MEAT AND MANKIND

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Meat's role as a component of man's daily food is that of one of many sources of nutriment, any one of which can be replaced by some other, none of which is essential in itself. So if meat is to remain a significant component of the diet it must survive by competing successfully with other foods - it has no permanent captive market. Only the essential elements of the diet have this - energy sources, the essential amino acids, vitamins and minerals, all of which can be supplied without eating meat. Hitherto meat has been remarkably successful but threats to its position have increased rapidly with increased affluence, which has resulted in greatly increased leisure time and the ability, and inclination, to afford to pursue the constantly changing newest nostra peddled by the extremes of fringe medicine, and enthusiastically disseminated by newspapers, magazines, radio and television. Nevertheless we may feel confident that meat will remain a very significant component of the diet for the simple reason that it is universally liked and preferred to many other foods. A Greek author writing about 200 AD sums it up well in an anecdote he quotes from five hundred years earlier. Menedemus, a Greek philosopher, had a reputation of being very mean but nevertheless kept open house for his students and friends. It was said that when they arrived for a meal they would come a little early and 'would walk up and down in front of the house door and enquire of the slaves as they came out what dish was being served..... Whenever they heard that the dish was a green vegetable or some smoked fish, they would go back home; but when they heard it was a bit of meat they would go in and eat' (Athenaeus, 1930) - behaviour with which many today would have an immediate sympathy. Little has changed in this respect in 2,000 years or so!

Until very recently increased consumption of meat followed an increase of disposable income. It still happens in developing countries but is no longer so in this country. Let me give some examples. One of the earliest journals of nutrition was 'The Family Oracle of Health; Economy, Medicine, and Good Living adapted to all ranks of society, from the palace to the cottage'. It ran in monthly issues for 5 years from 1824 and was produced by A.F. Crell, FRS and W.M. Wallace 'assisted by a committee of scientific gentlemen'. In its early issues (Crell and Wallace 1924,5) it published a number of examples of household expenditure at different income levels, from 5 shillings 3 pence per head per week to 27 shillings 4 pence per head per week - this last being a very comfortable income of £500 a year supporting a household of husband, wife, two children, two maids and a boy. That affluent family spent a third of its income on food - the average for Australia today is less than half that, 15.7%, and for the most affluent 10% of the population only 10.6% (English et al. 1987). The proportion of food expenditure that went on meat for the families of 1824 rose from 24% to 30% as income increased. In the middle '30s of this century Boyd Orr (Orr 1936) surveyed food expenditure in relation to income in Britain. His survey divided the populace into income groups with food expenditure per head rising from 4 shillings to 14 shillings. The percentage of food expenditure on meat was in the narrow range of 28% for the 4 shillings group decreasing only to 26.5% for the 14 shillings group. In Australia today meat appears to be losing ground as a component of food expenditure, for the greater income per head becomes, the smaller the proportion of food expenditure that goes on meat - a fall from 25.3% to 17.5% from the poorest to richest groups. In absolute terms, expenditure on meat per head dropped from $6.40 for the lowest income ten percentile to about $4.60 in the mid range of incomes and rose again to $5.60 for the highest of the ten percentile groups (English et al. 1987).

Meat consumption, in terms of carcass meat leaving the domestic market per head of population, neared 120 kg in Australia in 1938/9. In 1888 it was reported as 168 kg for Queensland (Coghlan 1889), in 1900 the figure for NSW was a more moderate 135 kg (Coghlan 1901). In the post-war years Australia, New Zealand, Uruguay, Argentina and the USA have, one year or another, headed the table of apparent carcass meat consumption per head. The figures usually lie in the 100-110 kg range but are not strictly comparable between countries owing to differences in the reporting mechanisms and variations in population age structure.

Whether meat consumption in this country can maintain its present level in the diet of the population remains to be seen. That the level may fall a little seems likely but I believe that we can be confident that it will not change dramatically. With a steady rise in population the home market may not be affected quantitatively and meat exports are likely to increase as standards of living rise in external markets. A single example of what can be expected will be enough. In 20 years of increasing prosperity in Greece, meat consumption rose by 150% while that of sugar and dairy products doubled (Cooke 1987). Similar trends can be expected in other markets and will offer a continuing opportunity for meat exporting countries.

