FARMING ANIMALS FOR FOOD:

TOWARDS A MORAL MENU

The third report published by

FOOD ETHICS COUNCIL
THE INDEPENDENT COUNCIL FOR ETHICAL STANDARDS IN FOOD AND AGRICULTURE

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The Food Ethics Council: General Aims

In 1998, in response to an initiative from the Farm and Food Society, the Joseph Rowntree Charitable Trust made funds available to establish the Food Ethics Council; a group of independent individuals (see right: Council Members) chosen to provide the range of expertise needed to address the following aims.

Our aims are to:

- Review developments in food and agriculture within a sound framework of practical ethics which addresses the principles of wellbeing, autonomy and justice with respect to consumers, producers, farm animals (where relevant) and the living environment
- Promote the incorporation of ethical thinking into decision-making in agriculture, food manufacturing and retailing
- Produce authoritative, well-researched reports, which highlight ethical concerns and make recommendations for action

Members of the Food Ethics Council

Ms Helen Browning: Organic farmer; Chair of the Soil Association
Prof Ruth Chadwick: Chair of Bioethics, University of Lancaster
Prof Paul Ekins: Director of Forum for the Future; and Dept of Environmental Social Sciences, University of Keele
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Prof Jules Pretty: Director of the Centre for the Environment and Society, University of Essex
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Background

The aim of the report was to review the current state of animal farming for food in the UK and to assess the ethical impacts of two alternative paths which it might follow in the coming decade or so. As in previous reports, it was decided to use the framework called the Ethical Matrix to explore these impacts in a manner which might be broadly comprehensible to a lay readership.

The report was written by Ben Mepham, who researched the subject and consulted with other Council members and with those listed in the Acknowledgements. Evidence in the form of questionnaire responses was received from a number of people who had been chosen for their known (divergent) views on the use of animals for food.

The report has been endorsed by the full Council membership.

ACRONYMS

AI - Artificial Insemination
BLUP -best linear unbiased prediction
BOD - mg/l of oxygen needed to permit microbial breakdown
BSE - Bovine Spongiform Encephalopathy
BST - bovine somatotrophin
CHD - coronary heart disease
CAP - Common Agricultural Policy
FAWC - Farm Animal Welfare Council
FSA - Food Standards Agency
FAO - Food and Agriculture Organisation of the United Nations
GM - genetically modified
HAS - Hygiene Assessment System
HSA - Humane Slaughter Association
IACR - Institute for Arable Crops Research
IMD - instantaneous mechanical destruction
IFPRI - International Food Policy Research Institute
LEAF - Linking Agriculture and the Environment
MAFF - Ministry of Agriculture Fisheries and Food
MAS - Marker Assisted Selection
MHS - Meat Hygiene Service
MOET - multiple ovulation/embryo transfer
MRL - maximum permitted residue level
MRM - mechanically-recovered meat
NHS - National Health Service
nvCJD - new variant Creutzfeld-Jakob Disease
OVS - Official Veterinary Surgeon
PPM - non-product related process and production method
RSPCA - Royal Society for the Prevention of Cruelty to Animals
SRM - Specified Risk Material
SPS - Sanitary and Phytosanitary measures
SVS - State Veterinary Service
UKROFS - United Kingdom Register of Organic Food Standards
WATO - Welfare of Animals (Transport) Order, 1997
WASK - Welfare of Animals (Slaughter or Killing) Regulations, 1995
WTO - World Trade Organisation

Executive Summary

1. The use of animal products in our food raises a number of ethical concerns. Food safety, animal welfare and environmental impacts of intensive systems, new biotechnologies applied to farm animals, and the increasing resources directed to farm animals in developing countries have all become matters of increasing concern.

2. The report surveys the issues raised in production of meat, milk and eggs, and their processed products, throughout the *animal products food chain* from 'farm to fork'. Notable recent improvements, nationally and internationally, are recognised, but there is continuing concern over many links in the chain.

3. A framework, the Ethical Matrix, is employed to analyse these issues in a structured, transparent manner, with the aim of facilitating decision-making, at personal and political levels. The framework permits examination of the ethical impacts of adopting different animal production systems for farm animals, farmers, consumers and the living environment. It is used in the report to consider two possible alternative scenarios: application of the *High-Tech* approach to animal production (entailing use of multiple ovulation/embryo transfer, genetic modification and cloning) and the *Holistic* approach, which is exemplified by organic farming.

4. Our analysis suggests that although the *High-Tech* approach may prove effective in producing standard, low cost products for the mass market, it is likely to entail major costs in terms of reduced animal welfare, adverse effects on the environment and erosion of social and economic sustainability.

5. Our analysis of the *Holistic* approach, using organic farming as a yardstick, suggests that its wide scale adoption would respect many of the principles identified in the Ethical Matrix when compared with the intensive systems of animal production now dominant in the UK and other Western countries. Currently, its major drawbacks are the higher cost of food produced and the financial constraints on farmers wishing to convert. However, these systems utilise resources in much more ecologically sustainable ways than the current intensive and projected *High-Tech* approaches. Hence, in the long run, they could produce food more economically.

6. We suggest that humans have an obligation to manage the fate of non-human sentient animals in ways which respect their welfare and intrinsic natures, and the environment which we share with them, but which take due account of matters fundamental to the human condition, such as nutritional, evolutionary, ecological, economic and cultural factors. Ameliorating many of the ethical concerns identified would be facilitated by envisaging a notional *contract* with farm animals, which requires us to repay the benefits we receive from them by ensuring, as far as possible, that we care for them respectfully and compassionately.

7. Veganism offers a possible solution for some people, but we do not see vegetarianism as a complete answer to the dilemmas we face, since it too depends on animal use. However, as a consequence of the strategies we advocate for a more humane attitude to animals the overall consumption of animal products, at least in Western counties, would be substantially reduced.

8. The report makes a number of recommendations of ways in which the identified ethical concerns might be addressed. At the philosophical level, there is a need to explore the legal implications of the EC Protocol on Animal Welfare (defining farm animals as sentient beings and not as agricultural products). In particular, proposed biotechnological innovations such as GM and cloned animals need to be subjected to ethical analyses in the light of this principle.

9. The UK Government should press for changes in international law to improve animal welfare, for example, by the introduction of mandatory labelling of food products based on the welfare conditions under which the animals were raised, and by introduction of import restrictions based on exemptions specified under Article XX of WTO rules. However, the Government should also seek greater international support for improving public health and animal welfare standards in developing countries, both to facilitate international development and to promote sustainable and fair trade.

10. The Government should press for changes to the EU Common Agricultural Policy to ensure that in future payments do not encourage intensive animal production and are linked to improved animal welfare and environmental standards.

11. Increased government support for sustainable systems, such as organic farming, is required, not only to assist farmers to convert, but also following conversion. This subsidy will make good sense in terms of economics, public health and the environment.

12. There is a need to change the emphasis, both in research, to divert funds from animal biotechnology projects towards sustainable farming systems, and in education, to encourage the adoption of more holistic approaches to our use of animals as sources of food.

1. INTRODUCTION

This report deals with a very large subject: nothing less than the ethical issues raised by the human use of animals as a source of food. It takes on this wide remit because the full significance of the recommendations we wish to make is only apparent if one examines the whole enterprise from 'farm to fork'. Of course, in seeking such a comprehensive overview we have had to forgo detail. However, a number of recent publications on specific aspects of the subject (such as animal welfare concerns, environmental issues, modern animal biotechnologies and food safety) are available (and listed in footnotes) for those who want a fuller documentation.

In the years immediately post-World War 2, there was little public concern for the issues raised in this report. Cheap, nutritious food for war-weary citizens, and an improved standard of living for farmers, were the major, and essentially unchallenged, priorities. Coupled with the need for more land for housing and factories, and the increasing application of scientific principles to all industrial activities, the result was an intensification of farming across the board. This led to the provision of plentiful, affordable food, while the use of antibiotics and other growth promoters, and an increase in mechanisation, allowed farmers to manage many more acres and more animals with fewer staff. From the 1950s onwards, the pig and poultry sectors underwent particularly rapid intensification, because these animals proved amenable to the, so-called, 'factory farming' approach.

It was the late Ruth Harrison's 'Animal Machines'[1] which first alerted the UK public to the dire effects of factory farming on animal welfare, and the Government lost no time in setting up an enquiry into the matter under the chairmanship of Professor Brambell. Although, 35 years later, a number of the recommendations of the Brambell Report[2] have been implemented, the ways in which many animals are farmed remain a matter of deep public concern. Certainly, over the last ten years, alarming news stories about farm animals and their food products – BSE, Salmonella, live exports and GM animals (to name but a few) have frequently hit the headlines. The reasons for this renewed interest seem to fall under the following headings:

- the change from, so-called, supply-side concerns (ensuring ample food at affordable prices for all) to demand-side pressures (the quality of food products and acceptability of the ways they have been produced), probably associated with the low average percentage of income which is spent on food

- concern over food safety due to high profile food scares, such as BSE, Salmonella and E Coli 0157

- raised awareness of the adverse effects of intensive animal production systems on animal welfare and the environment

- apprehensions about new technologies (such as GM crops, GM salmon and cloning) which raise deep concerns about the morality and/or wisdom of so radically altering the nature of sentient animals

- concerns that little research these days is genuinely in the public interest but is often strongly influenced by commercial agendas: moreover, this growing privatisation of knowledge, and the associated biotechnologies (exercised largely through patents), means that a very few, very powerful multinational companies are exerting increasing control over the global food system

- the increasing popularity of vegetarianism in some Western countries, largely due to a combination of the above concerns

- a greatly increased demand for animal products in developing countries, which, together with a progressive globalisation of trade in food, raises many ethical concerns relating to sustainability and equity, and to the improvement of animal welfare, food safety, working conditions and protection of the environment.

Mindful of such concerns, we aim in this report to take a synoptic view of the whole process, to see where there is room for implementing more ethically acceptable practices. We recognise that attempts to bring about radical change are often constrained by powerful political and economic forces. But amelioration is evidently possible, and it is our hope that the analysis and recommendations presented here will augment the efforts of many others in making change for the better a reality.

1.1 A Rationale for Animal Use

The main purpose of this report is to make recommendations, supported by reasoned arguments, for changes in the way in which animals are used as sources of food for human consumption. These are practical concerns demanding urgent attention. Yet, in order to appreciate the reasoning we have applied there is first a need to consider aspects of the relationship between humans and the animals we use as sources of food. So, this section amounts to a comment on the appropriateness of any (as opposed to all) forms of human use of animals. As such, it challenges the vegan claim that we should avoid all products of animals, including, for example, honey.

The most basic concern is that farm animals should be accorded appropriate respect, consistent with their status as fellow sentient

1 Harrison R (1964) Animal Machines. London: Vincent Stuart
2 Brambell F W R (1965) Report of technical committee to inquire into the welfare of animals kept under intensive husbandry conditions. (Cmnd. 2836) London: HMSO

beings. As a form of words, this will surely be universally acknowledged: the critical issue is how one interprets the word 'appropriate'.

In order to survive, all of us, including vegans, have to consume material derived from other living organisms. So a crucial constraint is the degree to which it is considered acceptable to exploit other sentient beings, given that this will almost inevitably offend their welfare and/or their 'rights' (assuming, for the present, that they have 'rights'). Although farm animals are different in very many ways from people, they almost certainly have analogous mental experiences. Indeed, there is overwhelming evidence, founded in common sense, and enshrined in law, that all the mammals and birds we farm for food are sentient beings with the capacity to experience the pleasures of food, comfort and social company and to suffer the distress of pain, anxiety and disease.

Moreover, modern molecular genetics confirms what has become increasingly apparent over the 150 years since Darwin first proposed his Theory of Evolution, i.e. the genetic continuity between humans and non-human beings. Not only do we share 98% of our genes with higher apes but scientists are planning to use organs from pigs (with but minor genetic modification) in human transplant surgery.

Does it then follow that animal use for food is thoroughly discredited from an ethical perspective? Several arguments are considered below to explore this proposition. The aim is to consider whether a reasonable and humane person would be compelled to avoid all relationships with animals from which some human benefit is derived. Certainly, the arguments advanced do not aim to justify the abuses to which animals have been subjected, most notably in modern factory farming systems, as will be apparent later in the report.

In considering human-animal interrelationships, there are a number of issues that might, for present purposes, be classed as *facts of life*. We label them *nutritional, evolutionary, ecological, economic* and *cultural* considerations.

1.2 Nutritional Considerations

Meat eating certainly goes back a long way. There is evidence that our forebears were hunting animals for food two million years ago, and although historians can point to some early references to vegetarianism, it never appears to have found widespread support. According to the eminent anthropologist Marvin Harris, probably no more than 1% of the global human population is vegetarian by choice, and no more than 0.1% is vegan.[3]

There are clearly some nutritional advantages from consuming animal products. Thus, meat and fish provide several nutrients that are scarce or absent from common foods of plant origin and these include iodine, taurine, vitamin B12, vitamin D and (certain) long-chain polyunsaturated fatty acids. Meat is an important source of iron in the diet and the haem form is particularly well absorbed.[4] This means that vegans and certain vegetarians may experience difficulties in meeting nutritional requirements. For example, those who eat large amounts of unrefined, unleavened cereals (e.g. brown rice and chapatis) may have problems with absorbing certain minerals, which may lead to iron-deficiency anaemia and rickets.[5] These might be called 'nutritional facts of life'.

However, dietary impacts on health are much more complex than can be described simply in terms of the absence or presence of meat or other animal products in people's food. Thus, compared with non-vegetarians, Western vegetarians have a 25% lower mortality from ischaemic heart disease and a lower risk of suffering from constipation, gallstones and appendicitis. No differences in mortality from common cancers have been established, but overall the data suggest that widespread adoption of a vegetarian diet could prevent approx. 40,000 deaths from heart disease p.a. in the UK.[6] Even so, vegetarians do use animals products (and some even eat certain meat products), so that such data do not fundamentally challenge the claimed 'facts' suggesting a human dependence on animals.

Of course, it is occasionally possible to 'break the rules' (and modern biotechnology, in the forms of genetic engineering and cloning, makes a habit of doing so). Thus, in modern Western society, a combination of detailed knowledge of nutritional requirements, access to multiple sources of food supply and high incomes means that veganism has become a viable option for certain people. And it is also true, of course, that some people in non-Western countries have traditionally practised veganism.

3 Harris M (1986) Good to eat: riddles of food and culture. London: Allen and Unwin
4 Sanders T A B and Reddy S (1994) Am J Clin Nutr 59. (suppl) 1176S-81S
5 See note 4
6 Ket T J et al (1999) Proc Nutr Soc 58. 271-5

1.3 Evolutionary Considerations

There is a recent tendency to idealise the Natural World and to attribute its ills to human thoughtlessness, or worse, exploitation. While this charge may have some justification, it ignores not only the enormous suffering which is the fate of much wildlife (where many animals are simultaneously both predators and prey) but also what might be called the evolutionary facts of life - that humans and the animals we have domesticated have undergone a process of co-evolution. Thus, "in an evolutionary sense" modern farm animals (and domesticated animals more generally) can be said to have "chosen us as much as we chose them".[7]

Their characteristics of docility, lack of fear and high reproductive capability would have encouraged their voluntary association with humans, from whom they would have derived food (initially from scavenging) and protection from both climatic extremes and predators.

According to this view, humans are not "arrogant despoilers and enslavers of the natural world, but part of it, and the custodians of a remarkable evolutionary compact among species". The consequence has been nothing less than the emergence of civilised society, in which animals' muscular power and their contribution to a nutritious diet released our ancestors from a constant preoccupation with survival and permitted the emergence of a role-differentiated society in which art and science could flourish.

Moreover, domesticated animals have undergone marked evolutionary changes which, in many cases, make them totally dependent on human care, having largely lost their adaptation to the wild. Their instincts of dominance and territoriality have become greatly diminished and their physical defence mechanisms atrophied. The much reduced flying ability of domestic fowl is a prime example.

So it would be a totally perverse act, resulting from a misguided sense of compassion, to attempt to return such domesticated animals to 'the wild', even assuming such territory could be found. They simply could not survive. The evolutionary fact of life is that, for all practical purposes, humans now have global control over both domesticated and wild species of animals. The lives of people and farm animals are inextricably entwined as a consequence of our co-evolution, and an important step to improving the lot of both the suffering people and the suffering animals in the world is to recognise that fact.

1.4 Ecological Considerations

Traditionally in the West, and still for the vast majority of people in the world today, animals are essential elements of a sustainable agriculture. Thus, they play key roles in integrated farming systems, maintaining soil fertility through their production of manure and efficiently utilising crop by-products. Ruminant animals, such as cattle and sheep, can bring into productivity land which is otherwise too poor, erodible or difficult to cultivate, while by converting fodder such as grass, inedible by humans, into nutritious food in the form of meat and milk, they sustain human populations on land which could not easily support them from plant foods alone. While poultry and pigs are not able, like ruminants, to subsist on plant cell walls, they can scavenge feed material inaccessible to humans and convert it into human food.

It has been claimed that, in future, a world without farm animals will be able to support a healthy global population – that *global veganism* is a feasible proposition.[8] The reality now is that animals perform crucial roles in the 'human food chain', and are likely to do so for years to come: this is, whether we like it or not, an ecological fact of life.

However, the particular ways in which many animals are currently produced and kept in intensive systems are decidedly *not* sound from an ecological perspective. Excessive use of fossil fuel inputs in producing, transporting and delivering feed to housed animals, together with major environmental problems associated with the disposal of their wastes, often totally undermine the advantages described above.

1.5 Economic Considerations

A major reason why farm animals are kept is that they provide us with desirable products. And whether or not, in developed societies, they provide irreplaceable components of a healthy diet (which the existence of healthy vegans appears to question), for the vast majority of people animal products, in the forms of meat, milk and eggs, have long been common dietary ingredients.

Outside developed Western societies the roles of animals are often even more fundamental. Animals provide traction power (for pulling the plough and general transportation), fuel (as dung) and fibre (as wool, bone and leather). World-wide, the activities of many societies revolve around the use of animals, which thus have enormous economic importance. This is an economic fact of life. Millions of people's lives and livelihoods depend on the farming of animals for food.

7 Budianski S (1992) The Covenant of the Wild. London: Weidenfeld and Nicolson
8 M.Gold (1999) In: The Meat Business: devouring a hungry planet. eds. G Tansey and J D'Silva. London: Earthscan

1.6 Cultural Considerations

A case can also be made for our relations with animals being a vital ingredient of human culture. It is a point which underlies the above discussion, but also goes beyond it. John Hodges, former head of 'animal breeding and genetic resources' at the United Nations Food and Agriculture Organisation (FAO), expresses the views that: "the historic interrelationships of animals and people deeply influenced the way in which people see life – giving society its world view", while "In rural society, domestic animals provide the most personal and intimate connection people have with nature." Hodges notes: "We are enough like animals to be kept humble; we are different enough from animals to be aware of our unique responsibility as 'husbandmen' of the natural world." Undeniably, then, farm animals have been part of our culture, appreciated not only for the food they provide but also for their contribution to a commonly perceived 'natural order'.

However, this is a view that we in the West have all but lost. Our values are instead now focused on material prosperity, economic growth, GNP and the rights of individuals to do as they please with the rewards of their labour and investment. Inevitably, in democratic societies, such values shape government policy and legislation. But a growing number of people are beginning to see that these narrowly focused values, with their emphasis on instant personal gratification, are a recipe for disaster.

To quote Hodges again: "We, in the West, need to ponder the deeper implications of the lost relationship of western civilization with the environment, with domestic animals, with each other in our communities and with other societies on earth. I believe better understanding of these relationships is a key to future options."[9] This might be termed a 'cultural fact of life'.

1.7 Taking Life

In virtually all forms of livestock farming, whatever the primary purpose (e.g. milk, eggs or wool), animals are ultimately killed and their flesh consumed as meat. Sometimes, when they serve no 'useful purpose' (such as day-old male chicks) they are dispatched summarily. In other cases, they live very short lives because meat from young animals is tender and/or because economics appear to require it.

What factors determine whether it is right or not to kill a sentient animal? The list of justifications for killing other humans goes something like this: in self-defence; in a 'just' war; (sometimes) out of compassion (euthanasia); and, for a substantial number of people, as a punishment for a capital crime. At the other end of the scale, many believe it right to kill vermin, such as rats; few have any scruples about killing insects, particularly if they are a 'nuisance'; and almost universally it is considered that we have an obligation to kill bacteria which cause infectious diseases.

Farm animals clearly lie somewhere in between these two extremes. In that they are qualitatively different from people, almost everyone considers that we have lesser ethical obligations to them. For example, it is generally accepted that it is right to 'put out of their misery' animals that are seriously injured or terminally sick. When human needs demand it (e.g. to alleviate starvation) most would endorse killing animals, while even less acute problems, such as ill-health, which could be remedied by consuming animal products, usually also provide adequate justification. Hence, almost without exception, people advance certain reasons to exempt themselves from a *prima facie* obligation not to kill others, whether humans or animals.

With farm animals, another form of justification might be cited. Since they have been domesticated from the wild state, they are, so to speak, products of human initiative and investment - existing solely because people have bred, fed and managed them. In the wild, their chances of living full, healthy lives might be decidedly slim: more likely they would fall victim to predation, disease or injury. In that sense, human intervention might be seen as enhancing animals' chances of a good life, although the price (as in the wild) is death. Yet in none of these cases is there any justifiable reason for treating animals with wanton cruelty or in other ways which demean their 'dignity' as sentient beings, sometimes called their 'intrinsic nature'.[10]

Thus, the arguments advanced for justifiable killing of animals can be said to depend on: i) having a good (perhaps vital) reason; ii) ensuring, as far as possible, that the animal has led as good, or better, a life than it is likely to have done in the wild; iii) ensuring that the animal is not treated cruelly at any stage; iv) respecting the animal's intrinsic nature.

It is obvious that frequently these conditions are not met adequately. Failure to satisfy conditions ii), iii) and iv) is documented in many sections of this report. 'Good reason' (condition i) is open to a wide range of opinions, not all of which are easy to categorise. For example, a vegan responding to our questionnaire approved of medical experiments involving animals, while a 'vegetarian' respondent had abandoned a vegan diet for health reasons and admitted now to eating eggs, dairy products, fish and, occasionally, pheasant.

9 Hodges J (2000) In: Livestock, ethics and quality of life. eds. J Hodges and I K Han. Wallingford: CAB International
10 Mepham T B (2000) J.Agric and Env Ethics 13, 65-78

1.8 Conclusions

The aim of this section has been to explore whether there might be a *prima facie* utilitarian case for using animals for food. That is to say, do the benefits of our use of farm animals outweigh the costs? On that basis, in terms of the nutritional, environmental, ecological, economic and cultural advantages which accrue to people and the protection afforded to the animals, it is suggested that an ethical case might be made for this practice, at least for some systems. Thus, at the most benign end of the spectrum, most people would consider it ethically acceptable to use the milk of cattle if they were well-cared for, allowed to express their full range of behavioural instincts (including suckling their young), were given appropriate veterinary care when necessary and allowed to live out their normal lifespans, their humane killing being occasioned only to relieve their suffering. Of course, even this practice would be considered unethical by vegans – and had we thought the vegan argument persuasive, there would have been little else to be said.

