some 12·5 A. is the mean distribution of the amine groups beneath a gliadin film. In the native protein such spacings are naturally different, and thus reactions involving two-point contact will not take place in bulk phase unless the spacing is unaffected by two-dimensional unrolling of the protein.

We have referred to the modification which must be introduced into either the Overton Meyer or Traube concepts of biological activity, that is, lipoid solubility or capillary activity necessitated by the concept of specific head group interaction. We see that a definite limit is also set to the hydrophobic portion of the molecule, not only on account of the decreasing solubility in the aqueous phase causing difficulty in transport, and on account of the ease of adlineation or packing having an optimum of C_{18} for association with sterols or fats, but also because a new phenomenon sets in with long chains, namely, dispersion of the monolayer. It is possible that this phenomenon of film collapse and dispersion may be a generally important factor in setting the upper limit to the chain length, or more generally the capillary activity of homogeneous series of biologically important substances, for example, anæsthetics. This dispersion of protein films may have biological counterparts in adsorption on specific portions of the cell surface similar to the hæmolytic activity of long-chain compounds such as oleic acid, which readily disperses protein films.

This method of attack permits us to investigate the nature of the coatings of cells or unicellular animals and plants by examining the effects of lipoid or protein penetrating substances on them.

Thus both red cells and Paramecia are affected by both lipoid and protein monolayer penetrating (cytolysing) or adsorbing (agglutinating) agents, and we deduce that their surface structures must contain lipoproteins or consist of a lipoid protein mosaic; whereas certain other unicellular animals frequently found associated with Paramecia and in addition the cilia of Mytilus are not affected by protein dispersants but are readily influenced by lipoid penetrating agents, and their coatings in consequence must be chiefly lipoidal in nature.

Examination of the carcinogenic hydrocarbons by the monolayer technique reveals the interesting fact that, whilst they themselves are unreactive, they are readily converted into extremely reactive water-soluble photo-oxides. These substances are not only reactive to protein monolayers like the water-soluble dibenzanthracene endosuccinate, but also are paramecicidal, the parallelism between the biological activity and monolayer reaction being maintained.

It has been the purpose of this address to re-emphasize the importance of the fundamental concepts introduced by Sir William Hardy and Dr. I. Langmuir as to the structure of matter in the boundary state. I have attempted to show that there is implicitly contained in the concept of molecular orientation a whole series of properties and events for which there are no analogies in homogeneous bulk phase systems. We note that many of the modes and types of the reactions which can be effected in monolayers, and which can be defined with precision and their mechanism established with a considerable degree of assurance, are unique for such interphases, but are again observed in living and organized material. It is with this object of ultimate correlation with biological behaviour that we have taken up the detailed study of interfacial reactions at Cambridge, and I should like to express my indebtedness to Dr. J. Schulman, who has been associated with me in this object.

Many 'vitalistic' models have been proposed in the past, and whilst it might be correct, although unscientific, to suggest that the ultimate level of integration in living matter is incapable of examination and definition, yet I believe that one is justified in asserting that at least one of the important levels to which due attention must be given for a proper understanding of biological activities is that of the ordered interface.

CULTURAL SIGNIFICANCE OF ANTHROPOLOGICAL STUDIES*

By Prof. H. J. Fleure, F.R.S.,

University of Manchester

THE vision of a universe in evolution has shown men that what had been accepted as absolutes are in several cases by-products of evolution. Old beliefs are increasingly relegated to the domain of folklore survivals, and the effects of this upon motive power in personal and social conduct are major factors of the present crisis in world affairs. Having been so long accustomed to accept an absolute basis which has now been undermined, men have hastily sought a new

* Prepared for a discussion on "Anthropology in Education" arranged by Section H (Anthropology) for the Dundee Meeting of the British Association.

absolute, and some think they have found it in the State, which is being made an object of worship. This growth of State worship has come earlier on the Continent than in Britain, for we have pursued our traditional policy of finding a compromise that postpones the crises due to insoluble problems. Evangelical and tractarian movements have had influences of this kind on British life; they have counted for much less on the Continent. Again, State worship has grown with the acceleration of production and communications, a process that has given rise to an uncomfortable feeling of jostling and trade-pressure. We have attained to an anarchy of sovereign States and understand one another too little.