The figures I have given for meat consumption relate only to populations living on a mixed diet. It is of interest to know whether meat alone can provide an adequate diet for man and if so in what quantity. It might be supposed from an examination of food tables that such a diet would not be possible owing to the apparent absence of vitamin C from meat. In fact two men lived on a diet composed exclusively of meat for over a year under constant medical supervision in 1928/9 and at the end of the period had not changed materially in weight, were perfectly fit and there had been no effect on their blood pressure, kidney function or bowel function and there were no signs of any vitamin deficiency (McClennan and Du Bois 1930). A typical day's food was about 600 g of lean meat and liver and 250 g of fat consumed in three meals. They ate meat at the rate of 290 kg a year per head which corresponds to about 415 kg of carcass meat or 750 kg live weight - ten times their own live weight. Both men had previously lived on an all meat diet in the Arctic - one, Stefansson, for a total of nine years. This dietary experience did not materially affect Stefansson's health or productivity, he lived to 82 and published his 23rd and last book at 80. It is interesting that a considerable amount of fat was

essential. At the beginning of the experiment in a hospital metabolism ward Stefansson ate nothing but lean meat but after three days suffered from nausea and diarrhoea which disappeared after a further two days during which fat was added to the lean. A 22 year old medical student on an all lean beef diet in 1878 had a similar experience, having to abandon the diet after three days (Rubner 1879).

The absence of any signs of scurvy during a year of an exclusively meat diet is of considerable interest, for the food tables (Paul and Southgate 1978) state that vitamin C is absent from raw and cooked meat. Liver, kidney and sweetbread however contain 10-20 mg per hundred grams raw and their consumption in reasonable amounts would give an adequate supply. Stefansson's experience in curing scurvy by changing the diet of expeditioners from canned meat to fresh meat (Stefansson 1944) could be explained if they were given these offals as well as skeletal muscle, as could the cure of acute scurvy in members of Shackleton's Australian Ross Sea party in 1916 (Butson 1972) by a diet of fresh seal meat. However Stefansson says the only non-skeletal muscle material the men were given was bone marrow, though 'they may have had an occasional kidney or heart'. In addition to the glands mentioned, the food tables tell us that there are significant levels of vitamin C in tongue and heart. Its presence in appreciable amounts in these muscles in contrast to the skeletal muscle is an interesting anomaly. There is evidence that fresh rather than stored meat may contain about 2 mg ascorbic acid/100 g (Nicolaysen 1980).

Throughout recorded history it has been clear that, in the absence of economic stringency or religious prohibition, people have enjoyed eating meat, which would lead one to suppose that its position as a strongly preferred component of the diet was secure. There are, however, forces that go against this supposition and they must be considered.

To be a member of society involves abstinence from activities which would harm that society, and we are taught from infancy to abstain from a wide variety of activities which we would find pleasurable, such as assaulting our brethren, appropriating their goods, or hurling surplus food round the room. When we abstain we are told we are good and are often rewarded. From this may arise a durable feeling that to abstain is in itself praiseworthy. This diffuse conviction can be used as a social glue to bind groups together, and abstention from particular foods has been used by many religions as a means of demonstrating one's goodness, apartness from the infidel, and membership of a superior group. Its exploitation began early in the West - Pythagoras before 500 BC taught his followers to abstain from meat, and to believe in the transmigration of souls, as well as the interesting properties of the squares on the sides of a right angled triangle. Fasting was a discipline in the Christian church and at its least demanding level required abstention from meat one day a week. It was the Abyssinian Christians who went to the greatest extreme; the pious were enjoined to fast on no less than 250 days of the year, but the less devout could get by with only 165 days (Shack 1978). An early splinter group of the Roman Catholic church which wished to demonstrate that they were holier than their fellows decided that the only true diet was one of leaves. They called themselves the Foliatans and were, quite properly, at once suppressed by the Pope who declared leaves unable to nourish man's body (Bacon 1627). As the universal sway of orthodox Christianity began to dissolve, the doctrine of vegetarianism became a feature of sects whose principal interest lay in the reform of society. An early, and influential, prophet of revolution and vegetarianism was the poet Shelley in his long early poem 'Queen Mab' (Shelley 1813) which went through many editions in a widely distributed pamphlet form. His extensive notes included a lengthy plea for vegetarianism which included statements still heard today. He claimed for example that 'Man, and the animals whom he has infected with his society.... are alone diseased' while wild animals 'invariably die either from external violence or natural old age' - no epizootics for him! He claimed that 'There is no disease, bodily or mental, which adoption of vegetable diet and pure water has not infallibly mitigated, wherever the experiment has been fairly tried'. The last clause 'wherever the experiment has been fairly tried' is a defence against criticism familiar enough today.