No mention has been made so far of the vegetarian position. This is for two main reasons: firstly, because it is open to so many different definitions (some of which allow the consumption of certain types of meat), and, secondly, because vegetarians (as distinct from vegans) do consume animal products (eggs, milk and dairy products), and are thus included in the arguments advanced above concerning the utilitarian justification for animal use. So, while some vegetarians may avoid all meat, they do not thereby escape full responsibility for the way the animals who provide their food must live and die. In a sense, unless they are vegans, they rely on others to eat meat for them. Of course, in a utilitarian sense, where what is important is the weighing of costs and benefits, vegetarian practices may significantly reduce overall animal suffering. But the fact that the same might be true of a meat-eater who eats only small amounts of meat, from animals raised and slaughtered under the most humane conditions, blurs the ethical distinction which is often drawn between these two practices.

It also needs to be recognised that even vegan diets and/or lifestyles are not immune from criticism in terms of their ethical impacts on animals. Thus, intensive crop production systems, industrial activities, collisions with road vehicles, and predatory activities of companion animals, can all have adverse effects on wildlife, both as individuals and at the species level.[11]

However, in a comprehensive ethical analysis (such as that based on the concept of the *common morality* to be discussed in section 3), other considerations apart from those classed as 'utilitarian' need to be taken into account. In the following sections of this report we proceed to an examination of the way in which specific agricultural practices might modify the *prima facie* case presented above.

Inevitably, the analysis is conducted largely from a UK, or sometimes EU, perspective. That does not, of course, imply that local concerns necessarily merit any priority, but rather that in seeking change we need to start from where we are. Indeed, in a shrinking world in the throes of economic globalisation, any sort of insularity would be as foolish as it was chauvinistic.

2. THE ANIMAL PRODUCTS FOOD CHAIN

2.1 Introduction

The process in which animals are now used for food (from 'farm to fork') in Western industrialised countries like the UK consists of a chain of inter-locking stages, each of which raises its own type of concerns (see Figure 1). The entire process might be referred to as the *animal products food chain*. Its operation is governed by the outcome of a tension between commercial objectives, consumer demands and ethical concerns. Because market forces have a tendency to marginalise factors which reduce profitability, it has long been considered necessary for governments, particularly in developed countries, to protect consumers from practices which threaten food safety, farmers from excessive fluctuations in market prices, and farm animals from procedures which reduce their welfare. Government regulation is thus often the means by which ethical concerns are recognised and ameliorated.

Intensive, high output farming of animals is the dominant way in which animal products are produced from pigs and poultry, but certain types of livestock farming remain substantially extensive, such as some of those using sheep and beef cattle. Dairy farming lies somewhere between these two extremes. At any one time about 215 million animals are kept on UK farms[12] (nearly four for each UK citizen), but the total number produced in a year is much larger: 800 million poultry and 15 million pigs were slaughtered in 1999. These intensive systems bear little resemblance to the former, traditional, systems of farming.

The breeding of farm animals, especially poultry and dairy cows, is often conducted by artificial insemination to aid management and to allow selective breeding. This provides much greater human control in achieving predetermined aims. Young pigs and chickens, genetically selected for desired traits such as growth rate or egg laying ability, are kept in artificial environments, avoiding the

11 Sainsbury AW et al (1995) Animal Welfare 4, 183-206
12 MAFF Statistics (2000) Website: http://www.maff.gov.org

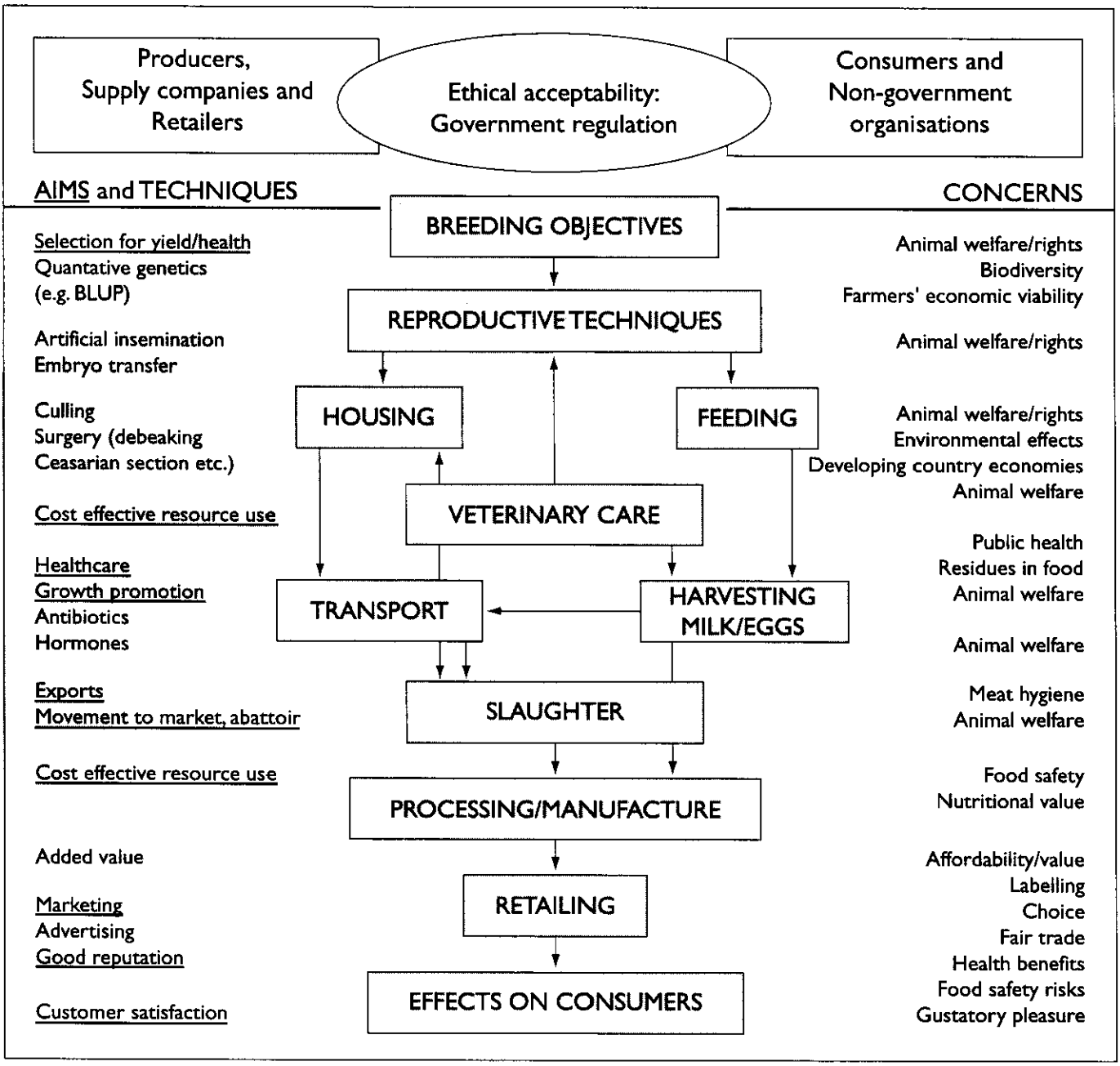


Fig. 1

The Animal Products Food Chain

Features of the standard animal-products food chain in the UK, illustrating (on the left) the principal aims (underlined) and techniques employed at different stages (centre panel) and (on the right) common concerns expressed. The major determinants of the way the chain operates, including commercial, regulatory and consumer pressures, together with standards of ethical acceptability, are shown at the top.

climatic variability which reduces productivity. Economies of scale demand that stocking rates are high, so that 30,000 broiler chickens may be housed under a single roof, and under the supervision of a single stockperson.

These animals, selected over generations for maximum growth rate and efficient conversion of feed into meat or eggs, achieve slaughter weight much earlier than hitherto, while adverse effects on health of overcrowding are often counteracted by routine prophylactic treatment with various drugs including antibiotics. The concentration of animals in small spaces has important environmental implications because of the problem of disposing of their excreta, while the specialised nature of farms means that feed is often transported long distances: indeed, often it originates from crops grown in developing countries.

Virtually all farm animals end their lives in an abattoir. Except for Halal or Kosher meat, slaughter has conventionally been a two-stage process. The intention is first to render the animal unconscious (without stopping the heart) by concussion, electrical stimulation or gas stunning, then bleed it to death before it recovers. However, recent research has shown that a beating heart is not essential to the bleeding process, and newer humane slaughter procedures aim to stun and kill in a single action. Workers in abattoirs encounter the intrinsically difficult problem of handling meat for human consumption in an environment containing potentially hazardous material (gut contents, faeces, soil encrusted skin), so that high standards of hygiene are required to prevent contamination of the meat.

Although some meat and other products are consumed without further modification, much food of animal origin is processed in various ways. This may simply consist of heat treatment, as in the case of pasteurised full-fat milk, but it often entails extensive modification in food factories, in which meat is incorporated into pies, sausages or convenience foods. Consumers are often not fully aware of the contents of the food containing animal products that they buy, partly through poor or deceptive labelling, and partly because legal definitions of words often do not correspond to their commonsense usage. But without doubt, consumption of animal products can have profound effects on people's health, both positively and negatively. Apart from food's nutritional qualities, it can also be the source of infectious diseases, such as Salmonella, particularly if improperly handled and cooked.

2.2 Links in the Chain

In the following sections, we consider the separate stages of the animal products food chain in more detail, in order to identify some of the features which affect the ethical analyses to be performed below. In the space available, the account cannot, of course, be comprehensive. So the aim is to provide illustrative examples of common features. Moreover, the allocation of the issues under separate headings is somewhat arbitrary because several links in the chain are highly interdependent. Because animal welfare and food safety are pervasive concerns, it is useful to identify the major UK legislation on these at the outset (see Box 1). Moreover, as veterinary care is so fundamental to many stages of the chain, its essential features are summarised in Box 2.

2.3 Breeding

There are two main aspects: i) the choice of breeding objective: ii) the reproductive techniques employed.

2.3.1 Breeding objectives

Recent developments in genetics, coupled with advances in statistical methods and computing systems, have enabled detailed analysis of how specific traits are inherited. Statistical techniques such as BLUP (best linear unbiased prediction) mean that, for example, the performance of a bull may be assessed from the milk yields not only of the cows sired by the bull but also from all their female relatives, no matter how distantly related. This is particularly valuable to breeders of species which breed slowly, such as cattle and sheep, because selective breeding can now be performed in most farm species with a high degree of precision.

Perhaps most importantly, our current knowledge of genetics allows breeders to chose the types of animal they want, almost to order. Thus, until recently, 50-70% of selection pressure in intensively reared broiler chickens was directed to rapid juvenile growth. As a result, growth rates more than doubled (to over 40 g/day) in the period 1965-1995. In the last 10 years alone, the weight of a 42 day old broiler (its slaughter age) has increased 17% to nearly 2 kg, while the amount of feed used to produce it has declined by 7%.[13]

However, these enormous increases in productivity have come at a severe cost to animal welfare. Leg weaknesses are very common in such intensively reared birds, e.g. tibial dyschondroplasia, femoral head necrosis and dislocated hock joints. Such conditions, which may affect a fifth of animals by the time they reach slaughter age, severely impair their ability to walk or run: in the worst cases they cannot even stand. Another consequence of rapid growth rates is cardiac failure, as the heart is unable to meet the demands placed on it.[14]

13 Sandoe P et al (1999) Animal Welfare 8, 313-28
14 Rauw W M et al (1998) Livestock Prod Sci 56, 15-33

In dairy cattle, genetic selection for milk yield, together with other practices, such as concentrate feeds, have resulted in a doubling of the average milk yield over the last 50 years (to nearly 6,000 litres/annum).[15]

But again, there have been some severe adverse effects on animal health, for example, reflected in increased incidences of mastitis (udder inflammation), lameness, digestive disorders, metabolic diseases (such as milk fever and ketosis) and calving difficulties.

2.3.2 Reproductive techniques

2.3.2.1 Artificial Insemination (AI): This technique has been in commercial use for over fifty years, and is used extensively in the UK dairy industry, in which over two thirds of cows are bred by the exclusive use of AI. It is also used for sheep, often for pigs and in virtually all poultry and turkey breeding. As well as being a tool for genetic improvement, AI permits more effective control of diseases.

In cattle, semen is collected by arranging for a sexually-aroused bull to ejaculate into an artificial vagina, generally at an AI centre but occasionally on farms. Insemination is achieved by passing a catheter containing the semen (previously stored in the frozen state) through the cervix of the cow. The technique requires the development of skills through training, but performed expertly it does not usually entail anaesthesia or sedation. Non-veterinarians must obtain an official licence to perform AI. While animal welfare might be compromised by the procedures of semen collection and insemination, the natural mating process is not free of such concerns, especially where there is a large mismatch in the sizes of cow and bull. However, some people consider that this highly instrumental use of animals respects neither the natural dignity of the animals themselves nor that of those who perform it.

In pigs, semen collection is similar to that in cows, e.g. the boar mounts a dummy sow before ejaculating into an artificial vagina. However, in sheep, the cervical route of insemination is less successful, and the more usual technique is laparoscopy (key-hole surgery) to deposit semen in the ewe's uterus.

In poultry, semen is obtained by pressing the male abdomen near the vent to 'milk' the semen. Insemination involves inserting a

BOX 1

ANIMAL WELFARE LEGISLATION

- *The Protection of Animals Act 1911, as amended, contains the general law relating to cruelty to animals, while the Agriculture (Miscellaneous Provisions) Act 1968 provides further protection to all farmed livestock on agricultural land.*
- *More detailed legal requirements are laid down in secondary legislation, such as the Welfare of Livestock Regulations 1994, as amended.*
- *On August 14th 2000, the new Welfare of Farmed Animal Regulations came into force in England (similar legislation is being drawn up by the devolved authorities), which implement the EU General Directive (98/58/EC). The Directive requires, for the first time, that minimum welfare standards for farmed animals must be met by all EU states. More specific regulations are discussed below, as appropriate.*

FOOD SAFETY LEGISLATION

Legislation is governed principally by the Food Safety Act (1990), together with more recent specific regulations concerning, for example, meat hygiene and GM foods. Since April 2000, food safety in the UK has become the responsibility of the Food Standards Agency (FSA) which was created to: "protect public health from risks that may arise in connection with the consumption of food, and otherwise to protect the interests of consumers in relation to food." The FSA coordinates the activities of a number of groups and divisions, e.g:*

- *Food Safety Policy Group: Additives and Novel Foods Division, Animal Feed Division, Chemical Safety and Toxicology Division, Contaminants Division, Food Chain Strategy Group, Nutrition Division; Microbiological Safety Division*
- *Enforcement and Standards Group: Food Labelling, Standards and Consumer Protection Division, Meat Hygiene Division, Veterinary Public Health Unit*
- *The Meat Hygiene Service is an Executive Agency of the FSA*

** http://www.foodstandards.gov.uk*

15 See note 12

pipette into the female cloaca. The almost universal use of AI in turkeys is largely due to the fact that selective breeding has resulted in their reaching such a size that they are incapable of breeding naturally.

AI in cattle and pigs is controlled by specific regulations, e.g. the AI of Cattle (Animal Health) Regulations 1995, as amended, and AI of Pigs Regulations, 1964. Laparoscopy in sheep and goats can only be performed by veterinary surgeons under the Veterinary Surgeons Act 1966 but there are no specific regulations controlling the technique of AI in these species, or in the case of poultry.

2.3.2.2 Multiple ovulation/embryo transfer (MOET) is a means by which genetic changes induced in the female can be readily propagated. In cattle, multiple ovulation (superovulation) involves the injection of hormones into cows to increase the ovulation rate (up to 20), followed some days later by more hormone injections to cause luteolysis. However, responses are variable, both in terms of ovulation rate and in the yield of viable embryos. Writing in 1993, animal scientist D Armstrong noted: "the practice of superovulation is still a primitive art form that has not advanced appreciably since it was first performed over 60 years ago."[16]

Embryo transfer involves removing the embryos from the 'donor' cow before they become implanted in the uterus and transferring them to a number of recipient (surrogate) animals. To achieve this, after AI, embryos are flushed from the donor cow using a flexible catheter incorporating a plastic balloon. As the procedure is performed a week after oestrus, it is often difficult to penetrate the uterus, resulting in risks of bleeding and uterine rupture. Transfer to recipient cows (usually following hormone injections) is generally non-surgical, although surgical procedures are sometimes employed for valuable embryos. Because the 'gun' has to pass further into the uterus than for AI, great care is needed to avoid traumatising the uterus and introducing infection.[17] Such skills can only be acquired with much practice.

Perhaps the most significant potential welfare problems relate to mismatches between the embryo and the recipient cow. "Major problems arise when embryos, obtained from large dairy breeds

BOX 2

VETERINARY CARE OF FARM ANIMALS

Veterinary surgeons make crucially important contributions to farm animal welfare through applying their training and expertise to the diagnosis, treatment and prevention of disease, the prevention of pain and suffering, the prolongation of life and the promotion of wellbeing.

Surveillance of animal disease on a regional level is performed by divisional veterinary officers, assisted by animal health officers, who carry out on-farm inspections. Local veterinary inspectors, usually members of private veterinary practices, are also contracted by MAFF to check animal health for particular purposes, e.g. to ensure that their welfare is not be jeopardised during transport overseas.

There are two veterinary agencies operating under the auspices of MAFF:

- *The Veterinary Laboratories Agency: the aim of which is to "protect public health, prevent farm animal disease and promote animal health and welfare, by delivering high quality veterinary surveillance, research and laboratory services"**
- *The Veterinary Medicines Directorate: which aims to "protect public health, animal health and the environment, by ensuring the safety, quality and efficacy of all aspects of veterinary medicines in the UK".†*

The protection of farm animal health and welfare often depends on appropriate use of veterinary medicines. The impact of European legislation and recent public concerns over the use of such medicines in food producing animals has led veterinarians to pay increasing attention to justifying their decisions to employ them. In response to these concerns, the British Veterinary Association recently published a new code of practice "to provide guidance on the prescribing and dispensing of medicinal products by veterinarians in consideration of legislation and best practice."‡

**** Veterinary Laboratories Agency mission statement. (http://www.maff.gov.uk)***

† Veterinary Medicines Directorate (http://www.vmd.gov.uk)

‡ BVA Code of Practice on Medicines (2000) London: British Veterinary Association

16 Armstrong D T (1993) Theriogenology 39, 7-24
17 Sreenan J and Diskin M (1992) Breeding the Dairy Herd. Dublin: Teagasc.

and particularly from large double-muscled beef breeds, are placed in recipients which are unlikely to able to give birth to them and therefore require surgery to deliver the fetus."[18] The use of MOET in other farm animals is much less common, either because it confers fewer advantages (as in pigs) or because surgery is required to recover embryos (as in sheep).

For cattle, legal control of the collection of *in vivo* fertilised embryos and transfer of embryos into recipients is effected by the Bovine Embryo Collection and Transfer Regulations (1993). These allow embryo collection to be performed not only by veterinary surgeons but also by suitably trained non-veterinarians, provided this is carried out under the responsibility of the team veterinarian. There are no specific regulations controlling embryo transfer in pigs, although, as surgical procedures, they may only be performed by veterinarians.

2.4 Mutilations

These are performed for a number of reasons. Some permit the animals to live together in the conditions in which they are housed without risking injury, as for example in the dehorning of cattle and de-beaking of poultry. Other mutilations prevent animals escaping (wing clipping); reduce the risk of disease (tail docking, teeth clipping); or allow ease of animal identification (ear notching, branding). Castration performed on cattle is usually a management procedure, allowing safe handling of animals and preventing unwanted breeding in mixed sex groups; while in sheep it is performed chiefly to prevent the growth check which occurs when ram lambs reach puberty.[19]

A number of these mutilations may cause considerable pain and suffering. For example, in piglets, teeth clipping, tail docking and castration are all generally performed without anaesthetic. Presumably, those who seek to justify such practices would claim that the pain, although significant, is transient.

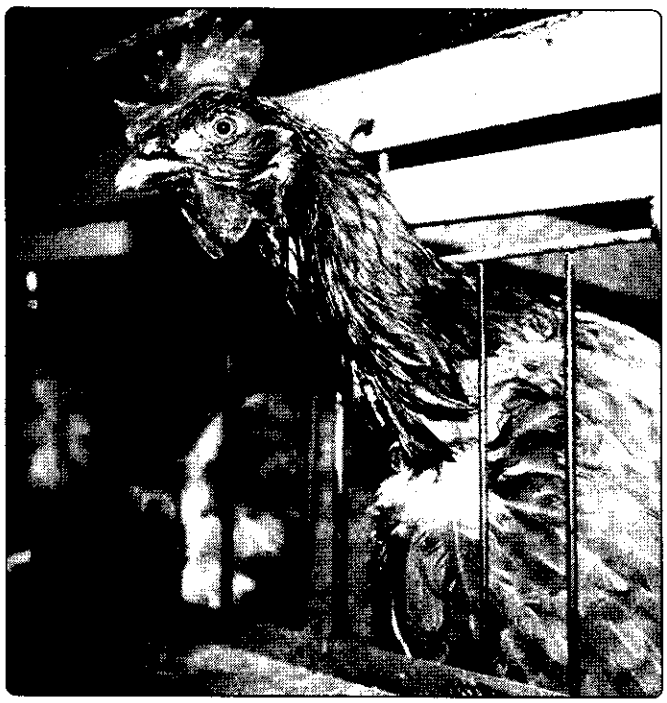
2.5 Implications of Housing and Habitat for Animal Welfare

The design and management of housing plays a critical role in the welfare of the majority of farm animals. Improving the (economic) efficiency of animal production has entailed increased control over the animals' lives, leaving little to chance – epitomised by the fine control exercised over the temperature, humidity and lighting of the housed environment.

Housing has long appeared amenable to regulation, and it is conservatively estimated that it is now the subject of 65% of all UK welfare legislation.[20] However, housing systems are often complex entities, in which animal welfare is a consequence of interacting physical and social factors, so that small changes in design or management practices can have disproportionately large effects. Evaluating different systems is also complicated by the precise definition attached to animal welfare. It is widely acknowledged that welfare assessments need to be multifactorial, including physiological, behavioural and biochemical indices. But it is then difficult to know how to interpret the data when different indices give conflicting messages. For example, in a free choice situation dominant animals may secure the best zones, leaving the subordinate animals with short shrift.

Another problem concerns the criteria for improving animal welfare. Should one aim to improve the *average* welfare of a group of housed animals or prevent the welfare of *any* animals falling below a specified standard? The housing designs adopted to secure these two aims might be quite different. However, we might note that if human welfare were any guide, the principle of respect for the individual (cf. the Universal Declaration of Human Rights) would take precedence over the utilitarian motive of reducing aggregate suffering.

With such caveats in mind we can profitably briefly review the housing and management conditions of specific farmed animals in the UK to exemplify the issues.



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18 Murray R D and Ward W R (1993) Vet Rec 133, 197-8
19 Gregory N (1998) Animal Welfare and Meat Science. Wallingford: CAB International.
20 Edwards S A et al (1999) In: Farm Animal Welfare – Who writes the rules? Occ. Pub. Br. Soc. Anim. Sci. 23, 65-73

2.5.1 Laying Poultry

Currently, there are about 30 million laying hens in battery cages in the UK, and it was concerns over their poor housing provisions that resulted in the first species-specific housing legislation in this country.[21] Welfare concerns focus on space allocation per bird, the absence of nestboxes and perches, and the quality of flooring. At the current EU approved figure of 450 cm^2 per bird, there are five birds in a standard cage, which prevents them from performing any sort of normal behaviour and leads to frustration and weak bones through lack of exercise, and aggressive behaviour towards their cage-mates. "Deprived of litter, caged hens are prevented from dust bathing and foraging. Without access to a nest site, nesting is frustrated and without a perch roosting is prevented".[22] In 1997, the UK Farm Animal Welfare Council (FAWC) recommended that laying birds be allowed 600cm^2 per bird (four hens per cage) and a recent draft EU Directive proposed 800cm^2 per bird (three per cage). Meanwhile, in the USA the typical figure is 350cm^2 per bird.[23]

In June, 1999 the EU Council of Agriculture Ministers agreed to a new Directive (1999/74/EC), specifying minimum standards for the protection of laying hens. From January 2003, no new battery cages may be brought into service and all use of battery cages will be prohibited from 2012. From that date only 'enriched' cages will be allowed, which will give each hen 750cm^2 of floor space, a nest (permitting pecking and scratching) and 15cm of perch space per hen. These provisions seem likely to favour loose housing systems, such as perchery, deep litter or free range.[24]

Confinement of poultry also predisposes laying hens to another form of reduced welfare. The high demands placed on the bird's calcium metabolism in producing egg shells (the average bird now produces well over 300 eggs per year) weakens her bones, and gives rise to the condition of cage-layer osteoporosis. About 35% of mortalities during the laying cycle are due to this condition, which is manifest as fractures of the ribs, sternum and leg bones.

