and small extent of the most productive lands of Great Britain, and points to the tracts which should be avoided in the siting of new towns if the productive capacity of the country is not to be impaired. The classification of land, when linked with the results of the Farm Survey (1941), suggests problems of the 'carrying capacity' of land in terms of primary producers, and so the population density to be expected with a given type of land and a given type of farming. Britain exhibits a curious super-imposition of an urban-industrial settlement pattern on an earlier rural-agricultural pattern. It may be suggested that many features of the latter are relatively permanent —the spacing of farm and village—whereas the former is changing and developing with new concepts of the standard of living and threatens to overwhelm the whole.

ECONOMICS : YESTERDAY AND TO-MORROW

SIR ALEXANDER GRAY'S presidential address to Section F (Economics) provides a survey of recent and current trends in economics. He points out that it would be possible to learn much about the continually changing view of the subject-matter of economics by reading in chronological order the definitions of economics given by its leading exponents. In Adam Smith, it was considered "as a branch of the science of a statesman or legislator". In the early part of the nineteenth century (as exemplified by Senior) there was a conscious effort to transform economics into a wholly independent scientific discipline, establishing laws or generalizations, while remaining perpetually and eternally neutral in a world of conflict. Broadly, the nineteenth century was in the main a period of specialization, when the economist tried to keep himself to himself, and to pursue the peculiar problems of his own specialism.

To-day the old frontiers have largely been obliterated; and perhaps in the next generation the economist's primary task may be to view his economics in relation to all the other so-called social sciences, and thereby to effect a new synthesis. The first and most complete disappearance of a frontier is that between economics and politics. To-day every economic problem has become a political problem; and most, if not all, political problems have their economic penumbra. So, also, it may be said that a structure of economic theory that is not based on a sound psychology is a house without foundation; and therefore your economist must be a psychologist—of a sort. Economics, in its modern form, sprang from the moral philosophy class-room of Adam Smith. Economics, in a familiar phrase, is the 'handmaid of ethics', and it is, indeed only in so far as we take some part in the ethical debate that our economics can acquire a meaning, an inspiration and a driving force.

The breakdown of the frontiers is accentuated by the fact that to-day the economic problems to be solved present themselves inextricably embedded in a whole mass of relationships which cut across purely economic considerations, and involve all phases of the manifold problem of men living together in society. It does not follow that we must cease to be economists; but more than ever, an economist, to be an economist, must be vastly more than an economist.

It follows, also, that in the near future there may be more urgent tasks for the economist than the elaboration of theory far above the heads of all but the experts. Never was there a time when so many experiments were being launched in the economic laboratory. Never was there a time of such far-reaching institutional change; and perhaps for the next ten years we may be constrained to revert, somewhat but not overmuch, to a point of view resembling that of the Institutionalists.

The economist of to-morrow will be living in a very different economic climate from that of nineteenth-century Victorianism, and the economico-politica-problem (of how to live together and keep things going) may be very different. There are three ways in which we may manage to live together in the complete Welfare State. The first is that of relying on a degree of compulsion vastly greater than we have yet had the courage or the honesty to admit may be necessary. If, disliking the idea of a world resting on compulsion, we ask for an alternative which will preserve our free society, the second possibility is to consider what can be done towards a solution of the age-long question of incentive. It remains true, however—and regrettably true—that the only effective incentives are of a material character, with an appeal to the individualistic and competitive instincts of mankind which we are supposed to be eradicating. If compulsion is rejected as immoral, if incentive is looked upon as a species of bribery, leading back to what some would regard as the jungle of individualism, there remains the third possibility of enrolling ourselves (for this purpose) among the followers of Lenin, and waiting in faith for the emergence of a better form of man, for the universal prevalence of a higher order of morality than that now to be found among us.

BRIDGING THE GAP BETWEEN SCIENCE AND INDUSTRY

THE theme of the presidential address by Sir Arthur Fleming to Section G (Engineering) is that industrial research and development form the bridge between scientific discovery and its practical application. Past technological achievements were obtained by the patient and persistent work of inventors and industrialists based on fundamental discoveries of scientific men. Such discoveries will always be the starting point; but to-day, as well as providing new ideas, science must also at every stage provide the means whereby their industrial application can be most completely achieved.

The function of industry is to make natural resources available for the use of man. Industry is dependent on engineering for power, machinery, transport and communications. It is never static, but its rate of progress depends on the acquisition and effective use of new knowledge. To-day new industrial knowledge is mainly derived from organised scientific research and is the result of team-work.

Facilities for pure research are expanding in university, Government and industrial laboratories and in research associations, but the cost is becoming increasingly heavy, especially in the field of nuclear physics, and this emphasizes the need for co-operation to avoid duplication of effort and waste of personnel. Further increased facilities for research are needed, but there must always be a balance between the cost of research in money and personnel and national

economy. The loss is serious if the results of research are not fully used, either through lack of trained personnel able to assimilate and implement new ideas, or through fear of risking capital in new ventures.

