In Vitro Meat

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Synonyms

Cultured meat; Lab meat

Introduction: A Strange Yet Hopeful Idea

The idea of in vitro meat (IVM from hereon), or cultured meat, is to grow meat from animal cells with the help of tissue engineering and/or 3D printing technology.

The basic idea is not new. Early in the 1930s, when the French scientist Alexis Carrel attracted attention by having kept chicken tissue alive for over 20 years, Winston Churchill (1932) wrote that in the future "we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium." Some decades later, the Dutch business man Willem van Eelen, who started brooding on new forms of food production after his experiences of severe hunger in Japanese internment camps during the Second World War, was another visionary.

For many decades, IVM was just a strange and hardly known idea. But then the problems associated with meat started to increase. From the 1970s onward, animal suffering has been a growing issue. Problems concerning animal disease and the sustainability of raising livestock followed. As a growing and more wealthy human population is expected to double its global meat consumption in the coming decades, all these problems will get worse. Not surprisingly, the moral reputation of meat has declined, at least in Western countries, where not only vegetarians but also many meat eaters are increasingly ambivalent about meat (Holm and Møhl 2000). In this growing sphere of urgency, IVM has stopped being just a wild idea and has become a source of societal hope. For example, in 2003 the Australian artist Oron Catts presented "victimless meat" in an artwork on IVM called *Disembodied Cuisine* (Catts and Zurr 2013), and in 2004 the American student Jason Matheny founded the organization *New Harvest* to propagate the development of IVM. In 2008 PETA (People for the Ethical Treatment of Animals) announced a one million dollar prize for bringing in vitro chicken meat to the market in 2012 (PETA 2008).

But IVM is not being developed that fast; so far, money for IVM research has been hard to obtain, and research interest has been modest. In the early years of the new century, NASA put some money into an IVM project with goldfish tissue, but it was dropped after a while. From 2005 till 2009, the ministry of Economic Affairs

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in the Netherlands subsidized a research project, led by Henk Haagsman of Utrecht University, that involved four Ph.D. projects. The results helped to illustrate the in-principle viability of IVM, but also made it clear how many obstacles still need to be overcome and that intensive research efforts will be needed, for example on the growth and differentiation of (stem) cells, the techniques of tissue engineering, the development of suitable and affordable growth medium, and on scaling up. The same ministry subsidized a modest follow-up project at the universities of Utrecht and Wageningen (2010–2014) that also includes the study of social responses and moral considerations. There are some other projects – for example, one subsidized by PETA – but they are scarce so far and modest in size.

Meanwhile, product-oriented efforts try to speed up the process. In 2011, Gabor and Andras Forgacs founded the company Modern Meadow, which aims to make cultured meat as well as leather with the help of 3D prining technology. In the summer of 2013, Mark Post of Maastricht University presented the world's first in vitro meat hamburger, made with imperfect existing technology, that was subsidized by Google founder Sergey Brin. The presentation aimed to show that it can be done in principle and to attract attention and money for intensified research efforts.

Both Post and Haagsman estimate that even with generous funding it will take 10–20 years for tissue-engineered IVM to enter the market.

This short and incomplete history may suffice to illustrate that so far the development of IVM is more a matter of societal (mainly moral) pull than of technology push. The idea of IVM generates great societal interest, though it is also still a strange idea, at least initially. First responses in the Netherlands, encountered in the context of the Utrecht-Wageningen project mentioned above, were mostly of three kinds, of which the first two, "wow" and "yuck," illustrate how surprising the idea of IVM is, while the third, "interesting, but very technological," is less immediate and more ambivalent (Van der Weele and Driessen 2013). The *wow* response is the most frequent one. It represents moral hope, primarily because of the prospects for animals. *Yuck* responses often turn out to rest on associations with "messing around with meat" or with genetic modification – GM debates clearly cast their shadow over IVM, which is why IVM researchers avoid GM technology. Immediate responses such as *wow* and *yuck* are invariably followed by more mixed and complicated responses, sometimes very quickly. For example, one person who said "yuck!" went on to say "but wait a minute, when I think of what it might mean for animals it already looks different". Likewise, unqualified enthusiasm is often followed by questions on what the technology might look like. What results in many cases resembles the third and ambivalent category, in which moral hope is mixed with reluctance about food becoming ever more technological, about the "unnatural" character of IVM, or about worries about industrialized food production. These mixed thoughts and feelings will return below.

