The fourth Boyd Orr Memorial Lecture, organized by the Boyd Orr Memorial Trust, was held at the Hannah Research Institute, Ayr, on 20 April 1978

FOURTH BOYD ORR MEMORIAL LECTURE

Problems and politics in nutritional surveillance

By A. M. THOMSON, *MRC Reproduction and Growth Unit, Princess Mary Maternity Hospital, Newcastle upon Tyne*

When feeling bemused by problems of nutritional policy, I try to fortify myself by contemplating the achievements of John Boyd Orr, Fellow of the Royal Society, Peer of the Realm and winner of the Nobel Peace Prize. A man of strong mind, who sometimes acted as though administrators really were his obedient servants, he had the Rowett Institute half-built before he asked his Committee to pay for it. His innate decisiveness must have been strengthened by his short career as a physician and surgeon; patients do not thank a doctor who says that the diagnosis is obscure and the treatment doubtful. His scientific achievements, which brought him the highest honours, show that he could also be cautious, objective and sceptical when necessary. But today we commemorate him mainly as an idealist who spoke for humanity, and who took nutritional research out of the laboratory into the world of political and economic affairs.

Forty years ago, I was conducted to his office at the Rowett Research Institute in Aberdeen to be interviewed for a junior medical post. It would be pleasant to recall that I was immediately captivated by his hypnotic personality, but in fact I can only remember a craggy face adorned by enormous eyebrows, and a voice saying in the accents of Ayrshire that I should see Dr Leitch. I shall therefore couple this celebration of the memory of Sir John Orr (as I think of him: Lord Boyd Orr was a more remote figure whom I last saw dancing an eightsome reel when in his eighties) with salutations to Dr Isabella Leitch, who is still very much alive at the age of 88 years. It would be difficult to exaggerate the influence of her erudition and constructive thinking on what we used to call 'the gospel according to Sir John'.

As a medical student in Glasgow, I had attended the lectures of another remarkable man, Edward Provan Cathcart, Professor of Physiology and for a short time Honorary Director of the Hannah Research Institute. A gifted, sardonic, sceptical man, he had a talent for phrases which linger in the memory: I recall his lecture on 'that mild and melancholy fluid, milk'. In 1913, Cathcart turned down the offer of a

research post in animal nutrition at Aberdeen University, and recommended the appointment of Dr Orr, who had worked with him on protein, creatinine and water metabolism. In 1928, he published, in Benn's Sixpenny Library (Cathcart, 1928), a popular account of nutrition and dietetics, which at that time was almost exclusively a matter of physiology and biochemistry. Only in his short final chapter did Cathcart discuss the social implications of nutritional knowledge. The link between poverty and malnutrition, which Orr was soon to emphasize, was dismissed in a single sentence: 'It has been our experience, as the result of repeated dietary studies, that one of the most prominent contributing factors towards defective and deficient dietaries is not so much the inadequacy of the income as its faulty expenditure'.

There is no reason to think that Orr would have quarrelled with that sentence when it was written during the 1920s. Dr Leitch tells me that during the early days at the Rowett Institute his views of society reflected the stern Calvinism of a family which raised his two brothers to become ministers in the Free Church of Scotland. He would argue that the poor were responsible for their poverty, and therefore for its consequences; essentially, God was punishing them for their own fecklessness. To which Dr Leitch retorted that a God who condemned people to live in the slums of Glasgow, because they were incompetent, was less moral and compassionate than most women. She says this shocked Dr Orr, as he was then, and gradually he became interested in poverty as a matter of politics rather than of divine displeasure. And he found that he could do more with political than with religious dogmas.

Orr's original attitude was consistent also with authoritative scientific opinion during the 1920s. Cathcart's predecessor in the Chair of Physiology at Glasgow, Noel Paton, and Leonard Findlay (Professor of Paediatrics) had undertaken a massive survey of child life and health in the cities and rural districts of Scotland. Their scientific credentials were impeccable: Paton, like Cathcart, was a Fellow of the Royal Society while Findlay was unusual among clinicians for possessing a DSc, and their study was published by the Medical Research Council (Paton & Findlay, 1926). They concluded: 'No clear indication has been found that the nutrition of the child is directly associated with the income of the family ... Of the environmental characters studied, "maternal efficiency" seems more closely associated with variations in the condition of the child than our measures of "poverty", "underfeeding" or "overcrowding" ... The evidence ... seems to indicate that the current thinking gives too much rather than too little weight to the environmental factors which, theoretically at least, it might be possible to remedy by economic adjustments'.

It is a measure of Orr's originality that he broke away from the orthodoxies of his religious as well as of his scientific training. The conversion seems to have been brought about by his involvement in a topical problem of economics and politics rather than by spontaneous humanitarian and scientific concern. H. D. Kay (1972) wrote that 'the main problem of the British dairying industry since the early 1920s had been the disposal of surplus milk ... Millions of gallons of surplus milk and

whey, containing nutrients of high value for human consumption and for children especially, were disposed of by pouring into abandoned mines or into local streams and sewers'. Orr himself put it more picturesquely: 'The Milk Board was drowned in its own milk' (Boyd Orr, 1966).

