

The following papers were to have been presented at the Annual Meeting of the Scottish Section of the Nutrition Society which was to have been held at the University of Aberdeen on 28–30 March 2000

Symposium on ‘The ethics of food production and consumption’

The role of food ethics in food policy

T. Ben Mepham

Centre for Applied Bioethics, University of Nottingham, School of Biosciences, Sutton Bonington Campus, Loughborough LE12 5RD, UK

Certain developments in the agricultural and food sciences have far-reaching implications for society and the environment, which suggest the need to examine their ethical acceptability as a standard component of technology assessment. Such considerations have led to the emergence of a new academic discipline, food ethics. The present paper describes how ethical theory may be applied to the analysis of the impacts of prospective food biotechnologies to assess potential effects on four ‘interest groups’, i.e. consumers, producers, treated organisms and the biota (fauna and flora). The principles which structure the framework used, i.e. the ethical matrix, are adapted to the field of agriculture and food from those applied in medical ethics. Use of the ethical matrix is illustrated by applying it to the specific case of bovine somatotrophin, the genetically-engineered protein hormone which is injected into lactating cattle to increase their milk yields. Ethical analysis is seen to depend on a number of critical requirements, i.e. scientific data, non-scientific evidence and predictions, suitably-qualified assessors (‘competent moral judges’), the ‘world-views’ of the assessors and application of the precautionary principle to cope with ‘uncertainty’.

Food ethics: Food policy: Ethical analysis: Bovine somatotrophin

The ethical issues raised by food production and consumption encompass a very wide range of activities; everything (in the alliterative phrase that has become popular) ‘from plough to plate’ (James, 1997). That such a broad remit is now receiving attention stems from the realization that a new attitude to food is called for; one that recognizes the importance of a holistic approach.

Following the Second World War, the application of industrial practices to agriculture and food was represented as Taylorism the process by which complex tasks are dispersed into defined specialist activities in the interests of improved efficiency (as described in Taylor, 1947). While such specialization undoubtedly allows economies of scale, the lack of any overall responsibility for the whole process is a significant drawback. Consequently, complex regulations have had to be introduced to ensure that adequate standards are observed, particularly in terms of food safety. However, bureaucracy can be extremely cumbersome and, frequently, important issues fall

through the net. It would be superfluous to document the regrettable consequences which stemmed from such bureaucratic inadequacies in the case of the outbreak of bovine spongiform encephalopathy, but the epidemic undoubtedly led to a wider appreciation of the hazards of reductionism.

The political consequence of such public concerns in the UK has been the establishment of the Food Standards Agency (House of Commons, 1999) and the Agriculture and Environment Biotechnology Commission (Cabinet Office/Office of Science and Technology, 1999). More fundamentally, they have led to the emergence of a new academic discipline, food ethics (for example, the European Society for Agricultural and Food Ethics (EURSAFE), of which the author was a co-founder, was established in 2000), the nature of which forms the basis of the present paper.

Specifically, the aims here are to:

(1) indicate why ethical analysis of the agricultural and food industries is important;

Abbreviations: BA, BJ, BW, CA, CJ, CW, OA, OJ, OW, PA, PJ, PW, individual cells in the ethical matrix; BST, bovine somatotrophin; I, infringement of a principle; IGF-1, insulin-like growth factor-1; R, respect for a principle.

Corresponding author: Dr Ben Mepham, The Food Ethics Council, Minster Chambers, Church Street, Southwell, Notts. NG25 0HD, UK, fax +44 115 951 6299, email ben.mepham@nottingham.ac.uk

- (2) summarize the ethical theories which underpin ethical analysis;
- (3) describe a framework to facilitate ethical analysis;
- (4) illustrate the framework using a topical example of a food biotechnology;
- (5) demonstrate the relationship between ethical analysis and policy decisions.

Food ethics

Food ethics is an emerging academic discipline: one of many in the burgeoning field of 'applied ethics'. Other acknowledged branches of applied ethics are: medical, scientific, environmental, legal, educational, political, business, media and social ethics (see Chadwick, 1998). Each branch attempts to address normative issues by applying ethical theory to the specific circumstances of its particular endeavours.

A number of features distinguish the food and associated agricultural industries from other types of industrial activity, and justify considering food ethics as a discrete and coherent field of academic enquiry. Thus:

- (1) food is vital to human survival, in a way in which cars and mobile phones are not;
- (2) food production is an organic process, which depends on the exploitation of living resources;
- (3) sustainable food supply necessitates ecological and environmental stability and depends on the recycling of essential nutrients, e.g. in the C and N cycles;
- (4) the ultimate dependence of agricultural productivity on the capture of solar energy by plants involves use of extensive land area, which has implications for the competing claims of other industries and of social amenity;
- (5) farming is a way of life which contributes to cultural norms to an extent disproportionate to the numbers actively engaged in it; it also safeguards skills which might prove of inestimable value in the event of military or environmental crisis (Mepham, 1998).