IVM and Ethics

Though IVM does not exist yet, at least two serious attempts have so far been made to gain some overview over potential gains and losses. One of them involves a moral evaluation, and the other is a first tentative life cycle analyses.

Hopkins and Dacey (2008)reviewed moral arguments for and against IVM, which they framed as a potential option for people who want to eat meat yet do not want to contribute to animal suffering. The arguments for cultured meat, they say, are very clear and straightforward and "in essence the hopeful outlook of a technological fix"; IVM could eliminate much animal suffering and environmental damage, and it might produce healthier food. Yet there are also objections and hesitations, to which they devote the heart of their paper. They discuss worries about unnaturalness and about yuck responses and the idea that technological solutions amount to "moral cowardice – choosing a quick fix over genuine moral work". In their analysis, none of the objections carries enough weight to counter the potential gains. The alleged "unnaturalness"

of cultured meat may be precisely what we are looking for, since at least some of the "natural" ways of producing meat are so problematic. *Yuck* responses are interesting and important but can hardly count as final judgments, and the argument from moral cowardice at best "suggests we should not be so naïve as to think technology can simply solve all our problems; it should not however lead us to think that technology cannot be a powerful moral tool"(p. 591). After weighing pros and cons, they conclude that cultured meat is not just interesting, but "something we may be morally required to support." They also note, more generally, that morality need not simply respond to new technologies as they arrive; it can also be guiding: it may "champion and assist" in the development of technologies as steps towards a better world.

Tuomisto and Teixeira de Mattos (2011) undertook a tentative life cycle analysis (LCA). Assuming that it will become possible to grow IVM tissue on the basis of algae, they predicted that IVM will come with huge environmental gains. Compared with conventionally produced European beef, the authors estimated that energy use will be reduced by 45 %, greenhouse gas emissions by 96 %, land use by 99 %, and water use by 96 %. As a result of the gains in land use, cultured meat could greatly contribute to feeding a future world of nine billion people, while at the same time large areas of land could be given back to nature through reforestation or otherwise. The estimations have contributed considerably to the force of moral pleas for IVM.

These attempts to gain some overview are helpful, but they also have limitations; acceptability of IVM as a technology and sustainability aspects do not exhaust the moral issues. IVM is a potentially very radical innovation that may lead to great changes in meat production and consumption practices, with perhaps profound consequences for large groups of people. For example, might IVM lead to a world without any form of husbandry and thus have abolitionist consequences for human-animal relations? Or will it rather only count as a replacement for factory farming, while creating more room for traditional small-scale husbandry? Either way, the consequences for farmers and existing meat industry will be huge, and transition processes will be complex. Nutritional aspects of IVM are also very uncertain; the development of IVM may remain focused on making it as precisely like "traditional" meat as possible, but IVM might equally be developed in different directions, with extra ingredients or other modifications, for example, for health reasons – think of the addition of vitamins or the removal of saturated fat. The results need not resemble meat as we know it; in this respect, too, IVM is a potentially radical innovation.