Orr's previous scientific interest had been the importance to agriculture of mineral deficiencies in pasture. The few early papers he wrote on social aspects of human nutrition strike me as worthy rather than original. But Walter Elliott, a friend since student days who had become a rising politician, now brought him into official discussions on the problems of the milk industry. Orr took the unexpected line that the problem was not one of over-production but of under-consumption, particularly among the poor. An increased demand for milk would be good for the industry and would also be good for health. And to demonstrate the benefits of giving milk to children, he proposed and obtained support for feeding trials in schools. This, of course, short-circuited the problems of parental efficiency, which had been emphasized by Cathcart (1928) and by Paton & Findlay (1926).

Feeding experiments

Generations of physiologists and stock-breeders have used controlled-feeding experiments as the method *par excellence* of showing what effect can be produced by a difference of diet. There are formidable practical difficulties in organizing large-scale trials with human subjects living their ordinary lives, but several trials of the effects of giving milk to schoolchildren were conducted during the 1920s and 1930s. Table 1 summarizes their nature and some of the findings. Comparisons are between children within the age range 5–11 years who were given whole milk, raw or pasteurized, and controls who were given no extra food or a token supply only. Results are expressed as mean increase of height per annum: the values for weight were in parallel. The means shown in Table 1 are weighted in accordance with numbers in the sex and age groups, where these were specified; the effect of these factors on height increments (as opposed to absolute heights) is small, so that differences in the age–sex composition of the various groups scarcely affect the findings.

Corry Mann (1926) was the pioneer. His trial, in which boys were observed for up to 3 years, took place in a residential 'colony', apparently an orphanage, near London. One daily pint of whole milk is reported to have increased rate of growth in height by approximately 20 mm/annum. The results are not easy to interpret, but in a statistical appendix Major Greenwood concluded cautiously that: 'On the whole, the Milk group shows a definite excess growth in height over the Basic'.

Orr (1928) subsequently initiated a trial lasting 7 months at schools in seven Scottish towns and cities, and obtained a significant but smaller increase in rate of growth in height among children given milk. He was abroad during the following year, but the trials were continued by Dr Leighton and Mabel Clark of the Scottish Department of Health (Leighton & Clark, 1929). The acceleration of growth was confirmed, and clinical examinations of the children and reports from teachers

Table 1. *Pre-war feeding experiments*

Trial	Period of trial	Subjects	Supplements	Mean height increase (mm/annum) (no. of children in parentheses) Supplemented	Control	Difference
Corry Mann (1926)	1922–24	Boys in residential industrial school, aged 7–11 years	1 pint milk daily for 1–3 years	66·8 (*c.* 30)	46·7 (*c.* 30)	2·01
Orr (1928)	Nov. 1926–Jun. 1927	Urban Scottish children aged 5 and 8 years	0·75–1 pint milk at school for 7 months	61·8 (*c.* 180)	55·4 (*c.* 180)	0·64
Leighton & Clark (1929)	Nov. 1927–Jun. 1928	Continuation of previous experiment (children aged 6 and 9 years)	0·75–1 pint milk at school for 7 months	65·1 (226)	51·2 (241)	1·39
Clark (1929)	Oct. 1928–May 1929	Rural English schoolchildren, age not specified	0·75–1 pint milk for 7 months	61·0 (19)	49·0 (10)	1·20
Leighton & McKinlay (1930)	Feb.–Jun. 1930	Children aged 5–11 years in industrial Lanarkshire (one-third of parents unemployed)	0·75 pint milk at school for approximately 4·5 months	55·1 (4375)	49·4 (8618)	0·57
Milk Nutrition Committee (1939)	1934–35	Urban children aged 5–10 years, mostly in England. Control children received a biscuit	0·67 pint milk for one school year	56·6 (1052)	54·6 (1003)	0·20
Rowett Research Institute (1955)	1938	British children aged 5–10 years (Carnegie Survey)	Dietary supplements given at school or at home for 1 year	58·5 (380)	53·8 (332)	0·47

https://doi.org/10.1079/PNS19780044 Published online by Cambridge University Press

suggested that the milk-fed children had improved in general condition and became 'much more alert and more boisterous and difficult to control than the others'. Such subjective impressions are easy to disregard, but 10 years later I heard teachers expressing similar spontaneous opinions during the feeding experiments of the Carnegie United Kingdom Survey (Rowett Research Institute, 1955); and during the Bengal famine of 1943, orphans collected into camps and given a diet rich in milk impressed me as being strikingly more lively and cheeky than the rather quiet, undemonstrative children of the Indian poor at ordinary times.

During the first half of the 1930s, Leighton & McKinlay (1930) undertook a further trial in Lanarkshire, at a time of severe industrial depression when approximately one-third of the childrens' parents were unemployed or in part-time work. The increase on growth in height was only 6 mm/annum, but teachers again reported better health and higher spirits among milk-fed children; one teacher was moved to claim that 'in the playground buoyancy and pugnacity are developing to an alarming extent'.

The results of these feeding experiments in Scotland stimulated immediate political action. Through the advocacy of Walter Elliott in Parliament, the Education (Scotland) Act, 1930, was passed to enable local authorities to supply milk to schoolchildren. The Chief Medical Officer in Scotland was reported as saying that the measure, 'by improving their physical and mental well-being, would have a powerful influence in improving the quality of the Scottish race'.