2.5.2 Broiler chickens

Approximately 700 million broiler chickens are reared and slaughtered p.a. in the UK, of which the vast majority (98%) are raised in intensive housing systems. The average broiler house contains about 30,000 birds, which allows freedom of movement when they are very young but becomes progressively more crowded as they grow. The MAFF guidelines on maximal stocking density are 34 kg/m^2 but according to the FAWC many broiler units have stocking densities above this figure. By the slaughter age (at 42 days) as many as 6% have died prematurely.

Major welfare concerns relate to leg problems, due to their difficulty in supporting the weight of the rapidly growing body. A study in 1992 suggested only 10% of birds had normal gait, while over 25% "suffered an abnormality of sufficient severity that their welfare was compromised". A more recent study showed less severe problems, but the data are not comparable because the 1992 study examined birds at 42-49 days (the slaughter age) whereas the more recent study collected data at about 36 days, when the problems would not have been at their worst. Because of the leg problems, birds often spend much of their time squatting, which leads to the development of hock burns – skin abrasions due to contact with the ammonia-impregnated litter (from the birds' excrement).[25]

2.5.3 Pigs

The UK pig industry is largely intensive, except for the growing niche market for outdoor pigs. Demand for the latter has been increased by the introduction, from January, 1999, of a ban on the use of tethers and stalls for pregnant sows, which restrict their movements so that they can only stand or lie down. The commercial sector comprises three types of unit:
i) breeding (both boars and sows are kept to produce weaners)
ii) rearing (of weaners of 5-30kg)
iii) finishing (of growers from 30kg to finishing weight).

Some farmers carry out all three stages, whereas others breed and rear, while some buy at 8-10 weeks and finish. *Finishers* may be grown to 60-70kg for pork, 70-80kg as *cutters* (for pork or bacon), 85-95kg for bacon, or to 100kg for meat pies.

Fixed costs per sow are fairly constant so the effects of higher weaner output per sow p.a. can be significant.[26] Hence breeders aim to wean the maximum number of piglets per sow p.a., while rearers and finishers aim to achieve their end points in the minimum number of days. In the UK weaning is normally at 2-4 weeks. It is theoretically possible to increase the number of litters p.a. from 2.4 to 2.5 by weaning at 3 weeks instead of at 4 weeks.[27] However, because pigs have immature immune systems they are dependent on the sow's colostrum and early milk for a supply of antibodies for at least 3-6 weeks.[28] Early weaning makes them vulnerable to infectious agents, and to counteract this medication of starter rations is an almost universal practice. Thus, the diet of growing/finishing pigs may contain antibiotics, probiotics, gut acidifying agents and/or enzyme preparations. Antibiotics act to promote growth as well as to control infectious agents.

2.5.4 Dairy cattle

The sight of cattle grazing at pasture is an archetypal image of the rural idyll, which for many people fortifies their belief that 'there's nothing wrong with keeping farm animals'. However, for many dairy cattle the appearance can be deceptive.

The modern dairy cow is worked extremely hard, not, evidently, by dint of physical exertion, but because her metabolism is

21 UK Welfare of Battery Hen Regulations, 1987. Website: see note 12
22 Baxter M R (1994) Vet Rec 23, 614-9.
23 McCoy et al (1996) Res in Vet Sci 60, 185-6
24 EC (1999) Council Directive. Website: http://europa.eu.int/comm/food/fs/aw/aw_index_en.html
25 Vaughan A (1999) Fowl Deeds. London: Sustain
26 Cronin G M (1996) In: Pig Production. eds. Taverner M and Dunkin A C. Amsterdam: Elsevier
27 Riley J E (1996). See note 26
28 Wilson M R and Friendship R M (1996). See note 26

'running fast' to support an unnaturally high milk yield. High levels of concentrate feeding, supplementing or replacing grass, coupled with genetic selection, often result in, so–called, *production diseases*, like mastitis (udder inflammation), lameness, metabolic disorders (such as, milk fever and ketosis) and infertility. In the UK dairy herd the average incidence of clinical mastitis is 35-40 cases per 100 cows p.a.,[29] while 25-30% suffer from a foot or leg disorder.[30] Increasing yields often exacerbate such problems.

2.5.5 Beef cattle

Rearing of beef cattle includes some of the best of UK animal husbandry systems, but also some of the worst. Beef suckler herds in which calves are not separated from their mothers but suckle and graze with the cows for at least one summer represent the 'welfare friendly' end. Like dairy cattle, they are usually housed over winter and generally slaughtered at one to two years. Their mothers might live as many as twenty years.

However, most calves raised for beef are products of dairy herds. Such animals, separated from their mothers after about 24 hours, will be reared initially on milk-replacers (generally based on skim milk powders) and then weaned on to cereal-based starter rations. They are usually confined in buildings and yards throughout their lives of just over a year. The incidence of calf pneumonia seems to be associated with weaning. Veal production in crates ("one of the most bizarre and ... unequivocally cruel forms of livestock production")[31] was banned in the UK in 1987, although it continues to be used in other EU states.

2.5.6 Sheep

As for cattle, it is commonly held that sheep lead a stress-free natural existence, and in many cases this might be true. As Audrey Eyton notes: "Through a happy accident of nature, sheep have proved singularly resistant to the so-called progress of post-war agriculture, and lamb provides one of the kinder choices in comparison to other farmed meat."[32] However, 'natural', in this case, does not necessarily equate with 'kind'. Hill sheep, in particular, have low monetary value and in consequence receive very little care. Thousands of hill lambs die every year from cold and starvation through exposure and neglect. Housing ewes at lambing (which is an act of intensification) has made a positive contribution to welfare by reducing lamb mortality.

As ewes are capable of producing twins or triplets, improved productivity is often sought through increased prolificacy. On lowland farms most crossbred ewes are housed in straw yards over winter, where they are ultrasound scanned to determine whether they are carrying twins and, if so, fed accordingly. The lambs are born indoors in a warm and protected environment but letting them out to grass in the Spring can cause reduced welfare. "The worst welfare problems for sheep, such as starvation, lameness and being eaten alive by maggots, arise from the sins of omission and neglect".[33]

2.6 Feeding

"The science of animal nutrition only became necessary when we took animals away from their natural habitats, so denying them the opportunity to choose for themselves what to eat and how much".[34] But now, in intensive systems, in order to ensure efficiency, feeds need to be formulated with great precision if production targets are to be met in a highly competitive market.

From a biological perspective, feed is needed for three purposes, namely, to maintain the body's basal metabolism (reflected in constant body temperature); to support activity (mainly as body movements); and to produce growth (i.e. meat) or other products (milk and eggs). The major dietary requirements are the macronutrients (carbohydrates, proteins and fats) but the body also needs constant supplies of water, vitamins, trace elements and certain minerals. Clearly, even if animals are not providing any useful product they need feed in order to survive. Hence, in crude economic terms, each animal 'pays its way' more effectively the more the economic value of its products offsets its 'maintenance costs'. Another strategy to maximise this differential is to reduce the maintenance costs, for example, by close confinement (as in battery cages), thus reducing body movements, or by environmental temperature control, both of which reduce the birds' energy expenditure.

Feed formulation has become a highly scientific process, designed to ensure that financial returns in terms of product output are maximised. However, at the same time, genetic selection has produced animals with quite unnatural appetites. Thus, broiler chickens selected to reach slaughter weight at six weeks of age are fed optimally to satisfy this genetic potential. Regrettably, such birds often outgrow the strength of their skeletons and suffer from severe bone and joint disorders.

Intensive rearing of animals –poultry, pigs, dairy and beef cattle – depends on supplies of specialised commercial compound feeds (concentrates), which can deliver high levels of protein and feed energy. The high energy crops consist of cereals (wheat, barley, oats and maize) and cereal substitutes, such as cassava, while the high-protein plants consist of crops such as oilseed rape and soyabean.* The fact that these can be bought cheaply on the world market can have major impacts on the welfare of people in less developed countries when land is diverted from growing food for the indigenous human population to growing animal feed for people in developed countries. The supply of such feedstuffs is

29 Hillerton J E et al (1995) J Dairy Res 62, 39-50
30 Blowey R W (1993) Cattle lameness and hoofcare. Ipswich: Farming Press
31 Webster J (1995) Animal Welfare: a cool eye towards Eden. Oxford: Blackwell
32 Eyton A (1991) The Kind Food Guide. London: Penguin
33 See note 31
34 See note 31
* Some fodder crops contain GM products and at the time of writing a public inquiry is proceeding on plans for the marketing of GM fodder maize for cattle (e.g. see M. Wrong, Financial Times, 10.11.00 p2)

now controlled by a small number of multinational companies, whose operations exert great power over the whole process (from farm to fork).[35]

It was the desire to utilise a rich source of protein in animal feeds that led to the recycling of farm animal remains, a process now banned following the BSE outbreak. However, animal protein continues to be used in animal feeds in many countries. For example, waste products such as meat and bone meal, feather meal and fishmeal are still employed, though only fishmeal is legal in the UK.[36]

For many years, compound animal feeds have also incorporated growth-promoting substances in the form of antibiotics. Originally employed as a prophylactic measure to reduce the spread of disease in intensive pig and poultry units, the discovery that their use improved feed conversion efficiency led to the development of, so-called, zootechnical feed additives (ZFAs) to improve growth rates.[37]

One of the commonest arguments advanced against using animals for food is that they are wasteful of energy resources, because the food energy yield per hectare is usually far greater for crops than for animals grazing or fed fodder crops grown on the same area. The point is valid, but sometimes only up to a point. The strongest counter-argument is for ruminant animals (like cattle and sheep) which graze land difficult to cultivate, such as hillsides. They turn grass, which we cannot digest, into edible products like meat and milk. However, this justification does not apply when the grazed land could be used to grow crops for direct human consumption, while feeding cereals to pigs and poultry would also not justified solely in such terms. Traditionally, such animals were efficient converters of wastes (e.g. 'pig swill' from school kitchens and canteens and scraps from the hen yard) into meat and eggs, but this has largely been stopped because of disease risks (e.g. of swine fever). Feeding concentrates to farm animals fails to take advantage of these former scavenging and conversion roles.

RSPCA PHOTOLIBRARY

2.7 Environmental Impacts

Feed requirements are clearly closely integrated with other elements of the chain, such as housing. But a common feature of intensive systems is that because they 'import' feed (either from abroad or from other farms) rather than allow animals to forage for themselves, the numbers of animals kept on a farm can be greatly increased. Inevitably, this raises the problem of dealing with waste products, which cannot be absorbed by the environment as they would be, usually beneficially, in extensive systems. Environmental problems include air and water pollution, and soil contamination and erosion.

A particular problem arises from the fact that farm animals are only able to absorb a small proportion of the nutrients consumed, so that their urine and faeces contain much of the nitrogen and phosphorus they have eaten. About 70–80% of dietary nitrogen fed to cattle, pigs and laying hens, and 60% of that fed to broilers, is excreted[38] and this may seriously threaten the aquatic environment, i.e. ground, surface and marine waters.

Environmental hazards due to dairy cattle take the form of silage effluents, slurry, dirty water (parlour and yard washings) and gaseous emissions (methane and microorganisms). For a typical dairy cow, 57 litres of excreta are produced, and 18-35 litres of cleaning water used per day. Such liquid wastes have extremely high biological oxygen demands (measured as BOD i.e. the mg/l of oxygen needed to permit microbial breakdown). The BODs for treated domestic sewage (20-60), raw domestic sewage (300-400), cattle slurry (10,000-20,000), silage effluent (30,000–80,000) and milk (140,000) illustrate the highly pollutive potential of these products if not controlled effectively.[39]

The environmental problems produced by the broiler industry are somewhat different. Broiler litter, consisting of a mixture of excreta, bedding, wasted feed and feathers is considered an important by-product, and in the UK about two thirds of it is spread on agricultural land and a third burnt in power stations. However, there are concerns that poultry litter may cause nitrate, phosphate and pathogen pollution of ground and surface water, metal contamination of the soil (due to copper, arsenic, iron, manganese etc), and adverse effects on wildlife due to 17ß-estradiol in poultry manure.[40]

Adverse environmental effects are not, however, limited to those produced by the animals, because the growing of fodder crops is a major reason for the intensification of arable farming on a global scale. To support the demand for large amounts of affordable feed, intensive crop production systems rely on high levels of application of herbicides, insecticides and fungicides. For example,

35 Tansey G and Worsley T (1995) The Food System. London: Earthscan
36 Turner J (1999) Factory farming and the environment. Petersfield: Compassion in World Farming
37 Food Ethics Council (1999) Drug Use in Farm Animals. Southwell: FEC
38 Tamminga S (1992) J. Dairy Sci 75, 345-57
39 MAFF (1991) Code of good practice for the protection of water. London: MAFF
40 See note 25

the area of UK fodder crops treated with herbicide increased by 40% during the 1990s, and that treated with pesticides by 56% between 1993 and 1999.[41] The increasing use of pesticides (and fertilisers) has seriously affected the biodiversity of wildlife, leading to what has been called 'The Killing of the Countryside'.[42]

A recent study has attempted to estimate the total external costs of UK agriculture in terms of a) treatment or prevention costs (to clean up the environment and restore human health to comply with legislation) and b) administration and monitoring costs. Costs were assessed for damage to i) drinking water, e.g. due to pesticides, fertilisers and zoonoses in the water, pollution and eutrophication; ii) air, e.g. due to ammonia, methane, carbon dioxide and nitrous oxide; iii) soil, e.g. due to erosion, losses of organic matter and carbon dioxide; iv) biodiversity and wildlife; v) hedgerows; vi) bee colonies; vii) to human health due to pesticides, nitrates, microorganisms, antibiotics and BSE/CJD. The conservative estimate was that these amounted to £2.34 billion p.a. (for 1990-1996), with a range of £1.15 – 3.91 billion. The mean figure amounted to 89% of average net farm income, and £208 per hectare of arable land and permanent grassland p.a.[43]

2.8 Transport

Animals raised on farms are often moved to other farms for further fattening, breeding or milk production purposes, and/or to markets for sale, and they usually end their lives in abattoirs after transportation. Some are sent overseas by air or ship, coupled with long journeys in lorries. Even hardened commuters can find travel in crowed trains and tubes extremely intimidating or uncomfortable, so it is hardly surprising that animals, with no concept of the 'journey's end' can be very stressed during transport.

Movement of all live animals through, in or out of the EU is subject to Council Directive 91/628/EEC, as amended. This legislation requires a general schedule of documents, i.e. an accompanying certificate, health certificate, list of unique identification numbers, movement licence (especially for pigs) and passport for cattle.[44] In the UK the Directive is implemented by the Welfare of Animals (Transport) Order, 1997 (WATO).

Despite the apparent rigour of the regulations, mortality and morbidity of animals in transit are serious problems. Surveys of animals either arriving dead at an abattoir or dying in the lairage show that poultry are at the greatest risk, followed by pigs, while deaths of sheep and cattle are uncommon.[45] In pigs, heat stress is a major risk, while for lambs the influence of markets and pre-existing pathology are important.

Morbidity takes several forms, for example, injury (such as bone fractures and joint dislocations); stress and fear responses; clinical and behavioural responses to food and water restriction; adverse responses to thermal conditions; and responses indicative of fatigue. The immediate causes might be a result of deficiencies in vehicle design and driving skills; control of the thermal environment, inadequate ventilation and space allowance; inappropriate mixing of animals; journeys which are too long; and inadequate lairage periods and food and water intervals.

Moreover, although poultry are protected by WATO, which prohibits the transport (including loading and unloading) of animals in ways which cause or are likely to cause injury or unnecessary suffering, they are at risk during handling before transport. Carrying broilers upside down, in transferring them from a house to a crate, is very stressful, and substantial traumatic injuries have been observed as a result.[46]

2.9 Markets

The treatment of animals at livestock markets is subject to the Welfare of Animals at Markets Order, 1990, as amended, and a Government Code of Practice has been issued on the advice of FAWC. The Government launched its Livestock Markets Strategy in September 1998, setting out achievable targets for the various bodies involved in running, and legal enforcement in, markets, with the aim of improving welfare standards. In June, 1999, the State Veterinary Service, reporting on a surveillance exercise, noted several respects in which standards fell short of requirements. For example, only 42% of markets clearly displayed the identity of an Animal Welfare Officer; nearly 10% of markets experienced difficulties with penning of sheep, mostly due to overcrowding; there were incidents of unsatisfactory movement or handling of animals (some of which were illegal) e.g. affecting 2% of calves; and about 3% of transport vehicles were defective in construction or maintenance.[47]

2.10 Slaughter

Slaughter comprises stunning, which renders the animal unconscious, followed by cutting of the major blood vessels resulting in death due to rapid blood loss. However, new humane slaughter procedures aim to stun and kill in a single action.[48] Relatively recently, the EU adopted detailed welfare rules (set down in Directive 93/119/EC) to protect animals at the time of slaughter, which are implemented in the UK as the Welfare of Animals (Slaughter or Killing) Regulations, 1995 (WASK), as

41 Agrow-World Crop Protection News 26.3.99. See note 36
42 Harvey G (1997) The Killing of the Countryside. London: Jonathan Cape
43 Pretty J N et al (2000) Agricultural Systems 65. 113-136
44 Harris T (1999) See note 20.
45 Cockram M S and Mitchell M A (1999) See note 20.
46 See note 45
47 State Veterinary Service (1999) The 1998 Strategy for the protection of animal welfare at livestock markets: report on SVS assessment of compliance. Website: see note 12
48 See note 19

amended. These regulations make it an absolute offence to cause or permit an animal any avoidable excitement, pain or suffering. Anyone slaughtering an animal must i) have the knowledge and skills to do the job humanely and effectively; ii) be competent and hold a Registered Licence; and iii) in every abattoir a competent person must be given authority to safeguard welfare, while iv) only permitted methods must be used to stun and kill animals.[49]

Supervision of licensed abattoirs is carried out by Official Veterinary Surgeons (OVSs) employed by the Meat Hygiene Service, a Government agency set up to ensure compliance with meat hygiene, animal welfare and other statutory rules. OVSs may give advice, warnings or, when necessary, recommend prosecution. Animal slaughter on farms and in knackers yards (where animals are not used for food) is also regulated by the State Veterinary Service.

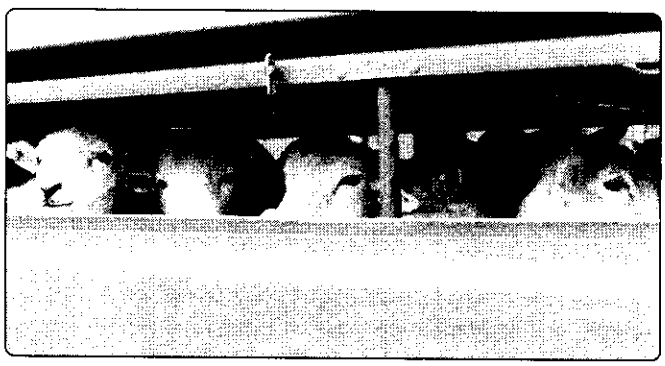
Long-term provisions in UK law permit slaughter without stunning to meet Jewish and Muslim requirements, but since March, 1999, all religious slaughter must be performed in licensed or officially regulated abattoirs. Despite these apparently extensive regulations, significant problems remain – and this is certainly the case in other countries, with less stringent regulations, which export their meat products to this country.

In the UK, the stunning procedure used depends on the species of animal. For cattle, a captive bolt is generally used, whereas for pigs and sheep electrical stunning is applied to the head to induce concussion. After stunning, bleeding ('sticking') must be performed quickly to deflect blood from the head before consciousness is regained. For poultry it is common for the heads of birds, suspended upside down from shackles, to be passed through an electrified water bath before they are bled with a neck cut. When a skilled operator, with effective and well-maintained equipment, is allowed ample time there is every reason to believe that these operations can be performed efficiently and humanely. However, problems might arise in a number of circumstances, for example, if i) the operator is incompetent or inconsiderate; ii) the equipment is faulty (e.g. providing an inadequate voltage for stunning); iii) the animal is abnormal (e.g. a small bird might fail to be adequately immersed in the stunning water bath) or iv) the throughput is too great, allowing insufficient time for due attention to be paid to individual animals.[50] In poultry units, 6000 animals/hour are routinely slaughtered.[51]

A major concern is the reduction in the numbers of small abattoirs. Ideally, farmers would take their stock to an abattoir close to their farm, but due to economic and regulatory pressures the number of premises is decreasing and their size increasing, making it more difficult to cater for individual animal's needs. The Humane Slaughter Association (HSA) lists the welfare benefits of the 'good low throughput operator' as: i) shorter travelling and lairage times; ii) less mixing of animals; and iii) more time allocated to each animal.[52] However, many abattoirs face serious economic problems, resulting from the fact that a handful of large supermarkets control over half of all household sales of meat and meat products in the UK. Consequently, a few outlets exert considerable power over their suppliers, who are generally small and fragmented. Sales revenues of abattoirs are only about 10% of purchase costs, which has to cover labour costs, investment in new plant necessary for safe and hygienic working conditions and a margin of profit.[53]

Other concerns relate to the level of skills and management in abattoirs. To promote improved welfare standards and encourage a sense of pride in a 'job well done' by operators, there is a need for objective scoring schemes, ranking performance according to avoidance of, for example, inaccurate placement of electrical stunners, slipping or falling during handling, or squealing of pigs. The appropriate design of premises, for example, by using curved races to prevent animals seeing people or activity ahead, can greatly reduce stress.[54]

Every year in the UK, 40 million chicks are dispatched in hatcheries either because they are males, unwanted for egg production, or because they are too sickly when hatched. A report from the HSA in 1998 revealed significant welfare problems and considerable scope for improvements. The recent HSA Code of Practice,[55] drawn up in consultation with industry associations, makes a number of recommendations; most controversially, the phasing out of the use of carbon dioxide for stunning, in view of its highly aversive nature. Instead, the report recommends use of 90% argon or instantaneous mechanical destruction (IMD) in a mincing device. The report claims that: "whilst it may be aesthetically unpleasant, IMD is an acceptable and humane method of chick disposal." It certainly appears to be more humane than systems operating in other countries. For example, in China "chicks are simply thrown away, burnt alive or left to die", whereas in the USA "the majority are culled by a vacuum system" in which "it was impossible to assess exactly when the chicks were killed".[56]



RSPCA PHOTOLIBRARY

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53 Schofield R and Shaoul J (1997) E Coli 0157: report 'Private wealth v. public health?' Manchester School of Accounting and Finance: Manchester University
54 Grandin T (2000) Livestock handling and transport, 2nd edition. New York: CAB International
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56 Metheringham J (1999) Disposal of day-old chicks: the way forward. Wheathampstead: HSA

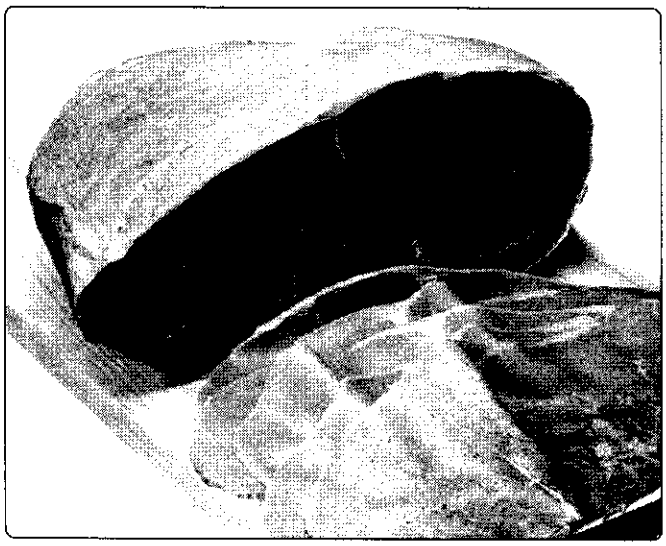
2.11 Meat Hygiene

The Meat Hygiene Service is an agency of the Food Standards Agency which is responsible for enforcement of hygiene, welfare at slaughter and Specified Risk Material (SRM) controls at premises licensed under the Fresh Meat (Hygiene and Inspection) Regulations 1995, as amended. The Meat Hygiene Inspector and OVSs together make up the Hygiene Inspection Team stationed at each licensed abattoir. All meat sold for human consumption in the UK must receive the Health Mark, indicating that it has been produced under veterinary supervision according to the statutory hygiene standards.