The stages in turning scientific knowledge to industrial account are well known. The first stage is carried out by industrial research, which requires laboratory facilities and trained personnel able to interpret the significance of scientific discoveries in the light of possible industrial applications. The next stage is to determine marketable possibilities, and the staff concerned must have commercial experience as well as scientific knowledge. The project then goes into commercial production, and the same team should see it through the difficult transition period until it is accepted into the orthodox manufacturing programme. The product and its production must then both be kept up to date by continued research.

The economic importance of reducing the time-lag between the discovery of a new idea and its ultimate industrial application cannot be over-stressed. Another important factor is the training of personnel. Training schemes for all grades of engineers exist, but particular attention should be given to the education of industrial research workers, development engineers and higher management executives. In the past, few industrial executives have received a scientific education. This, however, will be remedied in the future as a greater proportion of young people are taking science courses at school and university. Teaching staffs of the universities and technical colleges should be kept abreast of industrial practice by refresher courses in industry, and more attention should be given to the problem of making available to professional engineers technological knowledge which is too new to be included in a normal curriculum.

An outstanding example of bridging the gap between scientific discovery and industrial application is afforded by the production of the atom bomb, the starting point of which was the discovery of the electron fifty years ago. Fundamental research in atomic structure led to the discovery of the means of producing nuclear disintegration. Then followed the discovery of uranium fission and the chain reaction, which enabled the release of a vast amount of energy from the nuclear disintegration of the uranium-235. Carrying this discovery into effect involved extensive research activities in physics, chemistry, metallurgy and electrical engineering, and led to the construction of plant and equipment on an unprecedented scale. The eventual results are well known. Post-war research on this subject is being pursued in the United States on a large scale in Government, university and industrial laboratories. Though primarily conducted from the point of view of national security, it will ultimately produce knowledge of great benefit to mankind, and the United States will have a great number of scientific men trained in the practical application of nuclear physics and able to turn to industrial account new discoveries made in this field.

Our economic needs and the demands of national security emphasize the importance of utilizing science. All our assets of skilled personnel and knowledge must be fully used, and more co-operation between industrial and Government laboratories is essential to employ our scientific personnel to the best advantage.

PLACE OF ARCHÆOLOGY IN NATIONAL EDUCATION: A SURVEY AND A PLEA

MR. M. C. BURKITT'S presidential address to Section H (Anthropology) has two main themes running through it. While the foundations of studies in prehistory have been well and truly laid, there are a number of general problems in the subject which remain unresolved and some of which are touched upon in the course of a survey of the periods. For example, why is it that from the material point of view the evolution of the stone industries in widely separated areas of the world follows the same pattern, though the cultures concerned may have little or no apparent link with their counterparts in the various regions? Core-tool industries are almost everywhere succeeded by others made essentially on flakes, and these in turn are followed by industries made on blades, and these again by pigmy tools, with finally the appearance of a new technique for tool-making, namely, that of grinding and polishing. Yet there is no reason for thinking that, for example, the flake-tool industries of Western Europe—the Levalloisean, Clactonian or Mousterian—had any physical links with the great Middle Stone Age complex of South Africa, the flake-tool industries of which are in part, at any rate, evolved from the earlier core-tool industries of the region. The situation is different for the core-tools themselves, where it seems that some contact must be postulated. Some stress, too, is laid on problems of cave art and of the multiple origin of the Aurignacian culture in Europe. Coming to the Neolithic Age, the effect on human ideology of the discoveries of agriculture and the domestication of animals is considered. The material changes resulting are, of course, well known. But the effect of these new discoveries on the outlook on life of the early food producers has not been so carefully considered.

The other main theme which is worked out concurrently by Mr. Burkitt is a plea that the study of early archæology shall be considered for the curriculum of secondary schools in Britain. Since the present time is a period of flux, it is not inappropriate to examine whether some of the subjects now included are any longer very useful. From the grammar and public school points of view, intensive algebra and Latin verses would seem to have outlived their usefulness, except to the specialist, and any purely mind-training qualities these subjects possess can be found in other more useful and interesting studies. Even in secondary modern schools, some of the subjects taken by the older children in the 'A' streams are not particularly useful or thrilling. On the other hand, prehistoric archæology has much to commend it. The methods employed are strictly scientific and logical, and many of them—such, for example, as the stratigraphical law of superposition—can be demonstrated practically. Yet the study is of humanity and deals with our own origins. Again, while there is much of a general nature to learn, there are also many detailed practical considerations to deal with. There are youngsters who can realize and enjoy the general sweep of events, whether in prehistoric or historical times. Others somehow cannot imagine the general, and are attracted by the detailed and particular. For such the study of technology and typology would at any rate be more exciting than algebra, and equally useful for mind training.

We live in an age when democracy is ever demanding shorter working hours. Are we giving our young people hobby subjects to occupy the resulting