England followed Scotland's lead. In 1934–5, the Milk Nutrition Committee (1939), with Sir John Orr as chairman of its expert sub-committee, undertook a trial on which the English 'milk-in-schools' scheme was subsequently based. As Table 1 shows, the average annual difference to growth in height between the milk and the control group was small, only approximately 2 mm. Nevertheless after taking other measurements and impressions into account, the Committee felt able to conclude that 'The great value of milk for the growth and health of growing children, already established, has been abundantly confirmed'.

Although it is possible to criticize each of these feeding experiments separately, taken together they provide an impressively consistent body of evidence that giving extra milk to schoolchildren did accelerate growth and improve health and vitality. The additions to rate of growth were not large, and were smaller in the later than the earlier trials with milk, a point noted in the final report of the Milk Nutrition Committee (1939). But since the trials were instituted to demonstrate benefits that would justify social action, rather than to test the null hypothesis, it is understandable that the contemporary reports did not dwell on the smallness of some effects on growth rate.

As I have explained, these experiments were stimulated primarily by problems in dairy farming and milk marketing, and were being interpreted during a period of severe economic depression and high unemployment. The transition from scientific demonstration to practical action at a political level therefore took place with remarkable speed and apparently with little or no dissent. If Sir John Orr felt obliged to undertake political propaganda, he seems to have done so behind closed

doors in Westminster and Edinburgh; and he continued to have a powerful ally in Walter Elliott. But during the early 1930s, his interests and ambitions were beginning to extend far beyond the justification of free or subsidized milk for schoolchildren. Once again, the impetus seems to have come from problems of the food industry. In 1933, the Market Supply Committee was set up to advise the Government on the amounts of different foods which should be imported, and this created a need for information on consumption levels. The Rowett Institute was consulted, and the result was Orr's classic book, *Food, Health and Income* (Orr, 1936) which I think most people would agree crowned his scientific achievements.

Food, Health and Income

To anyone who has not read it, this remarkable book can be recommended as a model of terse but lucid exposition. It broke new ground by using, as a yardstick for the adequacy of diets, not the traditional physiological concept of requirements for subsistence, but of requirements for 'a state of well-being such that no improvement can be affected by a change in diet'. Dr Leitch culled such a yardstick from a publication of the US Department of Agriculture with the unpromising title of *'Food budget for nutrition and production programs'*, which contained a schedule of nutrient requirements prepared by Hazel K. Stiebeling (Stiebeling, 1933) from information provided by H. C. Sherman and others. So far as I know, Dr Stiebeling originated the modern concept of nutrient-intake standards, the development of which has been accompanied by much semantic and scientific hair-splitting, as well as by much valuable research.

Using fragments of published evidence from official statistics and *ad hoc* surveys, Orr constructed a pattern showing steep gradients in family incomes and expenditures on such foods as milk, eggs, fruit, vegetables, meat and fish. The poorer families, comprising approximately half the population of Britain, could not afford to buy diets which, according to Stiebeling's (1933) standards, would be fully adequate for health. Socio-economic gradients in growth and in incidence of morbidity, together with the evidence of feeding experiments, pointed to much stunting and ill-health that could be remedied by improving diets. The last paragraph of the main text (Orr, 1936) begins: 'If these findings be accepted as sufficiently accurate to form a working hypothesis, they raise important economic and political problems'. There were indeed some who doubted the validity of the evidence. In a foreword to the second edition of *Food, Health and Income,* Orr (1937) dealt with these criticisms and insisted that his hypothesis called for 'economic statesmanship of the highest order'.

But industry was now recovering from the depression of 1929–32, and politicians were sceptical. H. D. Kay (Kay, 1972) says that when the manuscript of the first edition was ready, a Minister from Whitehall told Orr that publication would be against public policy and that it should be suppressed. 'Orr would have none of this and sent the manuscript to Macmillans'. This confrontation caused Sir John Orr to undertake open propaganda in addition to discreet lobbying behind the

scenes; not as a 'party man', but as a scientist whose aim was 'to get the new knowledge of nutrition applied to the health of the people' (Boyd Orr, 1955).

That summarizes 'the gospel according to Sir John' which dominated work at the Rowett Research Institute during the 1930s, and which has become legendary. Those of us in subordinate posts were, of course, inspired by rather than actively participating in Sir John's political mission. Our job was the research that supported it. David Lubbock organized the Carnegie Survey (Rowett Research Institute, 1955) which confirmed many of the conclusions of *Food, Health and Income* (Orr, 1936, 1937) and also showed by means of further feeding experiments that the growth of children could still be accelerated by giving them better diets. (See Table 1). Sir John kept us busy by demanding facts and figures needed for meetings in London and elsewhere; demands which we sometimes had to meet by working through the night with pencil, paper and primitive calculating machines. Nor was more basic research neglected. Milk is the main source of calcium in our diets, and Dr Leitch's (1936–7) review of human Ca requirements remained the most authoritative statement on that subject until she revised it more than 20 years later (Leitch & Aitken, 1959). I, myself, became involved in research on night-blindness as a possible early sign of vitamin A deficiency (Thomson *et al.* 1939).