Hygiene is assessed using a risk-based method, termed HAS (Hygiene Assessment System), which entails the OVS assigning a score (0-100) to the licensed premises, based on inspection of the plant's structure, equipment and operation. "Meat plants that comply satisfactorily with all statutory hygiene requirements would score at least 70 points." However, "HAS scores are a general guide to long term hygiene and performance. They do not tell you whether an individual piece of meat is fit to eat – that is what the Health Mark does."[57]

Although HAS scores are not required by law, they are presumably regarded as important indicators. The July 2000 issue of the Enforcement Report showing that, of the plants listed, 123 (i.e. 9.1%) scored less than 70, some with scores as low as the 30's and 40's, suggests that many improvements still need to be made.

Recently, new MHS performance targets have been approved by the FSA, aimed at reducing further the microbiological hazards of meat and removing SRM from the human and animal food chains.



2.12 Processing and Retailing

Worth £12 billion p.a., the meat market is the UK's largest single food market, allegedly reaching 97% of consumers.[58] The UK dairy industry produces 14 billion litres of milk p.a., worth £2.7 billion (at farm gate prices),[59] while retail sales of eggs amount to £528 million and returns to the catering/manufacturing and processing sector to a further £135 million.[60]

Meat sold in traditional butchers' shops is often displayed unpacked, but in supermarkets packaged meat is the norm. Including high concentrations of carbon dioxide in the packs restricts bacterial growth and hence increases shelf-life, while the use of selectively gas-permeable plastic wrappers allows access of oxygen to the haem in the meat, preserving its red colour.[61] Over longer periods of storage, oxidation can produce undesirable effects on both colour and flavour, and various synthetic antioxidants, such as propyl gallate, butylated hydroxyanisole and butylated hydroxy toluene, are used to counteract the effects. Such additives may cause adverse health effects in certain people.[62]

The most palatable joints of meat, such as loin, sirloin, forerib, topside and fillet from young, growing animals (which naturally command the highest price) account for less than a third of the carcass. So, much of the rest, and that from older animals, which is inherently tougher, is comminuted, i.e. minced or ground into small pieces. This is then sold as minced meat or is reformed into moulded products such as burgers and reformed steaks, or used in production of sausages. Although this may be considered beneficial by providing a range of convenient-sized, more palatable products (and hence adding value to a low value raw material), there are some drawbacks. Thus, "as well as having relatively high loads of microorganisms, comminuted meat tends to lose beneficial vitamins".[63]

After normal boning of carcasses, some meat is still left attached to the bones. This meat can be recovered by grinding the bones to a paste and forcing it through small holes in a stainless steel drum, so that the meat fibres are separated from the bone particles. Current EU regulations require that this mechanically-recovered meat (MRM) shall not contain bone fragments greater than 0.5mm in diameter. Alternatively, MRM is removed from bones under high pressure. Industry codes of practice prohibit production of MRM from poultry heads and feet or from the heads, feet, tails (except bovine tails) and leg bones of other animals.[64]

The recently published BSE Inquiry Report (chaired by Lord Phillips) describes the continued food use of MRM contaminated with spinal cord material from BSE-infected cattle as a "sorry

57 Food Standards Agency (2000) Meat Hygiene Enforcement Report, Issue 39
58 Meat and Livestock Commission (2000) personal communication
59 See note 12
60 British Egg Information Service (2000). Website: http://www.britegg.co.uk
61 Warris P D (2000) Meat Science. Wallingford: CAB International
62 Hansen H (1987) The New E for Additives. Wellingborough: Thorsons
63 See note 61
64 Ranken M D (2000) Handbook of Meat Product Technology. Oxford: Blackwell

story" due to "a serious breakdown of communication" within Government.[65] Current regulations require that MRM from cattle or sheep: i) shall only be made on premises licensed for the purpose and ii) shall not contain spinal cord or material from the vertebral columns.

Comminuted meat and MRM are used in the manufacture of products such as burgers and sausages. Even with extensive labelling, it is hardly surprising that many people are confused by what they are eating. Thus, pork sausages are legally required to contain a minimum of 65% meat but others can have as little as 50%. But the definition of 'meat' is itself misleading, as it can include fat, skin, rind, gristle and sinew. Half of the 'meat' must be 'lean', but 10% of this 'lean meat' can be fat, and 10% gristle, while half of the 'regular meat' can be fat and gristle.[66] Moreover, 20% of the meat in a 'pork sausage' need not be pork, while only 50% of that in a 'beef sausage' must be beef. Sausages may also contain the artificial colouring red 2G (E128), which has been alleged to induce hyperactivity in sensitive children. Burgers and sausages typically contain between 23 and 25% animal fat.[67]

Meat joints, poultry and poultry portions may legally be injected with solutions of salt, polyphosphate and flavouring agents, thereby increasing the weight of the uncooked product offered for sale.[68] In the UK, addition of water above 5% requires declaration on the label. However, for products such as sausages, which may contain up to a third added water, there is no requirement to declare this, but only to include the total water content in the list of ingredients. Water can also be added extensively to bacon. As this need only be declared if it is greater than 10%, the claim made that 'it contains not more than 15% added water' is quite legal even if the added water actually amounts to 25%.[69] A recent report of the Food Standards Agency revealed that 30% of frozen chicken analysed had more than the European limit for added water, but none had been labelled as such.[70]

Animal products are added to many processed foods, in some cases without declaration on their labels. For example, animal fat is present in biscuits, cakes and pastries, and gelatin in jellies, sweets, and low fat dairy products and spreads.

2.13 Dietary Significance

2.13.1 Human nutrition

The nutritional rationale for animal products is necessarily advanced in rather broad terms. This is because we do not eat *nutrients* (as one swallows tablets from a bottle to satisfy an immediate requirement) but foods which form part of a diet over long periods. Whether, and how much, of a particular nutrient is required by an individual depends on many factors, such as age, gender, reproductive status, activity, environmental conditions and, not least, on other components of the diet consumed. So it is not possible to state categorically that, say, meat is required to provide iron for 'healthy blood', or that milk is needed to supply calcium for 'healthy bones', both because people's needs vary and because, for some, there may be other ways of meeting such demands.

Nevertheless, certain properties of animal products do merit identification. Thus, the protein in meat, milk and eggs has high biological value and meat is also a good source or iron, zinc, most of the B vitamins and, in the case of liver and kidney, of vitamins A and D. In relation to the calories it supplies, milk contains large amounts of a wide range of essential nutrients. It is also a rich source of calcium, and contains substantial amounts of other minerals apart from iron.

Certain alleged nutritional drawbacks have received much attention in recent years, so that many have begun to question whether (in terms of human health) the benefits of animal products outweigh the risks. As noted above (1.2), a review of recent epidemiological studies suggests that the consumption of meat is a significant cause of illness.[71] However, there are contradictory observations, and/or some data have been interpreted simplistically. Consider the *lipid hypothesis*, which claims that dietary saturated fat and cholesterol are the prime cause of coronary heart disease (CHD), through their effect in raising blood cholesterol levels. According to the hypothesis, risks can be reduced by decreasing blood cholesterol through dietary change. The prominence given to this hypothesis led to calls for a drastic reduction in consumption of animal fats. However, more recently, evidence from a number of sources has challenged the alleged link between saturated animals fats and CHD. For example, epidemiological data show that East Anglia and the South West have some of the highest consumption levels of dairy products but the lowest incidences of CHD. While excessive consumption of animal products is certainly inadvisable, a widespread avoidance of such products is likely to deprive the body of many important nutrients. A recent review of the evidence states: "No study has yet shown that milk as a whole is a risk factor for heart disease."[72]

Indeed, there are strong arguments for moderate consumption of certain animal products as part of a healthy diet. For example, milk and other dairy products such as cheese and yoghurt, are major sources of dietary calcium in the UK, consumption of which, particularly by adolescents, young women and the elderly living in the community, may play an important role in the prevention of osteoporosis. This condition, predisposing to bone fractures, is now a major public health problem, which costs the NHS nearly £1.5 billion p.a. to treat.[73] Moreover, there is evidence that milk, and in particular fermented milk products, can protect

65 BSE Inquiry Report (2000) Website: http://62.187.42.105/report/contents.htm
66 Dibb S (1997) What the label doesn't tell you. London: Thorsons
67 See note 61
68 See note 64
69 See note 66
70 Food Standards Agency (2000) FSA News 1, 07
71 See note 6
72 Maijala K (2000) Livestock Prod Sci 65, 1-18
73 National Osteoporosis Society (2000). Facts and Figures. London: NOS

against development of cancerous tumours[74] and that they may play a significant role in reducing dental caries.[75] Concentrating on the 'single issue' of the risk of CHD, the validity of which is questionable, detracts from other advantages of dairy products.

Despite these advantages, there are certain other recognised drawbacks of milk for some individuals. Thus, for many people of non-European origin the condition of *lactose malabsorption* limits the quantity of liquid milk which can be consumed without indigestive discomfort: but the problem does not occur with cheese, butter or yogurt consumption. Moreover, some individuals are allergic to certain milk proteins.[76]

2.13.2 Food safety

It has been estimated that in addition to the sickness and sometimes death resulting from food poisoning, the cost to the NHS and UK business is about £350 million p.a. Up to 4.5 million people p.a. are estimated to suffer from food-borne diseases, and 50-60 die as a result.[77] Animal products account for the great majority of the sources of infection.

Bacterial contamination of chicken has become a serious public health problem. Reports published in 1996 indicated that 18% of raw chicken from the UK and 64% of that imported was contaminated with Salmonella, while over 50% of UK-bred chicken produce for retail outlets contained Campylobacters. In fact, Campylobacter is the most commonly reported cause of food poisoning in England and Wales (58,059 cases in 1998) and Salmonella the second (23,728 in 1998).[78] A 'Which' survey (1996) showed that over 30% of chicken purchased from large supermarkets was 'unfit for human consumption', as defined by the Poultry Meat (Hygiene) Regulation 1995.[79]

The epidemic of E Coli 0157 in Scotland in 1996-7, caused by infected meat products, resulted in 21 deaths and the hospitalisation of 127 others, with 27 suffering from serious kidney and blood diseases. The increasing incidence of cases of nvCJD resulting from consumption of BSE-infected beef is too well-known to need discussion here, but the recent suggestion that the disease may also have crossed to sheep indicates the pervasiveness and intractability of the problems associated with the causative agent.

The Food Standards Agency recently set a target of reducing cases of food poisoning by 20% by 2006. They plan to improve risk controls in small businesses, ensure that food handlers have proper training, raise standards in the home, work with local authorities to improve surveillance and enforcement, and work with the food industry to raise standards of hygiene.[80] A number of control measures have been introduced to reduce the likelihood of infected products entering the food chain. For example, in the red meat sector these include controls to reduce contamination at abattoirs and throughout the distribution system.

However, the target to reduce the incidences of food poisoning is a challenging one, given the upward trend, at least until very recently. The number of reported cases rose by 10% in 1997 alone, while the increase over the last 15 years has been 600%. Yet the problem is clearly not insuperable: for example, in Sweden less than 1% of chickens are infected with Salmonella or Campylobacter compared with 33% of UK chickens in 1996.[81]

2.14 Global Concerns

The focus of the above account has been the situation in the UK, sometimes related to the EU. But since we live in a world in which trade is already, and is becoming increasingly, internationalised, a brief overview of the global scene is necessary. Moreover, while in the North we are becoming more reticent about animal products, the South grows ever more indulgent. Indeed, following the Green Revolution the International Food Policy Research Institute (IFPRI) identifies an impending Livestock Revolution, thus: "A revolution is taking place in global agriculture that has profound implications for our health, livelihoods and environment. Population growth, urbanization, and income growth in developing countries are fuelling a massive global increase in demand for food of animal origin."[82] By 2020, it is predicted that total meat consumption in the developing world will be 188 million metric tons and 115 in the developed world (compared with 88 and 97, respectively, in 1993).

If current trends continue the increases would require the annual feed consumption of cereals to rise by 292 million metric tonnes between 1993 and 2020. In a worst case scenario, feedgrain requirements per kg of meat would rise 1% p.a. over this period due to increased industrialisation of production. But IFPRI considers that even so, availability of meat, milk and feed would still satisfy demands by 2020. The key questions, then, do not concern availability but affordability and effects on human health, animal welfare and the environment.

IFPRI suggests that far from being a drain on food available to the poor, increased consumption of animal products can increase their purchasing power. There is much evidence that the rural poor and landless, especially women, get a higher share of their income from livestock than do better-off rural people (except in areas of large-scale ranching, such as Latin America). Livestock provide poor people with fertilizer and draught power, and with opportunities to exploit common grazing areas, build collateral

74 Schackelford L A et al (1983) Nutrition and Cancer 5, 159-64
75 Harper D S et al (1987) J Dental Res 66, 42-5
76 Freed D J L (1984) Health hazards of milk. London: Baillière Tindall
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78 Public Health Laboratory Service (2000) Website: www.phls.co.uk/index.htm
79 Which? Magazine (October 1996) How safe is chicken? London: Consumer Association
80 See note 77
81 Hird V (2000) Perfectly safe to eat? London: Women's Press
82 Delgado C et al (1999) Livestock to 2020: the next food revolution. Washington: International Food Policy Research Institute

and savings, as well as diversify their income. They also benefit greatly by supplying essential nutrients that are often otherwise in poor supply in less developed countries, such as high quality protein and micronutrients. Indeed, addition of quite small quantities of meat or milk to the diet can provide the same levels of nutrients and energy as much larger amounts of cereals and vegetables.

However, IFPRI warns that "rapid industrialization of production abetted by widespread current subsidies for large-scale credit and land use could harm this major mechanism of income and asset generation for the poor. Policy makers need to make sure that policy distortions do not drive the poor out of the one growing market in which they are presently competitive."[83]

Despite the claimed positive features, there are some significant risks associated with the predicted Livestock Revolution, which deserve serious attention. Many of the public health concerns, like the spread of animal borne diseases, microbial contamination through unsafe handling practices and accumulation of antibiotics and pesticides in the food chain, are familiar in the West, but through lack of rigorous controls they could prove even more damaging in developing countries. Environmental problems could well result from larger concentration of intensive animal production units in peri-urban areas, leading to land degradation of grazing areas and pollution problems.

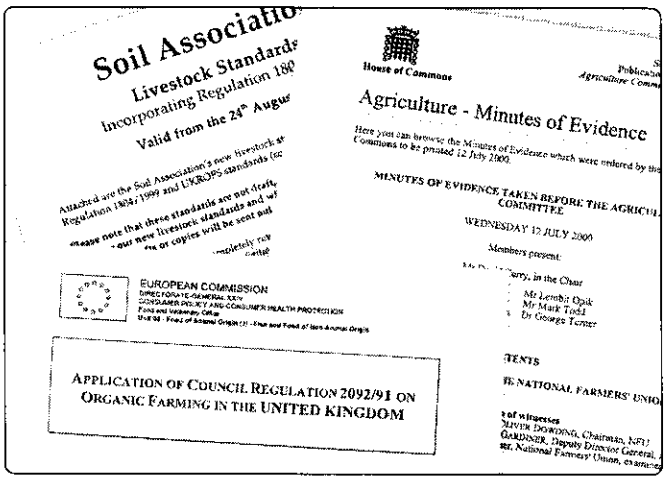
Such caveats should not, however, obscure the fact that livestock play a crucial role in the agricultural systems of many developing countries. The International Livestock Research Institute, based in Kenya, points out that one sixth of the world's population (in Africa, Asia and Latin America) lives in semi-arid zones, areas where the soils are sandy, poorly structured and hold little water, so that seeds only germinate with great difficulty. Such lands can only be used sustainably by using suitably managed ruminant livestock. It is a misperception of people in the West that livestock necessarily degrade the environment.[84]

Another, little appreciated, role of animals is in spreading farmers' risks.[85] Thus, herbivores act as buffers which absorb external environmental perturbations and maintain agro-ecological systems in a state of low sensitivity to variability. So, although growing of crops may be more productive, it is also less stable than livestock farming, and therefore carries greater economic risks. The constant supply of food and income from milk production, resilient to a degree of seasonal variability in the availability of feed, illustrates the point.

In addition to the critical role livestock farming seems destined to have in the economic and nutritional development of less developed countries, it will also impact in important ways on people in the Western world. In particular, there is concern that if animal welfare and food safety standards are not applied consistently throughout the international market this may undermine national standards through the importation of low-priced, but poor-quality, animal products. The recent EC White Paper on Food Safety stressed the importance of the EU's involvement with developing the World Trade Organisation's (WTO) Agreement on the Application of Sanitary and Phytosanitary measures (the SPS agreement) to ensure that the international framework encourages and defends the rights of countries to maintain high public health standards for food safety.[86] There can be little doubt that important issues need to be addressed urgently. For example, in some developing countries the hygiene and welfare standards observed in abattoirs are extremely poor.[87]

2.15 Conclusions

Farming animals for food in the UK in the early 21st century is a complex business, in which individuals are part of a global system that allows them very little freedom of action. Historically, the Common Agricultural Policy of the European Union has encouraged intensification and many farmers have had to adopt practices with which they had little sympathy, in order to stay in business. The new economic order emerging under the World Trade Organization seems likely to raise even greater challenges. That significant improvements in animal welfare and meat hygiene have been made in recent years is undeniable but there is much scope for further improvement. A critical question now is how the animal products food chain will be affected by future technological developments. It is this question to which we turn later in the report. But first we need to consider how we might go about assessing prospective changes in animal farming from an ethical perspective.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MINUTES OF EVIDENCE TAKEN BEFORE THE AGRICUL
COMMITTEE
WEDNESDAY 12 JULY 2000
Members present:
Mr Lembit Opik
Mr Mark Todd
Dr George Turner
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83 See note 82
84 International Livestock Research Institute (1998). ILRI 1997: Livestock, people and the environment: ILRI, Nairobi, Kenya
85 Orskov E R and Viglizzo E F (1994) Outlook on Agriculture 23, 81-9
86 Commission of European Communities (2000) White paper on food safety. COM (1999) 719 final. Brussels
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3. AN ETHICAL APPROACH TO FARMING ANIMALS FOR FOOD

3.1 Background

Currently, prospective technologies are routinely subjected to assessment procedures to ensure that they deliver the claimed benefits reliably and without significant risks (essentially, covered by the criteria *safety, quality* and *efficacy*). Once these criteria have been satisfied, market forces tend to be regarded as the appropriate means for addressing other issues of public concern. While in theory (e.g. in a society where there was a high level of public awareness and trust) the free market might be a satisfactory way of ensuring consumer choice and protection, many aspects of modern-day food production present a profound challenge to this assumption. Questions relating to the origins of our food, its means of production, dependence on problematical technologies, and impacts on the welfare of consumers, animals and the environment, cannot be assessed simply on the basis of economics and technology, not least because animals and the environment cannot express their interests as stakeholders. A satisfactory form of ethical assessment needs to take account of all these issues.

A sound starting point for deliberation is to outline principles of the *common morality* or *common-sense ethics*, which most reasonable people share. One problem with such a claim is that it depends rather critically on how you define 'reasonable'. Different cultures might see things differently (human autonomy, women's rights, animal rights) yet still be considered rational, if not reasonable. Nevertheless, despite multiculturalism and pluralism, the pursuit of democracy, which few in our culture would challenge, makes certain assumptions that conform to the idea of the *common morality*.

These assumptions have been described by the American medical ethicists, Tom Beauchamp and James Childress, who identify four principles, namely *prima facie* respect for *beneficence, nonmaleficence, autonomy* and *justice*.[88] In a medical context:

Beneficence refers to *doing good*, i.e. the duty to help the patient by effecting a cure or relieving suffering.

Nonmaleficence refers to *doing no harm* (the ancient Hippocratic Oath) and this applies, for example, to avoiding procedures undertaken primarily to advance knowledge or skills, rather than for the good of the patient.

Autonomy concerns respect for the patient as a *person*, and not just as a 'case'.

Justice is interpreted as *fairness*, e.g. showing no favouritism or sexual, racial or age preference.

This, so-called, *principled approach* to medical ethics seeks to assist doctors and nurses in addressing many of the dilemmas with which they are constantly faced. The use of the principles does not determine the outcome but it does ensure that attention is paid to a range of ethically relevant issues, that there is a consistency of approach towards patients, and that the decisions made are explicit and can be verified (or challenged). The principles are based on established ethical theories (even though most people are not aware of them) which commonly feature in perceptions of *right action* (see Box 4).

In adapting this approach to agricultural and food biotechnologies, Ben Mepham noted that the following are valuable with respect both to medicine and food production.[89]

- the assumption of a common morality
- a principled approach which is based on established ethical theory
- the characteristics of rationality, transparency and consistency.

There are, however, several important differences between medical ethics and food ethics. Thus, for the latter:

- ❖ there are more *interest groups* (e.g. animals, consumers, farmers and the living environment), some of which (animals and the environment) cannot express opinions
- ❖ the ethical analysis needs to impact on public policy decisions (not simply *ad hominem* as in the surgery)
- ❖ to be of use in democratic, publicly-accessible policy making, the terminology needs to be as simple and user-friendly as possible (or, at least, comprehensible to the committed non-expert).

3.2 The Ethical Matrix

In this report, we analyse the issues raised by applying the ethical principles described above to the interests of four groups, viz:

- ❖ *Treated Organisms:* in this case, the animals whose products are used for human food
- ❖ *Producers:* in this case, livestock farmers

88 Beauchamp T L and Childress J F (1994) Principles of Biomedical Ethics, 4th edition. New York and Oxford: Oxford University Press
89 Mepham T B (1996) In: Food Ethics. ed. T B Mepham. London: Routledge pp. 101-119; Mepham T B (2000) J. Agric and Env Ethics 12, 165-76

- *Consumers:* in this case, those who consume animal products (meat, eggs, milk, dairy products)
- *The Biota:* i.e. the living environment.