In short, to a greater degree than most other industrial activities, agriculture and food permeate our physical, biological, social and cultural environment, and are likely to do so for the foreseeable future. Consequently, the associated ethical concerns encompass a correspondingly broad range of issues, such as:

- (a) the mismatch between global food supplies and human nutritional needs;
- (b) the impact of agribusiness on rural employment;
- (c) the consequences of modern agricultural and food biotechnologies for human and animal welfare;
- (d) the effects of intensive production systems on the sustainability of the global environment.

Ethical issues are crucial in relation to food because these distinctive features mean that the normal checks and balances between producer, retailer and consumer are often inadequate.

Ethical theory

Two major ethical traditions influence the views of right and wrong of most individuals (for the most part, uncon-

sciously), at least in Western society (for an accessible account of these theories, see, for example, MacNiven, 1993). First, there is utilitarian theory, which judges the morality of actions by their outcome in seeking to achieve 'the greatest good for the greatest number'. For utilitarians, 'the good' is that which produces the most happiness in society. But since good outcomes can rarely be achieved without, at least some, unwanted consequences, the utilitarian approach to ethics always involves some form of cost-benefit analysis; if an action results (or is considered likely to result) in more happiness than misery, then it should be pursued.

The second major tradition of Western ethical thought is deontology, which identifies morality with the concepts of 'rights and duties', rather than costs and benefits. Attributed to, among others, the philosopher Immanuel Kant, this approach sets store by the maxim, 'Do as you would be done by', i.e. we have a duty to treat others as 'ends in themselves' and not as means to our own selfish ends. Such a philosophy depends on 'categorical imperatives', principles we should observe irrespective of consequences. If some things are wrong, they are wrong, full stop. The Kantian approach is widely recognized, if not always rigorously practised, and as such it informs ethical attitudes of many individuals. Kantianism may be seen as the basis of the view that animals have rights analogous, if not identical, to human rights.

A third important ethical theory, that equates justice with 'fairness', is that of the contemporary American political philosopher John Rawls. According to Rawls (1972): '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'.

In essence, then, utilitarianism relates to 'well-being', Kantianism to 'freedom' and Rawlsianism to 'fairness' (although such a superficial characterization risks 'caricaturization'). A moment's reflection reveals that, collectively, these theories represent important aspects of human values. Consider, for example, being seriously wounded by an assailant (reduced well-being), prevented from associating freely or practising your religion (deprivation of freedom), or being convicted of a crime you did not commit (injustice or unfairness). The theories may appear abstruse but they relate to critical human concerns.

The social contract

If ethical analysis is to be of value, it needs to be instrumental in effecting change, e.g. by reducing hunger, protecting the environment, ensuring food safety or improving farm animal welfare. It needs to take the ethical theories discussed and put them to practical use.

Central to these objectives in democratic societies is the concept of 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'. According to such a contract, members of a society will concede certain liberties to facilitate a fair and

mutually beneficial social structure. This concept might suggest that the focus is on government policy, but many of the issues also directly concern private corporations, which have great influence in shaping food provision on a global scale.

A social contract with respect to food is essential in a democratic society for several reasons. First, a society needs to ensure a supply of safe nutritious food that is universally available; failure to do so is simply inconsistent with the harmony and equity on which a viable democracy depends. Second, the contract needs to take account of issues such as the national economy, the working conditions of farm workers, public sensibilities to the treatment of animals and impacts on the countryside as a social amenity. Moreover, if the 'contractors' are to include all interest groups ('stakeholders'), 'society' needs to be defined in global terms, e.g. taking account of the impacts of biotechnological innovations on the population and economies of less-developed countries.

Ultimately, political decisions need to be made as to what is to be enforced or prohibited by law, what is to be encouraged or discouraged (e.g. by fiscal policy or by public education) and whether, and how much, provision is to be made for minority opinions (as in special food labelling requirements for vegetarians).

Broadly speaking, individual ethical judgements on specific issues which have political consequences (e.g. whether to require labelling of a genetically-modified food product) depend on three factors:

- (1) acceptance of a set of general ethical principles (such as, 'individuals should be free to choose the type of food they eat');
- (2) understanding of relevant evidence and scientific facts (e.g. whether or not there is a significant difference between a genetically-modified food product and the non-genetically-modified product to which it might be claimed to correspond);
- (3) adherence to a particular 'world-view' (from the German *weltanschauung*, meaning 'a particular conception of the nature and purpose of the world', reflected, for example, in an intrinsic preference for either organic food or genetically-modified food).

A principled approach

In attempting to harness these three factors in a rational form of ethical analysis, a sound basis for progress may be found in the concept of the 'common morality'. According to Beauchamp & Childress (1994) 'In its broadest sense ... the common morality comprises socially approved norms of human conduct', but 'Unlike utilitarian and Kantian strategies, common morality theories have no overarching principle to justify obligations or to adjudicate conflicts'. Rather, the common morality is pluralistic, with two or more *prima facie* theories forming the basis of its normative content; moral judgements thus depend on a weighing of the principles.

