.

In the development plans of most Colonies the goal is universal primary education with such secondary and further education as will meet urgent needs. Yet the problem is always one of how to meet new educational demands with limited resources. There are few features of life in these countries which so manifestly have such political priority as the education service. This political demand often outruns the wise use of resources and the establishment of good educational standards. The administrator is pressed, on one hand, to go ahead by the political situation, and, on the other, he is held back by economic considerations which are sometimes ignored by newly independent peoples. The chief challenge comes from such places as the Gold Coast, Nigeria and Malaya, where the pressure of the demand for education is in danger of submerging for a time the quality of the work undertaken.

Mr. Woodhead then reviewed briefly what seemed to him important priorities at each educational level. Something could be done to safeguard priorities in primary education by avoiding a complete dispersal of trained staff and by retaining a few good schools to serve as the guardians of standards. At the secondary school stage he stressed the need for alternative provision to grammar school education. Here again the maintenance of good standards lies in the hands of a few schools. These good standards, he thought, should be high on the list of priorities, especially since secondary education must for a long time be selective rather than universally available. The highest priority of all he would accord to teacher-training, for the preparation of really good teachers is the spearhead of educational progress. In dealing

with educational administration and personnel, Mr. Woodhead stressed that two important priorities affecting standards and quality are the administrative framework and the adequacy and suitability of its personnel. In the former there is an important part for the voluntary agencies, private schools and the development of local authorities. Inspection and supervision also must be improved if minimum standards are to be maintained.

In conclusion, Mr. Woodhead indicated what are to him a number of keys to quality. The responsibility for both quality and quantity must rest with the government of the territory. Care must be taken when building on inadequate foundations in primary and secondary schools in preparation for sixth forms, universities and teacher-training. The key points for the preservation of quality of work and development are the grammar school and the training college. Where choice exists, emphasis must always be put on persons of quality, whether officer, teacher or child. He thought that a few really good schools and institutions for further education should be developed in order that these might leaven the whole educational service. Every effort should be made to recruit local officers with suitable training, though expatriates should be retained where necessary in order that the best experience of the past might be available in new situations.

The problem of building secondary education on insecure foundations under pressure from a quickly developing higher educational system was the theme of a talk by Sir James Robertson, rector of Aberdeen Grammar School, when he spoke on "The Demand for Higher Education". The strain on secondary education, said Sir James, comes chiefly from the fact that it is sandwiched between primary education, on one hand, and the universities on the other. He referred to the limiting factors mentioned by earlier speakers in connexion with under-developed countries—the smallness of the resources available and the stubbornness of local educational demands. At the moment the latter can conceive of secondary education only in terms of the British grammar school, and there is a tremendous demand for formal British education because it leads to enhanced personal status and advancement. But the provision for secondary education is very small. In the Gold Coast, for example, only 2 per cent of the school population is in secondary schools, and this is a country well advanced towards self-determination. Sir James sees a number of obstacles in the way of efficient secondary education—obstacles such as insufficient preparation at the primary stage, the immense gap between local conditions and Western civilization, and the great difficulty of crossing from vernacular literacy to a facility in the English language. All these are weaknesses of the primary school; but they reappear in acute form in the secondary school and lead to a situation where pupils know words but not realities, where speech becomes vague and abstract, and where an obsession develops for examination results.

In addition to these educational problems, there are the forces of nationalism and independence, which force the pace by demanding more training college staff and quicker replacement of Europeans by local people in the education service, and which lead to compulsive demands from university and technical colleges for more students. The British have written one of the great chapters in their Colonial story in setting up the new university

colleges; but in some ways they have to pay the price, for national pride and aspirations are not satisfied with the meagre provision for higher education that is warranted in view of the poor schools. These latter could do with a period of patient quiet to develop; but, as it is, good teachers who could not be spared had been diverted to sixth-form work. In the end, this may prove a good thing, for sometimes it pays to be stretched educationally, and the schools will be compensated by receiving back a stream of good teachers. But for the period ahead in the development of secondary education, Sir James said that two things are necessary: schools must keep up standards in their lower forms and improve their English, and, if a rapid expansion of secondary education comes, good staffs must not be dispersed. A few good schools must be kept going while standards are being raised elsewhere.