Respect for these four groups is considered in relation to the principles of ethics described, namely autonomy, justice and, here, wellbeing (the latter combining, for simplicity, the principles of beneficence and nonmaleficence – which are often closely and reciprocally interrelated).

Because the three principles and four interest groups interact, the twelve resulting ethical impacts can be represented in the form of a table (the Ethical Matrix), which aims to facilitate analysis by imposing a rational structure (see Fig 2). But it would be a mistake to imagine that the Matrix can resolve complex ethical issues simply by consigning their elements to the separate 'cells'.

justice for animals is defined as *intrinsic nature*. This refers to the concept that justice for an animal corresponds to respect for its intrinsic nature (which philosopher Immanuel Kant considered was worthy of respect in every individual person) i.e. this can be seen as the basis of the view that animals have certain *rights* analogous, if not commensurate, with human rights.

In section 1 of this report, an argument was advanced for (limited) use of animals for food based on utilitarian criteria. It will be apparent from the principles advanced in this section that any decisions made on that basis alone need to be re-examined in the light of other important considerations, relating to the principles of autonomy and justice (so-called, deontological principles). At the very least, we wish to argue that ethical questions are not just a matter of costs and benefits.

RESPECT FOR:	WELLBEING (Health and Welfare)	AUTONOMY (Freedom/Choice)	JUSTICE (Fairness)
FARM ANIMALS	Animal welfare **1**	Behavioural freedom **2**	Intrinsic nature* **3**
PRODUCERS	Adequate income & working conditions **4**	Freedom to adopt or not adopt **5**	Fair treatment in trade and law **6**
CONSUMERS	Availability of safe food: **7A** Public acceptability: **7B**	Respect for consumer choice **8**	Affordability of food **9**
THE BIOTA*	Conservation of the biota **10**	Maintenance of biodiversity **11**	Sustainability of biotic populations **12**

Fig. 2

An Ethical Matrix showing, in twelve individual cells, the interpretation of respect for the three principles of wellbeing, autonomy and justice in terms appropriate to the interests of farm animals, producers (livestock farmers), consumers, and the biota.

***These terms are explained briefly in the text. The cells are numbered for ease of future reference.**

In the Matrix, the way in which the three principles impact on the interests of the various groups affected by agricultural and food technologies is expressed in terms that are intended to be familiar but are at the same time authentic from an ethical perspective; e.g. respect for consumer autonomy (effectively *choice*) may translate, at least partly, into a requirement for food labelling, and that for the wellbeing of animals as *animal welfare*. The *biota* are defined as *animal and plant life*, i.e. chiefly the wildlife which constitute the living environment (it is assumed that geological formations *per se* are not ethically relevant, although effects on them may well be ethically relevant for humans), but also including farm animals at the collective level (species or populations), rather than considering them as individuals. Somewhat more problematically,

At its simplest, the Matrix is merely a check-list of concerns, which happen to be based on ethical theory. But it can be much more, for example, by serving as a means of promoting public education and as a stimulus to ethical deliberation. It is, of course, impossible to discuss the full significance of this approach in a couple of pages. Since the Matrix *per se* has no substantive output, its value can only be measured in terms of its *usefulness*.

However, it is important to note that:

- the Matrix is not prescriptive: even if one were to assign scores to different cells (e.g. a food technology might improve food safety and thus score well in that cell, but reduce animal

welfare, leading to a poor score in that cell), the fact that individuals weigh the cells differently precludes a definitive decision on ethical acceptability.

- it is probable that no form of biotechnology or system of food production could afford equal respect to all the ethical principles, and hence some may need to be overridden by others or respect for some only partially discharged.

- the Matrix can only compare two situations (usually, conditions with and without a proposed technology) but if the conditions without the proposed technology represent the *status quo*, this might unduly limit the options for ethical action: alternative scenarios need to be included within the analysis.

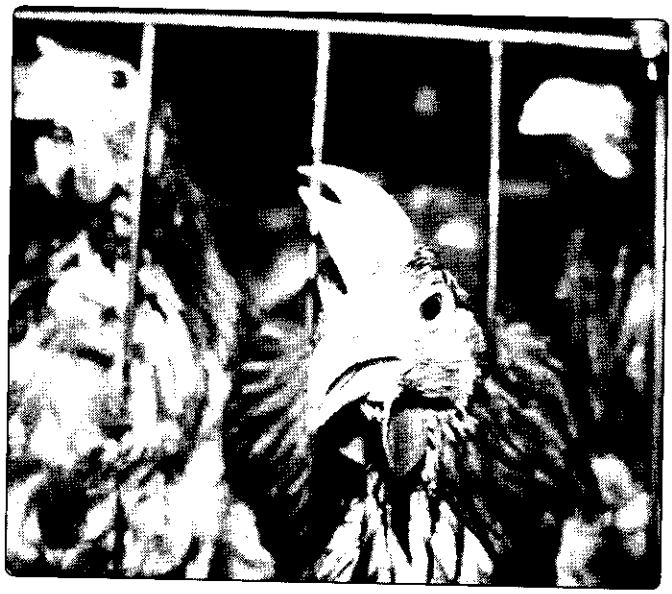
- the Matrix is designed to facilitate decision-making by making explicit the relevant ethical concerns, encouraging ethical reflection and discussion.

3.3 Ethical Evaluation

Our purpose in this report is to examine the impacts on respect for the ethical principles defined in the Matrix of two paths which might be adopted in our future use of animals for food. These two paths, which we call the *High-Tech* and the *Holistic* approaches, are explained more fully below (sections 4 and 5). As will be seen, when compared, each in turn, with the current dominant system of animal farming in the UK (discussed in section 2), they impact on the identified principles in quite different ways (see box 3).

Since the Matrix is not prescriptive of outcome, it does not in itself attempt to provide a judgement on the 'most ethical' of the outcomes. However, following each of the two analyses, we have provided our own evaluation of the two paths (boxes 5 and 7), based on our weighing of the impacts on the separate cells of the Matrix.

We believe that our ethical assessment of the evidence will find general support, although few readers will have previously considered the issues in the terms used here. But even if there is disagreement over the ethical evaluations presented, the framework used may nevertheless facilitate fruitful dialogue.



RSPCA PHOTOLIBRARY

BOX 3

SUMMARY ANALYSIS

Following the discussion of each interest group below (see Ethical Matrix) impacts are summarised in terms of three types of symbol:

☐ *indicates respect for the principle*
■ *indicates infringement of the principle*
◪ *indicates that the principle may be respected in some ways and infringed in others*

BOX 4

BACKGROUND ETHICAL THEORY

❖ According to the approach adopted here, respect for *wellbeing* corresponds to issues prominent in utilitarian theory, which characteristically employs a form of cost/benefit analysis to decide on *right action*. Most famously articulated in the eighteenth and nineteenth centuries by Jeremy Bentham and John Stuart Mill, it is epitomised in the phrase: '*The greatest good for the greatest number*'. While this might seem a worthy objective, such a naive form of utilitarianism suffers from several defects e.g.:

- it depends on predictions of outcome (which might be wrong) and (fallible) assessments of who or what counts in the cost/benefit analyses
- it can be held to justify gross inequality (as long as the majority 'are happy') or even crime (stolen money distributed to the needy)
- goods and harms are often incommensurable (how can we weigh the benefits of a new hair shampoo against the suffering of animals used to test it?)

❖ Respect for *autonomy* corresponds to the notion of *rights* advanced in the eighteenth century by Immanuel Kant, which appeals to our responsibilities and duties to 'treat others as ends in themselves'. In essence, this is the Golden Rule: '*Do as you would be done by*'. For Kant, ethics was about respecting others as individuals, not calculating costs and benefits (i.e. in contrast to utilitarianism, irrespective of outcome).

- A major defect of this approach taken in isolation is that there is no rule by which to decide how to prioritise duties, e.g. the duties to protect others from harm and to tell the truth - if, as may sometimes happen, telling the truth is itself a cause of harm.

❖ Respect for *justice* corresponds to Rawls' notion of 'justice as fairness'. For Rawls (a contemporary US philosopher): "*Justice is the first virtue of social institutions, as truth is of systems of thought. A theory, however elegant and economical, must be rejected or revised if it is untrue; likewise laws and institutions, no matter how efficient or well arranged, must be reformed or abolished if they are unjust*".*

- However, there is a problem in defining what fairness means. Does it mean that goods should be distributed according to need, or ability, or effort?

In practice, all these theories are likely to contribute, to varying degrees, to people's attitudes on what should be done in specific circumstances. It seems unlikely that anyone could consistently act as an out-and-out utilitarian; or as an out-and-out Kantian. Instead, each of us blends these theories (consciously or unconsciously) with intuitive responses and cultural influences to achieve what has been termed a *reflective equilibrium*.

* *Rawls J (1972) A Theory of Justice. Oxford: Oxford University Press*

4. AN ETHICAL ANALYSIS OF THE HIGH TECH APPROACH TO FARM ANIMAL USE

4.1 Introduction

In a recent review of breeding and reproduction in farm animals prepared for an EC-ELSA project,[90] a group of EU scientists and industrialists identified the following features of a future *low cost path* for animal production.

• New methodologies for increased efficiency will be explored. Because research in biotechnology is likely to be too expensive for some individual companies, this may stimulate collaborative research and/or amalgamation of companies

• Economic pressures will result in adoption of the most effective technologies available, including embryo technologies, transgenesis (also called genetic modification or GM) and cloning, to ensure higher production at lower cost. This path is likely to be followed by those producing for the global market and could thus affect a large sector of the food supply

• For ruminants (cattle, sheep, goats), intensive farming will be the main system: e.g. in beef cattle, there will be selection for double muscling; while in sheep, technology will be applied to increasing the number of lambs born per delivery

• In pig farming, there will be genetic selection for increased uniformity, e.g. in the onset of oestrus, body size and birth weight. This will inevitably mean a reduction in genetic variation

• For poultry (layers and broilers), emphasis will be on genetic technologies to increase the cost-effectiveness of production.

This *low cost path* thus corresponds to the *High-Tech* path we have identified in this report (section 3.3). We prefer to call it the High-Tech path because it is by no means certain that it will actually entail lower costs, even if expressed solely in monetary terms. In fact, many additional 'costs' may be born by animals in terms of reduced welfare and by the environment as a result of unsustainable resource use. An important point is that the High-Tech breeding programme, and the breeding technologies used to implement it, will to a large degree set the agenda for the whole animal products food chain. This is because the capital intensive nature of this approach only makes economic sense if it is applied on a large scale. Mass produced foods for international markets imply intensification of production and prioritisation of convenience and uniformity in the products.

How will these outcomes affect the ethical principles we have identified above? The following analysis employs a number of examples, drawn from technologies used in different farm species, to illustrate typical effects. The analysis is structured on the Ethical Matrix (Fig 2) and the implications of High-Tech biotechnologies are discussed with reference to three examples: MOET (multiple ovulation/embryo transfer), GM animals and cloning, although, apart from direct effects on the animals, many of the impacts are similar for all three. Numbers in **(bold)** refer to the cells of the Matrix in Fig. 2

4.2 Animal Wellbeing and Behavioural Freedom (1 and 2)

4.2.1 AI and MOET

The EC-ELSA report suggested that AI and MOET will be used routinely in the High-Tech path to achieve objectives such as double-muscling in cattle (which necessitates Caesarian section to deliver calves) and increased litter size in sheep (placing increased stresses on the ewes). The outcomes of such breeding programmes are thus likely to infringe animal welfare.

The impacts on wellbeing and behavioural freedom resulting from the use of AI and MOET were described in 2.3.2.1 and 2.3.2.2, since these technologies are already in use. However, cumulative adverse effects are likely to be greatly increased if the High-Tech path were to become the norm.

4.2.2 GM Animals

This technique allows the direct modification of the genetic make-up (genome) of farm animals in ways not possible by mating, since genes from entirely different species may be introduced. Although genetic modification (also called transgenesis) has not been used commercially in farm animals to date, it is undoubtedly part of the High-Tech scenario. A number of prospective applications of GM farm animals are directed to medical uses e.g. pigs whose organs (xenografts) may be used in human transplant surgery and 'bioreactors' (cattle and sheep), which secrete valuable pharmaceutical substances in their milk. This report does not cover such applications. Prospective applications to food-producing animals have three principal objectives, namely, productivity promotion, altering the quality of animal products and providing resistance to specific diseases.[91]

The production of GM animals involves incorporation of a *transgene* (DNA containing the appropriate genetic code) into the genome of the prospective genetically modified animal. The technique involves micro-injection of DNA into a single cell embryo and entails a number of surgical and hormonal

90 Neeteson A-M et al (1999) In: The future developments in farm animal breeding and reproduction and their ethical, legal and consumer implications. EC-ELSA project 4th Framework Programme. Utrecht, The Netherlands, pp. 15-33
91 Murray J D et al (1999) Transgenic Animals in Agriculture. Wallingford: CAB International

interventions. Thus, embryos are extracted from pregnant female animals, cultured *in vitro*, and then transferred to a hormone-treated, pseudopregnant *surrogate mother*. In pigs, sheep and goats, this generally involves two rounds of surgery (although not on the same animal), whereas in cattle non-surgical techniques are used.[92]

The process by which the transgene is incorporated into the genome of the prospective GM animal may significantly reduce animal welfare. Thus, the micro-injection procedure causes breakage of the chromosomes, which enables the transgene to be incorporated during the course of chromosomal repair. But incorrect repair can cause numerous adverse effects (deletions, translocations and inversions), while the transgene itself may become incorporated within an existing gene. The result is that mutations are common. A large proportion of mutations are lethal, leading to the early death of the embryo, and these are unlikely to cause significantly reduced welfare. However, some are not lethal so that the fetus survives to term, frequently resulting in the birth of deformed young. Because of the low efficiency of the whole process, usually less than 1% of microinjected embryos survive to become functional GM farm animals.

Other effects (due to, so-called, *epigenic* and *pleiotropic* properties of genes) mean that the consequences of random transgene insertion are liable to be unpredictable and give rise to widespread physiological changes, some of which may only become evident after several generations of breeding.

The earliest examples of GM farm animals, produced in the 1980s with the aim of increasing growth rates and reducing body fat, were the notorious Beltsville Pigs, expressing the human growth hormone gene. These animals experienced severely reduced welfare, including lameness, degenerative joint disease, gastric ulcers, reduced libido, heart disease, kidney disease and pneumonia. Such adverse effects have not been reported since but, in principle, it is possible to identify a 'spectrum of harm' to which GM animals might be exposed, depending on the nature of the transgene.[93] Recently, G E Seidel, a leading animal scientist, wrote: "Transgenic procedures often produce extreme phenotypes (i.e. physical characteristics), and nature tends to select against such extremes...Although (they) would not survive in nature, the farmers who use them in production agriculture may survive well economically." It thus seems clear that proponents of the High-Tech approach recognise that welfare is compromised by economics.[94]

In contrast to the problems associated with the generation of GM animals, it has been claimed that the technique has the capacity to *improve* animal welfare. Thus, by inserting genes for disease resistance both welfare and productivity might be enhanced. An example is GM chickens expressing a gene that confers resistance to a type of avian leukosis virus. While this is a theoretical possibility, to date, a number of adverse effects have been associated with this technique, including severe symptoms when the animals become infected by another type of virus, delayed sexual maturity and reduced egg production.[95]

Another way in which animal welfare might be improved stems from the high value of the products. For example, bioreactor cattle secreting lactoferrin in their milk, which might be added to babyfoods to more closely simulate human breastmilk, would justify a high level of veterinary care. (However, the many advantages of breastfeeding over any form of artificial substitute should be more widely appreciated[96]). While it is true that veterinary care is likely to be increased for such animals, it is also possible that respect for their behavioural freedom will be infringed, e.g. by confining them indoors for security reasons.

4.2.3 Cloning

The word cloning is used in a confusing variety of ways but in this context it refers to the process of producing genetically almost-identical animals from a single cell derived from an adult animal. The first successful application of the technique of nuclear transfer to achieve this aim was reported in 1997. It resulted in the birth of the cloned sheep, Dolly, which had been derived from a single mammary cell of an adult sheep. This technique raises the possibility of producing, to order, limitless numbers of identical animals. Thus, if a particular characteristic (such as high milk yield or a lean carcass) were to be achieved by GM, or by selective breeding, in just one animal, nuclear transfer would permit its exploitation in any number of cloned animals.

Nuclear transfer involves two cell types, namely, a 'donor' cell and an unfertilised egg. The genetic material is removed from the unfertilised egg and the genetic material from the donor cell (i.e. the adult mammary cell in the case of Dolly) introduced into it. An electric current is then applied to fuse the donor nucleus and the recipient cell cytoplasm. This process enables the birth of live sheep grown from cell cultures.[97]

In sheep, the procedure involves recovering the egg cells by laparotomy (a surgical incision), following the induction of superovulation by hormone injection and insertion of a vaginal tampon. The genetic material is then removed from the egg cells by micro-suction and replaced by the genetic material (DNA) from the donor cell, when the process of cell reproduction in the egg cells has been halted by 'starving' the cells in a nutrient-poor medium. Following the application of the electrical current to stimulate cell fusion and reactivate the quiescent cells, the cells are cultured *in vivo* in the ligated oviduct of a live sheep for a period of seven days, one ewe being able to carry large numbers of eggs for this purpose. After this period, the ewe is killed and

92 Mepham T B and Crilly R E (1999) ATLA 27, 847-55
93 Mepham T B et al (1996) ATLA 26, 21-43
94 Seidel G E (1999) See note 91, pp. 269-82
95 Gavora J S et al (1995) Poultry Sci 74, 852-63
96 Mepham T B (1995) Bioethical issues in the marketing of infant foods. In: Issues in Agricultural Bioethics. eds. Mepham TB et al. Nottingham: University Press
97 Bruce A and Bruce A (1998) eds Engineering Genesis. London: Earthscan.

the developed blastocysts transferred to hormonally-synchronised recipient sheep by laparotomy. The blastocysts are then allowed to develop to full term to be delivered.[98] The cloned offspring are not genetically identical with the nuclear donor because they also contain some DNA which was present in the mitochondria of the egg cell cytoplasm.

The success rates of this procedure are poor. In the series of experiments resulting in the birth of Dolly, although 21 ewes were confirmed as pregnant, only eight produced live lambs. In a previous series of experiments resulting in the birth of the lambs Megan and Morag, two lambs died and at autopsy revealed signs of developmental abnormalities in liver and kidney. Instances of the successful use of the technique for cloning of cattle, goats and pigs have been reported.[99]

When a MAFF report on ethical implications of animal breeding technologies was published in 1995[100] there was no anticipation of the technique of cloning by nuclear transfer which was announced in 1997. The authors wrote: "As regards the alleged risks involved in the production of genetically identical stock, these seem to us to be illusory." The rather different attitudes which emerged 'post-Dolly' led to another enquiry, this time by FAWC, into the implications of livestock cloning.[101]

The FAWC report identified a number of potential welfare problems:
i) large offspring syndrome, afflicting some animals born following nuclear transfer
ii) wastage of life, due to "an unacceptably high loss of embryos, fetuses and mature animals which are killed as part of the procedure": it was also noted that in the experiment in which Dolly was produced, only one successful live birth resulted from 277 attempts using cells in which mature DNA had apparently been transferred
iii) possible problems of aged DNA, which might result in shorter lifespans, or other abnormalities, in cloned animals
iv) adverse effects of surgical and other procedures used in *in vivo* culture procedures.

Many of FAWC's recommendations were for more research, for example, into the underlying causes of oversized offspring, the causes of embryonic and fetal deaths and birth abnormalities. But they also recommended that there should be a moratorium on the use of cloning by nuclear transfer until such problems had been "satisfactorily resolved".

4.3 *Animals' Intrinsic Nature (3)*

Many concerns about the application of High-Tech to farm animals do not relate to impacts on welfare or behavioural freedom *per se* but to a notion of respect for the animal's intrinsic nature. There is a sense for some people that it is unfair to animals to treat them in the highly instrumental fashion that High-Tech entails, although this may not apply to more natural treatments which correspond to the 'hunter and prey' relationship.

In MOET, animals are injected with hormones to alter their normal reproductive cycles and behaviour; and they are subjected to substantial surgery and non-surgical manipulations. In GM techniques, they are similarly subject to numerous hormonal and surgical procedures, and in addition may have their physiological processes fundamentally altered through the expression of additional or foreign genes. In both cases, they are inseminated by AI, a process which subjects bulls to repeated 'teasing', or in some cases electrical stimulation to cause semen ejaculation.

In the report of their enquiry into cloning, the FAWC stated that it could be considered instrinsically objectionable if it involves an unacceptable violation of the integrity of a living being, and that "an attitude may be developing which condones the moulding of animals to humankind's uses, irrespective of their own nature and welfare."

Other concerns falling into this category are those due to the patenting of animals produced by High-Tech. In that patents are only granted for 'inventions' the granting of a patent is seen by some people to offend the respect due to the intrinsic nature of the animal, and by others holding particular religious views as tantamount to blasphemy. However, according to EU law,[102] inventions shall be considered unpatentable where their commercial exploitation would be considered contrary to public order and morality (Article 6.1) or where the processes involved "are likely to cause (the animals) suffering without any substantial medical benefit to man or animal, and also the animals resulting from such processes" (Article 6.2d). Moreover, "processes the use of which offend against human dignity, such as processes to produce chimeras from germ cells of humans and animals, are obviously excluded from patentability" (para. 38). But such constraints are not necessarily very restrictive. Because a primary objective of patent law is to stimulate biotechnological innovation, it rarely appeals to the Precautionary Principle when adverse effects are not clearly established, for example, in cases such as the *in vitro* production of bovine embryos which might lead to reduced welfare of offspring.[103]

98 Farm Animal Welfare Council (1998) Report on the implications of cloning for the welfare of farmed livestock. London: MAFF
99 Polejaeva I A et al (2000) Nature 407, 86-90
100 MAFF(1995) Report of the Committee to consider the ethical implications of emerging technologies in the breeding of farm animals. London: HMSO
101 See note 98
102 EC Directive 98/44/EC of the European Parliament and of the Council on the legal protection of biotechnological inventions. Official Journal L213, 30.07.98. pp. 0013-0021
103 See note 90, pp. 87-96

But as the EU Directive acknowledges, to some degree, concern for the intrinsic nature of animals may be an expression of the way such procedures impact on the concept of human dignity. Respecting the intrinsic nature of farm animals may then correspond to 'conferring' a quality on them by responding to a perceived human duty so to act. According to this view, the High-Tech approach, by treating animals with such little respect, violates us as much as it does them.[104]

4.4 Other Animal Biotechnologies

It is important to realise that the three biotechnologies described, namely, MOET, GM and cloning, do not encompass all prospective High-Tech animal biotechnologies. For example, we have previously discussed, and recommended a ban on, the use of the hormone BST in dairying, on the grounds *inter alia* of the risks identified by an EU committee to animal welfare and food safety.[105] Another recently proposed technology involved injecting three week old piglets with "a package of DNA that boosted the production of the pig's natural growth hormone" and led to piglets weighing 40% more than normal at 2 months.[106]

In addition to these *invasive* approaches, biotechnology can be used to diagnose diseases, prevent disease (e.g. with vaccines) and treat sick animals (therapeutic drugs). These did not feature in the EC-ELSA report's low cost path but they represent ways in which biotechnology might enhance animal welfare.

