

still pervades Britain, although it takes just as much brains to become a first-class technologist as to become a first-class lawyer, and probably more. Since this battle which he has fought for the past twenty years has been unsuccessful, Lord Cherwell found the reason for his being awarded the Messel Memorial Medal in his early work on physical chemistry, dating from that with Prof. W. Nernst in Berlin more than forty years ago. Nernst was then mainly concerned with the heat theorem known as the third law of thermodynamics, and Lord Cherwell showed briefly how a suggestion by Einstein regarding the derivation of Planck's formula led to the discovery that action could only be transferred in units of a minute but finite size. The processes for synthesizing ammonia or petroleum depend, in fact, on the reinstatement in a space-time description of the conjugated dynamical co-ordinate.

The world is now entering an epoch of nuclear chemistry, continued Lord Cherwell, about which our knowledge is as rudimentary as that of chemistry itself a hundred and fifty years ago. No one can say whether the building up or the breaking down of nuclei will play the predominant part in generations to come. Even in classical chemistry there are problems of which we have only scratched the surface, such as the extraction of the uranium and the plutonium after irradiation from the rods full of lethal fission products and the disposal of these intensely active products. Whether we can utilize the energy potentially available has yet to be seen, and meanwhile man for the first time has it in his power to destroy all life on this planet. The question is whether he will be able to avoid some such form of universal suicide, and it is a sad reflexion on our political achievements and mental processes that, despite the universal wish for peace, man has not been able so to arrange his affairs as to avoid war and the continuing threat of war.

STANDARDS AND LEVELS OF LIVING

A COMMITTEE of United Nations experts has concluded that most of the short-cut methods for comparing levels of living in different countries are unsuitable and sometimes misleading. For example, both national income *per capita* and real wages have serious defects as indexes of levels of living*.

To present useful comparison the committee recommends a pluralistic approach by analysis of various 'components' of living which are amenable to quantitative treatment and reflect internationally accepted values or aims. The twelve components listed by the experts are: health, including demographic conditions; food and nutrition; education, including literacy and skills; conditions of work; employment situation; aggregate consumption and savings; transportation; housing, including household facilities; clothing; recreation and entertainment; social security; and human freedoms.

In addition, the report includes a series of more specific statistical indicators that should be used as

* Report on International Definition and Measurement of Standards and Levels of Living. (Report of a Committee of Experts convened by the Secretary-General of the United Nations, jointly with the International Labour Office and Unesco.) Pp. xii+96. (New York: United Nations; London: H.M. Stationery Office, 1954.) 0.80 dollars; 6s.; 3 Swiss francs.

a guide in measuring the various components; these indicators are chosen with the view of availability of information. In view of deficiencies of data in many countries, however, the report gives a minimum list of 'priority indicators'; it indicates how they may be obtained and adds another set of indicators to illustrate lines of further improvement.

Members of the committee recognized that an international analysis of levels of living, in terms of the components and indicators they proposed, would nevertheless fall short of giving a complete and balanced picture of the total situation. They stressed the importance of the use of descriptive materials and background information, particularly in the form of social and cultural analyses. A more direct and comprehensive assessment may be attainable by 'family living surveys' carried out by the use of sampling methods and designed to ensure international comparability.

The committee was appointed by the Secretary-General of the United Nations, jointly with the International Labour Organization and the United Nations Educational, Scientific and Cultural Organization. Members came from six different countries and represented various disciplines of social sciences and statistics. They were Prof. Raymond Firth, professor of anthropology in the London School of Economics and Political Science; Prof. Philip M. Hauser, professor of sociology in the University of Chicago; Mr. Erland v. Hofsten, chief of the Statistical Section, Social Welfare Board of Sweden; Father Louis Joseph Leuret, editor of *Economie et Humanisme*, France; Mr. O. Alexander Moraes, acting secretary-general of the Inter-American Statistical Institute of the Organization of American States; and Mr. V. K. R. V. Rao, director of the Delhi School of Economics, University of Delhi.

MANAGEMENT COSTS

THE costs of managing industrial firms have traditionally been regarded as an incidental class of expenditure. These costs have been rising rapidly and, to-day, administrative costs have become a major expense in the operation of industrial firms. By 1948, for example, of every hundred production workers in British industrial firms, twenty were administrative employees; in 1907 the number was only eight.

Information collected by Seymour Melman shows that, in Great Britain at least, there has been no correlation between increases in administrative overheads and the growth of productivity. (*Manchester Guardian* "Survey of Industry, Trade and Finance", 1954). In the United States, on the other hand, output per worker man-hour rose by 232 per cent from 1899 to 1947 while the administrative overhead ratio increased by over 40 per cent. In Great Britain the output per worker man-hour increased by 73 per cent from 1907 to 1948 while the ratio of administrative overheads grew by 133 per cent. It has been assumed that the growth in the cost of managing necessarily yields some economy in production; there is no evidence of any relationship of this kind.

Various reasons have been put forward to explain the growth of administrative costs in view of increasing mechanization and systematization. Melman suggests that increasing costs are due to the develop-

ment of new managerial functions. Industrial management has chosen solutions to its problems which also involve the extension of formal managerial controls over ever-widening areas. The extension of managerial controls is the common feature of the growth of new functions in industrial management, including sales, accounting, cost accounting, personnel and industrial relations, as well as the addition of staff specialists trained in economics, psychology and similar disciplines. This growth in administrative staffs represents more than the trend of a business cost. It is also a social cost owing to its bearing on the effective productivity of industrial man-hours. The growth of administrative overhead will be stopped or reversed only when its development becomes the source of pressing problems to one or more of the important groups closely concerned with industrial production: that is, management, labour or government. Only then will there be a search for alternative ways of industrial decision-making which would simplify and reduce the costs of managing.

