of social medicine. Social science workers would be helped by such instruction, and in extra-mural university classes and in adult education such teachers could play an important part.

To provide these teachers it will be necessary for the universities to increase the number of students taking honours courses in physiology, but who are not going on to medicine. It will also be necessary for the various educational institutions to realize the value of having on their staffs teachers so trained.

In schools, broadcasting and films can be useful aids, though they in no way lessen the responsibility of the class-room teacher, from whom the main inspiration must always come. In preparing such aids it is necessary to have co-operation between three sets of experts, the class-room teacher and the experts in the subject and in the medium to be used. It is necessary, too, for teachers to have training in the of such use aids.

It is Prof. Cullis's firm conviction that this wider teaching of physiology would result in a better understanding of various problems intimately associated with healthy living, so leading to a higher and better standard of health for the individual.

## MAN'S ADAPTABILITY

THE question of the adaptability of man was the theme of Dr. S. J. F. Philpott's address before Section J (Psychology). Many of the problems psychologists have handled during the War and that will face them during the peace have had to do with man's adaptability. Can a bank clerk be changed, almost overnight, into a tank gunner? Can he be changed back by a stroke of the pen?

If the doctrine of round pegs in round holes were strictly true such transformations would be difficult, if not impossible. In practice, they can take place with surprising ease, especially if the will to act is present. There are limits. Broadly speaking, men are only adaptable within the limits of their all-round ability; but granted the will and the ability, man can play many parts.

In asking just how an individual is equipped and just how he can adapt himself, we must realize that he works as a whole. When in the workshop planing or sawing a piece of wood, it is my body as a whole that I use, throwing it now into the attitude appropriate to the use of a plane, now into the attitude appropriate to the use of a hand saw. I do not use a planing organ or a sawing organ.

In similar fashion, I am now in the mental attitude appropriate to making an abstract. In a moment I may be in the frame of mind appropriate to making some calculations, or writing a letter, and so on. It is my mind as a whole that I use in each of these operations. I do not use an abstracting organ or a calculating organ.

The problem of education into a given culture is that of giving the individual an enormous number of such attitudes, skills or techniques, ranging from the simplest of everyday actions like opening doors up to the highest expression of the arts and sciences. We only begin to realize the significance of the complex of skills thus built up when we learn about 'wolf children' realizing how much they have lost. Yet no matter how complex the result of all this training, it still remains that all activities can be traced to the functioning of the one general-purposes body-mind instrument.

The problem of drill arises whether in peace or war. It is that of making these various techniques automatic. One cannot enjoy riding a bicycle until all movements of hands and feet and body take place well below the conscious level. No man can be master of his craft until he has made himself a slave to the minor habits involved, the fingering of his instrument or the handling of his tools.

Before advising training, we often to-day apply tests of potentiality. The naïve view is that we ought to be able to devise tests to distinguish between those born to be tank gunners and those born to be tank drivers. In fact, a one-time carpenter can often succeed at either of the other two occupations. Granted that at the moment he knows nothing about either of them, will tests for potential drivers or potential gunners pick him out? If so, will it not be a case of a test for drivers picking out a potential gunner? Or so far as that goes, will it not have picked out an actual carpenter? Put briefly, although it is easy to devise tests of all-round ability (trainability or adaptability) it is quite another matter to discover tests that shall assess potentiality in respect of some one occupation and it alone. There is wide overlap. The bearing of this on problems of peace, such as that of advising children into the best form of education, is obvious.

## THE HISTORY OF PLANT FORM

ALTHOUGH in recent years botanists have been mainly interested in the study of growing plants, many of their generalizations are based on a belief that evolution has taken place in the plant world. But since very little historical evidence of the evolution of the flowering plants has been forthcoming, this belief has become a dogma, maintained in spite of the absence of proof. This unsatisfactory position, said Dr. H. Hamshaw Thomas, in his presidential address to Section K (Botany), warrants a survey of our present knowledge of the fossil record.

Past failure to find any clues to the early history of the flowering plants may be due to a deductive examination of the evidence. The logical basis of evolutionary study is different from that of pure or typological morphology, but it has been assumed that the *Urform* of the pure morphologist represents the primitive type of flowering plant. Consequently we may have been searching for structures which have never existed. The actual record of changes in plant form through the ages suggests the evolution of the angiosperms through types very different from those imagined.

The geological record becomes clearer if we compare the plant forms from successive *terrestrial* periods, dividing the geological time-scale in a manner complementary to the normal classification of strata, the groups of which represent periods of marine sedimentation. Owing to the rare conditions under which plants are preserved as fossils, we can never hope to trace real phylogenies, but we can obtain evidence of the ways in which structures have changed in the past 400 million years.