Miss F. Gwilliam, assistant educational adviser to the Secretary of State for the Colonies, then spoke on "The Challenge to Teacher-Training". She asked three questions: Who are the teachers, what standards are they trying to preserve, and how are they meeting the challenge? The teachers themselves, said Miss Gwilliam, have greatly varying backgrounds and qualifications, and often they were of many nationalities. There are Austrian nuns, American missionaries, teachers from Britain who have gone out through the Overseas Appointments Bureau, the personnel of the Colonial Education Service and the local teachers themselves. All these, said Miss Gwilliam, are the teachers. The standards they are seeking to preserve, she thought, are of four sorts—academic, personal, professional and civic standards—and to maintain and improve them constitutes the challenge to teacher-training. In the different territories of the British Colonies this challenge is being met in a number of ways: local training colleges are being built in increasing numbers, scholarship funds are being provided to send students to Britain for training, and 'on-the-spot' vacation courses are being run for practising teachers. The teachers themselves are taking full advantage of these facilities, and in Cyprus, for example, 80 per cent of primary school teachers take part in unpaid, voluntary vacation courses. The in-service training

schemes of the Gold Coast and the Malayan training colleges in Britain are other outstanding examples of the way in which the challenge is being met. Behind all these efforts, said Miss Gwilliam, lies the educational resources of Britain in inspiration, advice and help.

The symposium was brought to an end by Mr. Philip Sherlock, vice-principal of the University College of the West Indies, who spoke on "National Aspirations". Speaking with great eloquence and clarity, Mr. Sherlock, himself a West Indian, reminded his audience that Britain had long had a well-developed sense of nationhood. This the West Indies lacks. The great task there is to bring together a great variety of strains and races and to build from them a common nation. They have to fashion a new society, unlike the Gold Coast and Nigeria, who are seeking to rebuild an old one. It is in this task of nation-building that the contribution of the West Indies to the world and human understanding lies, for to do this successfully means a great emphasis on human relationships, and perhaps in this the West Indies may have something to offer others.

Mr. Sherlock paid great tribute to Britain for its help and foresight in setting up the new University College of the West Indies, for this, he said, is basic to the whole task they have in hand. The West Indies and the United Kingdom now stand as partners in the great enterprise of finding new patterns of social development. But this, he emphasized, is not a one-way process. Both sides will profit. The West Indies wants from Britain advice on an expanding secondary school system, on teacher-training, library services and other matters, and in return Britain might profit from the lessons learnt in what is a tremendous, dynamic move forward by the peoples of the Caribbean.

After each symposium there was a discussion in which the audience participated. Contributions were made by county education officers, professors of education, training college staff and local teachers, all of whom expressed the hope that there would be, in the future, even greater collaboration between Britain and the overseas territories in the task of promoting the latter's educational advancement.

P. C. C. EVANS

PHYSIOLOGY IN THE POLAR REGIONS

DURING the meeting at Sheffield of the British Association, Section I (Physiology) arranged a session on September 4 on "Polar Physiology".

The degree of physiological adaptation to cold by man is still an unsettled problem. Although there is convincing evidence that laboratory animals can be so acclimatized that they will survive at temperatures which are lethal to control animals, chronic physiological changes in man as a result of exposure to cold have not been clearly established.

Many studies have been made in climatic chambers, in which men can stay for relatively prolonged periods in a controlled environment. Changes have been looked for in the rate of body cooling, alterations of skin temperature, changes in metabolic rate, time of onset of shivering, alteration in the peripheral blood flow and shifts of the blood volume. There has been a number of reports indicating some change in one or

more of these parameters as a result of repeated exposure; but there have also been many negative reports. One of the practical difficulties of experiments in climatic chambers is to persuade subjects to stay in such chambers for long periods. There are indications that some significant physiological changes develop slowly over a period of many weeks or months. It is for this reason that observations have been sought on polar explorers, who spend one to two years at high latitudes. Many of the members of polar expeditions are trained scientists and can make accurate and systematic observations on themselves. Detailed investigations of the subjects can also be made before and after prolonged sojourn in the polar regions, in laboratories in the country of origin.

Apart from low temperatures, another environmental characteristic of polar regions is of interest to