EXPERIMENTS ON THE CAUSE OF DORSIVENTRALITY IN LEAVES

IN a recent article, R. and M. Snow¹ reported experiments bearing on the cause of dorsiventrality in leaves, the results of which differed from those which I had obtained². If, in my experiments, the position at which a leaf primordium was about to arise at the shoot apex of potato was isolated from the remainder of the apical meristem by a single vertical incision, the leaf which arose on the isolated panel of tissue was radially symmetrical³, and I concluded that dorsiventrality of the leaves is induced by the activity of the apical meristem of the shoot.

It is this conclusion that the Snows question. They have repeated this experiment using potato shoots, and in only one instance, when the apex suffered from loss of turgidity after the incision was made, did the isolated leaf develop as a radial structure; in all other shoots the leaf formed was dorsiventral. However, they state that in *Epilobium hirsutum*, but not in other species, radially symmetrical leaves arose when the central part of P_1 , the youngest leaf primordium, or the presumptive position of I_1 , the next leaf to arise, was confined at its sides by two vertical incisions which left them continuous with the stem apex towards the centre. (In potato shoots dorsiventral leaves emerge between such pairs of incisions.) R. and M. Snow¹ suggest that a radial leaf may develop, in *Epilobium* at least, from an area which is in some way weakened, or is insufficiently large to give rise to a dorsiventral leaf. If this conclusion is valid then intrinsic factors, in the leaf primordium itself, would be operative in determining the symmetry of the leaf.

The following experiments, performed on potato apices, are relevant in that they permit a distinction between the two hypotheses of intrinsic and extrinsic determination of leaf dorsiventrality. If the centre of the apical meristem is punctured with a fine needle new leaves continue to emerge on the apical flanks. In some shoots up to eight new leaves have emerged in normal phyllotactic sequence while the puncture remained at the summit of the meristem. In every case the new leaves so formed were dorsiventral, and of normal size. In other experiments, a newly emergent P_1 primordium, or the presumptive

position of I_1 , together with a small adaxially situated panel of meristematic tissue not used in leaf formation, was isolated by a vertical incision from the centre of the apical meristem³. The isolated P_1 and I_1 primordia developed as dorsiventral leaves.

The position of the isolating incision in relation to the presumptive position of the leaf is critical. When the incision is close to the presumptive position of the leaf, the leaf is radially symmetrical²; when farther away, as in the experiments just described, the leaf is dorsiventral. Thus, if dorsiventrality is induced in the leaf primordium by the shoot apical meristem, the induction can be carried out by small areas of the meristem, approximately one-sixth of the meristem being sufficient³. This may explain the variation between results obtained by R. and M. Snow and myself. It seems probable that the incision by which they isolated the I_1 presumptive position was not close to the I_1 position, but was sufficiently far from it to include on the isolated panel some small portion of the apical meristem of the shoot, for they state¹ that in their experiments "radial leaves developed from small unoccupied areas of tissue that were left over somewhere between the isolated I_1 leaves and the stem". From the experiments described above it would be expected that I_1 would be dorsiventral when so isolated.

That the hypothesis of apical control of leaf dorsiventrality is reasonable is shown in the following series of experiments. When the I_1 presumptive position in potato is isolated from the remainder of the apical meristem, I_1 develops as a centric organ². On the isolated panel, and lying on the cathodic (P_1) side of the I_1 presumptive position, is a small group of cells which were part of the apical meristem. These cells undergo differentiation and do not produce a new shoot meristem when so isolated, apparently being unable to compete successfully with the larger bulk of the terminal part of the meristem^{3,4}. If, however, the emergent leaf primordia P_1 and P_2 , and the terminal part of the apical meristem of the shoot are excised, leaving only the isolated I_1 panel, then the meristematic cells on the panel lateral to the I_1 presumptive position regenerate a new shoot meristem, and when I_1 emerges it does so as a dorsiventral leaf, orientated towards this new meristem, and deflected by approximately 90° from its expected orientation in an intact apex. If the excision of P_1 , P_2 , and the terminal part of the shoot meristem is delayed for 24–48 hours, by which time I_1 is just beginning to emerge as a centric organ, and the meristematic tissues lateral to it have begun to differentiate, no shoot meristem is regenerated on the panel, and I_1 develops as an enlarged centric organ encroaching over most of the panel surface. These enlarged centric I_1 primordia have a well-developed and extensive solenostelic vascular cylinder, and may be taller than dorsiventral leaves of the same age. They do not, therefore, appear to be the result of nutritional depletion in the leaf-forming area. It thus seems that factors extrinsic to the leaf primordium are effective in determining leaf dorsiventrality and, for dorsiventrality to occur, the leaf-forming area must be in direct continuity distally with cells of the apical meristem.

This explanation does not in its present form account for the emergence of radial leaves between two lateral incisions in *Epilobium*; however, the apical control of leaf dorsiventrality in the fern *Dryopteris aristata* has been experimentally demonstrated by Wardlaw⁵ and more recently by Cutter⁶,