IVM is still an open idea in many ways; it is an "as-yet undefined ontological object" (Stephens 2010). Specific consequences and impacts are therefore highly uncertain, and their moral evaluation would be a speculative affair at this moment. In that situation, the development of more concrete scenarios of IVM might be helpful for getting some idea of how a future with IVM might or might not be attractive. Ethics, apart from trying to assess pros and cons of IVM as an idea, could also help to explore and morally probe such scenarios. This role fits in with Dewey's pragmatist view of ethics as a form of inquiry, in which, apart from thinking and feeling, the imagination takes a central position: "the first intimations of wide and large redirections of desire and purpose are of necessity imaginative" (Dewey 1980/1934, pp. 348–349). The process involves what Dewey called "dramatic rehearsal": thinking through possible futures, with the help of new ideas, their combination, doubts and objections, positive and negative feelings, as well as argument and reflection. In the same pragmatic spirit, Driessen and Korthals (2012) stress the "world disclosing" effects of new technology, with IVM as an example, pointing out, for example, how technologies can function as art and open new ways to morally relate to the world. For this interaction to begin, it is not necessary for the new technology to have materialized; the mere idea of IVM turns out to be enough to stimulate thought on our present meat consumption and its alternatives.

In current debates, the thought of IVM is already taken up in several ways. The next section distinguishes three emerging moral profiles in societal debate, while the last section

exemplifies in some more detail how moral inquiry may take an active role in further developing these and other future scenarios, thereby contributing to a larger search space for future protein practices.

Three Profiles for IVM

The prospective evaluations mentioned above illustrate that expectations of IVM run high. In theory, IVM might perhaps alleviate all the problems of meat simultaneously. In actual debates, however, specific priorities can be distinguished that take IVM in different directions and that can be associated with different moral "profiles." One main profile for IVM prioritizes animal considerations, while a second one focuses on sustainability. Both tend to neglect uneasiness about the technological character of IVM. A third profile, "the pig in the yard," does address that uneasiness, at least in part.

1. A "vegetarian" profile. For many people, the first and most significant characteristic of cultured meat is its promise for animals in a world that eats ever more meat. This is why animal organizations tend to embrace the idea, often after some reluctance about the use of animal cells in IVM production. PETA director Ingrid Newkirk wrote an essay for the New York Times (Kaminer 2012) in which she said that IVM might make her eat meat for the first time in 40 years. When PETA conspicuously encouraged cultured meat through the announcement of an IVM contest, the announcement also said that anyone who doesn't know a test tube from a champagne flute can still help animals by eating plant-based products. For PETA, cultured meat is a step on the road to a vegetarian or vegan world.

   This perspective also meets with criticism. According to Simon Fairlie (2010, pp. 228–231), who sees IVM as part of a vegan strategy, the convergence of technological developments such as genetic manipulation, synthetic biology, and cultured meat amounts to a horror scenario that will perhaps satisfy vegans but that will decisively estrange us from animals and nature. Fairlie more generally denies that veganism is the best answer to the unsustainability of meat eating. Instead, he proposes to return to more rural and traditional forms of agriculture that would include small-scale animal husbandry and a significant decrease in meat consumption, but would explicitly exclude new technology such as IVM.
2. A sustainable profile. Global meat consumption is very unsustainable. This can quantitatively be illustrated in many ways, starting from the inefficiency of producing animal proteins from plant proteins (with conversion losses of 60–90 %). Now that 70 % of all arable land is already used directly or indirectly for livestock, and a doubling of meat consumption is expected in the coming decades, anyone can do the math, says Mark Post; it's easy to calculate that we need alternatives. "If you don't do anything, meat will become a luxury food and be very, very expensive" (Sample 2012). If the aim is to keep meat available and affordable for everybody, this is a problem.

   In this profile, safeguarding future meat consumption is the goal, its (environmental and economic) unsustainability is the problem, and IVM is the solution. In order to fulfill its sustainability promise, the aim of IVM development is not to satisfy vegetarians or vegans (after all, they are not part of the meat problem), but meat eaters.

   This profile aims to align IVM with mainstream and quantifiable trends about growing meat consumption in a world of growing numbers of people with an increasing demand for meat. But this profile, too, has its unattractive sides, especially for people who think that the problems of meat can only be solved by new consumptive values. IVM would allow the continuation of morally problematic consumptive attitudes.

Thus, different as these profiles are, in societal debate they are subject to similar misgivings about technology: technology will not solve our real problems; we should rather aim for changes in agricultural practices, food values, and/or our consumptive behavior.