In the field of medical ethics, the 'four principles approach' proposed by Beauchamp & Childress (1994) has achieved wide currency. The approach recognizes *prima facie* duties to respect certain principles, i.e. non-

maleficence, beneficence, autonomy and justice, as elements of the common morality. Thus, in treating patients a doctor is regarded as having ethical duties to respectively:

- (1) cause no harm (enshrined in the Hippocratic Oath), i.e. non-maleficence;
- (2) effect a cure (or at least provide palliative treatment), i.e. beneficence;
- (3) respect patients as 'individuals' (and not regard them merely as 'cases'), i.e. autonomy;
- (4) treat patients fairly (e.g. without sexual or racial discrimination), i.e. justice.

The principles are 'general guides that leave considerable room for judgement in specific cases and that provide substantive guidance for the development of more detailed rules and policies' (Beauchamp & Childress, 1994). According to Gillon (1994) they provide a set of 'substantive moral premises upon which to base reasoning in health care ethics' and, moreover, offer 'a transcultural, transnational, transreligious, transphilosophical framework for ethical analysis' by allowing differences of emphasis within a scheme of universal applicability. So, although the common morality is hardly likely to provide the last word in moral judgement, it would be difficult to conceive of a better starting point for the development of ethical theory.

The ethical matrix

In recent years, I have attempted to extend the applicability of these principles in order to assess the ethical impacts of biotechnologies in the fields of agriculture and food (for example, see Mepham, 1996*a,b*, 2000; Mepham *et al.* 1996), and thereby provide a means of analysis to facilitate ethical decision-making. Despite sharing a common dependence on biological science, food supply differs substantially from medicine in the pervasive impact of its activities at the production, distribution and consumption stages. Consequently, application of the principles to this different field requires that they be translated into terms appropriate to a wide range of different 'interest groups'.

Fig. 1 summarizes suggested interpretations of the ethical principles as they apply to four broad interest groups (treated organisms, producers, consumers and biota) in the form of an 'ethical matrix'. Since the matrix is designed to facilitate analysis of the ethical impacts of any activity (e.g. application of a food biotechnology) from the perspective of the different groups affected by its employment, some of the specifications of the principles might at first appear surprising. However, experience suggests that on reflection they usually appear less so.

In Fig. 1 the utilitarian principles of 'respect for beneficence and non-maleficence' are combined as 'respect for well-being', partly because it simplifies the framework, but also because in terms of human stewardship over organisms used in food production these two principles are inextricably related; combining them in no way diminishes the importance which attaches to them separately. The, now, three principles may be considered to correspond to three major ethical theories, i.e. utilitarianism (well-being), Kantianism (autonomy) and Rawlsian theory (justice; Winkler, 1993). However, in some circumstances it might be preferable to retain the original distinction between the

Respect for:	Well-being	Autonomy	Justice
Treated organism	e.g. Animal welfare OW	e.g. Behavioural freedom OA	Intrinsic value OJ
Producers (e.g. farmers)	Adequate income and working conditions PW	Freedom to adopt or not adopt PA	Fair treatment in trade and law PJ
Consumers	Availability of safe food; acceptability CW	Consumer choice (e.g. labelling) CA	Universal affordability of food CJ
Biota (fauna and flora)	Protection of the biota BW	Maintenance of biodiversity BA	Sustainability of biotic populations BJ

Fig. 1. The ethical matrix

two utilitarian principles, as for example in Mepham *et al.* (1996).

As noted earlier, the principles employed in medical ethics need to be appropriately translated if they are to be effective in this different context. For example, in relation to animals treated in biotechnology, respect for well-being, autonomy and justice are interpreted respectively as respect for: welfare (freedom from pain and stress); freedom of behavioural expression; 'intrinsic value' (see Fig. 1). In the case of consumers of food produced by biotechnology the principles are interpreted respectively as respect for: food safety; consumer choice (e.g. by appropriate labelling); affordability. The definitions used are proposed as representative of the common morality, but by extending the number of affected groups an ethical matrix of any desired degree of complexity could be constructed.

It is important to appreciate the aims and limitations of the matrix:

- (1) impacts defined for each of the separate 'cells' may depend on rigorous examination of objective (often, but not invariably, scientific) data;
- (2) the duties described are *prima facie* duties; circumstances frequently arise when the different duties are in conflict and compromises have to be made;
- (3) although the aim of the matrix is to encourage objective analysis in terms of the specified ethical principles, in practice, the analyses of individuals are often informed by different 'world-views', so that rarely is there a full consensus on the ethical impacts of actions on the different interest groups;
- (4) moreover, the process of ethical evaluation requires a weighing or ranking of the different impacts, so that differences of opinion may become even more evident at

this level. For example, even in (the unlikely) event of complete agreement on the extent of harm suffered by animals from use of a new technology, an animal rightist might consider any exploitation of animals inadmissible, while a utilitarian might consider that substantial human benefits outweigh minor harms inflicted on animals;

(5) the matrix records ethical impacts in one set of circumstances (e.g. the prospective introduction of a technology) with another set of circumstances (usually, the status quo). Hence, the impacts recorded are relative to a pre-existing condition, which itself might be far from ethically acceptable by reference to some other actual or possible condition;

(6) while it might guide individual ethical evaluations, the principal aim of the matrix is to facilitate rational public policy decision-making by articulating the ethical dimensions of any issue in a transparent and broadly comprehensible manner.