Just as the atmosphere of industrial depression in 1929–32 had favoured the Scottish 'milk-in-schools' scheme, so the threat of war in 1938–9 began to act in favour of the political message of *Food, Health and Income* (Orr, 1936, 1937). Although he gained many allies in official and scientific circles I feel sure that without Sir John Orr's tireless and single-minded evangelism, Britain's wartime food policy would have aimed at merely tolerable levels of subsistence, rather than at improving the health of civilians. There is no doubt that the wartime policy was effective. The infant mortality and stillbirth rates began to decrease at an accelerated rate (Fig. 1). In 1946, the Chief Medical Officer in England wrote: 'The national provision of milk and vitamin supplements ... has probably done more than any other factor to promote the health of expectant mothers and young children' (Chief Medical Officer, Ministry of Health, 1946).

John Boyd Orr's idealism was infectious. It spread to provide the impetus for the Welfare State and for the National Health Service in Britain. On the international scene, it led to FAO and other technical agencies for the betterment of health. Forty years later, I feel privileged to have fetched and carried during the early stages of such stirring development.

The contemporary scene

The euphoria could scarcely have been expected to last in a post-war world which has had to grapple with change on a scale never previously experienced. The British Empire, which Sir John mentioned with pride in the last sentence of *Food, Health and Income* (Orr, 1936, 1937) soon collapsed. So did the League of Nations where, in 1935, the High Commissioner for Australia was acclaimed for proposing 'a marriage of health and agriculture'. That marriage ended in divorce after the

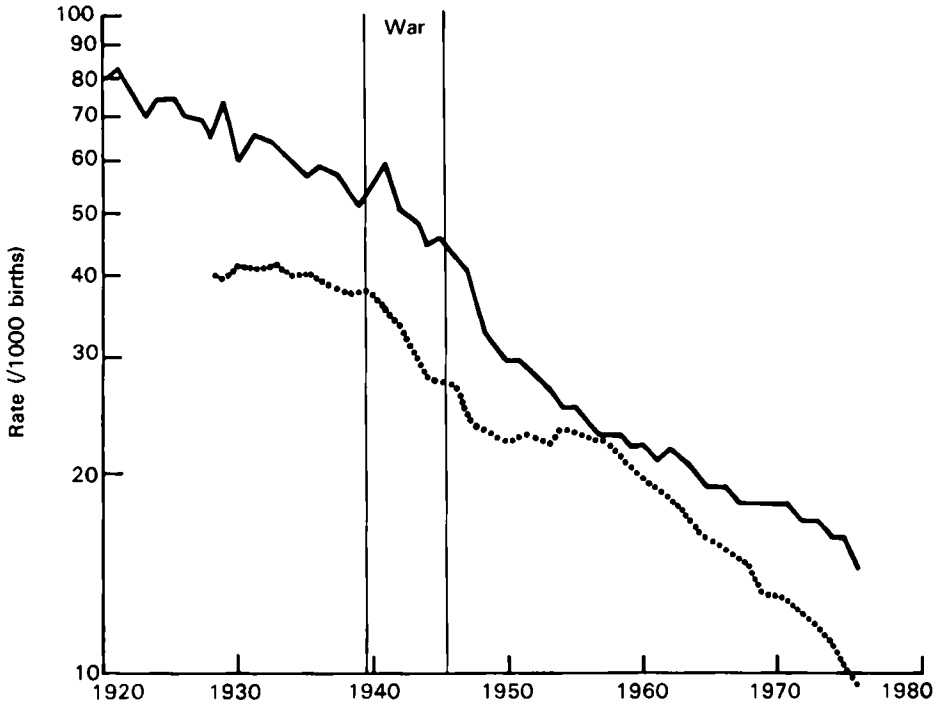

Fig. 1. Stillbirth (.....) and infant mortality (——) rates (/1000 births), England and Wales, 1920–1976.

war; agricultural policy became dominated by economic self-interest. Sir John left FAO in a state of disillusion but continued to preach his gospel all over the world, and was rewarded with the Nobel Peace Prize. In Britain, the Agricultural Research Council confined the Rowett Institute, which was my nutritional *alma mater*, to the farmyard; perhaps wisely, since advances in agricultural and food science, though sometimes attacked by 'back to nature' enthusiasts, have so far helped us to keep pace with the growth of populations. The Medical Research Council, until the publication of the Neuberger Report (ARC/MRC Committee, 1974), showed little favour to research with a nutritional label, perhaps because it felt sensitive about political implications.

Yet problems of human nutrition remain. In the developing countries, the familiar triad of poverty, malnutrition and disease remains the common lot. In industrialized countries, the diseases of affluence loom large, but impaired growth and health continue to be associated with pockets of poverty. In a world increasingly disturbed by violence, I sometimes recall ruefully the schoolmaster in Lanarkshire who complained, nearly 50 years ago, that well-fed children were becoming difficult to control. People with new aspirations, more resources and novel methods of exerting pressure multiply the problems of democratic government. The voice of the consumer is being heard as never before, and even science, technology and multinational commerce cannot ignore it.

The nutritional sciences may have lost some assurance because they now cover a range too wide for any one person to master. This was foreseen by Professor R. C. Garry, who with Sir John Orr and William Thomson, conducted a famous feeding experiment with rats on a human dietary (Orr *et al.* 1935). During his Presidential address to the Nutrition Society, Garry (1953) pointed out that: 'It is doubtful if nutrition is a science in the common sense of the word . . . it is wise to regard it as a meeting place of the sciences and of scientists rather than a single scientific discipline.' Since 1953, the range of the nutritional sciences has continued to expand. A notable example is the involvement of microbiology and immunology, through recognition that infections are a major cause of protein–energy malnutrition in babies and toddlers. That recognition was probably retarded by nutritional enthusiasts who created what Donald McLaren (McLaren, 1974) has called 'the great protein fiasco'. I well remember that when I expressed mild doubt about the alleged extent of world-wide primary protein malnutrition at a meeting in WHO during the 1960s, using the not unreasonable argument that few acceptable diets provide less than approximately 8% of their energy from protein, it was as if I had questioned the existence of the Holy Ghost in the Vatican. In their initial enthusiasm for protein, nutritional experts underestimated the importance of the energy supply, and also failed to recognize that most children in tropical countries become heavily infected. Several malnutrition may thus occur even when supplies of protein are adequate.