The remains of the Upper Silurian–Lower Devonian land plants show forms widely different from the plants of to-day. Types with smooth forking axes predominated; they had little differentiation into

stems, roots and leaves. During the Middle Devonian period there were leaves of several types which seem to be derived from specialized photosynthetic branches. A variety of large, much divided fronds appears in the Upper Devonian–Lower Carboniferous rocks; their ultimate segments were usually small or narrow. Several of them belonged to seed-bearing plants—the pteridosperms. In Upper Carboniferous–Lower Permian times this group had more compact fronds, with larger, partly concrescent pinnules; reticulate venation appeared in some genera. Among these, *Gigantopteris* approaches the type of leaf now characteristic of dicotyledons. Petrified stems with a wide range of structure have been found; some of them suggest an approach to angiospermous structure.

The sequence of reproductive structures forms a coherent series which should be studied without reference to morphological preconceptions. Most of the earlier types had their sporangia on the ends of fertile branches, often in groups. This habit continued through Upper Palæozoic times. Kidston described six different forms of pteridospermous pollen-bearing structures from the Lower Carboniferous, with terminal groups of radially arranged sporangia, and Halle has investigated a number of similar structures from the Upper Carboniferous. All are constructed on the same general plan, which is also seen in the male flowers of many unisexual angiosperms to-day. These structures, as well as the cupulate seeds, generally grew on special branch systems. Halle's suggestion is recalled, that in one line of pteridosperm evolution the plant body was differentiated into a vegetative and a reproductive region, the spore-producing members congregating to form some kind of inflorescence or flower borne directly on branches of the stem and not on leaves. The Triassic pteridosperms from South Africa had dichasial inflorescences and support this view. Another link between the pteridosperms and the angiosperms is provided by certain rare and undescribed fossils from the Molteno beds of South Africa. These show inflorescences of a dichasial type, bearing small flowers with delicate perianth segments.

The closed ovary of the angiosperms may have been derived from the open cupules of the pteridosperms. The Jurassic *Caytonia* suggests how the closure may have come about, and Prof. Doyle's researches on pollination and fertilization in the conifers are interesting in this connexion.

Traces of flowering plants occur in the Upper Jurassic and increase in number until they form more than 90 per cent of the floras in the Eocene rocks. The widely different types present in Cretaceous beds suggest that the group must have originated in Upper Palæozoic or early Mesozoic times. An investigation of the spore content of freshwater sediments may throw light on this suggestion. A high percentage of the families represented in the Upper Cretaceous–Lower Tertiary floras show primitive characters in their secondary wood; by statistical analysis, Sporne has been able to discover other characters probably possessed by the more primitive dicotyledons.

All these studies are independent of morphological theory, and since plant morphology has developed as a deductive study they suggest that a reconsideration of its concepts are necessary. The War showed the importance of a complete and objective analysis of information as a basis for action. This is a principle applicable both to the problems which have been here considered, and to all the affairs of national life.

## EVOLUTION OF SECONDARY EDUCATION

IN her presidential address to Section L (Education), Miss Lynda Grier discusses "The Evolution of Secondary Education in Britain". The most notable features in the evolution of secondary education in Britain have been, she said, the growth and constant power of the classical tradition, and its decay; the growth of democracy, including the growth of the woman's movement; the coming of science with a new conception of humanism in education, and the interest in technical education.

The dominance of classics in education in the first instance was due to the fact that they were useful and paved the way to office in Church and State, that they were necessary to lawyers and diplomatists, won favour at court, and were, in brief, the main requisite for any who wished to enter the learned professions. Conservatism kept classical teaching powerful when the direct usefulness of the classics had ceased, and brought about a decline in the number of grammar schools, and in the numbers at the universities, until the latter began to take note of the new learning, and it was slowly recognized that education should have some connexion with the world in which men and women had to live. This recognition was due to the growth of democracy and the increasing need of the sciences for the contribution of learned thought and training. As these things came to the fore, secondary education began slowly to take its rightful place in men's minds as something that should be offered to all children.

Early democratic ideas in education in England, unlike those of Commenius, were selective and concerned with the provision of ladders for the poor and able, which would set them side by side with the rich, or even, as some of the most democratic of early English thinkers suggested, above the rich, if the rich were not worthy of the education offered. Hence the English system was profuse in scholarship provision, generously but definitely selective. Interest in the higher education of women suffered an even greater decline than did that for men, until the gradual emergence of a true democracy.

Mathematics and science were not neglected entirely, for indeed much fine work was done in both. But it was carried on outside the universities and grammar schools; and schools of a different type were set up for their teaching, or else, as suggested by Locke, they were taught by private tutors, until at last the ancient universities began to recognize their importance. Technical education, which should long since have come into an important place in education, given the decay of apprenticeship and the competition of other countries, has only recently established its claims in the provision of secondary education.

The general neglect by the State of secondary education in Britain allowed for great variety in it, since what was done was in the hands of private bodies and individuals with widely different points of view. The recent Education Act and all the interpretations given to it by the Ministry of Education recognize the value of that variety. In achieving for the first time a complete system of education, with secondary education for all, it is recognized that unity is incompatible with uniformity, and that the greater the variety the more perfect can be the result.