It must be appreciated that the types of evidence considered in the different cells of the matrix are of variable nature. Some evidence might be based on numerical data, other evidence on predictions of future consequences, which could be highly speculative. In some cases those assessing ethical impacts might place emphasis on immediate effects, while others might discount short-term consequences and place emphasis on future developments. In all cases the extent of trust assigned to those presenting the relevant information is certain to influence the ethical evaluations. While it might be possible to design stringent consultation procedures which reduce subjectivity, ultimately, as for jurors in a court of law, decisions are likely to depend on an unarticulated sense of conviction, what Polanyi (1969) called 'tacit knowledge'.

In attempting to present complex issues in unfamiliar contexts (in this case, in a journal dealing principally with scientific reports) there is a risk that the analyses might be considered simplistic and the conclusions banal. However, it would seem to be a risk worth taking when the importance of the issues merits serious intellectual enquiry. (The ethical matrix has been applied to numerous food and medical biotechnologies in publications by the author, and others, since 1993. A list of these publications is available from the author on request.)

Application of the ethical matrix to the case of bovine somatotrophin

To illustrate the application of the matrix, it is employed here to analyse ethical impacts of the use of bovine somatotrophin (BST) in dairying. This genetically-engineered protein hormone is used in the USA and several other countries to increase milk yield in dairy cattle, but was recently banned for commercial use in the EU, after many years of being subject to a moratorium.

Responses to subcutaneous injections of BST every 14 d are claimed to increase yield by 10–15 %. Benefits of BST use are primarily economic, either more milk being produced or fewer cows being required to produce a given quantity of milk. In the latter case, environmental benefits are also claimed because production of certain undesirable products, such as manure and CH₄ gas, might be reduced.

The following application of the ethical matrix to BST considers impacts on the treated animals, dairy farmers, consumers of dairy products and the biotic environment. It should be appreciated that the selection of ‘interest groups’ is to a degree subjective, even though it has been chosen to conform to the common morality. The list might be considered too restrictive, e.g. it excludes economic impacts on society as a whole, although these impacts are included indirectly in consumer issues, since milk consumption is almost universal in Western countries. In view of space limitations, the analysis is summary in the extreme.

Treated cattle

Although there is an extensive body of scientific literature on the physiological effect of BST in increasing milk yields (for example, see Burton *et al.* 1994), the number of studies which have specifically addressed its impacts on animal welfare is relatively small. For current purposes a recent EC report (European Commission, 1999a), which includes a bibliography containing 175 references, is used as an authoritative source of reference. The report’s authors expressed the opinion that ‘animal welfare does not appear to have been an issue in the decision making process on BST in the USA’, i.e. as performed by the Food and Drug Administration, and concluded that an adequately wide range of studies on welfare indicators in animals receiving BST had not been performed, making accurate assessment of risks impossible. Despite this factor, the authors were able to draw a number of conclusions.

In the following, where there is perceived ‘respect for a principle’ this is indicated by *R* (listed first), whereas perceived ‘infringement of a principle’ is indicated by *I*.

Abbreviations (e.g. OW) refer to individual cells of the matrix

Cow welfare (OW) (*R*) It has been claimed that in some cases the reduction in herd size required to meet a given milk yield target may allow stockpersons to give increased time to individual cow welfare.

(*R*) In the particular circumstances in which BST injections given in late lactation allow economic returns from extending the normal lactation, thus obviating the necessity for annual calving, welfare might be improved by reducing the total lifetime stress associated with pregnancy and parturition (van Amburgh *et al.* 1997). (This practice is not, however, at all widely carried out.)

(*I*) Use of BST increases the risk of clinical mastitis, a painful disease resulting from inflammation of the udder. The magnitude of the increase in incidence of this condition following BST use has been variously recorded as: 15–45, 23, 25, 42 and 79 %, and the duration of treatment was longer than normal in cows receiving injections of BST (European Commission, 1999a).

(*I*) Increased incidences of foot and leg disorders associated with long-term administration of BST have been reported, e.g. in the largest-scale study the number of multiparous cows with foot disorders and the number of d affected were both more than doubled (European Commission, 1999a).

(*I*) Reproductive capability is reduced by BST, with some studies showing that the pregnancy rate (i.e. the number of inseminated animals which become pregnant) fell from 90 to 63 % in primiparous cows and from 82 to 73 % in multiparous cows. Rates of multiple births, which may reduce welfare, were substantially increased by BST (European Commission, 1999a).

(*I*) BST-treated cows often have reduced ‘body condition’ at the end of the lactation period and experience increased periods of being ‘off feed’. This condition results from the increased demands on both the energy reserves of the body and the digestive capacity of the gut (European Commission, 1999a).

(*I*) A number of other conditions are associated with BST use, e.g. increased incidences of bloat, indigestion and diarrhoea, reduced ability to cope with raised environmental temperatures and increased culling rates in multiparous cows (European Commission, 1999a).