Summary of the ethical impacts of High-Tech on farm animals
Animal welfare: ■
Behavioural freedom: ■
Animals' intrinsic nature: ■

4.5 Producer Wellbeing (4)

The primary producers, farmers, are likely to experience quite different impacts, depending on whether they can, or are inclined, to adopt the High-Tech approach. Those embracing it are likely to flourish if public acceptance ensures a growing (global) market. However, there are significant secondary effects when farmers are forced out of business through the rigours of competition.[107] Adverse effects on rural communities become evident when reduced demand leads to closure of shops, schools and churches; house prices increase beyond the reach of the younger people in villages, and public transport services are terminated, particularly affecting the elderly. Thus, the 'efficiency' of the High-Tech approach seems likely to exacerbate the already increasing 'problems of the countryside'.

Agricultural suppliers in the form of biotechnology companies, veterinary pharmaceutical companies, feed suppliers *et al* might benefit financially from widespread adoption of the High-Tech approach.

4.6 Producer Freedom to Adopt or not Adopt the High-Tech Approach (5)

Opportunities to capitalise on new technology may be seen as respecting the entrepreneurial talents of farmers wishing to advance their businesses. However, many farmers who are unsympathetic to the High-Tech approach may feel compelled to adopt it despite their inclinations, thereby becoming unwilling recruits to the 'technological treadmill'. Hence, economic necessity may prove the decisive factor in farmers' decision-making.

4.7 Producers' Fair Treatment in Trade and Law (6)

The concept of 'fairness' is problematical. For some, "all's fair in love and war – and business". Is it an ethical concern if some farmers do better than others, or if some become so uncompetitive that they are forced out of farming? The critical point would seem to relate less to the cornfield than to the (level) playing field. If legal arrangements for trade in food are discriminative there is cause for legitimate concern.

In the case of GM crops there have been highly publicised concerns about the unfairness of a situation where non-GM farmers might have their crops contaminated by pollen from neighbouring farmers' GM fields. It is difficult to envisage a parallel problem occurring with GM farm animals. The problems here are more likely to lie in the perceived economic advantage High-Tech farmers might have over other farmers through the nonpayment of costs incurred by their practices. For example, intensive animal enterprises, which are likely to be adopted in the High-Tech approach, might place considerable burdens on the environment but the cost might not be borne fully by the farmers causing the problem.

104 See note 10
105 See note 37
106 Coghlan A (1999) New Scientist 18.12.99
107 The American Corn Growers Association claims that "growing biotech crops is costing US farmers up to £700 million in lost markets as consumers around the world shun GM food." Ingham J (2000) Daily Express 25 August, p.36

4.7.1 Patents

Another type of impact on this ethical principle relates to the patenting of High-Tech processes and the resulting animals. Patents are granted for inventions which must be:
i) non-obvious
ii) novel
ii) industrially applicable.
Patents are limited to a 20 year period, during which time the holder can obtain a return on investments by exploiting the invention free of competition or by permitting others to exploit it under licence and in return for a fee. The claimed merits of patenting are that it allows those who have committed time, energy and money to recoup their just rewards, and that it fosters technological and scientific progress by requiring the disclosure of detailed information on the patent.

Under European law,[108] patents may be granted both on High-Tech processes and on the resulting animals. Thus, many of the new processes being developed, such as methods to produce GM animals and cloning techniques, are theoretically patentable, even if they involve a purely biological stages at several points. However, inventors usually try to obtain stronger protection than that afforded by process patents by securing patents on the animals as well. Such patents can have very broad applicability, because a company that discovers a coding gene for a substance increasing muscle growth, or a new cloning technique, can apply this to any animal. So, the exploitation of the invention applies not only to a specific animal variety, such as cloned Friesian cattle, but to any cloned non-human mammal exemplified in the patent.[109] Patents are also frequently written with a number of claims, which may cover genes or gene sequences. The latter may be identical in structure to natural genes in the animal body, because if the gene has been isolated from the body and the inventor has disclosed its precise use it is no longer considered a 'discovery' but an invention.

Christine Noiville, a lawyer at Paris University, has identified a number of problems associated with patents on farm animals which impact on this ethical principle, namely: a) the risk of competition between patent holders and traditional breeders; b) effects of patents on research and development in animal biotechnology; and c) impacts on 'farmer's privilege' and the traceability of High-Tech animals. The following paragraphs draw on her analysis.

a) Consider the, hypothetical, example of a company obtaining a patent on a GM process which makes cows resistant to mastitis (a painful condition resulting from inflammation of the udder). Such a company will claim protection for "any GM cow resistant to mastitis infection" and will be entitled to collect royalties for the commercialisation of any bovine variety genetically modified as exemplified in its patent. The company will then be able to sell these GM animals without any authorization from the developer of the original variety, who will be unable to contest the situation, and will receive no returns from it, because traditional breeding practices are not legally protected.

b) Although patents are supposed to promote innovation, there are concerns that because many patents are based on very broad claims they might confer wide monopolies, and as a consequence impede research and development.

c) Under law, farmers appear to have the right to mate patented animals and perpetuate offspring without incurring payment of royalties. That is, as long as the objective is 'agricultural' (producing meat, milk etc) it does not infringe the patent law to produce a patented GM animal through breeding. However, several problematical issues remain unresolved. For example, in the beef cattle sector, there are frequent transfers between farms for various purposes (e.g. breeding, slaughter). In some cases, the intention might be to use the animals to produce semen or embryos, which would be illegal. Hence farmers might be put in the invidious position of becoming involved in patent enforcement. Whatever benefits might be ascribed to some producers (probably usually companies rather than farmers) the laws of patent would appear to seriously challenge this ethical principle.

Moreover, if we include in the interest group 'producers' those millions who live in developing countries (and why should they be excluded?), there seems little doubt that their competitive positions (already extremely weak in an increasingly globalised market) will be affected even more seriously. Whatever the underlying political or economic causes of this situation, it can hardly be regarded as 'fair' for their already desperate position to made even worse. The claim that High-Tech approach will improve the situation in developing countries has been viewed with deep suspicion.[110]

Summary of the ethical impacts of High-Tech on producers

Income and working condition of farmers: ◪
Income of agricultural supply companies: □
Farmers' freedom to adopt or not adopt: ◪
Farmers' fairness in trade and law: ◪

108 See note 102
109 See note 103
110 See note 9. This book contains several important chapters written by scientists from developing countries.

4.8 Consumer Wellbeing: Food Safety and Acceptability (7A and 7B)

If the main objective of High-Tech approaches is low cost production, increased safety is perhaps unlikely to be an explicit target. Indeed, the associated intensive systems and large volume slaughter facilities are intrinsically prone to disseminate disease organisms widely. However, it is clearly not in producers' interests to risk diseased material in their products and this may lead to increased investment in measures to prevent and control disease outbreaks.

While MOET and cloning have few direct implications for food safety, unanticipated changes in the composition of animal products from GM animals would seem to demand rigorous safety testing. Instances where administration of BST to dairy cattle led to alleged risks to public health are discussed in an earlier report (see 4.4). Our current understanding of these issues does not allow us to generalise about the effects of GM on food safety but prudent application of the Precautionary Principle would seem to be essential.

Some proposed applications of GM animals are designed to produce milk of altered composition, such as "altering the proteins to change the manufacturing properties" and "altering the type and amount of fatty acids in milk."[111] It is difficult to believe that such changes could make a significant difference to consumer wellbeing: indeed, they might be considered trivial objectives for a technology which carries the risks to animal welfare identified.

Public acceptability of High-Tech approaches seems to be low for just such reasons. Opinion polls conducted over a number of years in the EU have consistently revealed very low support for biotechnology applied to farm animals.[112] Of all possible biotechnological applications, this is regarded as the least acceptable, more people being opposed than in favour. The most recent Eurobarometer survey posed specific questions about animal cloning to over 16,000 people throughout the EU. On a scale from 5 (totally agree) to 1 (totally disagree), the average scores recorded in response to the following statements were: "even if animal cloning has advantages, it is basically against nature" (4.24); "animal cloning threatens the natural order of things" (4.12); "animal cloning is simply not necessary" (3.85); "if something went wrong with animal cloning, it would be a global disaster" (3.80);"the idea of animal cloning causes me great alarm" (3.73).[113]

4.9 Consumer Choice (8)

As there are currently no GM food animal products on sale, the issue of labelling has not been debated publicly. The precedent of GM crops suggests that there will be pressure in the EU for labelling of GM animal products but this may not provide adequate protection for consumers. The absence of labelling of GM food products in the USA and elsewhere, the virtual impossibility of labelling all foods containing such products (e.g. those in meals purchased in restaurants), and the ease with which GM material can be introduced adventiously into nominally GM-free foods – all suggest that respect for this principle will undergo inevitable erosion if High-Tech animal products become commonplace. Indeed, the advice of a UK Government's advisory committee suggested that there was only a need to label foods that were 'ethically sensitive', i.e. those containing human genes or animal genes which would be proscribed on religious grounds.[114]

Despite this, certain food products derived from animals treated by other forms of biotechnology, such as AI and MOET do not appear to have caused adverse public reactions. This may, of course, be due to a lack of awareness of the techniques. In contrast, in the UK there appears to be overwhelming support for labelling of milk from cows treated with the hormone bovine somatotrophin (BST), were it to be licensed.[115]

4.10 Affordability (9)

The aim of the High-Tech approach is high volume, uniform, low cost products. If the approach is successful in its aims, affordability should be increased. This might be considered the major virtue of the High-Tech approach, with some people even claiming that it, alone, will be capable of feeding the growing world population.

Summary of the ethical impacts of High-Tech on consumers

Food safety: ■ Public acceptability: ■
Choice: ■ Affordability: □

111 Murray J D and Maga E A (1999). See note 91, pp. 193-208
112 Eurobarometer 46.1 (1997) The Europeans and modern biotechnology. Brussels: European Directorate XXII
113 Eurobarometer 52.1 (2000) The Europeans and biotechnology. Brussels: INRA (Europe) - ECOSA
114 MAFF (1993) Report of the Committee on the ethics of genetic modification and food use. London: HMSO
115 Millar K M, Tomkins S M, White R P and Mepham T B (2000) Consumer attitudes to the use of two dairy technologies. British Food Journal (in press)

4.11 Biotic Conservation (10)

Effects on the *wellbeing* of fauna and flora are secondary to management changes resulting from adoption of High-Tech approaches. Consequently, such effects are less easy to predict because they may become subject to various controls resulting from legislation, economic pressures or consumer preferences.

However, as indicated by the EC-ELSA report, the High-Tech approach is likely to encourage intensification. "In pig farming, family farms would gradually or rapidly be replaced by industrial farms, large well organised farms with very low labour input per animal". Moreover, "Farms where the farmer lives near the farm will disappear more and more. In the USA farms with a million pigs or a hundred thousand beef cows already exist."[116]. Such concentrations of animals will exacerbate the problems of environmental pollution, which are already very serious in many cases.

A counter-argument is that because fewer animals are needed to produce the same amount of food for humans, the adverse environmental effects (e.g. manure, fertilizers, pesticides) will be reduced. This seems a questionable argument for many pollutants, because the intensification process is likely to lead to greater concentration of animals in large farms, and hence to more point-source pollution. However, the point might not apply to any reduced amounts of methane produced by (fewer) High-Tech cattle, since this aerial contaminant will exert its adverse (greenhouse gas) effects on the atmosphere as a whole.

4.12 Biodiversity (11)

There are two types of potential impact: a) those relating to wildlife and b) those which concern the diversity of farm species.

a) There is much evidence that intensive agricultural practices have had significant adverse effects on the wild flora and fauna. For example the UK population of farmland species of birds, such as the skylark, grey partridge and corn bunting have fallen in numbers by more than 50% in the past 25 years.[117] High-Tech approaches might be expected to exacerbate these changes.

b) While, in theory, High-Tech approaches could increase the diversity of farm species, in practice the reverse is likely to occur. Already, concerns have been expressed about the narrowing of the genetic base of national breeds of cattle through use of AI,[118] and this is likely to be exacerbated by increasing use of MOET and, particularly, cloning.

4.13 Biotic Sustainability (12)

A key aspect of sustainability in the terms of the Ethical Matrix is *intergenerational justice*. Will High-Tech improve the chances of our descendants experiencing long and healthy lives in a self-sustaining biotic environment? Relevant questions relate to nonrenewable energy use and long term environmental impacts. In that the High-Tech path seems likely to aggravate many contemporary problems it might be thought likely that efforts to achieve sustainability will be increasingly undermined. And since the envisaged *low cost* character of the High-Tech scenario will make animal products more available to far greater numbers of people, the adverse environmental impacts identified might result in collapse of our biological support system sooner than otherwise.

However, some counterclaims have been made. Thus, if GM/cloned animals are more efficient in energy terms (i.e. they use less feed and support energy to produce the same amount of energy as food), they might spare the use of resources and prolong the Earth's ability to maintain its living populations.

Summary of the ethical impacts of High-Tech on the biota

Biotic conservation: ◪
Biodiversity: ■
Biotic sustainability: ◪

116 See note 90
117 Allison R (2000) The Guardian 20.11.00 p.12, reporting on a survey compiled by the Royal Society for the Protection of Birds, the British Trust for Ornithology and the Joint Nature Conservation Committee
118 Heap R B and Moor R M. See note 96, pp. 247-268

BOX 5

AN ETHICAL EVALUATION OF THE HIGH-TECH APPROACH TO ANIMAL USE FOR FOOD

In our view, the High-Tech approach will do little to ameliorate existing concerns over the use of animals for food, and in many respects is likely to exacerbate them.

- *Increasing use of multiple-ovulation/embryo transfer and the introduction of genetic modification and cloning seem likely to affect animal welfare adversely, while also constituting an increasingly instrumental use of animals which fails to show respect for their intrinsic natures.*

- *While farmers adopting the High-Tech approach, and the biotechnology companies which supply them, may benefit financially from the ability to streamline the production of uniform, low-priced foods, those traditional farmers who are unwilling to join this 'technological treadmill' may be priced out of business. Respect for the principle of fairness may be challenged by existing patenting law relating to GM and cloned animals and associated techniques.*

- *Food prices may be reduced, while effects on food safety are difficult to predict, but the significant ethical concerns of consumers over the application of such biotechnologies to farm animals may be overridden if markets become dominated by such food and choice is thereby curtailed.*

- *There are competing opinions on whether High-Tech approaches are consistent with sustainable agriculture, but we are persuaded that their widespread adoption will lead to significant loss of biodiversity and an unsustainable reliance on the intensive practices that currently jeopardise the continuing viability of the biosphere.*

5. AN ETHICAL ANALYSIS OF THE HOLISTIC APPROACH TO FARM ANIMAL USE

5.1 Introduction

The EC-ELSA review of breeding and reproduction in farm animals,[119] described an *alternative path* to the low cost and conventional paths discussed above. The following characteristics of this alternative path were identified:

- The production system and breeding goals will aim at moderate production levels

- Breeding goals will promote balance, avoiding negative effects of breeding for productivity on other traits, such as mobility, disease resistance and reproductive performance

- Certain technologies now available will be avoided to allow food products to be marketed with certain characteristics, e.g. organic food

- Other technologies (the report cites AI and MOET) could be used to ensure survival of endangered breeds and allow dissemination of genetic material free of disease, while the use of Marker Assisted (genetic) Selection could facilitate production of animals with improved longevity and reduced susceptibility to disease

- Hence, different types of alternative system might emphasise i) non-productive traits that are able to improve animal welfare; ii) high quality products to satisfy niche markets, e.g. for production of foods characteristic of different geographical regions; or iii) production of organic foods.

Thus, the *alternative path* bears a strong resemblance (at least, at first sight) to what we have designated the *Holistic* approach. As for the High-Tech approach, Holistic breeding goals, and the breeding technologies used to implement them, will influence the whole animal products chain. But, because there is a much greater emphasis on quality rather than quantity, the Holistic approach seems likely to invest more heavily in improving the standards of human, animal and environmental life throughout the entire length of the chain. Rather than seeking to subvert the natural physiological and ecological controls, which is the aim of the High-Tech approach, the Holistic approach seeks to work with these controls to ensure that they continue to operate effectively for the foreseeable future.

119 See note 90

How would adoption of the Holistic approach impact on the ethical principles we have identified above? The following analysis employs a number of examples, drawn from practices used for different farm species, in order to illustrate typical effects. As for the High-Tech approach, the analysis is structured on the Ethical Matrix (see Fig. 2), with cells again referred to in **(bold numbers)**. The implications of Holistic practices are discussed with particular reference to the organic standards specified by the EU Council Regulation (1999).[120]

In the UK, standards are set by the United Kingdom Register of Organic Food Standards (UKROFS), an advisory body to MAFF. The EU Regulation enables Member states to impose, on producers in its own territory, stricter conditions than those prescribed in the Regulation. While UKROFS considers that, in general, the EU Regulation ought not to be supplemented by stricter UK standards, it has retained such standards in a few cases, notably requiring that, except for poultry, organic meat should be derived from stock born and raised entirely under organic management.[121] The new EU standards for livestock (specified in Regulation 1804/1999) came into effect in the UK in August, 2000.[122]

It is perhaps important to note that the EC-ELSA report sees the alternative path in very pragmatic terms. The horizons are determined by (contemporary) consumer-led demands – which are largely related to the relatively recent, but growing, concerns expressed over animal welfare. However, the motive for farmers wishing to adopt Holistic approaches will often have a much broader basis, rooted in a worldview which values traditional cultural norms, social equity, and conservation of the environment, as well as respect for animals and their welfare. In several respects, the organic philosophy is an evolving one, and because its ideals cannot be realised overnight, interim compromises have had to be made.[123] Thus, in this analysis we view the Holistic path as an ethically sound direction of change rather than as a clearly defined trajectory to a specified destination. Moreover, although in this analysis we are necessarily focused on the role of farm animals, Holistic approaches, and organic standards more specifically, obviously envisage mixed farms, involving both crops and livestock (see Box 6).

The following analysis compares the effects of implementing organic standards with the existing, dominant, animal production systems in the UK. As we have seen, these often suffer many drawbacks, so that even if the effect of the Holistic approach were neutral with respect to current systems this would hardly be a satisfactory outcome in ethical terms. In some cases we refer to practices/technologies which are not currently features of organic farming, but which we feel might be generally consistent with the Holistic approach. The same types of summary analyses are used as were employed with the ethical analysis of the High-Tech approach (section 4), with the same provisos.

5.2 Animal Wellbeing and Behavioural Freedom (1 and 2)

5.2.1 Breeding practices

"In principle, the reproduction of organically reared livestock should be based on natural methods. Nevertheless artificial insemination is permitted. Other forms of artificial or assisted reproduction (for example embryo transfers) are prohibited" ***(6.1.1)***. Here, and subsequently, bold italicised numbers refer to paragraphs in the EU Regulation on organic farming.[124] This regulation thus prohibits any use of MOET, GM or cloning. In that MOET is currently used in conventional animal agriculture, on this basis alone, adoption of the Holistic approach would respect this ethical principle.

We noted in 2.3.1 that genetic selection for increased productivity often has adverse effects on animal welfare. However, just as it is possible to breed for productivity, it is also possible, at least in some cases, to breed for improved welfare. Moreover, such strategies also benefit farmers by reducing losses of output, veterinary fees and negative reactions from consumers. For example, a Nordic study of dairy cows in which breeding goals included improved health, fertility and calving performance showed that financial profits increased 34%. Although yields were down by 25% on average, the greatly improved resistance to diseases more than compensated for the smaller milk cheque.[125] Attempts to reduce gait problems in broilers by selecting against tibial dyschondroplasia have been less successful, but the general principle is sound and clearly merits much more research in particular cases.

A biotechnology which might facilitate this approach is Marker Assisted Selection (MAS), which utilises data based on the presence of desirable genes together with phenotypic information. The advantage is that the effects of genes are measured directly from the genetic make up of the animal and not solely from its phenotype. The authors of the EC-ELSA report consider that MAS is "likely to be applied" by those adopting the alternative path and since it is solely 'knowledge-based' and does not involve any biotechnological interventions it appears consistent with the Holistic approach.

Respect for animal wellbeing and behavioural freedom are also likely to be enhanced by numerous other requirements, recommendations and prohibitions of the organic regulations. The following list exemplifies these.

120 Council of the European Union Regulation (EC) No 1804/1999, supplementing Regulation (EEC) No 2092/91. Official Journal of the European Communities L222/1-L222/28(24.8.99)
121 MAFF (2000) Consultation document on draft UKROFS standards for organic livestock and livestock products. Website: See note 12.
122 United Kingdom Register of Organic Food Standards (2000) Standards for livestock and livestock products. Website : See note 12.
123 Woodward L (1999) Evidence to House of Lords Select Committee on organic farming and the EU. Website: http://www.parliament.the-stationery
124 See note 120
125 See note 13

BOX 6

PRINCIPLES OF THE INTERNATIONAL FEDERATION OF ORGANIC AGRICULTURAL MOVEMENTS

- *Work as far as possible as a closed system, drawing on local resources*
- *Maintain the long-term fertility of soils*
- *Avoid all forms of pollution resulting from organic techniques*
- *Produce foods of high nutritional quality in sufficient quantity*
- *Reduce fossil energy use to a minimum*
- *Give livestock conditions that conform to their physiological needs and in accordance with humanitarian principles*
- *Make it possible for agricultural producers to earn a living through their work and develop their potentialities as human beings*
- *Use appropriate technology based on an understanding of biological systems*
- *Use decentralised systems for processing, distributing and marketing products*
- *Create a system which is aesthetically pleasing to those both inside and outside the system*
- *Maintain and preserve wildlife and habitats*

Source: Woodward L et al (1997) Health, sustainability and the global economy: the organic dilemma. Newbury: Elm Farm Research Centre. p.iii

5.2.2 Housing

"Housing conditions for livestock must meet the livestock's biological and ethological needs" ***(8.1.1)***. "The stocking density in buildings shall provide for the comfort and well being of the animals which, in particular, shall depend on the species, the breed and the age of the animals. The optimum density will seek to ensure the animals' welfare by providing them with sufficient space to stand naturally, lie down easily, turn around, groom themselves, assume all natural postures and make all natural movements such as stretching and wing flapping" ***(8.2.2)***. It is clear that such conditions are absent in many conventional systems, e.g. battery and broiler house systems for poultry.

5.2.3 Feed

"Livestock must be fed on organically produced feedingstuffs ***(4.2)***. Feed is intended to ensure quality production rather than maximising production, while meeting the nutritional requirements of the livestock at various stages of their development ... Force feeding is forbidden" ***(4.1)***." All mammals must be fed on natural milk for a minimum period (three months for bovines, 45 days for sheep and goats and 40 days for pigs)" ***(4.5)***." Rearing systems for herbivores must be based on a maximum use of pasturage according to the availability of pastures at different times of the year ***(4.7)***," while "Poultry must be reared in open-range conditions and cannot be kept in cages" ***(8.4.1)***. Again, such conditions demarcate organic systems very clearly from conventional systems.

5.2.4 Animal health

Animal health is central to organic livestock husbandry. Disease prevention is based on four principles: i) selection of appropriate breeds or strains; ii) application of appropriate husbandry practices, encouraging strong resistance to disease and prevention of infections; iii) use of high quality feed, which together with regular exercise and access to pasturage, encourages natural immunological defence mechanisms; iv) avoiding overstocking ***(5.1)***. The use of chemically-synthesised allopathic veterinary medicinal products or antibiotics for preventive treatments is prohibited ***(5.4)***. However, if despite such measures, an animal becomes sick or injured, it must be treated immediately. In this respect, modern biotechnology might provide valuable tools in the form of vaccines and diagnostic reagents for disease detection, and since these are non-invasive applications they appear compatible with the Holistic approach.[126]

However, "The use of substances to promote growth or production (including antibiotics, coccidiostats and other artificial aids for growth promotion purposes) and the use of hormones or similar substances to control reproduction (e.g. synchronisation of oestrus) is prohibited" ***(5.5)***.