To study the peoples of the world in process of evolution in their varied environments is thus one of the greatest needs of our time. Men and women, their physical characteristics and functions, their social organization and material equipment, their reproductive rates and all that is linked with this, interrelations of groups, including production and exchange of commodities and ideas, their systems of control and the clashes thence arising, all need deeper interpretation for all peoples of the world, from the pigmies of the equatorial forest to the citizens of the United States of North America.

Specialists have taken up studies in physical anthropology, in social organization especially of the illiterate peoples, in archæology, in human geography and so on. But the difficulty has arisen that these subjects are too separate to allow a sufficient number of those who follow some of them to find opportunities to teach them in such a way as to make them a feature of a general education. So long as they remain pure specialisms, they must have small followings. We need a co-operative scheme that will bring them together, not as one 'subject', but rather as a linked group.

The human geographer, seeking to elucidate relations between men and environment, will study situation, climate in its relation with vegetation, and the annual cycle of cultivation, and this should lead on to the discussion of the round of festivals and ceremonies that marks the agricultural year. Here the social anthropologist dovetails with his appreciation of those rites and ceremonies his understanding of the fact that both these and the agricultural processes they accompany are not results of direct planning but rather the product of ages of 'trial and error'. This undeliberate method has been man's chief tool through the ages; the reason has come in to correct misapprehensions and wrong sequences of argument. The human geographer, again, will try to understand land-tenure and will appreciate the fact that better watered patches in an arid area are likely to have a scheme of tenure different from that used in areas of equatorial forest.

The anthropologist will then come in and study schemes of inheritance and control of land, and so one might go on and show how human geography and anthropology combine. The more they are studied together the better will it be for both subjects, for both their research and their educational aspects. They may co-operate with special advantage in studying the changes of land tenure, agriculture, organization and government among African peoples who have come into contact with Europeans. Intertropical Africa produced very little for export sixty years ago; recently its export trade approached one hundred million pounds sterling per annum. This change has had many repercussions on every part of a social structure that had been built up on subsistence agriculture and the almost completely self-supplying village. An analogous change from local self-sufficiency to complex interdependence has been going on among the peasantry of Europe in the last hundred years, and this is part of the problem of clashing national sovereignties that is threatening ruin to us all.

During the last twenty years, archæologists have realized, to a greater extent perhaps than social anthropologists, the need for studying environment. Concurrent studies of climate change, recently assisted by work on pollen analysis, and of soils, have shown increasingly that environments have undergone extensive changes within the period of human history and that recon structions of environments of the past should be reconstructions for the climatic and vegetative conditions of a specified period. It has also been increasingly realized that prehistoric archæology tells us about our own ancestors, not about exterminated and forgotten peoples, and this has been an important factor in making archæology a study of the evolution of the future from the past.

At the same time, there is increased objection to accepting old parallels between peoples of antiquity and peoples of to-day. It is now considered less than a half-truth to say that the Australian blackfellows are surviving Mousterians, or the Bushmen of South West Africa surviving Aurignacians. Some of the Aurignacians were the leading peoples of their day and were on the upgrade; the Bushmen are rather a lingering remnant. Bushmen and Australians have picked up fragments of more advanced cultures even if, in some cases, these fragments are barely half-digested.

Physical anthropology, greatly helped by modern views of heredity, is learning to treat mass statistics with reserve and to criticize schemes of classification. Head form and pigmentation, for example,

have very different kinds of histories. Depigmentation has affected a number of elements of differing bony structure in north-west Europe, and the idea of a unified Nordic race belonging basically to the Baltic is almost as fantastic as the twin-fancy that this Nordic race developed the essentials of European civilization and spread them from this assumed early home.