Later in the 19th century vegetarianism was drawn into successful collaboration with both God and Mammon creating, with the aid of food technology, one of the few new food forms - the breakfast cereal. In due course it swept the world and eventually banished meat from even the Australian breakfast table. Shelley had published Queen Mab in 1813 and four years later William Metcalfe, an English dissenter, emigrated from Manchester to Philadelphia where he founded a vegetarian church - the Bible Christian Church - which was succeeded by an Adventist church. It was established in Battle Creek, Michigan and in 1860 adopted the name of Seventh Day Adventists; in that year W.K. Kellog was born in Battle Creek. His older brother J.H. Kellog began the manufacture of the first Battle Creek health food, Granola, in 1878; in 1895 the first wheat flake, Granose; and three years after the first corn flakes. The boom in cereal breakfast foods began about 1900 and never broke. W.K. Kellog took over the business side of affairs from his brother and was perhaps too successful for his coreligionists, for both brothers were excommunicated by the Adventists in 1907. It did not affect their health, for both died in their 92nd year - W.K. in 1951 (Carson 1959).

Three main factors with a predominantly ethical basis leading to a feeling that meat eating should be discouraged, or abandoned, currently motivate people towards vegetarianism or an approach thereto. They are a rejection of God's grant to man in Genesis (Bible 1611a) of dominion over animals coupled with a revulsion at the slaughter of animals, and an extension to sentient beings of man's ethical principles which has led to the declaration of animal rights. Lastly there is the belief that starvation and malnutrition in the world could be avoided by the use of agricultural land for producing plant foods rather than animal foods. Two further reasons for reducing meat consumption are based on what are

believed to be sound medical grounds. I shall discuss them in order.

Old Testament authority for eating meat is considerable and unequivocal. God said to Noah 'Every moving thing that liveth shall be meat for you' (Bible 1611b). This sweeping statement was modified under Mosaic law which identified those living things which might be eaten and those which might not (Bible 1611c). In the New Testament St. Paul adopted a detached attitude saying 'But meat commendeth us not to God; for neither, if we eat, are we the better; neither, if we eat not, are we the worse' (Bible 1611d). The eating of blood is condemned in both Leviticus and Deuteronomy (Bible 1611e,f) which is the basis today of the Watch Tower religious sect saying 'If one learns that his butcher does not properly bleed the animals sold for food, he wisely finds another place to do business or even refrains from eating those meats'. Furthermore sausages of all kinds are avoided by them as they may contain blood, or blood fractions, and of course they regard acceptance of a blood transfusion as prohibited to Christians (Anon 1961).

Revulsion at the slaughter of animals is probably inherent in most of us - controlled by those who have to do it, and completely dissociated from the eating of meat by the majority. It is a revulsion that can be awakened by those advocating vegetarianism as a way of life, rather than adopting it as a result of individual preference, and has been played on recently by those concerned with extending human rights to other sentient beings - most particularly at present if they are warm blooded though the campaign for the emancipation of fish has begun.

Singer (1983) has summed up the philosophical basis of animal liberation as follows:

> 'In considering the ethics of the use of animal flesh for human food in industrialised societies, we are considering a situation in which a relatively minor human interest must be balanced against the lives and welfare of the animals involved. The principle of equal consideration of interests does not allow the major interests of one being to be sacrificed for minor interests of another. Therefore the eating of animal flesh would appear to be incompatible with the principle'.

The principle of equal consideration of interests appears to have been formulated by Jeremy Bentham in the late eighteenth century and applied, naturally enough, only to men of different conditions and races. In the present climate of protest it is not surprising that 'speciesism' has joined sexism and racism in the demonology of today. Bioethics, if widely adopted, would not only reduce the demand for meat but also, by its effects on conditions of animal raising and restrictions on animal experimentation, increase its cost and slow development of more economic production methods.

