

sidering the storage of memories within the nervous system, but it is equally applicable to the control systems of cells. The replication of a representation without distortion through a series of copies requires that it shall consist of discrete units. The molecular aggregates within cells can be considered as such specific unit signals, not only within the nucleus but probably also in the cytoplasm.

Signalling between cells presumably developed out of the system of signals within cells. As nervous systems became more complicated they allowed selection of responses from larger sets of possible actions. Moreover, the actions are influenced by memories of sets of occurrences in the past. In *Octopus*, memories can readily be set up ensuring that one figure will be attacked and another avoided. If the amount of tissue available is reduced by removal of part or all of the vertical lobes, there is a corresponding reduction in the accuracy with which the animal forecasts the probable outcome of a situation. The nervous tissues responsible for the storage of the memories consist of a set of lobes each connected with the next through a plexiform arrangement and containing numerous small cells. The lobes can re-excite each other in a circuit. The specific representations that ensure correct responses presumably consist of facilitated pathways in these networks. During the period after an octopus has received food, the probability that it will attack any moving figure is increased, and conversely after a shock. These effects still occur after removal of the vertical lobes, but both last for a shorter time than in the normal animal. In the absence of these lobes, octopuses can learn only if trials are given at short intervals. Moreover, memories set up before operation are disturbed but not wholly lost after removal.

Although we are still ignorant of the nature of these memory processes, we can see that they involve selection among many possible alternative pathways, such as are open to a system composed of aggregates of dissimilar entities. Such systems can show the process of 'adaptation' with various time-scales, either by selection of certain responses during the life-time of the individual or by the slower process of 'natural selection'. In general, animals with large brains that learn well live longer, reach a larger size and breed less rapidly than those which depend mainly on natural selection to ensure that their responses are adequate. All these problems can be considered together. We can inquire how each species receives the information that ensures that its control system contains a representation that elicits responses which ensure survival. The analogy of information theory is helpful at least for introducing us to the nature of the problems to be solved.

THE EVERLASTING HILLS

"MOUNTAINS are not everlasting, nor are they by any means all of the same age. The antiquity of the Alps and the Himalayas is little compared to that of our Scottish and Welsh mountains, which indeed are so low because they are so old." This view, expressed by Lord Avebury in 1902, is quoted by Prof. David L. Linton in his presidential address to Section E (Geography), who points out that it is quite in line with that of Sir Archibald Geikie, who thought the "prodigious denudation" involved in cutting the glens of the Scottish High-

lands could be ascribed to Tertiary times, but relegated the fashioning of the "plane of marine denudation" represented by the present Highland summits to the Palaeozoic.

In the half century that has since elapsed, it has become clear that mountains can be carved from uplifted segments of the Earth's crust in much less time than such workers supposed. Thus the Kaikoura Ranges of New Zealand, some 9,000 ft. high, have been carved from the solid in Pliocene and later times. The mountains of Scotland erected by the Caledonian orogeny were laid open to their granite cores, and possibly peneplaned, before the Middle Old Red Sandstone was deposited. The Hercynian mountains of Devon which were rising in Lower Coal Measure times had been largely destroyed by early (and completely peneplaned by late) Permian times. From such evidence, combined with the absolute chronology provided by radioactive dating, it becomes clear that high mountains on continental margins are likely to be base-levelled in 20-40 million years; and since post-Cretaceous time is reckoned to comprise some 70 million years; it is evidently more than ample for two erosion cycles to have been completed in Britain, on hard and soft rocks alike. It is clear also that our existing hill and mountain scenery will display no pre-Tertiary elements unless these have been exhumed during Tertiary time.

Geomorphologists in Britain and Ireland are to-day attempting to educe from the forms of our hills the pattern of their physiographic history. In the mountains of most drastic glacial sculpture, which can be shown to be essentially those that to-day receive more than 100 in. precipitation a year, little if anything survives that can be called pre-glacial. Elsewhere, and especially in the massive uplands of eastern and southern Scotland, central Wales and south-east Ireland, the uplands have been only lightly modified by the ice and enough survives from later Tertiary times to make attempts to construct a denudation chronology both possible and profitable. Such attempts are still in the exploratory stage and indeed it appears that some of the work done in the past twenty years has pursued a false scent and led to conclusions for some areas that are inherently improbable. This set-back, however, need not daunt us, and if care is taken to see that all the possibly relevant evidence is used, and to avoid over-dependence on a single set of morphological criteria, there is no reason why the familiar forms and features of the hills of our homeland should not in time disclose their ages to within two or three millions of years.

THE BALANCE-OF-PAYMENTS PROBLEMS OF A EUROPEAN FREE- TRADE AREA

IS it possible in Western Europe to combine free trade with the maintenance of full employment and the avoidance of deficits on international balances of payments? Prof. J. E. Meade, of the London School of Economics and Political Science, states in his presidential address to Section F (Economics) that there are five possible approaches to an answer to this question; they may be called the liquidity approach, the gold-standard approach, the integration approach, the direct-control approach, and the exchange-rate approach.