Sir John Orr's nutritional revolution in Britain could not have been so successful without the sanitary revolution that began during the nineteenth century, and which was being reinforced by applied immunology before the discovery of the antibiotics. At the time of the pre-war British feeding experiments, many papers on milk were more concerned with its bacteriological safety than its nutritive properties. The provision of National Dried Milk during the war years, by giving a baby food that was clean, as well as cheap, to mothers who had been indoctrinated with the importance of cleanliness, may have been an important cause of the accelerated decrease in infant mortality that began during the most difficult years of the war (Fig. 1). The situation is quite different in most developing countries where mothers have neither knowledge of nor facilities for cleanliness, and where hot climates favour the growth of pathogens. There, the well-intentioned distribution of substitutes for breast milk by welfare agencies as well as by commerce may have killed as many babies from gastrointestinal infections as it saved from primary malnutrition.

Clearly then, a nutritional policy may fail unless it takes the wider context into account. Nor is it wise to assume that politicians and administrators find it easy to share the outlook of scientists. Field (1977) has pointed out that nutritional scientists and the bureaucracies they hope to influence have characteristically different points of view. The scientists are more concerned with the objectives they wish to attain than with the administrative means of attaining them. On the other hand, civil servants and their political masters see nutritional aims as part of a much wider spectrum, and their first concern is to sustain the system on which

progress is seen to depend. Their desire to protect the system may on occasion be a greater barrier to achievement than lack of money or knowledge.

Given such complications, what can we reasonably expect a government and its official agencies to do about nutrition in a country such as Britain? (I shall not discuss our responsibility towards other countries.) I suggest that their internal responsibilities can be summarized under five headings: supplies, safety, surveillance, education and research.

Supplies and safety

In peace as in war, no government can survive that does not ensure that people have enough to eat. The primary problems are those of production, distribution and purchasing power. Safety is covered by the Food and Drug acts and by a well-established organization for supervision and control. Despite great advances in bacteriological control, the need for safety regulations is as great as ever, since practically everything we eat undergoes treatment aimed at greater production, slower deterioration or improved marketability. A return to so-called natural methods would be a sure recipe for starvation in a densely-populated and heavily-urbanized world.

Surveillance

Another necessity, in times when social changes may be rapid and unpredictable, is vigilance. We cannot assess trends in the nutritional status of society without information, systematically collected. A recent Nutrition Society symposium included reviews of current surveillance practices and results in the United Kingdom; I refer particularly to the papers by Darke (1977), Baines (1977) and Buss (1977). Here, I propose to ride a few 'hobby-horses'.

Most of our official monitoring procedures are *ad hoc*. If a plausible or politically-sensitive problem exists, a study to investigate it is mounted. There have been some striking successes (for example, the virtual elimination of hypercalcaemia traced to an excess of vitamin D in baby foods, and the more recent attribution of hypernatraemic dehydration to the use of unsuitable, or improperly-prepared infant feeding mixtures).

But the essence of good surveillance is continuity, the ability to discern trends, to make forcasts, and to intervene when necessary. In 1971, the government curtailed the 'milk-in-schools' scheme by withdrawing free supplies to children aged over 7 years except on medical certificate and to modify the arrangements for supplying 'Welfare' milk to pregnant women and to children age 5 years. (1 week before the present lecture was delivered, this policy was partly reversed. Neither the 1971 nor the 1978 decisions appear to have been taken on grounds of health.) The Department of Health and Social Security prudently decided to convene a Sub-committee on Nutritional Surveillance which was asked to detect the effects, if any, on the nutritional status of those affected. I doubt if the Department's decision was caused by real fears of adverse effects; the more

probable reason was that the decision to restrict a long-established nutritional privilege (for which, as we have seen, Sir John Orr was largely responsible) resulted in some political unrest. I have been told of one local Councillor who urged his council to take the bull by the horns and demand more milk. Considering the matter more dispassionately, the Department of Health and Social Security's Sub-Committee soon realized that it had little base-line information against which to measure trends in health that might be associated with the legislative changes of 1971. And it also became apparent that methods of nutritional surveillance have progressed remarkably little since Sir John Orr used them half a century ago.

The Sub-committee (Department of Health and Social Security, 1973) decided against a controlled-feeding experiment on the grounds that 'the chances of obtaining any positive result were small and the difficulty of interpretation of any result, either negative or positive, would be enormous because so many variables could not be avoided'. It noted that the experiment made by the Milk Nutrition Committee (1939) resulted in a difference of height gain amounting to 2–3 mm/annum only (see Table 1) and anticipated that an even smaller effect might now be obtained. Nevertheless Dr Peter Elwood, of the MRC Epidemiology Unit obtained support for a small-scale but well-organized feeding experiment in South Wales. This is still in progress, but he has allowed me to say that the preliminary information indicates that one-third of a pint of milk/d given to primary school-children causes an average increased height gain of approximately 1 mm/annum.