Such worries about technological fixes in food are widespread, and they are associated with concerns about our growing estrangement from food, animals, and/or nature.

3. The third profile, "the pig in the backyard," at least partially addresses the worries about technology. It centers on the idea of an animal that is held as a pet and also serves as a donor of muscle stem cells that are turned into IVM at home or in a local factory. This idea regularly turns up in conversations on IVM, and it tends to inspire a remarkable degree of enthusiasm. This may have something to do with the unexpected combination of many good things that have always seemed incompatible. The pig in the backyard or on an urban farm seems to provide a glimpse of a possible world in which we can have it all: meat, the end of animal suffering, improved relations with animals and simple technology close to our homes – be it a local factory or a machine on the kitchen sink. Either way, this profile fits in with trends to reestablish our contacts with food and nature through urban farming. The urban pig that is a pet and an IVM cell donor at the same time creates the prospect that factory farming is not replaced by the abolitionist vegan prospect in which animals are removed from the human life world, but instead by increased and improved human-animal relations.

While in the first two profiles cultured meat was an answer to a clear problem, animal suffering, and unsustainability, respectively, the third profile is different in that the pig in the yard does not seem to be an answer to one main problem, but rather results from a kind of tinkering with problems, desires, solutions, objections, and societal trends. It may come up as an alternative to both intensive husbandry and the abolitionist tendencies in vegan proposals. It may also arise from the desire for local and low-key technologies, which most people at first thought tend not to associate with IVM. Interestingly, this scenario does not raise worries about alienating technology. On the contrary, it is typically seen as a way to establish more intimate contact with the sources of our food. This suggests that thinking about the future of IVM should not only address products; production methods are just as important.

These three profiles do not exhaust the possibilities. For example, human health might be conceived as the core value of a fourth moral profile, while global food security might define a fifth. But three profiles suffice to show that the idea of IVM can be developed in different directions. Such divergence is constructive and helpful in order to design and think through future forms of IVM, meat, and protein consumption in general. The next paragraph sketches a more active role for design and ethics in this process.

Ethics Through and as Design

Thinking on cultured meat started by simply transplanting ideas about meat to cultured meat. Illustrations often showed an ordinary piece of meat and added an in vitro element, for example, by simply depicting a steak in an Erlenmeyer flask. Yet at the same time, this in vitro component turns IVM into something very different. As noted above, IVM is a potentially very radical innovation that could lead to large changes in the production as well as the consumption of meat, or proteins more generally. And it may do so in very different ways. While it is now often assumed that in order to count as an alternative for meat it has to look and taste exactly the same as meat as we know it, the possibilities to design very different products (in terms of form, texture, color, etc.) are almost limitless. The options invite a play, first imaginary, potentially also real, with form, color, additions, and taste, as well as with various production processes, moral profiles, marketing profiles, and consumer practices.

Design makes scenarios available in concrete and lively ways, which is helpful for elaboration and reflection. In this search process, scientists, ethicists, designers as well as many others can play a role. The active role of science is evident here; the role of designers and ethicists deserves some illustration.

At the University of Eindhoven, IVM is one of the themes in the industrial design program *Next*

In Vitro Meat, Fig. 1 Four student designs of cultured meat in the context of *Next Nature* (Courtesy of Koert van Mensvoort)

Nature, led by Koert van Mensvoort (Van Mensvoort and Grievink 2012). From the fall of 2011 onward, students of industrial design have been working on many different ideas of what cultured meat could be, what it might look like, how it might be produced, how it might be packaged and marketed, etcetera. The images in Fig. 1 show some of the results. Mark Kanters' *Magic Meat* is essentially a marketing device: it is meant to seduce children; Frank van Valkenhoef devised *Origami meat* to illustrate how 3D-printed layers of cells might be folded in different ways; Ilse Maessen's *Paint with meat* depicts IVM of different color tubers with which paintings can be made (to be baked in the oven), while Alberto Gruarin's idea in *Knit the new meat* is that different constructions can be made starting from a narrow thread of muscle cells.

