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## Biotechnology

IN an address to the University of New Zealand, referred to briefly in NATURE of April 15, p. 538, the Chancellor, Dr. J. Macmillan Brown, emphasised the need for building university education on broader foundations than the narrow specialisation which seems to prevail. Every degree, however specialised or technical, should have as its first stage the broadest culture possible. In this Dr. Macmillan Brown was only echoing a point of view stressed at greater length by Dr. Flexner in his well-known work “Universities: English, American and German”, as well as by Prof. Findlay and others in recent addresses. The absence of anything like a true *universitas literarum* has long been lamented by close observers of our university life who have seen the dangers of the rapid development and inevitable specialisation, which result in young men of all countries being so immersed in their own special branches of science that they have scarcely the time or energy to devote to the study of more comprehensive problems.

The peril is indeed increasing, and the tendency to over-specialisation, to exclusive preoccupation with one small field of science, is definitely greater than a couple of decades ago. Even industry is suffering from the absence of perspective in the recruits which it now draws from the universities, and this the more in that, as the general cultural level falls, the demand for a sense of values and of perspective increases, industrial advance like scientific development originating more and more in the borderline sciences which are common ground to two or more of the great divisions of knowledge. Science is, after all, only one of the many civilised activities of mankind and inevitably suffers from any prolonged isolation from those other activities. The specialists' knowledge must therefore be supplemented by comprehensive surveys of the problems before science.

The value of such contributions, not merely to the understanding of the present position of science but also to the interpretation of the many difficult social, economic, and political problems with which our civilisation is confronted, is scarcely to be computed by those who have received no training in science. The need to-day is for those who can truly interpret the values of human life, and recent literature testifies not merely to the capacity of the man of science to assess such values, but also to the indisputable fact that when

he is freed by a broad culture and outlook from the restraints of a narrow specialisation, he forms such judgments of value like all other men, and that indeed to become an investigator demands a certain sense for judgments of value. Moreover, even in specialisation at its worst, the man of science has learnt to discard the dogmatism with which he so justly reproached the theologian of a former generation, but with which he was frequently strongly tainted himself.

The change which has come over science in this respect can scarcely be attributed to the tendency of scientific laws, even in modern chemistry and physics, to assume the character of average or statistical laws, or even to the convergence of scientific investigation. It may be due in part to the realisation that the classification of the sciences is largely arbitrary and inadequate—that differences existing between physics and history or biology, for example, are mainly in the complexity of the material and not in the method. Human actions in history are so overwhelmingly complicated that general laws are much more difficult to discover, and consequently to apply, than are physico-chemical laws. It may be due, further, to the recognition that it is fundamentally wrong to believe that we now hold in our hands the absolute and final truth in any category value. As Einstein has said, every scientific theory can be, and needs to be, merged in a higher and more comprehensive theory from which it finally receives its limits.

On the other hand, if the limitations of science are now more clearly perceived, it is also true that the tacit assumption behind the whole of scientific knowledge—that knowledge is possible concerning an objective set of facts, in other words, that there is such a thing as truth—has become more and more unassailable. We are indeed leading up to a final condition of physics in which all past discoveries are comprehended in a single unitary logical structure which is independent of the various possible methods of approach.

An outstanding feature of the present position is that we are now able to state very exactly where lie the problems still to be solved, and the chances of a really fundamental new discovery by random experiment or purely speculative theorising are well-nigh negligible. All really great theoretical and experimental discoveries of the last decade have been made by trained specialists, and in the main by men who had long reached the highest eminence in science. This position does not indeed

entitle us to believe that investigation in this field is likely to become stagnant. It may, on the contrary, begin deductively in greater earnest. It does, however, provide some real explanation of the strong plea for the concentration of effort on the human sciences, where the greater complexities have delayed advance to a comparable extent and where the true laws have largely to be discovered.

To grant this is not to concede that the sole object of science is to understand the present state of affairs; its goal is rather the whole course of events in the past, present and future. What is clear to even the most casual observer is that man's development has been unbalanced. His knowledge of physical laws and his control over physical forces is out of all proportion to his knowledge of biology or of the sciences concerned with man, still more with the growth of ethics and morality. For example, it is well known that there are inherited differences in cultural endowment among the members of a people, and these endowments are on an average proportional to the social level of the various layers. It is equally well known that in all modern civilised nations the relative increase in population is inversely proportional to the social level. The corollary that the civilised European nations are allowing their leading cultural elements to die out is, however, not generally faced. Few grasp the extent to which our modern social, hygienic and educational measures promote the well-being of the individual at the cost of humanity. The future of the world lies with the race that is the first to apprehend the true causes of cultural decay and to resolve to eliminate these causes.