5.2.5 Handling, transport and slaughter

Organic standards emphasise the importance of avoiding mixing of animals from different social groups, employing experienced staff: and using local abattoirs. "Loading and unloading must be carried out with caution and without the use of any type of

126 Persley G J (1990) Beyond Mendel's Garden: biotechnology in the service of world agriculture. Wallingford: CAB International.

electrical stimulation to coerce the animals" **(6.2.1)**, while "During the period leading up to the time of slaughter, livestock must be handled in such a way that stress to the animals is reduced to a minimum" **(6.2.2)**.

5.3 Animals' Intrinsic Nature (3)

There seems little doubt that the priority placed by the organic farming regulations on respect for the animals' natural behavioural instincts and for their wellbeing represent a considerably greater respect for their intrinsic nature than many practices in conventional animal agriculture, detailed in section 2.

Summary of the ethical impacts of the Holistic approach on farm animals

Animal welfare: ☐
Behavioural freedom: ☐
Animals' intrinsic nature: ☐

5.4 Producers' Wellbeing, Freedom to Adopt or not adopt the Holistic Approach, and Fair Treatment in Trade and Law (4, 5 and 6)

These three principles of the Matrix are considered together because they are so closely interrelated in this case.

Opportunities to adopt the Holistic approach are severely constrained by the financial penalties associated with conversion. Thus, it takes at least two years for a normal farm to convert to accredited organic status, and during this period farmers almost inevitably experience loss of income because they will have to abandon former intensive practices but are unable to receive the premium payments for organic produce. It was estimated in 1997 that 20% of farmers could go organic immediately, with little financial loss, but 80% would incur greater penalties because, for example, they might need to include animals on a previously all-arable farm.[127]

However, in recent years, the UK Government has substantially increased aid to farmers wishing to convert, especially under the England Organic Farming Scheme, begun in 1999. In June, 2000, Countryside Minister Elliot Morley, stated: "Last year we allocated more than £11 million to farmers wishing to convert compared to 1997 when it was just £1 million. Over the next seven years a further £140 million will be made available. This is a substantial commitment and vote of confidence in the future of the organic sector."[128]

Despite this increase in aid for conversion, there is strong case for continuing support for organic farmers after conversion. As is evident from the analysis of Pretty et al (2000),[129] the external costs of conventional farming practices (see 2.7), which have to be met, in one way or another, by the general public (now and in future), imply that further support for organic systems could make good financial sense. In other EU countries, such as Denmark, Germany, Austria and Italy, farmers continue to receive Government support after conversion.[130]

The growing public demand for organic produce is undoubtedly encouraging many more farmers to want to convert to organic, although the UK, with only 3% of the land being farmed organically (and 70% of organic food purchased being imported), is still far behind other EU countries. Scandinavian countries, Germany, Austria, Switzerland and Holland all exceed the UK's efforts, with Austria aiming to be 10% organic by 2000 and Sweden 20% by 2005.[131] The increased uptake of organic farming may be predicted to increase employment opportunities in the country, and hence assist in the efforts being made to revitalise the rural economy and ameliorate the problems of social exclusion.

Summary of the ethical impacts of the Holistic approach on farmers

Farmers' income and working conditions: ☐
Freedom to adopt: ◪
Fairness in trade and law: ◪

5.5 Consumers' Wellbeing (7A and 7B)

The Food Standards Agency (FSA) recently published its view on organic foods, claiming that "there is not enough information at present to be able to say that organic foods are significantly different in terms of their safety and nutritional content to those produced by conventional farming."[132] Specifically, the FSA's message is that currently there are no grounds for claiming that, by comparison with conventional food, organic food is any more or less nutritious, microbiologically safe, or prone to mycotoxin contamination.

127 Steele J (1997) Green Futures, June/July 1997
128 MAFF (2000) Elliot Morley announces massive organic expansion. Press Release 12.6.2000
129 See note 43
130 House of Lords (1999) Select Committee report on Organic farming and the EU Website: see note 123
131 Sustain (2000) Organic Targets Bill. Website: www.sustainweb.org
132 Food Standards Agency (2000) position paper: FSA view on Organic Foods (23.8.00). Website: www.foodstandards.gov.uk

However, while there is certainly a paucity of data (which itself suggests that this is a priority area for future research), there are some indications that consuming organic food does confer benefits. For example, a comprehensive review of the literature (referring to 150 publications) suggested that by comparison with conventionally-produced foods organic food has far lower nitrate content, lower pesticide residues, higher dry matter concentration and, in feeding studies with animals, higher palatability.[133]

The FSA also stated:" We do not object to the use of pesticides and veterinary medicines ...as long as any residues are kept as low as possible and do not pose a threat to health. Foods are monitored regularly to ensure that this is so." This statement is problematical in that it assumes that *post hoc* monitoring, often on a very small scale, can ensure safety. Where veterinary medicines are used routinely the risks of intentional or unintentional abuses must be increased by comparison with circumstances where, as in organic systems, their use is positively avoided. Indeed, the National Surveillance Scheme for Residues data frequently show that maximum permitted residue levels (MRLs) are exceeded. For example, the most recent data show that 13% of liver samples from broilers contained the coccidiostat nicarbazin at concentrations above the MRL.[134] Although MRLs are not defined as 'safety levels', they are indicative of acceptable practices, and on that basis alone, organic animal products would seem to carry lower risks than conventional animal products.

Moreover, it has been suggested that organic feeding practices are likely to significantly reduce the risk of infection of meat with E.Coli. Virulent strains of E Coli, such as 0157:H7, develop in the digestive tract of cattle that are mainly fed starchy grains.[135] However, organically-reared cattle fed with hay generate less than 1% of the E Coli found in faeces of grain-fed animals. According to a recent FAO report: "It can be concluded that organic farming potentially reduces the risk of E Coli infection".[136]

Recently, questions have been raised about the alleged risks of organic farmers using farmyard manure, which might harbour disease organisms, as a fertiliser. The House of Lords report was dismissive of such suggestions, firstly, because all such manures are composted or stacked for six months, in which time all or most of the pathogens will have broken down, and secondly, because manures are not applied to the parts of plants to be consumed. In any case, such wastes are also used in conventional systems.[137]

Although some might argue that organic food respects the principles of food safety by comparison with conventional food, we feel that the evidence is not sufficiently strong to assess this impact as other than neutral.

However, respect for wellbeing is not confined to issues of public safety. Purchase decisions, while often moderated by food prices, may also be influenced by the desire to support a particular *worldview*, and the purchaser or consumer gains satisfaction from so doing. In that sense, if eating organic food 'seems healthier' it 'is healthier'. An opinion survey published in 1997 found that 83% of organic food consumers bought it because they wished to avoid pesticides, 75% because it was considered kinder to the environment, while 70% were concerned about the intensive rearing of animals.[138] Wellbeing might also be reflected in the taste and appearance of food. For example, in a study in which consumers were presented with steaks from cattle reared organically and non-organically (but were not informed which was which), significant preferences for both the taste and appearance of the organic meat were recorded.[139]

5.6 Consumer Choice (8)

There is a tendency to interpret this requirement in terms of labelling. Adequate, informative labelling is clearly essential but it does not in itself ensure consumer choice. Poor supplies or prohibitively high prices (discussed below) restrict choice, as does a lack of appreciation of what is at stake in making purchase or consumption decisions.

Organic foods marketed in the UK must be labelled with the code of the appropriate certification body (e.g. Soil Association, Organic Farmers and Growers or UKROFS), which indicates that the premises have been inspected and approved, and continue to be on a regular basis. In other EU countries different certification authorities perform this role, but minimum standards are set by the EU Regulations.[140] Food imported from outside the EU presents a more complex vetting procedure but it can only be labelled 'organic' if it has come from a country recognised as applying equivalent standards and regulatory procedures. Nevertheless, some consumers, unaware of such regulations, might be deceived by retailers selling food labelled 'organic' which has not been certified as such.

5.7 Affordability (9)

Organic food is generally more expensive than conventionally-produced food. This is a result of several factors. For example, i) although often produced in more energetically efficient ways, yields tend to be lower, at least until soil fertility has built up; ii) the food is produced in small quantities and does not benefit from economies of scale; iii) the organic food sector bears the annual cost of registration and certification; iv) guaranteeing that the food

133 Woese K et al (1997) J Sci Food Agric. 74, 281-93
134 Veterinary Medicines Directorate (2000) Medicines Act Veterinary Information Service 35, 16. See also note 37.
135 Couzin J (1998) Science 281, 1578-9
136 United Nations Food and Agriculture Organisation (2000) Food safety and quality as affected by organic farming. Website: http://www.fao.org
137 See note 130
138 See note 130
139 Lowman B G (1991) Proc Brit Cattle Vet Assoc, pp 176-193
140 See note 124

is free of genetically modified ingredients entails extra costs in sourcing non-GM feedstuffs. Many of these constraints might be removed if the volume of organic food produced reached a critical threshold.

However, organic livestock farming incurs some significant additional costs. Thus, a) it is more labour-intensive to raise animals extensively than intensively; b) subsidies are paid on headage per hectare, so that fewer animals means fewer subsidies and a lower income; c) it is more expensive to feed animals naturally on feed of organic origin, and to keep them longer by not forcing their growth with high protein diets and antibiotics; d) there are additional costs to allowing calves to suckle naturally, piglets to be left with their sows longer and poultry freedom of expression and movement.

Unsurprisingly then, the price of organic food is generally substantially higher than conventional food: possibly, on average, 50-60% more. But in some cases the differential has disappeared, e.g. for organic yoghurt. Indeed, since in the UK the value of farm produce 'at the farm gate' is now only about a third of the retail price, significant premiums to the farmer can show up as quite modest premiums on the selling price.[141] But to the extent that high prices will adversely affect affordability for some people, organic food currently fails to respect this principle.

Summary of the ethical impacts of the Holistic approach on consumers

Food safety: ◪
Public acceptability: □
Choice: □
Affordability: ■

5.8 *Biotic Conservation, Biodiversity and Sustainability (10, 11 and 12)*

In the following, these three principles are discussed together.

Organic systems are principally designed to respect these principles, so it is hardly surprising that the greatest benefits are likely to be achieved in this context. Thus: "Organic agriculture includes all agricultural systems that promote the environmentally, socially and economically sound production of food and fibres. These systems take local soil fertility as a key to successful production. By respecting the natural capacity of plants, animals and landscape, it aims to optimise quality in all aspects of agriculture and the environment. Organic agriculture dramatically reduces external inputs by refraining from the use of chemo-synthetic fertilizers, pesticides and pharmaceuticals."[142]

Moreover, as noted in the EU Regulation: "livestock production is fundamental to the organisation of agricultural production on organic-production holdings in so far as it provides the necessary organic matter and nutrients for cultivated land and accordingly contributes towards soil improvement and the development of sustainable agriculture."[143]

There is recent scientific evidence that conversion to organic farming can help reverse the decline in wildlife which has resulted from intensive practices. Reviewing evidence from 23 studies (many in refereed academic journals) conducted in Europe over the last 13 years, a recent report[144] concluded that for organic lowland farms, in comparison with matched conventional farms, there were:

- 60% more arthropods that comprise bird food, three times as many non-pest butterflies and up to five times as many spiders in the crop area
- up to twice as many species of spider in cereal fields
- 25% more birds at the field edge, over 40% more infield in autumn/winter, over twice as many breeding skylarks and, on average, more breeding yellowhammers.
- on arable fields, almost 60% more wild plant species and twice as many species of rare or declining wild plant species
- Moreover, the biomass of wild plants in arable fields (including rare and declining species) was five times greater.

In fact, the results are likely to have underestimated the beneficial impacts of organic farming on biodiversity and abundance for several reasons. For example, i) in attempting match organic with equivalent conventional farms, many of the highly specialised farms that characterise conventional farming were excluded; ii) many of the organic farms had probably only recently converted and thus would not show the full effects of mature organic systems; iii) most organic farms are "islands in a sea of conventional farming", which is likely to dilute and limit the beneficial effects.

Organic farming is likely to have highly beneficial impacts on water quality, although lack of research means there are few hard data. One major study shows that leaching of soil nutrients, such as nitrates and phosphates, was only 67% of that in conventional systems, although others found no difference. However, scientists at the Government's Institute for Arable Crops Research state: "certainly organic farming, by not using such chemicals, completely avoids the issue of groundwater pollution."[145] Organic farming also contributes significantly to sustainability through much lower use

141 Gardiner I (2000) Evidence (from the NFU) to the House of Commons Select Committee on Agriculture (12.7.00) Website: http://www.publications.parliament.uk
142 International Federation of Organic Agricultural Movements (2000) Website: http://www.ifoam.org
143 See note 120
144 Azeez G (2000) The biodiversity benefits of organic farming. Bristol: Soil Association
145 See note 130

of fossil fuel. This is largely because artificial fertilisers, the manufacture of which involves very high energy use, are not used.[146]

Summary of the ethical impacts of the Holistic approach on the biotic environment

Conservation: ☐
Biodiversity: ☐
Sustainability: ☐

BOX 7

AN ETHICAL EVALUATION OF THE HOLISTIC APPROACH TO ANIMAL USE FOR FOOD

In our view, the Holistic approach provides a sound basis for a future system of food production involving animals. Its ethical impacts rank high in a comparison with the existing conventional system in the UK.

- *Organic standards ensure that animals are treated in ways which respect their welfare and behavioural instincts, and which do not significantly infringe their intrinsic natures.*
- *However, currently, farmers' freedom to convert to organic systems is often hindered by significant financial and/or logistical constraints. The situation could be improved by increased government aid, which could be cost-effective in terms of reduced public spending on environmental and food safety measures.*
- *The significant, and increasing, public demand for organic and animal-welfare-friendly food products would be respected by their increased supply. However, the higher price is a significant deterrent to many less wealthy potential consumers. To a large degree, this appears to be consequence of the inability to adopt economies of scale. Even so, many consumers are prepared to pay more, recognising that cheap food necessarily has hidden costs in reduced animal welfare and environmental degradation.*
- *Environmental conservation, biodiversity and sustainability are all markedly respected by the Holistic approach.*

6. THE WAY FORWARD

6.1 Introduction

It is clear from the account of the current animal products food chain (see section 2) that there are significant ethical concerns at many points. Few of those who consume animal products, including vegetarians, would deny that, although significant progress has been made in recent years, serious problems, affecting animals, farmers, consumers and the environment, still need to be addressed.

Yet, a characteristic of modern life is that things change so rapidly that simply reacting to events is often inadequate: we need to be proactive; to foresee the shape of things to come and be prepared to arrange our affairs accordingly. In this report, two scenarios have been envisaged, based on the opinions expressed in the report of a group of informed EU scientists and industrialists.[147] Each is claimed by its proponents to provide solutions to the existing problems by providing food for the growing global population in ways which respect several of the ethical concerns identified, such as animal welfare, environmental pollution and consumer choice.

Our evaluations of these two scenarios (boxes 5 and 7) lead us to believe that the Holistic approach (exemplified by organic farming systems) is far more likely to address the future problems

146 See note 130
147 See note 90

in ethically acceptable ways. We do not believe that organic farming is necessarily the only route to a more ethical animal products food chain but its rigorous standards provide a set of bench-marks to which all might aspire. This is a view shared by a high proportion of British Members of Parliament, i.e. 239 (46% of all MPs permitted to do so) have signed an Early Day Motion supporting a draft bill which calls for the Government to adopt a target and strategy for 30% of UK agricultural land to be organic by 2010.[148] Moreover, in February 2000, Prime Minister Tony Blair claimed: "Our plans envisage a trebling of the area under organic farming by 2006".[149]

Not only does the Holistic approach we have defined respect many of the wide range of ethical principles encompassed by the Ethical Matrix but it shows itself to be superior to the High-Tech approach, which fails to respect several of these principles, even by comparison with the conventional intensive systems which are dominant in the UK (see Fig. 3). The main advantage of the High-Tech approach seems likely to be the increased affordability of the food products (cell 9). But does this advantage outweigh other important considerations identified in the Matrix?

	ANIMALS			PRODUCERS			CONSUMERS				BIOTA		
CELL	1	2	3	4	5	6	7A	7B	8	9	10	11	12
HT	■	■	■	◪	◪	◪	◪	■	■	□	◪	■	◪
HL	□	□	□	□	◪	◪	◪	□	□	■	□	□	□

Fig. 3

Summary of Assessed Ethical Impacts

Summary of the assessed ethical impacts of the High-Tech (HT) and Holistic (HL) approaches to farming animals for food. Numbers refer to the cells listed in Fig.2. More detailed discussion of the impacts is provided in sections 4 and 5 of this report.

Key: principle respected: □; principle infringed: ■; principle both respected and infringed: ◪

It is also perhaps worth remarking that many of the more unnatural applications of the High-Tech approach have failed to generate the profits envisaged, for the very reason that they distort the naturally-evolved fitness of the species, i.e. the efficient utlisation of a particular resource to achieve succesful development and reproduction. The Beltsville Pig (see 4.2.2) is a classic example of a High-Tech approach that simply did not work. Other High-Tech applications which have been tried but rejected, largely because they proved too expensive, laborious or damaging, include: i) hormones used to induce twinning in beef cattle, ii) use of hormones and controlled lighting to breed sheep three times in two years, and iii) selection of pigs with the malignant hypothermia gene to increase lean meat production.[150]

A recent conference organised by the European Society for Agricultural and Food Ethics in Copenhagen, was a meeting place for leading scientists and ethicists who have thought deeply about such issues for many years. Their concerns merit serious attention. Thus, characterising current North American industrial agriculture as "comprising the major agricultural chemical and equipment companies, the principal grain, processing and packing companies, the major grocery and restaurant outlets, and the majority of farm producers", American philosopher Paul Thompson expressed his concerns over the way it has developed: "I believe the industrial model of agriculture embodies a form of cultural and political one-dimensionality that crushes human creativity, and promotes an unsatisfying portrayal of human potential, social purpose and the meaning of the natural world".[151]

Other commentators stressed the economic implications of the modern agri-food business: "In the USA a few hundred thousand individuals produce the food eaten by 270 million persons. This could equate to considerable power over an entire food system being controlled by a few persons. Globally, multinational corporations in combination with the scientific community appear to be making decisions based on developing food that is of a type considered by decision makers to be best for the people, and not necessarily providing people with food of the type they say they want."[152]

A European perspective was provided by John Hodges: "Decision-making has been removed from people on the land to the corporate boardrooms. The ultimate and sometimes the only motive for any decision in agriculture is profit. The key to maximising profit is usually the reduction in unit costs of production and these are minimised by large-scale operations,

148 See note 131
149 Opik L (2000) See note 141
150 Webster A J F (2000) Personal communication.
151 Thompson P B (2000) Reshaping of conventional farming: a North American perspective. In: EurSafe 2000 Congress Preprints. Royal Veterinary and Agricultural University, Copenhagen. pp. 53-9
152 Strickland W R et al (2000) Bioethics and sustainable agriculture. See note 151, pp. 249-53

mass production and high-tech inputs into, and processing of outputs from, the land. Contacts with consumers is limited to anonymous supermarkets."[153]

We believe that changing the attitudes that are attuned to the 'business as usual' mentality, which the High-Tech approach builds on, will require the issues to be considered at a number of levels, viz. i) the philosophical level (relating to ethical insights); ii) the international political level; iii) the UK level (concerning laws, codes, institutional changes and education) and iv) the personal level. The implications of these are developed below.

6.2 The Philosophical Level

6.2.1 The need for a 'contract' with animals

It is implicit in the above discussion that we need a new approach to our treatment of the animals with whom we share the planet. This approach needs to recognise the mutual benefits which can accrue to both people and animals (and to the biotic environment) from the adoption of a more explicitly ethical rationale in our agricultural practices, and also to acknowledge many people's deeply held beliefs about the respect due to the *intrinsic nature* of non-human species.

A concept which has the capacity to capture these ideas is the *human-animal contract*. With reference to farm animals, this would impose on us a duty of care for individual animals throughout the whole of their lives - affording protection from predators, adverse weather, disease and other illnesses, and allowing expression of the animals' feeding, reproductive and other behavioural needs. That is, the contract requires farmers (in line with society's wishes) to provide conditions equivalent to, or ideally better than, those to which farm animals would notionally be exposed in the wild. (The concept here is notional only, because most of our current farm animals would be unable to survive long in the wild, so that the comparison made is with the assumed conditions the wild relative would have encountered.) The human side of the contract thus entails ensuring (as far as is possible) that each animal has a good life and a 'good death', i.e. more humane that it would be likely to experience in the wild. In return, humans receive the products and services which animals can supply, chiefly in the form of food but also as fibre, fuel and muscular energy.

However, when we come to consider wild animals, different criteria necessarily apply. It is commonly recognised that Nature is not 'fair'; and we cannot protect the interests of the prey without endangering the lives of the predators. This implies that what is important is not the life, freedom or well-being of this or that individual animal, but rather the survival of a population or, *in extremis*, of a species. Hence, "Our relationship with wild animals arises out of an environmental ethic, which we have reason to think can only be 'eco-centric', that is it must not assign value to natural beings themselves but rather to their diversity and to the ecological systems on which they depend."[154]

Of course, in a strict sense, the idea of a contract with animals may appear cynical, even perverse. Legal contracts require formal consent by competent individuals, and clearly animals cannot enter into such a contract. However, the idea corresponds to another which has been employed by philosophers (such as Locke, Rousseau and Rawls) through the ages, namely, the *social contract*, which may be defined as 'an unwritten agreement between members of a society, which serves as the basis for social cooperation, legal provision and governance.'[155] According to such a contract, members of a society will concede certain liberties to facilitate a fair and mutually beneficial social structure. In equivalent terms, it is not inconceivable that domesticated animals (were they capable of rational thought) would see a human-animal contract as preferable to the rigours of life - and death - in the wild. The reality now is that humans (whether we like it or not) have to 'manage' the circumstances of both domesticated and wild animals; and observing a human-animal contract may be the most ethical solution of which we are capable.

An allegedly troublesome feature of the contract is the perceived *instrumental* use of animals. Thus, we might be accused of only being 'respectful' of them because of what we can get out of them: we 'use' them, even if, cynically, we affect to pander to their wishes. However, the accusation is not necessarily justified. The fact that we employ other people, such as taxi drivers, carpenters or dentists to perform services, is not generally seen as an instrumental use, since both the provider and the client benefit. But the arrangement depends on trust, and if your cheque bounces you have failed to honour the unwritten contract. Similarly, although animals can be used in a totally instrumental fashion, with no regard paid to their interests (the equivalent of 'payments due'), more humane treatment, respectful of their needs and interests, is also possible. However, because animals cannot be normal parties to a contract, its value will depend on our willingness to act on their behalf, as we do for other humans who, because of age or disability, are unable to act for themselves.

6.2.2 Engaging in ethical dialogue

In considering how society might act more ethically in using animals for food, it is important to recognise the need to start from 'where we are at', as modern parlance has it. However much we might as individuals deplore many features of modern intensive systems of animal production there would be little hope of improving matters were we to opt out of any engagement with those who operate and support the systems. Principled stands of

153 Hodges J (2000) Reshaping of conventional farming: a European model? See note 151, pp. 43-51
154 Larrère C and Larrère R (2000) J. Agric and Env Ethics 12, 51-8
155 Mepham T B (1998) Agricultural ethics. In: Encyclopedia of Applied Ethics. Ed. Chadwick R F. San Diego: Academic Press

any sort which refuse to acknowledge the other person's point of view risk degenerating into pettiness when pursued to extremes. So there is a need to recognise the existence and characteristics of the *common morality*, the set of ethical standards informing most people's (often unreflective) attitudes. This does not, of course, mean that we must opt for the lowest common denominator in ethical terms but that reaching out to the sensitivities inherent in the *common morality* provides an avenue for reform.