While the occurrence of increased levels of morbidity in BST-treated cows is generally acknowledged (twenty-one identifiable health risks are listed on the Posilac ‘package insert’, see Monsanto Company, 1994), dispute has arisen as to whether the increased morbidity is attributable to BST *per se* or to its effect in increasing yield. Some researchers (for example, see White *et al.* 1994) argue that because increased morbidity may also be associated with increased milk yields achieved by other means, it is inaccurate to blame BST. Other researchers (for example, see Willeberg, 1994) consider this argument spurious. However, it clearly does not apply to the following:

(*I*) Adverse injection-site reactions occur in BST-treated animals, with severe reactions in at least 4 % of cows (European Commission, 1999a). The procedures involved in administering the injection may be stressful in some cases.

Behavioural freedom (OA) (I) Increased incidences of lameness reduce mobility (see cow welfare).

(I) The need to supply the cows with greater amounts of concentrate feed (to more fully exploit the effect of BST) favours systems in which cows are kept indoors and deprived of opportunities to graze. This regimen also has implications for cow welfare, since lameness and mastitis are more prevalent in permanently-housed animals.

Intrinsic value (OJ) (I) The concept of 'respect for an animals' intrinsic value' (sometimes equated with respect for 'telos') implies that they should not be unfairly treated, in particular by being employed in a merely 'instrumental' fashion (for a more detailed description of this principle, see Mepham, 2000). In such terms, the enforced alteration of physiological and behavioural norms (e.g. reflected in reduced reproductive fertility) may be seen as an infringement of the respect to which animals 'under human care' are entitled.

Producers

Dairy farmers' well-being (PW) (R) Official predictions (US Government, 1994) envisaged that financial returns for farmers adopting BST would be increased, e.g. by \$3/cow per year in 1999. (However, in a study of the economic effects of BST use on New York dairy farms, Tauer & Knoblauch (1997) reported that net farm income increased by a mean of \$27/cow per year which 'was not significantly different from zero'.)

(I) Official predictions (US Government, 1994) envisaged that financial returns for farmers not adopting BST would be decreased by \$84/cow per year in 1999.

Dairy farmers' autonomy (PA) (R) Farmers are allowed to use BST in several countries, most prominently in the USA.

(I) Farmers are not allowed to use BST in other countries, notably the EU.

(I) In countries such as the USA some farmers may have adopted BST against their real wishes, out of perceived economic necessity (i.e. unwilling recruits to the 'technological treadmill'). For example, in a recent survey of the opinions of UK dairy farmers, Millar *et al.* (1999) showed that 79 % did not consider BST 'ethically acceptable'. It has been argued that each new 'technological advance' both limits freedom of choice and leaves the industry more dependent on external inputs and the commercial imperatives of biotechnology companies.

Dairy farmers' justice (PJ) (R) It is claimed that because BST is applied on a cow-by-cow basis it is scale-neutral, so that benefits are available to even small farmers (Bauman, 1992).

(I) It is claimed that the effectiveness of BST use depends on 'a high level of management skills' (Bauman, 1992), which are defined by the scale of the milk-yield response observed (a circular, and hence questionable, argument). However, there is considerable variation in responses to BST injection (and in some cases no significant yield increase is observed). Its economic use might thus depend on sufficiently large herds (to allow for poor responders), adequate feed (crucial to sustain the response) and recourse to veterinary treatment to manage increased illness. Such

conditions seem unlikely to apply for most livestock farmers in less-developed countries, whose ability to compete with dairy products produced using BST might thus be adversely affected. The principle of 'respect for justice' might thus have international implications.

Consumers

Food safety (CW) While BST itself is unlikely to exert any adverse biological effects in human subjects, because it is substantially different chemically from human somatotrophin, BST administration increases the concentration in milk of a substance with undisputed biological activity in human subjects, i.e. insulin-like growth factor-1 (IGF-1; European Commission, 1999b).

One official report claims 'rbST (recombinant BST) can be used without any appreciable health risks to consumers' because, among other substances, IGF-1 is degraded in the gut (Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Additives, 1998). This factor would thus represent a neutral impact on this principle.

(I) However, according to a later EC report: 'clear evidence is provided that orally ingested IGF-1 reaches the receptor sites in the gut in its biologically active form'. Moreover, 'The diverse biological effects attributable to the intrinsic activity of IGF-1, exerting a broad variety of metabolic responses through endocrine, paracrine and autocrine mechanisms, make the definition of an *in vivo* quantitative dose-effect relationship virtually impossible' (European Commission, 1999b).

(I) There is a need to evaluate 'the possible contribution of life span exposure to IGF-1 and related proteins, present in milk from BST treated cows, to gut pathophysiology, particularly of infants, and to gut associated cancers' and the 'association between circulating IGF-1 levels and an increased risk of breast and prostate cancer' (European Commission, 1999b).

(I) Increased use of anti-microbial substances (to treat BST-associated mastitis) might lead to the selection of resistant bacteria (European Commission, 1999b).

(I) According to surveys in the EU, milk consumption would decline if BST use were to be legalized (for example, see Nienhaus, 1997). This issue raises a different type of public health concern, in that milk is an important source of dietary nutrients (particularly Ca), and any significant reduction in its consumption might have adverse effects on public health. For example, inadequate Ca intake increases the risk of osteoporosis.

