

been suggested that this hydrocarbon and others like it present in the tobacco wax form the main source of the aromatic hydrocarbons in the smoke.

Polycyclic aromatic hydrocarbons occluded in the soot in the atmosphere have also been considered as a cause of the increasing incidence of lung cancer, either acting alone or in conjunction with cigarette smoke. Goulden and Tipler estimated about 300 mgm. of benzpyrene per kilogram of soot. Polycyclic aromatic hydrocarbons including 3:4-benzpyrene have also been detected in the exhausts of internal combustion and diesel engines. Again, Kotin, Falk and Thomas, in Los Angeles, have obtained tumours on mouse skin with artificially produced smog free from aromatic hydrocarbons. There is some evidence that the responsible agents here are epoxides arising from oxidation of hydrocarbons in petrol vapour.

There is little doubt that specific chemical substances are also responsible for the increased liability to lung cancer found among workers in a number of industrial processes. The classical example of this, among the miners of Schneeberg, in Saxony, and of Joachimsthal, in Bohemia, is almost certainly due to ionizing radiations from radioactive gases and/or dusts. Other examples, in the nickel, chromate and asbestos industries and among the hæmatite miners of Cumberland, seem to be associated with dusts of metals or metallic oxides or salts. The total number of cases attributable to these occupational causes may be very large, and Hueper, in fact, regards such causes as outweighing cigarette smoking in importance.

Clearly, the whole question of lung cancer and its increase is complex and is unlikely to admit of a simple solution. The balance of evidence is strongly in favour of the view that carcinogenic chemical agents are primarily concerned, although in the present state of our knowledge, it is very difficult to arrange the sources of these in any undoubted order of importance.

ORDOVICIAN VOLCANOES

THE presidential address by Dr. G. H. Mitchell to Section C (Geology) recalls the centenary this year of the birth of a great Irishman, John Joly, to whose brilliant thought modern ideas of vulcanicity and earth-movement owe so much. Joly suggested that a direct connexion exists between heat accumulated within the crust of the Earth as a result of radioactivity and the periods of orogenesis and volcanic outbursts which recur from time to time.

Despite the vicissitudes of many millions of years of geological history, there appear even now among the outcrops of Ordovician strata at the surface in the British Isles a remarkable number of volcanic rocks which afford evidence of one of those outbursts of volcanism. They form, as it were, a great broken ring, near the centre of which lies the city of Dublin. In Ireland the most important exposures are in Tyrone, Galway, Waterford and Wexford. Across the Irish Sea, the Welsh Ordovician rocks, stretching from St. David's to the Menai Straits, include numerous lava-flows and pyroclastic rocks. Farther north, the products of great volcanoes form most of the high fells of the English Lake District. Other remnants of the eruptions of those far-off days are found across the Scottish border in Ayrshire, as scattered outcrops throughout the Southern Uplands

of Scotland and even as far afield as Arran, Aberfoyle and Stonehaven. We do not know how many more such deposits lie buried beneath later rocks or have been removed by erosion during the many periods of denudation which have occurred within the 350-400 million years that have elapsed since they were erupted.

The composition of the lavas varies from andesites to rhyolites, with notable developments of spilites. The pyroclastic rocks range from agglomerates to the finest dusts, and include lithic, crystal, vitric and welded tuffs, comparable in composition to the lavas with which they are associated. Both lavas and tuffs show considerable alteration, with the formation of many secondary minerals.

Ordovician volcanic activity broke out early in Arenig times at a number of centres in Ireland, Wales and Scotland. So far as the imperfection of the geological record will allow, the violence of the eruptions appears to have increased with the opening of new foci in the Llanvirn Epoch, in particular in the English Lake District. There is evidence that this phase was followed by uplift and considerable erosion, which are revealed by striking unconformity, pre-Caradoc in age.

Volcanic activity flared up again in Caradoc times. To judge by the thickness of the surviving deposits, there must have been centres of importance in Ireland and North Wales, but in England and Scotland the outpourings were on a smaller scale. With the passing of the Caradoc Epoch volcanism waned, and in the Ashgill Beds, formed at the close of the Ordovician Period, there only remain thin beds of tuff or lava to mark the dying phases of one of the most violent of those volcanic storms which on several occasions have swept the area where the British Isles now stand.

EVOLUTION OF ORGANIZATION IN THE NERVOUS SYSTEM

PROF. J. Z. YOUNG points out in his presidential address to Section D (Zoology) that the controlling functions of the nervous system are a special development of the systems by which all life is regulated. The properties of signalling, memory and prediction that we attribute to the nervous system can also be recognized throughout cellular activity. In order to describe complicated self-adapting systems such as living organisms, we have to consider that there is a sense in which the system 'could' do several things and that it 'selects' the appropriate ones in the light of past history. The behaviour of such complicated aggregates can only be adequately described if we know their history over considerable periods. One method for handling such a study is to use the analogy of signalling and language, where the function of a symbol is to influence the choice among the various things that a human being can do. The significance of the word in this respect is not seen from the wave-form of its sound unless the student has a complete history of the way this wave-form has influenced human populations in the past.

For the control system of an organism to be able to maintain stability it must contain what we may call a coded representation of those events in the outside world that are likely to be significant for its life. We are familiar with this concept when con-