Although acting 'on principle' has the dangers identified, *principles* (in the plural) are certainly important in ethical deliberation, because they generalise our convictions on specific issues in ways that assist reasoning. (Similarly, scientific laws often systematise the regularities of numerous individual observations.) In the *common morality*, there is no single overriding principle but a blend of utilitarian and deontological principles, represented in the Ethical Matrix, which structure most people's ethical decision-making.

If the above observations are valid, they have certain implications for the way forward. Firstly, we need to proceed in ways that recognise all interest groups and not only animal interests. Undoubtedly, animals suffer in modern intensive systems; but so do farmers, here and abroad, who lose their employment when new animal welfare regulations prove too costly for them to remain in business.[156] Secondly, while there is evident need for changes in the animal product food chain at many levels, proceeding *too* quickly could make things *worse*, e.g. if the financial burden of new legal requirements forces a farmer to reduce labour costs to the detriment of animal care. Thirdly, in a world in which globalisation of trade is increasing rapidly, it needs to be acknowledged that the ability of individual countries such as the UK to act autonomously in improving standards is severely constrained. Finally, with a rapidly growing global population (and perhaps, just as significantly, rapidly growing material consumption), sustainability becomes an ethical concern of the highest priority. How do these concerns translate into practical 'trajectories for ethical improvement.'?

6.3 The International Political Level

6.3.1 Animal welfare and the EU Common Agricultural Policy

There are those who claim that many of the most serious infringements of animal welfare in the EU can be attributed to the structure of agriculture resulting from the Common Agricultural Policy (CAP), which has placed high emphasis, at least until very recently, on improving productivity. According to Winter *et al*:[157] "Concentration, regionalisation, specialisation, mechanisation, intensification and adoption of new technologies have resulted in fewer mixed farms, larger farms and larger livestock units, herds and flocks; fewer stockmen: livestock ratios; much greater numbers of housed livestock, with higher in-building stocking densities and less or no access to range; greater use of growth promoters, and high energy and/or high protein diets; longer transport distances; and fewer, but larger, abattoirs. As a result livestock *productivity* has increased considerably while the value per individual animal (*unit value*) has decreased."

We do not believe that the CAP can be held fully responsible for such effects. After all, intensive animal production systems are by no means confined to (or at their most extreme in) the EU, while no payments are made to producers in support of pig and poultry farming. Indeed, up to a point, improvements in productivity can result in improved welfare, because veterinary care, controlled environments and good nutrition both improve yields and reduce morbidity. However, beyond that point, the productivity increases at the expense of welfare[158] and there is no doubt that much intensive livestock production falls into this category.

Are there signs that the reforms to the CAP set out in Agenda 2000[159] will have any significant effect? On the face of it, the proposals are not particularly radical. The policy objectives refer to the need to improve competitiveness, continue the emphasis on food safety, ensure a fair standard of living for the agricultural community, and integrate environmental goals into the CAP. However, there is a clear need to incorporate animal welfare concerns as a central component of the CAP.

The Eurogroup for Animal Welfare (of which the RSPCA is the UK's representative) has called for the inclusion of the following in any reform of the CAP:

- de-coupling of payments which encourage intensive production
- phasing out of quota payments which encourage intensive production
- ensuring that payments are linked with good welfare practices
- withdrawal of refunds for the export of live animals to third countries.[160]

These are worthy aims, which would make a great difference if implemented. However, the most positive ways of achieving them will almost certainly entail a commitment to reviving mixed farming and reversing farm specialisation.[161] In this way, improvements in animal welfare and environmental concerns might be addressed together. But in view of the amounts of capital currently invested in specialised systems, it seems likely that specific incentive payments (like those provided for organic conversion) will be necessary to encourage farmers to make the change.

156 Deloitte and Touche (2000). At the time of writing, a report has quantified the recent critical decline in UK farmers' incomes ('down by 90% over the past 5 years'). Website: http://www.deloitte.co.uk
157 Winter M et al (1998). Food Policy 23, 305-23
158 McInerny J P (1999) See note 90, pp. 56-65
159 European Commission (2000) Agenda 2000: Strengthening the Union and preparing enlargement. Website: http://europa.eu.int/comm/agenda2000
160 RSPCA (1997) Memorandum on Animal Welfare to the UK Presidency of the Council of the EU. Horsham: RSPCA
161 See note 157

6.3.2 The World Trade Organisation

Although it is evident from the account in section 2 that many welfare problems still need to be addressed, it is generally recognised that the UK, and the EU more generally, has some of the highest farm animal welfare standards in the world. There is nothing in the WTO rules to prevent individual states from raising their own standards, but the rules have three important consequences:

- because improved welfare entails increased costs, farmers using such systems may be unable to compete financially with lower-priced, imported animal products derived from systems where welfare is accorded low priority. Such effects may also impact significantly on national economies.
- the aim of increasing animal welfare standards is closely associated with, so called, non-product related process and production methods' (PPMs), but, as currently interpreted, WTO rules prevent members' marketing or import regulations from distinguishing between products on the basis of PPMs if the distinction applies to imported as well as domestic products.
- changes introduced under the Uruguay Round, according to which decisions of dispute panels are mandatory, and require offending governments to amend national legislation, pay compensation or risk retaliatory action, have heightened the potential impacts of animal welfare legislation.

There are some serious consequences for EU animal welfare standards. For example, in 1999, EU Agriculture Ministers agreed to improve standards for laying hens by increasing the minimum space and environmental quality available to each hen and phasing out battery cages by 2012 (Directive 99/74). But these changes incur financial costs. The RSPCA estimated that the average cost of a dozen battery eggs was 49.9p, while that of free-range eggs was 66.7p.[162] The experience of Switzerland is instructive: although domestic egg production from caged hens was banned, 60-70% of eggs consumed continued to be derived from caged systems – imported across the border. In an effort to counteract this, the Swiss Government recently introduced a mandatory system of labelling of all eggs (which came into effect in July, 2000) and insisted that all hospitals, restaurants etc should only use eggs not produced in battery systems. A proposal to introduce a mandatory labelling scheme for all eggs produced in the EU has been delayed, partly due to concerns that it conflicts with WTO rules.

Another example concerns the welfare of animals in abattoirs. EU Directive 93/119/EC harmonises rules on the welfare of animals at slaughtering, and requires that only meat from EC approved abattoirs be imported into the EU. Although health and hygiene are the major concerns, welfare conditions are also involved. However, EU proposals to raise such standards have again been delayed due to uncertainties about their legality under WTO rules.[163] Indeed, two of the EU's key animal welfare achievements –prohibition of fur from countries using the leg-hold trap and the ban on marketing of cosmetics tested on animals – have been largely abandoned because of fears that they will not survive a WTO challenge.[164]

There are a number of ways in which such problems might be addressed.[165]

i) *Preferred market access*, enabling WTO members "to give preferential or conditional market access on the basis of objective, non-discriminatory production criteria, including animal welfare." For example, if a nation has an import quota for eggs it would be able to fulfil this by importing eggs produced under equivalent welfare conditions to its own, which, providing it is not applied discriminatively, should not concern the WTO.

ii) *Domestic support*, whereby costs to consumers would be subsidised by Governments to maintain animal welfare standards.

iii) *Labelling*. Although voluntary labelling of food products is already allowed under WTO rules, a strong case can be made for mandatory labelling, particularly as increasing liberalisation of trade means that consumers can no longer assume that production standards of imported animal products will be equivalent to those produced in the UK. Labelling schemes based on animal welfare policy criteria (such as the RSPCA's Freedom Foods) could be effective instruments for change.

iv) *Import restrictions*. Article XX of current WTO rules permits members to adopt measures 'necessary to protect animal life or health.' A strong case can be made for amending this phrase to 'relating to the welfare of animals'.[166] Import restrictions could then be imposed in cases where animals have not been raised under agreed welfare standards. The whole issue of PPMs and the Article XX exceptions demands urgent attention.

The UK Government's response to these concerns has been cautious. MAFF claims that, because there is little support for improving animal welfare standards outside the EU, it is "aiming to develop realistic goals", which "might include clarifying within WTO rules whether governments could require labelling of livestock products according to welfare standards of production" and make payments "to offset the added costs of complying with higher welfare standards".[167]

162 RSPCA (2000) Memorandum submitted to the House of Commons Select Committee on Agriculture (29.10.99). Website: http://.publications.parliament.uk/pa/cm199900/cmselect/cmagric
163 See note 162
164 Compassion in World Farming. (2000) Memorandum submitted to the House of Commons Select Committee on Agriculture (14.9.99). Website: see note 162
165 See note 162
166 See note 164
167 MAFF (2000) Memorandum submitted to the House of Commons Select Committee on Agriculture (13.12.99). Website: see note 162

However, there are some dangers in seeking to raise international welfare standards solely through trade restrictions. If we are genuinely concerned to make global improvements we need to avoid adopting practices which are merely self-serving. There are often good reasons why people in less developed countries operate to lower standards, not least because they cannot afford to do anything else. So, improvements in standards might be dependent on external assistance in implementing them. International development aid directed to supplying effective equipment in abattoirs might not attract the same kudos as help provided to build roads or install field irrigation systems, but in reality it could be quite as critical for public health and international trade.

6.4 The United Kingdom Level

6.4.1 Is the Holistic approach viable?

One of the commonest arguments made against organic farming is that it is not a viable system on a large scale. There are two aspects to the question: a) whether the country could afford it and b) whether the output would satisfy national food needs. Because such a process would clearly not happen overnight, some rough figures will suffice to suggest the feasibility.

a) At current conversion rates, a simple calculation shows that it would cost about £1.2 billion a year over five years to convert the whole of the UK agricultural area (18,600,000 ha). Because organic farmers receive lower CAP subsidies (about £40/ha less) maintenance payments thereafter of, say, £40/ha, could be made at no extra cost. By contrast, £3 billion a year is being spent in supporting current systems, to which must be added the estimated £2.3 billion external costs of current UK farming practices,[168] (see section 2.7).[169]

b) Several studies have indicated the potential of organic farming to meet nutritional needs. Certainly, if there were to be complete conversion to organic farming major structural changes would be involved. The need for rotational farming would mean reduction of certain crops in some areas but their reintroduction into others.[170] Output of cereals would be significantly reduced (by 30%) and of oil seed rape and sugar beet by 60%, whereas production of vegetables and legumes, particularly grain legumes, would need to increase by 175%.[171] Much of this home-grown protein would be available for animal feed, but consumption of animal products would need to decline (which happens to be in line with dietary advice).

Of course, even with achievement of universal organic farming as a long term objective, there would be substantial areas of agricultural land under non-organic cultivation for a considerable time. However, there is no bar to particular organic standards being adopted by conventional farms, and if such initiatives were to qualify for support under Government *stewardship schemes*[172] this would be a sound step in the right direction.

Moreover, a number of other beneficial schemes have been introduced which, while not sharing the organic philosophy, ameliorate some of the problems identified with the current animal product food chain. These include the integrated farm management practices advanced by the organisation, LEAF[173] (Linking Agriculture and the Environment) and the RSPCA's Freedom Food scheme, which ensures that animals are reared under conditions respecting FAWC's Five Freedoms.[174] Several such forms of sustainable agriculture are described by Pretty.[175] This is the reason we have preferred to refer to the Holistic approach, rather than nailing all our colours to the organic mast.

No one should underestimate the difficulties of converting to the Holistic approach for many farmers, but there may be intermediate steps. An important initiative introduced in the Netherlands involves close cooperation between two or more specialised farms, each producing crops or animals, with the aim of improving sustainability, nutrient balances and labour requirements. A detailed study of this half-way house to mixed farming showed that it was possible to realise higher incomes without increasing environmental pollution.[176]

6.4.2 What would a Holistic food system offer?

A pen sketch of a mature Holistic food system in the UK might look something like this. Farming will have essentially converted to an organic system of production, if not by every individual farm having converted then by neighbouring farms working in mutually beneficial cooperative enterprises in order to achieve sustainable practice. Farmers will probably receive continuing government subsidy to maintain measures to protect the environment and animal welfare, which will nevertheless not be as great as the current external costs of intensive systems. They might take advantage of certain (non-invasive) products of modern biotechnology that could genuinely enhance animal welfare, such as therapeutic drugs, vaccines and MAS to aid selective breeding for disease resistance. They will also exploit modern information technology as a tool of effective farm management, while increased employment opportunities in the country will facilitate rural social development. Biodiversity and species abundance will be much restored, most evidently in increased numbers of farmland birds and wildflowers. The appearance of the countryside will be greatly enhanced.

Consumers will have full access to details of production methods, enabling informed choice. In all likelihood, overall

168 See note 43
169 See note 144
170 Woodward L (1996) Can organic farming feed the world? Newbury: Elm Farm Research Centre
171 Lampkin N (1990) Organic Farming. Ipswich: Farming Press
172 MAFF (2000) New directions for agriculture: Eliot Morley announces boost to countryside stewardship. (The Countryside Stewardship Scheme) Press release (14.2.00)
173 LEAF (2000) LEAF's mission, values and vision. Website: http://www.farmshop.net/leaf
174 Farm Animal Welfare Council (2000) Annual Review 1999/2000. London: FAWC
175 Pretty J (1998) The Living Land. London: Earthscan
176 Bos J F F P and Van den Ven G W J (1999) Netherlands J Agric Sci 47, 185-200

consumption of animal products will be reduced, particularly eggs, chicken and pork, but consumers will be assured that all animals have been raised under conditions respecting their welfare and intrinsic natures, and that they have been slaughtered with minimal distress. (Nevertheless, certain practices permissible under organic standards, such as castration, de-horning and artificial insemination, may be unacceptable to some consumers, who may thus need to exert pressure for further change, at least for a niche market.)

The opportunity to consume certain imported animal products might be constrained by changed WTO rules which allow governments to prohibit importation of products from animals raised under conditions which fail to meet agreed standards, and/or labelling requirements might enable consumers to make more informed choices. However, if international aid has been targeted effectively, global food safety and animal welfare standards may both have been substantially improved.

Compare the above scenario with that which could result from concentration on the High-Tech approach: massive industrial animal farms (recall the 'one million pig farms' in the USA), in which permanently housed, cloned animals are genetically tailored to provide low cost, uniform products for globally-managed fast-food outlets. The cultural significance of the choices we face is clearly no less important than their agricultural significance.

6.4.3 *Can we survive without pursuing a new approach?*

One of the most important lessons of the recent fuel crisis is the vulnerability of modern industrial society to even a temporary suspension of petrol supplies. Society was effectively paralysed from top to bottom by blockades of a handful of fuel depots. It is evident that really 'smart technologies' would not depend so absolutely on provision of a resource which can be suspended with such ease. In short, progressive agricultural technologies, need to be energy-efficient, self-sustaining, resilient and decentralised.

6.4.4 Do we know enough about the Holistic approach to adopt it on a wide scale?

The question might be more pertinently addressed to those advocating the High-Tech approach. On any reading of the Precautionary Principle, defined extensively in a recent EU Communication,[177] the hazards of the Holistic approach pale into insignificance compared with those presented by techniques such as GM and cloning. Nevertheless, there would be much to be gained from investment in research in systems such as organic farming which have been largely ignored by UK Governments over the years. The MAFF organic research and development budget for 1999-2000 is £2.1 million (up £1.5 million from the previous year).[178] By contrast, in 1996, the Danish Government made DKK100 million available for organic research[179] – about £8 million, in a country with a population only one tenth of that of the UK!

6.4.5 What changes are required?

Making progress in the Holistic approach will entail effective action at all the levels described above. The key is in the attitudinal change, if not initially as a groundswell movement by the public then among decision-makers in government, industry and education. If there were conviction at that level, political and legal changes should follow. For example, in May 1997 agreement was reached in the EU on the important Protocol on Animal Welfare (an annex to the Treaty of Rome), which recognises for the first time that animals are 'sentient beings' and not merely agricultural products. Moreover, an amendment to Article 120 of the Swiss Federal Constitution now requires respect for 'the dignity of creation' (*wurde der kreature*). The implications for animal protection law are currently being explored, and advice is provided by the recently-established Federal Ethics Committee on Non-Human Gene Technology.[180]

However, while legislation is vital, it is likely to be ineffective if there is not genuine public support. Hence, there is a need for educational programmes to seriously address the wider issues of animal use for food. The dominant reductionist approach to science teaching, by teachers who were themselves schooled in that approach, encourages an unduly instrumental attitude to our treatment of non-humans. Although many people have strong reservations about the wisdom of applying new biotechnologies, their objections are often dismissed as merely an appeal to the emotions and/or a fear of the unknown, and therefore irrational. "If they understood the way the world works" one can imagine a leading animal biotechnologist saying (and those who defer to him) "they would have no problem with new technologies –which accomplish, with greater efficiency, what we are already doing."

However, it is a conceit of those who adhere to this view that our intellectual prowess (if not individually, then collectively) has emancipated us from the constraints imposed by the natural world, and that intelligence has replaced instinct. As philosopher Mary Midgely puts it: "This won't do. Instinct and intelligence are not parallel terms. Instinct covers not just knowing how to do things but knowing what to do. It concerns ends as well as means."[181] Coupled with the fact that individual sciences have become such narrow, specialised disciplines, there is no justification for assuming that scientists, as scientists, have any special insights into the 'ends' which society should seek. So, although many of the things that matter to people can be profoundly affected by science and technology, this does not mean that scientists are in position to set the agenda.

177 European Commission (2000) Communication on the Precautionary Principle. COM (2000)1: Brussels
178 See note 130
179 Danish Research Centre for Organic Farming (2000) (brochure) Foulum, Denmark: RCOF.
180 See note 10
181 Midgley M (1980) Beast and Man: roots of human nature. London: Methuen.

The *common morality* provides, at least, a starting point for decision-making on how biotechnology should be used. A fundamental change would involve requiring ethical analyses to be performed on all new animal biotechnologies, taking account of the range of concerns identified in the Ethical Matrix (Fig. 2).

Promotion of the Holistic approach clearly requires much more government support (in financial aid, further research and increased provision of advice), and government action is also required to promote the animal welfare and environmental measures discussed above, both nationally and internationally. A particular issue meriting identification is the need to provide support for small abattoirs, the increasing numbers of closure of which are having serious adverse effects, both socio-economically and to efforts to enhance animal welfare.

6.4.6 What this report is not saying

It is perhaps important to stress three further points:

- The recommendations of this report do not amount to opposition to biotechnology *per se*. Indeed we consider that recombinantly-produced therapeutic veterinary medicines, vaccines and diagnostic reagents, together with much information gained by such laboratory techniques (what has been called 'biotech-knowledgy'[182]), could be of great value in improving animal health and assisting sound breeding programmes to promote animal welfare
- Comments here do not refer to biotechnology applied to animals for non-food purposes
- We have previously reported on GM crops,[183] over which we have expressed several ethical concerns, but to which we are not, in principle, opposed.

6.5 The Personal Level

We believe that the arguments marshalled in this report make a convincing case for change. That is, we need to move *towards a more moral menu*. But our readers may differ as to how far and how fast we should proceed. They might also conclude that, however much governments ought to take the initiative, they too have personal responsibilities for change, even if these are only reflected in more considered food purchase decisions.

Some may be persuaded by the description of the current food system in section 2 that adoption of veganism is the only honourable course of action: others that vegetarianism, despite its complicity with the livestock industry, is an acceptable compromise. But others will consider that the justification for animal use given in section 1, coupled with the evaluation in section 5, mean that the Holistic approach advocated is intellectually honest, realistic and ethically acceptable. Differences of opinion on such issues and the speed with which they should be pursued will, among other things, relate to "the pains of structural adjustment."[184] Implementation of ethical decisions may be genuinely constrained by lack of political and economic opportunities,[185] although these are often used as excuses for inaction.

However, even if our report has only persuaded our readers that there are both serious problems to be addressed and that they demand their urgent attention, its production will have been worthwhile.

FOOD ETHICS COUNCIL

THE INDEPENDENT COUNCIL FOR ETHICAL STANDARDS IN FOOD AND AGRICULTURE

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182 Doyle J (1990) In: Agricultural Bioethics. eds Gendel S M et al. Ames: Iowa State University Press pp. 177-93
183 Food Ethics Council (1999) Novel Foods: Beyond Nuffield. Southwell: FEC
184 Marsh J S (1996) Food aid and trade. In: Food Ethics ed. Mepham T B London: Routledge. pp. 18-34
185 Mepham T B (2000) The role of food ethics in food policy. Proc Nutr Soc (in press).

7. RECOMMENDATIONS

7.1 There is a need to examine the legal and procedural implications of the recent EU Protocol on the treatment of farm animals as sentient beings, rather than agricultural products. In relation to the use of farm animals, it is suggested that the concept of the *human – farm animal contract* described in this report will provide a sound basis for further reform in animal protection legislation.

7.2 There is also a need to examine the implications of the Protocol for application of several proposed animal biotechnologies, such as genetic modification and cloning. This is an issue that would seem to fall within the remit of Government advisory bodies such as the Agriculture and Environment Biotechnology Commission and the Farm Animal Welfare Council.

7.3 Systematic ethical analysis should be a routine and essential component of all proposed farm animal biotechnologies. The framework described in this report, the Ethical Matrix, could form the basis of such analyses, although, like all innovations, it is capable of refinement and improvement.

7.4 The ethical implications of patent law with respect to animal biotechnologies need urgent consideration, particularly as they relate the concept of fairness applied to farmers and to the concepts of 'animal sentience' and the 'dignity of creatures' applied to farm animals.

7.5 The UK Government should press for changes in international law with the aim of improving farm animal welfare at the global level. Specifically, within the remit of the WTO, the following should be explored:

- preferred market access to nations sharing common, higher, animal welfare, standards
- domestic support to compensate farmers for added costs of improved welfare measures
- labelling of animal products based on welfare standards
- import restrictions based on exemptions specified under Article XX of WTO rules.

7.6 Because standards of hygiene in abattoirs have effects on both public health and animal welfare, the Government should press, through its influence in the EU, for the adoption by the Codex Alimentarius Commission of new, internationally agreed basic hygiene standards in abattoirs, observance of which would be required before countries were granted export licences for meat products. The role of the Food Standards Agency in achieving this objective could prove crucial.

7.7 The UK Department for International Development should promote, and press for greater international support for, improvements in animal welfare and food safety standards in developing countries with the aims of both raising standards in those countries and improving their ability to meet international trading standards.

7.8 Within the EU, the UK Government should press for reforms to the CAP involving:

- de-coupling of payments and removal of quota payments which encourage intensive production
- ensuring that payments which are made are linked with improved welfare practices.

7.9 Increased UK Government support for organic farming, financially and in terms of advice, should be made available to farmers wishing to convert their farms, and following conversion, in line with that provided by some other EU States. The costs will bring far greater benefits, financially and in other ways, to the welfare of the nation.

7.10 There is a need for changed priorities in research funding in the applied biological sciences in the UK. The current emphasis on animal biotechnology needs to be re-evaluated in the light of public concerns about these approaches and the adverse impacts identified in this report. In contrast, there should be much greater investment in research into sustainable methods of food production, such as organic farming.

7.11 There is an urgent need to take measures to ensure the financial viability of small abattoirs in the UK, the increasing numbers of closures of which are likely to have major adverse effects on animal welfare.

7.12 The importance of a healthy diet and of the ethical, social and environmental consequences of food production from animals should feature more prominently in secondary, tertiary and public education curricula and programmes.

Website: http//www.users.globalnet.co.uk/~foodeth