Respect for well-being also includes attitudes encompassed by 'ethical acceptability'.

(I) In a recent UK consumer survey, carried out before the announcement of the EC ban on BST use, 65.4 % considered that the use of BST was not 'ethically acceptable' (Millar *et al.* 1999).

Consumer autonomy (CA) Respect for this principle would allow consumers to choose whether or not to purchase the dairy products that result from BST use, e.g. by requiring such products to be labelled.

(R) Negative labelling (that the product is derived from cows not treated with synthetic BST) is allowed in the USA,

at the expense of the non-BST user. The wording must include the statement: 'The FDA has said no significant difference has been shown and no test can now distinguish between milk from rBGH (i.e. BST) treated and untreated cows' (Anonymous, 1997).

(I) However, milk from cows treated with BST in the USA is not labelled.

Consumer justice (CJ) There appears to be no clear evidence that BST use in USA has benefited consumers through reduced prices, suggesting that 'respect for affordability' is unaffected.

The biota

The living environment is represented in the ethical matrix as the biota (i.e. wildlife in the form of fauna and flora). The ethical principles are translated as respect for conservation (BW), biodiversity (BA) and sustainability (BJ), which are considered here collectively.

Precise definition of these ethical impacts is difficult because most effects are likely to be secondary to BST treatment, and thus depend principally on herd sizes and locations, feeding and housing regimens, and alternative forms of land use if grazing is reduced. In theory BST use might lead to effects which respect the ethical principles or to others which infringe them. Much will depend on the particular management practices adopted, predictions of which will doubtless be based on evidence derived from analogous previous developments.

(R) Some claim that because BST increases yield per cow, the total number of cows needed to supply milk requirements will be reduced, and this factor could free up land for more environmentally-friendly purposes.

(R) Reducing cow numbers could also reduce environmental pollution caused by dairy farming, e.g. on a global scale fewer dairy cows would produce less CH₄ (a greenhouse gas; Johnson *et al.* 1992).

(I) Conversely, increased intensification, considered by some observers to be a likely result of widespread BST use, often leads to more point-source pollution, e.g. from slurry and silage effluents.

(I) Moreover, if increased feeding of concentrates (to more fully exploit the effect of BST) leads to reduced grazing (in extreme cases zero grazing) land not being used to graze animals may be used for increased monoculture, risking a decrease in biodiversity.

Ethical evaluations of bovine somatotrophin use

It is clear that two diametrically-opposed evaluations are possible using such an analysis. Those evaluations approving the ethical acceptability of BST use would probably cite the economic benefit to the manufacturers of BST, to the economies of countries in which it is manufactured, to the farmers who use it, and, were prices to fall, to consumers of dairy products. Moreover, if its use led to reduced cow numbers it might result in marginally-reduced emissions of CH₄. This case also rests on perceptions that the welfare of treated cows is not affected significantly (or that increased morbidity can be effectively treated) and that there are no risks to human safety, so that labelling is

unnecessary. Job losses in the dairy industry are not seen as an ethical issue, being an inevitable feature of market economies.

The ethical case of those claiming BST should be banned would probably focus on respects in which it appears to infringe several commonly-accepted ethical principles. They would point to authoritative reports which suggest that use of BST substantially increases the risk of pain and disease in dairy cows, and that it might present a risk to human safety through ingestion of increased IGF-1 in milk. Moreover, they might consider that BST use will: compromise the autonomy of farmers; undermine consumer autonomy because milk products from BST-treated cattle are not labelled; jeopardize public health if a widespread rejection of dairy products were to follow the licensing of BST (e.g. in the EU); increase local pollution as a consequence of the intensification of dairying.

Competent moral judges

The matrix *per se* does not adjudicate on ethical evaluations, both because the principles allow room for the exercise of judgement with respect to specific cells of the matrix, and because individual judgements also depend on the 'ethical weight' attached to different cells. Clearly, however, making ethical evaluations, particularly when they have such widespread impacts, should not be a matter of expressing personal prejudices. For example, it would make a mockery of the procedure if those with vested commercial or ideological interests were allowed to exploit the framework to further their own ends. Hence, procedures must be adopted to ensure that those assigned critical roles in decision-making are representative of the 'common morality' and suitably qualified to act in this capacity.

Rawls (1951) claimed that ethical decision-making depends on the existence of 'a class of competent moral judges', who should have the following characteristics: normal intelligence; reasonable knowledge of world affairs; a capacity to 'reason', i.e. see both sides of a question, making allowance for personal bias; an imaginative appreciation of the predicaments of other individuals. Certain constraints were attached to the judgement procedure, i.e. the judge must be immune from, and have no vested interest in, the judgement, which must only be arrived at after a careful enquiry into the facts of the case, be delivered with appropriate certitude and be stable. More recently in the UK, the Nolan Committee on Standards in Public Life made similar recommendations, which form an essential element of the selection procedure for government advisory committees (British Council, 1999). Despite such conditions, in practice the selection of representative committees of 'competent moral judges' is fraught with difficulties.