There is no doubt that good agricultural land will yield more food per hectare for human consumption, if used for cereals and root crops, than if used to raise animals for meat. An early demonstration of this was provided by Germany in the First World War. The German authorities had been advised by the most respected nutritional physiologist of the time, Voit, that the army could only fight successfully and be adequately supported in the factories if it, and the population, had an adequate supply of animal protein in the national diet (Lusk 1922). He insisted agriculture should not be forced to change from its emphasis on animal production. Many historians believe that the increasing shortage of food from 1917 onwards that resulted from this policy was a major factor in the Allied victory in 1918. In the Second World War the lesson had been learned and there was, in the United Kingdom, a shift from raising animals for food to the production of cereal and root crops which enabled the country to survive the effects of submarine warfare on imports of foodstuffs. In the post war period, when wildly exaggerated prophesies of a world food shortage were current, Boyd Orr in 1950 stated 'A lifetime of malnutrition and actual hunger is the lot of at least two thirds of mankind' (Orr 1950). This became an article of faith for the concerned in affluent countries. The claim was based on his misunderstanding of the figures provided to him (Bennett 1954) and while embarrassing to FAO it was in its way useful. It was not until 1961 that FAO officially reduced the figure from over 66% to 10-15% and it took another 10 years to abolish the World Protein Gap by adopting a rational figure for protein requirements which had been established experimentally before the First World War (Tracey 1985). In that climate of concern there were many who pressed for a world-wide switch of emphasis to plant production away from animal production, in the belief that in this way the world's food problems could be solved. That policy had been successful in war time largely because of the favourable and reliable rainfall regime of Europe. The enthusiasts for a world wide change ignored the fact that very large areas of land in low rainfall areas are not suitable for arable production but can usefully produce animals for human food, as testified by the rangelands of Australia and the United States. It seems likely that agricultural practice balanced between animal and plant production will remain on a world basis for many generations to come.

We now come to what might be called the practical, rather than the emotional, objections to meat consumption at its present levels and in its present form. Both proposals rest on the belief that high levels of meat consumption can have a deleterious effect on health, bodily efficiency and longevity.

Since Hippocrates, regarded as the founder of medicine, the profession has found the contents of the lower bowel a fruitful source of blame for ill-defined conditions not easily assigned to clear cut causes. The discovery that meat on bacterial putrefaction gives rise to putrescine, cadaverine and other toxic diamines led to the supposition that this was a process likely to occur in the lower bowel and increase with time of residence there. Here was the explanation of all those malaises connected popularly with constipation, for the immediately comprehensible theory of autointoxication could explain most chronic human ailments since it was impossible to test experimentally. It was also the cause of the introduction of yoghurt into the Northern European and American markets. The reasoning was simple. The highest incidence of elderly peasants was in Bulgaria -

they ate yoghurt regularly - yoghurt was responsible for their longevity because the lactobacilli it contained were believed to hinder the multiplication of putrefying bacteria in the bowel - therefore the Bulgarian peasants did not suffer from autointoxication and lived longer - therefore eating yoghurt would not only prolong life but make it pleasanter by avoiding the multiform symptoms of autointoxication. Autointoxication could also be reduced by eating less meat, thus giving the bad bacteria less material to ferment to ptomaines, as the diamines were called. In fact ingestion of lactobacilli seems to have little, if any, effect on the make up of the bacterial population of the bowel. The other, and possibly harmful, fad that the theory of autointoxication brought with it was the practice of having one's colon washed out at regular intervals 'to rid the body of toxins'. You can still have it done in Sydney at five different establishments for $25-35 a time (Miskin 1988).