At this point we touch an ideal characteristic of our modern Western civilisation—the technical ideal of fitness for a purpose for its own sake. This ideal, as distinct from mere utility, is behind much of the opinion urging the rationalisation of industry, the movement for scientific management, for scientific administration. It is in the direct succession of the ideal of pure science, the discovery of truth for truth's sake—a late conception in the development of humanity. In the technical ideal the fact that elimination of waste of material or effort, for example, in bridge building, involves a saving in cost is purely secondary if not irrelevant. Construction to fulfil the technical ideal must achieve the best possible result with the least possible means. To state, therefore, that technology demands the fulfilment of a purpose by the most

suitable means and that quite commonly it consists in the choice of the correct means to achieve that given end, is to realise the immense significance of technology for every side of our social life to-day and the value of liberating it from a mere pecuniary conception of the principle of economy.

It is incontestable that, even in this narrow sense, technical progress has been of immense economic advantage to the world and has raised the average standard of living very considerably. Moreover, the regrettable results of industrialisation and the mechanisation of industry are less the direct responsibility of technology than of economic developments connected with particular technical achievements. None the less, profound problems are raised at this stage. It is possible that wise statesmanship may yet avert the worst consequences of such economic developments by foresight and appropriate action. In particular, there is the problem of leisure and how far it can be utilised to balance the mechanising influence of work and those other influences which perpetuate or increase the ratio of undesirable work.

The whole effect of technology upon our spiritual and mental life has yet to be examined. Once we accept the facts that the advance of science, both pure and applied, and the command of man over Nature cannot be resisted, we are compelled to face the problem how such developments can be made to conform to the elementary spiritual needs of mankind, which themselves cannot be abolished by simple decree.

### Aeroplane and Camera in Anthropological Fieldwork

*Äthiopien des Westens: Forschungsreisen in Portugiesisch-Guinea.* Von Hugo Adolf Bernatzik. Mit einem Beitrag von Bernhard Struck. Band 1. Pp. xii + 303 + 12 plates. Band 2. 152 plates. (Wien: L. W. Seidel und Sohn, 1933.) 135 gold marks.

TO state that "Äthiopien des Westens" is a sumptuous production is not to exaggerate the lavish feast which this beautifully produced work unfolds to the eye. To write that the 531 plates—400 of which form the sole contents of vol. 2—comprise the *pièce de résistance*, is not to belittle the narrative matter which constitutes the greater part of the text of vol. 1.

Dr. Bernatzik has summoned the camera and the aeroplane to be his interpreters in his successful

attempt to portray the life of the inhabitants of little-known Portuguese Guinea. The result is, very literally, a vivid series of pictures of the peoples among whom he travelled. Prof. Struck's contribution supplies—what may have been deemed the necessary—more strictly scientific touch. It deserves special notice which it will presently receive.

This must surely be the first occasion—if we omit Lady Bailey's survey flights in North Africa, and the solo flight over the Gold Coast of a professional anthropologist in 1929—upon which the aeroplane has been called in to assist the anthropological field-worker. Perhaps only those who know the ever present and dread possibilities of forced landings when flying over tropical forests, can fully appreciate the skill and courage of the airwoman, Fraulein Elli Beinhorn, which made possible the many bird's-eye views of native houses and homesteads. Dr. Bernatzik's methods were, throughout, simple and straightforward. Handicapped by a lack of knowledge of the local vernaculars, he was compelled to rely more on what he could himself observe than on what he heard or was told. He has taken each of some dozen tribes in turn, and under such headings as religion, birth, marriage, funeral rites, dances, law, love-making, etc., has described what any trained and careful observer would be likely to see with his own eyes. He has then recorded these sights and scenes with the aid of an artistic wife and of a fine camera. The rites and customs which he describes exhibit many of the features which we are now beginning to find common to most West African primitive societies, the more we come to know about such communities. Ideas on land tenure; law; standards of morality, where the desire for children far outweighs any narrow jealous feeling of sexual prerogative on the part of a childless spouse; the absence of chiefs—in the narrower territorial sense—all these and many other customs described are found among other west coast peoples.

One statement, however, made by Dr. Bernatzik seems so extraordinary as to merit some doubt as to whether he has not either been misinformed or misled. He writes, speaking of the Balante, that they do not believe in a life after death; that they do not follow the cult of ancestor worship, that they do not fear the dead. All this, too, in West Africa, where the cult of ancestors is the keystone of all religious beliefs. It seems well-nigh impossible.