Indeed, it is a feature of democratic societies, particularly modern multicultural societies, that the normal outcome of the exercise of human reason is 'a plurality of reasonable yet incompatible doctrines' (Rawls, 1993). Hence, consensus on a moral orthodoxy is probably an unrealistic, if not a dangerous, objective. A sounder aim might be that of devising a social contract which benefits from social

cooperation despite the differences of opinion between the contractors. Thus, the role of ethical theory in this process is not to determine the right policies but to act as a means of assessing whether specific proposed policies are ethically acceptable.

World-views

A number of attempts have been made to characterize the different 'world-views' which individuals bring to their ethical judgements (for example, see Krinsky & Wrubel, 1996; Kockelkoren & Linskens, 1997). Since none of the attempts is ideal for present purposes, another is introduced here, simply to illustrate the point.

According to this scheme, in very general terms, world-views may be characterized as:

- (1) anthropocentric, placing value chiefly in humans subjects and human achievements, and seeing the natural world as a resource;
- (2) ecocentric, placing value in the natural world, of which humans are only one species, whose activities ought not to unduly disturb the ecosystem;
- (3) ambicentric (a neologism), a moderated anthropocentrism, believing that human interests demand precedence but also recognizing qualified duties to the ecosystem.

According to such a characterization, anthropocentrists are more likely to sanction BST use than are ecocentrists, because they consider economic benefits carry greater weight than respect for animal welfare and animal rights. On the other hand, both anthropocentrists and ambicentrists would be expected to attach significant weight to human welfare, reflected in concerns for food safety.

The dominance of the ambicentric position in the UK is suggested by the observation that the low level of 'ethical acceptability' of BST use which was recorded in a recent UK public opinion survey (Millar *et al.* 1999) was almost equally associated with major concerns over perceived reductions in animal welfare and the safety of milk from BST-treated cows.

Uncertainty and the precautionary principle

Another important element of ethical analysis is the way in which moral judges deal with uncertainty. While in some cases the known facts might be accurate and pertinent, in others they might be inaccurate, unreliable or irrelevant. Sometimes uncertainty might be rectified readily by investing resources in acquiring the appropriate missing data, but on other occasions progress might continue to be hampered by a significant amount of ignorance. For example, in the case of BST, the EC report (European Commission, 1999b) claimed there is a need to evaluate 'the possible contribution of life span exposure to IGF-1 and related proteins, present in milk from BST treated cows, to gut pathophysiology, particularly of infants, and to gut associated cancers' and drew attention to 'an association between circulating IGF-1 levels and an increased risk of breast and prostate cancer'. In such cases there could be said to be a requirement to adopt the precautionary principle.

Recently, the EC adopted a Communication (European Commission, 2000) on the use of the precautionary principle, which: 'covers cases where scientific evidence is insufficient, inconclusive or uncertain and preliminary scientific evaluation indicates that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be inconsistent with the high level of protection chosen by the EU'. The Communication makes a number of notable claims, cited as follows, by paragraph number:

- (1) paragraph 5: 'the risk assessment on which a measure is based may include non-quantifiable data of a factual or qualitative nature and is not uniquely confined to purely quantitative scientific data';
- (2) paragraph 7.2: 'even if scientific advice is supported only by a minority fraction of the scientific community, due account should be taken of their views, provided the credibility and reputation of this fraction are recognised';
- (3) paragraph 7.3.1: 'the precautionary principle will often need to be invoked in situations where adverse effects will not emerge until long after exposure and/or will affect future generations';
- (4) paragraph 7.3.4: 'examination of the pros and cons of an action cannot be reduced to an economic cost-benefit analysis. It is wider in scope and includes non-economic considerations. A society may be willing to pay a higher cost to protect an interest, such as the environment or health, to which it attaches priority';
- (5) annex 2: As each member of the World Trade Organization has the independent right to determine the level of environmental or health protection considered appropriate, a member may apply measures based on the precautionary principle which lead to a higher level of protection than that provided for in international standards or recommendations.

Such an approach, addressing the scope and validity of scientific evidence relating to ethical judgements on food and agriculture, represents an important element of ethical evaluation.

The role of ethics in food policy formulation

It was noted earlier that the role of ethical analysis is to translate, often abstract, ethical theory into forms in which it might inform practical decision-making. In this context, practical outcomes are most likely to be realized in the form of policy decisions.

Fig. 2 illustrates a scheme relating ethical analysis to policy formulation, which incorporates the separate elements of the process discussed earlier. According to this scheme, a proposal for, for example, a novel food biotechnology would be considered by a representative committee of 'competent moral judges', employing an agreed framework (such as the ethical matrix). The analyses performed would be informed by 'evidence' (often, but not invariably, scientific data) and by the individual world-views of the committee members. Account would need to be taken of the degree of 'uncertainty' to be attached to some of the evidence and the precautionary principle applied judiciously. Even so, it is unlikely that consensus would emerge from a committee that accurately reflected social