My plea is that a group of linked humane studies based on direct observation and measurement is needed not only for specialist work but also at all stages of education, and that the group should include human geography, social anthropology, physical anthropology and archæology, though it is obvious that one can scarcely expect any one person to cover all these specialisms. All that is needed is that they should have some common ground.

OBITUARIES

Prof. R. S. Troup, C.M.G., C.I.E., F.R.S.

THE death of Prof. R. S. Troup on October 1, at the age of sixty-four years, removes one of the outstanding figures in the development of forestry in the Empire. He passed the competitive examination into the Royal Indian Engineering College at Coopers Hill in 1894, and ever since then his profession had been his predominant interest. Endowed with more than the usual amount of Scottish common sense and with a good deal of Aberdonian caution, his mentality was peculiarly adapted to the orderly collection and presentation of facts.

After a brilliant career at Coopers Hill, where he took a number of prizes, not only among the few forest students, but also in competition with the far more numerous students of the engineering side, in such subjects as geology and surveying, Troup went to Burma with the other four men of his year. There he started with practical experience in some of the finest and best managed forests of the Empire. His reputation had preceded him and after a few years he was called to Dehra Dun, then beginning to assume its position as the headquarters of the Indian Forest Service. From about 1904 until 1920, when he left India, he was engaged in research and administrative and scholastic work, as a teacher at the Forest College, as forest economist, as sylviculturist, and finally as assistant inspector general of forests to the Government of India. These posts gave him unique opportunities not only of seeing all the finest forests in the quarter of a million square mile forest estate of the Indian Empire, but also of gaining an accurate knowledge of how this magnificent property could and should benefit the population.

Troup's own interests lay more in scientific sylviculture than in the utilization side, but his early training ensured that he should fully recognize that first-class sylviculture is not an end in itself but, to put it briefly, a means of obtaining the largest volume of the finest timber on a given area. Apart from a number of publications on the uses of woods and allied subjects, the principal works which he produced during his service in India were "The Silviculture of Indian Trees" in three fine volumes and "A Note on some European Sylvicultural Systems with Suggestions for Improvements in Indian Forest Management". This latter work, "the outcome of a tour made in 1913 in certain selected forests of France and Germany", appeared in 1916, and has always seemed to the writer to be of outstanding interest. Illustrated by excellent and well-chosen photographs, a clear and vivid description is given of all the important sylvicultural systems employed on the continent of Europe, and the possibility of their adaptation to the very different conditions of India and Burma is fully discussed. "Silvicultural Systems", which was published by the Clarendon Press in 1928, is an up-to-date and more generalized study of the same kind. It has been praised by Continental experts as being better than anything they have. In the work of 1916, Troup gave evidence of a very broad and catholic outlook on the main problems of Indian forestry, and established the principles on which the most important measures of progress have been based during the last twenty-five years.

Troup's greatest work, "The Silviculture of Indian Trees", appeared in 1921 and is, in his own words, "the outcome of several years of research into silvicultural problems at the Forest Research Institute, Dehra Dun, and at outlying experimental stations, combined with observations recorded in many parts of India and Burma for a period extending over twenty years". The writer, having accompanied Troup on many occasions in the field, can confirm the care with which these observations were made and recorded, and can testify to the technical interest of the scholarly descriptions of the very varied types of forests in India and Burma and to the great value of the estimates of the sylvicultural needs of the more important species. Constant use has been made by Indian forest officers of the information stored in these volumes, which have become standard works of reference, and contain much that was not available before.

After leaving India to succeed Sir William Schlich as professor of forestry at Oxford, Troup's interests gradually changed, and, as the result of a number of tours to various parts of the Empire, particularly Africa, he became recognized as an authority on forestry in the Colonies, and was, at the time of his death, engaged on a work on Colonial forest administration. His last publication, in 1938, was a small volume on "Forestry and State Control", which reviews the position in all the more important forest