local removal of antibiotic substances, the re-concentration of nutrients and the spreading of spores to places where they can flourish. The biological properties of the microbes are such that high-energy food materials become inaccessible and energy becomes dammed up. The animals are the 'dam-busters' that disperse the accumulations of energy and restore the flow—and with it the nutrients needed by the higher plants.

It is not known yet how important these catalytic actions are, nor which of them are the most significant. Clearly, over the whole range of soil types, from forest and pasture to moorland and degraded arable land, the details of the picture are going to vary enormously; but the few experiments reported indicate that the animals' 'catalytic' role greatly exceeds their metabolic role as decomposers.

Current experiments are aimed at building up a good knowledge of the metabolic rates of isolated organisms under conditions as close to those in Nature as possible. At the same time systems are being developed containing micro-organisms and essential soil constituents of varying degrees of complexity but with predictable metabolic behaviour. It is hoped to go on from there to introduce different kinds of animals into the cultures and observe their effects on total metabolism, and to analyse the biochemical basis of these effects. In this way it is planned to bridge the gap between field conditions and laboratory experiments.

Dr. C. L. Duddington discussed "Predacious Fungi and Soil Eelworms". Predacious fungi are micro-fungi that attack small animals, including protozoa, rotifers and eelworms. They are abundant in most fertile soils. We can distinguish two kinds of predacious activity among the fungi that attack eelworms. Some capture eelworms alive, while others are internally parasitic, attacking the host through the agency of sticky spores or by other means. At least two species of *Nematoctonus* combine both methods. Most of the work on predacious fungi attacking eelworms has been concentrated on the trap-forming species.

In the common *Arthrobotrys oligospora* and others the eelworm traps consist of systems of sticky networks, formed from curled, anastomosing branches of the mycelium. Eelworms that happen to touch

the networks stick to them like flies on a fly-paper. Other species, like *Dactylella cionopaga*, have short, sticky lateral branches, while in *D. ellipsospora* and others small sticky knobs are attached to the mycelium by short stalks.

Some predacious fungi have mechanical traps. In *Dactylaria candida* rings, composed of three curved cells, are attached to the mycelium by short stalks; eelworms accidentally pushing their heads into the rings become wedged. In some species, such as *Dactylella doedycoides*, the cells of the rings are sensitive to touch; if an eelworm passes its body into the ring the three cells swell suddenly inwards, holding the eelworm by constriction.

Whatever trapping mechanism is used, the end result is that the eelworm is killed, and its body is invaded by hyphae that consume its contents.

A survey of 49 British arable soils produced 82 records of predacious fungi, belonging to 20 different species. *Arthrobotrys oligospora* was the commonest: both eelworm-trapping and internally parasitic species were represented. There is direct evidence that predacious fungi prey on eelworms in the soil under natural conditions, for mycelium with traps and captives has been found on slides immersed in soil both in field plots and in the laboratory. There is also convincing evidence that their predacious activity is enhanced by the presence of decomposable organic matter in the soil. There is reason to believe that the organic matter affects the activity of the fungi directly and not, as has formerly been supposed, through its stimulating effect on the population of free-living eelworms in the soil.

The importance of predacious fungi in limiting the soil nematode population under natural conditions has yet to be fully investigated, but experiments on the use of predacious fungi for the biological control of plant pathogenic eelworms suggest that their effect is not negligible. Soil treatment designed to enhance the activity of predacious fungi was successful in controlling pineapple root-knot eelworm in Hawaii, and in Britain the number of larvae of cereal root eelworm invading the roots of oat seedlings has been significantly reduced by soil inoculation with *Dactylella thaumasia* combined with the addition of organic matter to stimulate the fungi.

C. L. DUDDINGTON

DOMESTIC FOOD CONSUMPTION AND EXPENDITURE, 1959

THE survey for 1959 of the National Food Survey Committee* completes twenty years of continuous recording of domestic food consumption in Britain. Two reports cover the years 1940–49 and since 1950 a report has been published each year. These twenty years have seen a complete change from severe restriction in food supplies, followed by a period of gradual increase, to the point recently reached at which the housewife with money to spare looks for greater variety and shows a preference for what may be called 'convenience foods', processed and packed to save time and trouble.

A gap necessarily intervenes between the year of survey and the publication of these annual reports.

* Ministry of Agriculture, Fisheries and Food. Domestic Food Consumption and Expenditure 1959: Annual Report of the National Food Survey Committee. Pp. vi+142. (London: H.M.S.O. 1961.) 8s. 6d. net.