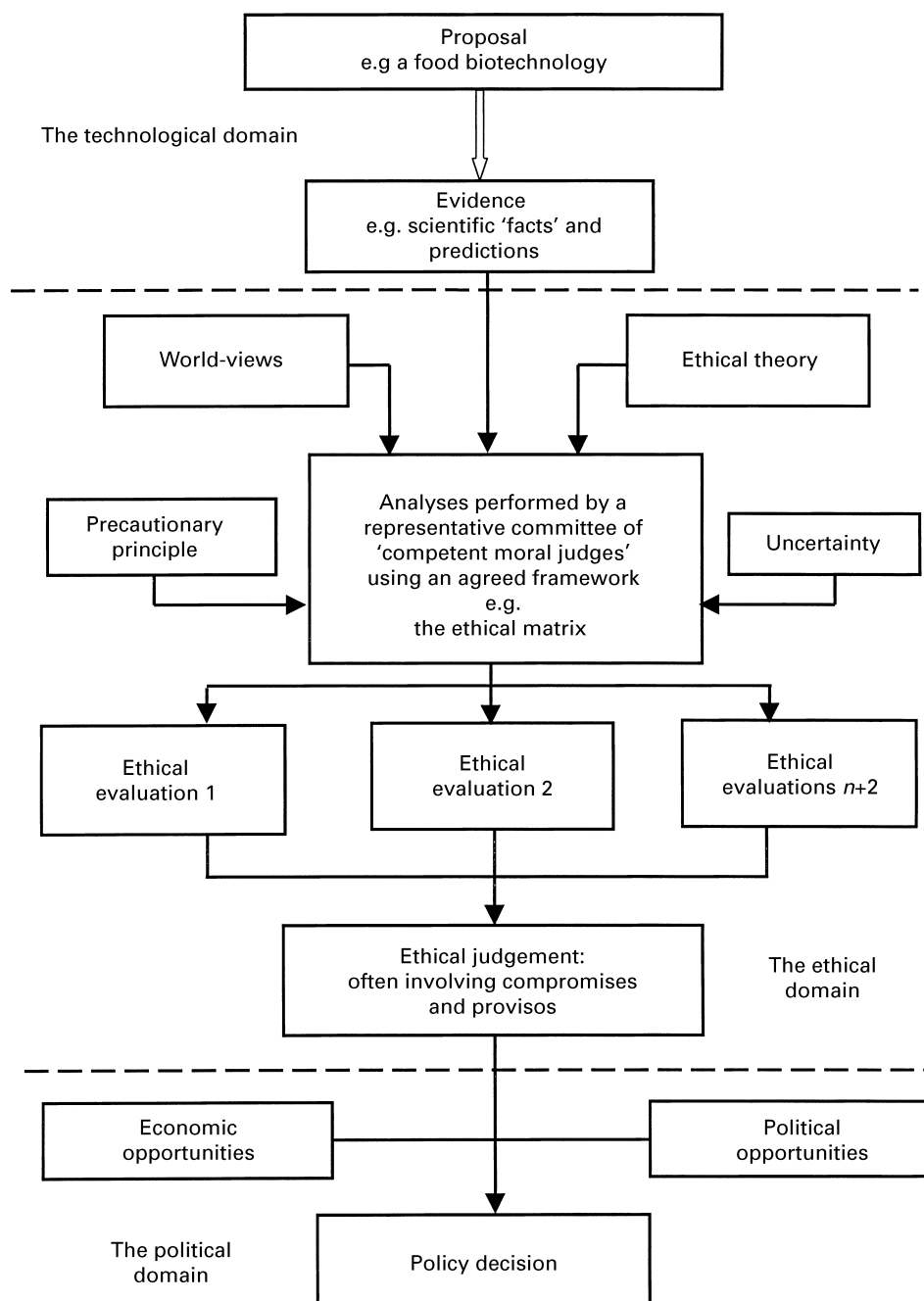


Fig. 2. A scheme indicating the relationships between technological innovations, ethical analysis and policy decision-making. The whole process is divided into three 'domains', the technological, ethical and political, but the boundaries are shown as 'porous'. For example, ethical factors influence the choice of whether a technological innovation is desirable, whether it merits special attention, and the political consequences of legalizing its use. For details, see text.

opinions; instead, a number of 'ethical evaluations' can be envisaged, each of which would be deemed acceptable by their proponents.

However, given the time frames in which policy decisions usually need to be made, it will normally be necessary to achieve 'closure', i.e. some mutually-agreed course of action which respects the differing ethical evaluations but does not necessarily implement them all fully.

That is to say, compromises and provisos will be necessary in arriving at an ethical judgement. Moreover, it is not always feasible to implement an ethical judgement, because of political and/or economic constraints. For this reason, the steps by which ethical judgements are derived and applied to government policy decisions are almost certain to involve leading politicians, such as government ministers.

The question of how the differing ethical evaluations which are evident within society, particularly multicultural democratic societies, are to be accommodated within public policy decisions is beyond the scope of the present paper. However, in essence, policy makers have a range of strategies at their disposal, from proscription, to limitation, to mitigation of adverse effects, to prescriptions on labelling, or to reliance on market forces. Justice demands that when important biotechnological innovations are at issue such decisions should be made only following full public consultation and after performing a comprehensive ethical analysis. The ethical matrix is proposed as a means by which those processes might be facilitated.

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