Ethics too can help in this process, by exploring if and how the production and consumption of IVM can be developed in morally attractive ways. Reflection on public debate and sorting out the arguments is one way to do so, with the distinction of moral profiles as an example. But ethicists can also play a more active role, for example, by organizing workshops in which designs such as shown above are used to wake up the imagination for thinking through different futures for IVM (Van der Weele and Driessen 2013). In such a context, IVM also turns out to act as a catalyst for new perspectives on meat. This need not surprise; since IVM is meant as an alternative for meat, thinking about IVM necessarily interweaves with thinking about meat. For example, thoughts about the alleged "unnaturalness" of cultured meat almost invariably lead to the question how natural conventional meat really is (Welin and Van der Weele 2012). Another example is the pig in the backyard; this scenario is not only about producing cultured meat, but at the same time addresses our present relations with animals and the way we keep them in husbandry practices.

By undermining present self-evidences, the idea of IVM also unsettles existing lines of polarization and moral division; it offers new options for finding common ground. Although the ultimate goals of vegans, ambivalent meat lovers and sustainability-oriented IVM researchers may be different, IVM fits in with all these perspectives, uniting them in joint searches to a certain extent however uneasy the alliances may be.

The mere idea of cultured meat thus opens up new search space, by stimulating creativity and new alliances. As this entry has been emphasizing, ethics as a form of pragmatic inquiry may join and strengthen this search process through reflection on existing ideas and exploration of new ones.

Summary

The basic idea of in vitro meat (IVM) is to grow meat from animal cells with the help of tissue engineering and/or 3D printing. At present, IVM is an idea under research that is still far from the market. It is not a new idea, but only recently, due to the increasing problems of meat, it has become a source of moral hope rather than a strange idea: tentative evaluations have made it clear that it holds great promise for all the major problems associated with meat. Though in theory all these problems might be addressed simultaneously, in actual public debate three different moral profiles can be distinguished. Meanwhile, it is still very

open what kind of product in vitro meat will become and how it might be produced. In this situation, an exploration of future scenarios with and through design is a helpful activity. Ethics as a form of pragmatic inquiry can join and strengthen this search.

Cross-References

- ▶ Aesthetic Value, Art, and Food
- ▶ Agricultural Ethics
- ▶ Animal Welfare: A Critical Examination of the Concept
- ▶ Environmental Ethics
- ▶ Food Security
- ▶ Meat: Ethical Considerations
- ▶ Population Growth
- ▶ Sustainability of Food Production and Consumption
- ▶ Synthetic Meat
- ▶ Urban Agriculture
- ▶ Vegetarianism
- ▶ Water, Food, and Agriculture

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Industrial Food Animal Production Ethics

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Animal agriculture; Concentrated animal feeding operation (CAFO); Ethics; Factory farming; Philosophy; Public policy

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Introduction

Over the past 50 years, animal agriculture in the United States (USA) has transformed from an extensive model characterized by many small family farms to an intensive, industrialized model. This industrial model – sometimes called "Industrial Farm Animal Production" (IFAP) or more colloquially "factory farming" – is characterized by frequent corporate ownership, economic consolidation, and vertical integration; the extreme confinement of large numbers of animals; the use of "technological sanders" such as growth-promoting antibiotics; the use and long-distance transport of remotely grown concentrated feedstuffs, instead of forage or pasture-based feeding; and tight control over the breeding, feeding, and living conditions of animals so as to achieve the greatest production at the lowest cost and in the shortest amount of time (Singer 2002; Singer and Mason 2006; Foer 2009; Pew 2008). This model has successfully produced a large supply of cheap meat and dairy but at significant costs to animal welfare, the environment, the risk of zoonotic disease, the economic and social health of rural communities, diet-related disease, and overall food abundance.