Clinical and biochemical indices of malnutrition are difficult to interpret with people who do not show obvious signs of illness. The National Food Survey gives regular estimates of consumption and expenditure within households, but surveys of individuals are too difficult and expensive to undertake on a routine basis. Mortality statistics in this country are excellent, but do not now yield much evidence unequivocally related to nutritional status; while statistics of morbidity are technically unsatisfactory and also of limited relevance. No approach by such methods has revealed serious cause for contemporary concern; but rumours of unsatisfactory nutritional conditions in poorer areas or families, or among special groups such as the elderly, immigrants or students on inadequate grants, continue to be reported from time to time in Parliament and the Press.

There is one approach to continuous nutritional surveillance which seems to me to have been neglected, that of anthropometry (see Tanner, 1976). Satisfactory growth and form have been regarded for generations as good evidence of satisfactory health. The time was when all children were measured routinely at least three times during school life, and Dr Leitch and her colleagues assembled information from 1911 to 1953 to show conclusively that heights and weights of English schoolchildren had increased quite remarkably (Boyne *et al.* 1957).

Fig. 2 illustrates changes in the heights of London schoolboys between 1905–12 and 1959; at age 13 years, for example, they were slightly over 130 mm taller in 1959 than before the First World War; probably there has been little or no additional growth since 1959 (Rona & Altman, 1977), and we may be near the genetic ceiling. Many beneficial changes have occurred since the beginning of the

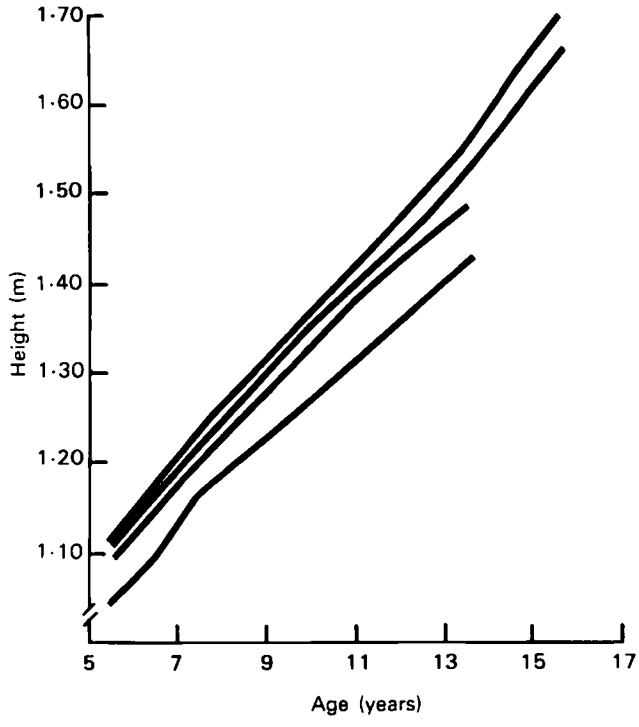

Fig. 2. Average heights (m) of London schoolboys, from 1905–12 to 1959 (London County Council, 1955, 1961).

century, and one should not minimize the effect on growth of better accommodation, more exercise and enormously reduced rates of infection among children. But this very remarkable increase in linear growth could scarcely have taken place without improving supplies of the body-building materials derived from food. Nor is it merely a matter of increased body size which, by itself, would be of no great importance. As Dr Leitch (1951, 1976) has noted, impaired growth caused by malnutrition leads not only to smaller size attained, but also to distortion of form and impairment of health and performance. There is some evidence that tall adults, on average presumably better-grown than smaller adults, are physiologically 'better'. One of my own interests has been information showing that tall mothers have on average much less obstetric disability, and a much higher survival rate among their babies, than shorter mothers (Thomson, 1959). And Morris, Marr & Clayton (1977) report that, other things being equal, short men are at greater risk of suffering from coronary heart disease than tall men. I offer the hypothesis that maximum linear growth (but not increase of body-weight), within the limits imposed by genetics and in the absence of endocrine disorders, is necessary for optimum physiological efficiency. It may be that most children are

now near the optimum, but social-class differences remain, and are not necessarily of genetic origin.

The value of monitoring body size and form can scarcely be doubted in the context of social nutrition. A DHSS/MRC Group (James, 1976) introduced its recent review of research on obesity by referring to 'widespread anxiety among the general public as well as the medical profession about the prevalence of obesity in this country', and it believed that at least 20% of the population attempts to lose weight each year. Yet there has been no large-scale survey of body-weight in a national sample of British adults since the Ministry of Food commissioned such a study in 1943 (Kemsley, 1950). A follow-up by Kemsley in 1950 (Kemsley, 1953) and a large industrial sample investigated during the 1960s by Montegriffo (1968) suggested some increase in adult weights, but we have very little more recent information. Nor do we know much about regional, occupational and social-class differences in adult weight-for-height *v.* age. Business executives may be growing fat, and their wives may be trying to slim, but we have practically no measurements.