As a result, they often clarify and extend facts already known in a general way. For example, the present report throws light on the increase in expenditure on food known to be taking place during the period under review. The average weekly expenditure a head increased from 28s. 5d. in 1958 to 29s. 3d. in 1959. This was partly due to an increase in the price of foods such as butter, meat, cheese and fruit, but there was also a shift in demand from staple foods such as bread, flour, potatoes and fresh fish to fresh fruit, fresh green vegetables and a wide variety of processed foods. Expenditure on processed foods prepared ready for the table, which include canned and frozen foods, cakes, pastries and biscuits, has risen from 4s. 3d. a head a week in 1955 to 5s. 5d. in 1959. Doubtless, as the range of such foods increases and advertising becomes more clamorous,

the expenditure on them will continue to rise, though a certain lack of variety in the taste of foods prepared by mass-cooking methods may eventually drive some housewives back to the kitchen stove. In the section dealing with the effect of the housewife's age on the household diet, it is shown that young housewives devote up to 19-24 per cent of their total food expenditure to these 'convenience' foods, while older housewives devote considerably less. The fact that 'single-earner' families with two children spend more on them than childless couples shows how useful they can be to the busy mother. Their cost in terms of food is increased by packaging and advertising, but this is offset by saving in time and less wastage. The expenditure on cooked and canned meats rose 5 per cent from the previous year, and on prepared fish the rise was 14 per cent. The most striking change in food habits in Britain, apart from the growing preference for processed foods, is the increase in consumption of poultry. Total supplies of poultry and rabbits are 31 per cent higher than pre-war, although there has been a considerable decrease in supplies of rabbit.

Comparison of the nutritive value of the diets of the different social classes with the recommendations of the British Medical Association showed that intakes of all nutrients, except protein, considerably exceeded the figures of the British Medical Association. Total protein intakes were 'borderline' in the lower income groups and the national average 99 per cent of the recommendation of the Association. As income rises, the calorie value of diets and their content

of all the nutrients also rises. The diet of the most prosperous classes is 'richer' in these respects than that of all other classes. This perhaps suggests that wealthy people eat too much, but on the other hand it might be taken to imply that the recommended allowances are set too low. Such questions could be clarified only by correlating national food consumption data with data on the health of different sections of the population—an extremely difficult task.

Study of the relation between food consumption and family composition and size gave a less favourable picture. In households containing four or more children the diets were inadequate in certain respects. Intake of calories was 94 per cent of the recommended level, and that of protein, calcium and riboflavin 82, 81 and 95 per cent respectively. These deficiencies may not seem great, but it must be remembered that these families contain a high proportion of growing children whose health and development depend largely on proper feeding. At the other end of the life-scale an improvement is recorded. In earlier reports it was shown that the diets of old age pensioners were unsatisfactory; it is good to note that their diets included in this survey were adequate for all nutrients.

Interesting facts are given about geographical differences in food consumption. These give rise to many fascinating speculations on feeding and cooking habits in different parts of Britain, but it would be foolhardy to hazard guesses on the merits and efficiency of housewives according to locality.

JOYCE DOUGHTY

NITROGEN IN SHEEP SALIVA

IN a series of articles, M. Somers, of the Institute of Agriculture, University of Western Australia, describes the factors influencing the secretion of nitrogen in sheep saliva (*Austral. J. Exp. Biol. and Med. Sci.*, 39, Part 2; April 1961).

Measurements were first made on the distribution of nitrogen in the mixed and parotid salivary secretion of sheep and on the amount of nitrogen secreted daily in the parotid saliva. The distribution of nitrogen in the mixed saliva followed the same pattern as that in the parotid secretions obtained when the glands were in a quiescent state. The concentration of nitrogen in both fluids depended on the rate of secretion. Although the concentration of total nitrogen in the mixed and parotid saliva increased during short-term stimulation, the pattern of nitrogen distribution was not affected. During prolonged stimulation of the parotid glands, the nitrogen composition of the saliva changed.

Quantitatively, urea was the most important nitrogen compound in both the mixed and parotid saliva, accounting for 60-70 per cent of total nitrogen. The average volume of saliva secreted daily by one parotid gland was $2,380 \pm 43.8$ ml. and the average total nitrogen content was 295.5 ± 5.77 mgm. when the nitrogen intake was 14.8 gm./day.

Somers later examined the influence of nitrogen intake on blood urea nitrogen and on the total nitrogen and urea nitrogen in the parotid saliva of sheep. Urea was added to the rumen of three merino sheep at the rates of 5, 10 and 20 gm. daily to increase the overall nitrogen intakes from 10.7 gm. in the basal ration to 13.0, 15.4 and 20.0 gm. a day. A

marked increase in the total amount of nitrogen secreted in the parotid saliva was found to occur as the nitrogen intake of the sheep increased. A similar high correlation was found between the level of nitrogen intake and the amount of urea nitrogen secreted in the saliva daily.

Between the highest and the lowest levels of nitrogen intake the magnitude of the increases were 0.26 gm. of total nitrogen and 0.18 gm. of urea nitrogen/gland/day. The concentration of urea nitrogen in the blood increased with the level of nitrogen intake of the sheep, but fluctuations in the level of blood urea could not be accounted for by nitrogen intake alone. A significant correlation was found between the concentrations of urea nitrogen in the blood and in the saliva. This offered a partial explanation of the higher concentrations of salivary urea resulting from the increased nitrogen intakes.

Further investigations were made of the factors affecting the nitrogen fractions in the parotid saliva of sheep with special reference to the influence of production of ammonia in the rumen and fluctuations in level of blood urea. Quantitative measurements were made on the volume of saliva secreted hourly by the parotid glands of Merino sheep over a period of 24 hr. on three separate days. At the same time fluctuations in the concentration of urea and total nitrogen in the saliva were studied in relation to the production of ammonia in the rumen and changes in the level of blood urea which occurred throughout the day.

Levels of both rumen ammonia and blood urea followed a relatively simple cyclical pattern over