Over the past 40 years, numerous ethical critiques of IFAP have been published, which discuss the various costs outlined above, though often with a predominant focus on animal welfare (e.g., Regan 2001, 1983/2004; Pluhar 1995; DeGrazia 1996; Singer 1980, 2002; Foer 2009). With very few exceptions, these critiques have concluded that IFAP is morally indefensible. This entry will briefly review the costs of IFAP, the ethical critiques that have been and could be levied against it, and also a few attempted defenses.

The Costs of IFAP

IFAP is associated with numerous and significant costs to animals, humans, and the environment. Here these costs will be briefly reviewed. Because space prohibits a detailed exploration, the reader is encouraged to review the cited resources. First, IFAP exists to provide large supplies of cheap animal products to the consumer public, and this is often touted as an important benefit by the industry itself. However, populations in the developed world are currently struggling with high rates of obesity and chronic disease, and evidence suggests that this is in part due to diets containing large amounts of animal products. Animal products are our main source of saturated fat and our sole source of dietary cholesterol – important risk factors for many of our chronic diseases (Akhtar et al. 2009; Walker et al. 2005). Emerging evidence suggests that plant-based diets offer benefits as compared to omnivorous diets as concerns lower body mass index and all-cause mortality and a lesser incidence of type-II diabetes, hypertension, and certain types of cancer (ADA 2009; Craig 2009). Properly planned plant-based diets can meet nutritional requirements for all stages of life (ADA 2009), and furthermore such diets are comparable in cost to omnivorous diets (Hyder et al. 2009). Therefore it would be better for the public's health for most persons to transition to diets containing little or no animal products.

Second, many persons in the world already suffer from malnutrition, food insecurity, or even starvation, and these problems will likely only worsen as the global population grows. While these are multifactorial problems, increasing the available food supply can only help to remedy them, and IFAP represents an extremely inefficient way to produce food. The (sometimes overwhelming) majority of the corn, wheat, and soy crop are used to produce feed for animals in concentrated animal feeding operations (CAFOs), and these animals convert only a fraction of the protein they consume into edible meat. For example, the US livestock population consumes more than seven times as much grain as is consumed directly by the entire American population, and the amount of grains fed to US livestock is sufficient to feed about 840 million people who follow a plant-based diet (Pimentel and Pimentel 2003).

Third, IFAP contributes significantly to climate change and environmental pollution. Animal agriculture contributes anywhere from 18 %

to 51 % of global anthropogenic greenhouse gas (GHG) emissions (UN FAO 2006; Goodland and Anhang 2009). It is also the leading cause of ammonia pollution in the United States, at about 75 %, which can affect community quality of life on a regional scale. Locally, particulate airborne emissions from IFAP facilities significantly affect rural community health (Pew 2008).

Animal agriculture consumes 70 % of the world's groundwater resources (UN FAO 2006); IFAP uses 5-fold more water than extensive animal agriculture and 100-fold more water than plant-based agriculture (Pew 2008). This is exacerbating dangerous water shortages and depletions of the water table already present in some parts of the United States and the world (Pew 2008). Agriculture is the leading cause of waterborne pollution, and much of this is due to runoff of manure from IFAP facilities into waterways. IFAP produces 500 million tons of manure, more than three times that of the entire human population (Pew 2008). This leads to contamination of major waterways, leeching of nutrients from the soil, and dangerously low levels of oxygen in the water (hypoxia) that can result in major coastal dead zones (Pew 2008). Agriculture uses a large amount of fossil fuels, with between 4 and 39 kcal (average 25) of fossil-energy input required for 1 kcal of meat output. By comparison, 1 kcal of plant protein presently uses 2.2 kcal of fossil-energy input (Pimentel and Pimentel 2003).