We also know too little about current trends in the growth of children. Nearly all babies are weighed at birth, but there is no regularly-published information on birth weights. Growth from birth to school age is not being monitored, as a routine, although we know that social-class differences in height and weight are well-established by age 5 years. Schoolchildren are now weighed and measured routinely only at entry and on leaving, but the information is collated and analyzed centrally in Scotland only.

Only the government can collect evidence, on a sufficiently large scale and for a long-enough time, to find out the extent to which children and adults may be changing in height and weight, and what factors other than age influence trends. The Sub-committee on Nutritional Surveillance has promoted studies of growth in pre-school and primary schoolchildren and I hope these will continue. Discussion has begun on the possibility and methods of running surveys of height and weight in adults.

Such studies may be a far more important result of the 1971 changes in welfare and school milk legislation than the probably trivial immediate effects on health and growth of that legislation. I believe that monitoring growth and body size and shape in children and adults, is even more important, from the point of view of nutritional surveillance, than the systematic collection of mortality and morbidity statistics.

There are two technical points which deserve mention. First, Fig. 2 shows that schoolchildren have grown taller throughout the age range, so that the lines for different years are not grossly unparallel. This means that height increment per annum (the classically-used measure of growth rate in short-term feeding experiments) may be a relatively insensitive measure of improvement or deterioration. For example, the difference in average growth rate between ages 7–12 years in the 1959 and 1938 boys was only approximately 4 mm/annum, in agreement with the pre-war feeding experiments; but the 1959 boys were more

than 50 mm taller at age 12 years than their predecessors in 1938. Secondly, the differences in height were already well-established by age 5 years, so it appears that the earliest stages of growth determine much of the height attained at subsequent ages. This underlines the importance of monitoring growth in babies and children below school age.

Education

Food manufacturers find it profitable to spend enormous sums on market research and advertising designed to alter food habits, by no means necessarily to the nutritional advantage of consumers. It may be argued that governments should do more, by legislation and propaganda, to steer consumption in directions believed to be beneficial to health. There are however, some difficulties.

In the absence of a real emergency such as occurred during the Second World War, I doubt if legislation to regulate food habits would ever be acceptable. Sir John Orr never made the mistake of trying to dictate what people should eat. The thrust of his argument was against poverty, which in those days limited the ability of many people to choose what they ate. In a Welfare State, this kind of argument can be applied only to special groups who fall through the economic safety net.

Politicians and civil servants are understandably reluctant to enforce policies which may be controversial or unpopular, even when the scientific case is very strong. A case in point is the fluoridation of water supplies, which world-wide experience has shown to be a safe and effective way of reducing the incidence of our most common disease, dental caries. Fluoridation has been endorsed by expert opinion nearly everywhere, yet many local authorities and probably all governments have hesitated to make it compulsory.

If that is so when the scientific case is so strong, governments can scarcely be expected to restrict freedom of choice in more debatable aspects of nutritional policy. Consider, for example, the question of coronary heart disease and fat. The causes of the disease are poorly understood and certainly multiple, but most authorities seem to agree that it might be helpful in a country like Britain if people ate diets with a smaller proportion of fat, with a higher ratio polyunsaturated: saturated fatty acids. A report by the Royal College of Physicians and British Cardiac Society (1976) said so, and the Government's Chief Medical Officer sent copies to all doctors in this country. But the Government's own expert advisory panel (Department of Health and Social Security, 1974) came to the conclusion that there was no case for legislative action designed to bring about major changes in the dairy and edible fat industries, and through such changes to impose changes in dietary habits. If, on the other hand, the public can be persuaded to change its eating habits, industry may follow.

In matters of nutritional education governments rightly expect a very high standard of proof. Changes in expert opinion are not unknown, today's medical doctrine becoming tomorrow's heresy. Yet that should not be an excuse for inaction. As I mentioned at the beginning of this lecture, doctors have to advise patients even when the treatment is uncertain. I see no reason why governments should not subsidize professional organizations to advise the public directly in

accordance with the best scientific opinion. Bearing in mind the importance that Cathcart and others attached, quite rightly, to good management of existing resources, professional organizations might also be encouraged to educate consumers to manage their nutritional affairs more efficiently, as well as in ways more beneficial to health. Such organizations should be able to exercise the same responsibility to society as a doctor to his patient. Their record to date has been good. The propaganda of the Royal College of Physicians has probably done far more to discourage cigarette smoking than the 'Government warning' on packets. I believe that consumption of butter is already decreasing. And the spectacle of 'joggers' in city streets suggests that the public is becoming persuaded that exercise is beneficial.

Research

Without research, the understanding of nutritional problems remains shallow and incomplete. James Lind showed in 1753 that scurvy could be prevented by oranges and lemons but, as Dame Hariette Chick (Chick, 1953) pointed out two centuries later, the lesson was forgotten and mistakes were made, and scurvy recurred until laboratory research identified the real cause, lack of ascorbic acid.

The need for basic research and development has to be pressed on politicians because most of the money comes from public sources. It seems a pity that the Rothschild Report gave greater political and bureaucratic respectability to an artificial separation of 'basic' and 'applied' research. Both are necessary, because the intellectual traffic, and the benefits, run both ways. Empirical observations arouse curiosity and the search for explanations on which sound policy should rest. Conversely, 'basic' research often suggests unforeseen applications and enables practical policy to be examined more rigorously. Human nutrition may have been suffering from an excess of empiricism. It was a child of physiology and should be reconciled with its parent.