The old fear of autointoxication by ptomaines has been succeeded by a suggested causal link between a high consumption of meat and an increased risk of cancer of the colon (cancer of the rectum is a cause of worry for beer drinkers, not meat eaters). It is clear that colonic cancer rates are higher in countries with a high per capita meat consumption. In a study of 17 countries the correlation coefficient between rates of death from cancer of the large intestine and meat consumption was as high as 0.8-0.9 while cereal consumption was negatively correlated at about -0.7. Inversely, cancer of the stomach and liver were positively correlated with cereal consumption (Schrauzer 1976). These correlations are between consumption figures and cancer rates for large populations living in different environments at different standards of living. As pointed out at the beginning of this talk, meat consumption rises with increasing affluence while cereal consumption decreases. It is obvious that other factors will also increase with increasing affluence - pollution by polycyclic aromatic hydrocarbons, consumption of alcohol, tobacco and caffeine and a host of other possible influences of life style and environment. We can experiment on laboratory animals with a short life span and a different range of susceptibility to environmentally induced cancer, but we can only observe human populations and, where possible, use experimental results on laboratory animals to suggest explanations of our observations on human populations. Such explanations might, for example, include the observations that selenium acts as a cancer protecting agent in mice and that cereals are the main source of selenium in the diet, so that diets rich in cereals will contain more selenium than those rich in meat (Schrauzer 1976). Another is that exposure to polycyclic aromatic hydrocarbons is likely to be higher in affluent societies, which also enjoy a high level of meat consumption. There has been a study, however, in which individuals instead of populations have been observed to see whether cancer of the large bowel is related to diet. Married couples are likely to have more in common in their diets than randomly chosen couples of similar age and income. One would expect, if diet had a significant role in colonic cancer, that the spouses of individuals with that cancer would be more likely to suffer from it than individuals of the same sex, age and background as the unaffected spouse. A Swedish study of over a thousand spouses whose partner had died of large bowel cancer found their risk of dying from this cancer was no higher than that of a matched population (Jensen et al. 1980). That there are many obscurities in the evidence that is put forward for a relation between meat eating and large bowel cancer is evident. Kritchevsky (1981) concluded that colon cancer incidence cannot be directly related to any specific nutrient and points to the necessity of examining the contribution of environmental factors. A similar situation is found in the relation between coronary heart disease and the plasma cholesterol level.

Plasma cholesterol levels are influenced by diet. The most important dietary factor leading to raised blood levels of cholesterol is the content of saturated fatty acids - in particular the shorter chain saturated fatty acids - lauric, myristic and palmitic. Stearic is less effective and the monosaturated acids appear to have some influence in lowering levels. There is no doubt, however, that the polyunsaturated acids are effective. Cholesterol itself is synthesised in the body and the effect of dietary cholesterol on blood levels is not clear cut. Some individuals show appreciable increases in blood cholesterol levels when dietary cholesterol is increased, others do not (Grundy 1986). There has developed a clear consensus of expert opinion that it is desirable to reduce the amount of saturated fat in the diet. The primary means is, of course, to reduce the total fat in the diet and much is being achieved by a shift in public demand towards meat cuts with less obvious visible fat and this demand is being met by the industry in ways that will be familiar to you. Further steps to reduce the total consumption of saturated fatty acid involve substitution of saturates with polyunsaturates in cooking oils and fats.

There have been some calls for caution in advocating high intakes of polyunsaturated fats in view of the possibility of long-term undesirable effects becoming apparent. One reservation concerns a possible mode of action by which they might lower blood cholesterol levels. If their effect results in increased excretion of bile acids or neutral steroids into the gut then there is the obvious possibility that this might increase the level of carcinogenic steroid formation by the intestinal flora and increase the risk of colonic cancer. There appears to be a tendency for colonic cancer patients to have lowered blood cholesterol levels which may indicate an increased formation of bile salts from circulating cholesterol (Rose et al. 1974).

We live in an age of fear - fear that beneath the surface of past unquestioned practices lurk possibilities of evil - never of good. We are persuaded - and taught - that the old certainties of science are no longer to be trusted and that our trust must be in the quicksands of newly proclaimed 'certainties' that are increasingly being revealed by social science, opinion polls and the all too unrelievedly concerned commentators of the media. The frequent fatuities furnished by 'phone-ins' reveal real fears which have their origin in the media, that are nurtured by the media, and which are largely baseless, but fuel the flames of further unreason. Sanity, appeal to experience, logic and factual evidence are regarded as old hat, dull and unexciting and, worse, will not increase

circulation or a Nielson rating. This all pervading negative attitude towards all aspects of life today except for the spectacles of sport, the more conventional aspects of sex, and the spectacles of political point scoring has of course affected the public attitude towards food and nutrition. In the last decade air, water, sunshine and all foods have been damned for the conceivable risks that might be incurred by exposure to them and meat has not escaped. One fact remains - we need them all and shall continue to do so.

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