IFAP exerts a number of social, economic, and health-related costs on rural communities in which concentrated animal feeding operations (CAFOs) are located. Working conditions in CAFOs and slaughterhouses are documented to be very poor, with hard, often brutal work, high injury rates, and human rights abuses (Singer and Mason 2006; Human Rights Watch 2004). Farm workers in IFAP systems and associated communities are more likely to contract a variety of zoonotic diseases (notably including influenza). Upwards of 30 % of CAFO workers have chronic respiratory disease (Pew 2008). These health effects extend to rural communities more broadly, which are at increased risk of respiratory diseases such as asthma, zoonotic diseases, and possibly neurologic disease (Pew 2008). CAFOs often make associated communities aesthetically unpleasant and difficult to live in (Singer and Mason 2006; Pew 2008; Foer 2009). Corporate consolidation has resulted in a decrease in economic investment in rural communities. Large farms making more than $900,000 annually invest less than 20 % of their revenue locally, in comparison to >90 % for small farms making less than $100,000 annually. IFAP-associated communities are associated with greater crime, poverty, and depression and a lesser sense of control and self-determination by residents (Pew 2008).

IFAP imposes massive harm upon animals. Approximately 10 billion animals are raised and killed in the United States per year to provide food. This includes about 9 billion poultry (chickens and turkeys), 100 million pigs, and about 40 million cattle (Humane Society of the United States 2012). Whether death per se harms sentient (but non-self-conscious) animals has been a point of debate among philosophers, but a good case can be made that it does under normal circumstances (Harman 2011). If this is true, then based solely on the number of animals killed, IFAP inflicts massive harm upon animals. In addition, the way modern food animals are bred, fed, and housed specifically results in a large number of "production-associated" diseases and deformities. Such maladies are too numerous to list in detail, but representative examples include mastitis, ketosis, abscesses, and lameness in dairy cattle; feedlot bloat and abscesses in beef cattle; lameness, feather-pecking, respiratory problems, sudden death, and broken bones in poultry; and musculoskeletal problems and tail-biting in pigs (Singer 2002; Singer and Mason 2006; Rollin 2009; Foer 2009).

Poultry, pigs, veal calves, and many cattle may be kept in such close confinement that they cannot walk or even turn around, as exemplified by gestation crates, veal crates, battery cages, and tie stalls. Often the animals are kept in barren environments, on uncomfortable surfaces (e.g., hard, slatted floors), and lack environmental enrichment or opportunities for socialization. This close confinement prevents the animals from satisfying most if not all of their preferences

and is associated with physical discomfort, injury, and mental distress. Because close confinement and the continual disruption of social groups lead to in-fighting among animals, pigs' tails and a portion of birds' beaks will be often cut off to prevent biting and pecking. This is typically done without anesthesia and may cause lasting pain or difficulty eating (Singer 2002; Singer and Mason 2006; Pew 2008; Foer 2009).

The US Humane Methods of Slaughter Act requires stunning of food animals prior to bleeding, skinning, and dismemberment, but does not apply to poultry, who are conscious during the slaughter process (Humane Methods of Slaughter Act). Both the US government and eyewitness accounts of slaughterhouse practices indicate that the Humane Slaughter Act is inadequately enforced (GAO 2010; Foer 2009). Animals may be scalded, skinned, or dismembered while partly or fully conscious. Other sadistic abuses at slaughterhouses, such as ramming animals with forklifts, beating them with pipes, chasing them into scalding tanks, stomping on them, or holding electric prods in their eyes, have been documented and do not appear to be rare, perhaps resulting from the stressful workplace environment for slaughterhouse workers and the dehumanizing nature of the work (Foer 2009).

Finally, IFAP presents infectious disease risks to the public. Between 60 % and 80 % of total antibiotic production in the United States goes to animal agriculture, with much of this representing nontherapeutic use for growth promotion (Mellon et al. 2001). Antimicrobial use in agriculture has been closely linked with the emergence of antimicrobial-resistant (AMR) strains of multiple species of bacteria; some of these antimicrobials are critical to human health. Overall, antimicrobial resistance is a serious public health problem, accounting for many emerging infections worldwide, and is associated with increased morbidity and mortality, billions of dollars in additional healthcare costs, and longer hospital stays (Pew 2008).