For that reason, I shall give the last word to that sceptical physiologist, the late Professor E. P. Cathcart, who, empirically, recommended John Boyd Orr to Aberdeen University 65 years ago. At the end of his book in Benn's Sixpenny Library (Cathcart, 1928) he wrote (or quoted without giving the source) the following pleasant poem:

'Eat all kind nature doth bestow,
It will amalgamate below,
If the mind says it shall be so.
But, if you once begin to doubt,
The gastric juice will find it out:
Calm courage conquers Sauerkraut.'

REFERENCES

ARC/MRC Committee (1974). *Food and Nutrition Research.* London: HM Stationery Office.
Baines, A. H. J. (1977). *Proc. Nutr. Soc.* **36**, 241.
Boyd Orr, Lord (1955). *Rowett Research Institute* (1955), p. 10.
Boyd Orr, Lord (1966). *As I recall.* London: MacGibbon and Kee.
Boyne, A. W., Aitken, F. C. & Leitch, I. (1957). *Nutr. Abstr. Rev.* **27**, 1.

Buss, D. H. (1977). *Proc. Nutr. Soc.* **36**, 247.
Cathcart, E. P. (1928). *Nutrition and Dietetics.* London: Ernest Benn Ltd.
Chick, H. (1953). *Proc. Nutr. Soc.* **12**, 210.
Chief Medical Officer, Ministry of Health (1946). *On the State of the Public Health During Six Years of War.* London: HM Stationery Office.
Clark, M. L. (1929). *Lancet* i, 1270.
Corry Mann, H. C. (1926). *Spec. Rep. Ser. med. Res. Coun. no.* 105.
Darke, S. J. (1977). *Proc. Nutr. Soc.* **36**, 235.
Department of Health and Social Security (1973). *First Report by the Sub-committee on Nutritional Surveillance.* London: HM Stationery Office.
Department of Health and Social Security (1974). *Rep. Publ. Hlth Social Subj., Lond.* No. 7. London: HM Stationery Office.
Field, J. O. (1977). *Food policy.* **2**, 228.
Garry, R. C. (1953). *Proc. Nutr. Soc.* **12**, 270.
James, W. P. T. (1976). *Research on Obesity: a Report of the DHSS/MRC Group.* London: HM Stationery Office.
Kay, H. D. (1972). *Biogr. Mem. Fellows R. Soc.* **18**, 43.
Kemsley, W. F. F. (1950). *Ann. Eugenics* **15**, 161.
Kemsley, W. F. F. (1953). *Ann. Eugenics* **18**, 22.
Leighton, G. & Clark, M. L. (1929). *Lancet* i, 40.
Central Policy Review Staff (1971). A Framework for Government Research and Development, Cmnd 4814. London: HMSO.
Leighton, G. & McKinlay, P. L. (1930). *Milk Consumption and the Growth of School Children.* Edinburgh: HM Stationery Office.
Leitch, I. (1936–7). *Nutr. Abstr. Rev.* **6**, 553.
Leitch, I. (1951). *Br. J. Nutr.* **5**, 142.
Leitch, I. (1976). *Prog. Fd Nutr. Sci.* **2**, 99.
Leitch, I. & Aitken, F. C. (1959). *Nutr. Abstr. Rev.* **29**, 393.
London County Council (1955). *Report on the Heights and Weights of School Pupils in the County of London in* 1954. London: London County Council.
London County Council (1961). *Report on the Heights and Weights of School Pupils in the County of London in* 1959. London: London County Council.
McLaren, D. S. (1974). *Lancet* ii, 93.
Milk Nutrition Committee (1939). *Milk and nutrition,* Part 4. Reading: National Institute for Research in Dairying.
Ministry of Agriculture, Fisheries and Food. *Annual Reports of the National Food Survey Committee.* London: HMSO.
Montegriffo, V. M. E. (1968). *Ann. hum. Genet.* **31**, 389.
Morris, J. N., Marr, J. W. & Clayton, D. G. (1977). *Br. med. J.* **2**, 1307.
Orr, J. B. (1928). *Lancet* i, 202.
Orr, J. B. (1936). *Food, Health and Income,* 1st ed. London: Macmillan and Co.
Orr, J. B. (1937). *Food, Health and Income,* 2nd ed. London: Macmillan and Co.
Orr, J. B., Thomson, W. & Garry, R. C. (1935). *J. Hyg., Camb.* **35**, 476.
Paton, D. N. & Findlay, L. (1926). *Spec. Rep. Ser. med. Res. Coun.* No. 101.
Rona, R. J. & Altman, D. G. (1977). *Ann. hum. Biol.* **4**, 501.
Rowett Research Institute (1955). *Family Diet and Health in Pre-war Britain.* Dunfermline: Carnegie United Kingdom Trust.
Royal College of Physicians of London and British Cardiac Society (1976). *J. Roy. Coll. Physicians, Lond.* **10**, 213.
Stiebeling, H. K. (1933). *U.S. Dept. Agric. Misc. Publ.* no. 183.
Tanner, J. M. (1976). *Proc. Nutr. Soc.* **35**, 315.
Thomson, A. M. (1959). *Eugenics Rev.* **51**, 157.
Thomson, A. M., Griffith, H. D., Mutch, J. R., Lubbock, D. M. & Logaras, G. (1939). *Br. J. Ophthalmol.* **23**, 697.

Printed in Great Britain