Furthermore, IFAP creates risks for zoonotic disease transmission, the most significant being the risk of a pandemic influenza outbreak. Both poultry and swine carry influenza viruses, the spread and mutation of which are facilitated by the close crowding of animals in CAFOs. Mutated strains of these viruses could cause a pandemic among humans, and indeed there is reason to think that this is a reasonable probability. A 2009 influenza pandemic was of swine origin, and the 1918 "Spanish Flu," which may have killed as many as 100 million people, is thought to be partially or wholly of animal origin. Certain highly pathogenic strains of avian influenza can infect humans, and though such strains are not highly infectious at present, this could easily change (Greger 2006; Neumann et al. 2009).

Existing Critiques of IFAP

Moral critiques of IFAP and/or animal agriculture in general have been made from a variety of normative theoretical perspectives, including utilitarianism (e.g., Singer 1980, 1993; Singer and Mason 2006), rights theory (e.g., Regan 2001, 1983/2004), coherentism/common morality (e.g., DeGrazia 1996), and a feminist ethic of care (e.g., Donovan 1990/2007). To date, many if not most developed philosophical critiques of IFAP have focused on human obligations to animals and the ways in which IFAP violates these obligations. However, many of these critiques, as well as nonphilosophical reports on IFAP (e.g., Pew 2008), also emphasize the negative environmental and human health impacts of IFAP without necessarily locating these impacts within a specific moral framework, theory, or argument.

Peter Singer provided one of the first and most famous critiques of IFAP in his book *Animal Liberation* (Singer 1975/2002). Though Singer is a utilitarian, the argument that he presents in this work is based more on the common morality than on explicit utilitarian calculations. Singer argues for a principle of equal moral consideration of interests (EC), which requires that we recognize a similar presumption against causing a certain amount of animal suffering as we would a like amount of human suffering. He arrives at this conclusion based on the rejection of species or mental capacity as relevant criteria for morally

"discounting" animals' interests. As concerns farm animals, he devotes a chapter to arguing for the conclusion that, in modern IFAP systems, "these animals live miserable lives from birth to slaughter" (Singer 1975/2002, p. 97). Given an implicit presumption of nonmaleficence against humans, this empirical conclusion, coupled with a principle of equal consideration, secures the moral conclusion that IFAP is indefensible.

In multiple works, David DeGrazia (1996) extends Singer's common-morality approach. DeGrazia, too, argues for a principle of equal moral consideration of interests, building upon the arguments Singer presents, but overall presenting a more philosophically developed and rigorous defense of equal moral consideration. Like Singer, DeGrazia argues that IFAP causes tremendous animal suffering, that sentient animals and humans possess a relevantly similar interest in not suffering, and that our common morality strongly endorses a principle of nonmaleficence, thus yielding the conclusion that IFAP is morally indefensible. However, DeGrazia strengthens this nonmaleficence-based case against IFAP as compared to Singer by arguing that confinement and death, and not just suffering, are harms to animals.

While multiple philosophers have presented compelling cases for a principle of EC, many persons will still not accept this view, and furthermore the philosophical case for EC is not indisputable. Therefore it is significant that a rejection of IFAP on animal welfare grounds need not rest upon this principle. Elsewhere, DeGrazia (2009) and Garner (2005) have argued that we only need acknowledge that animals have nontrivial moral status in order to reject IFAP, not that we need acknowledge EC or even unequal but substantial moral consideration. This conclusion is based on a specification of nonmaleficence so as to be consistent with even the weak anticruelty ethic currently predominant in Western society, thus holding that "we should not cause massive, nonconsensual harm to animals for unimportant human purposes."

Not only is it argued that the consumption of animal products per se is an unimportant human interest, given that plant foods can provide adequate nutrition and also be palate pleasing, but in addition the rejection of IFAP-derived animal products (on the argument presently considered) does not rule out the consumption of animal products from nonindustrialized agricultural systems. Here the human interest at stake is perhaps a modest additional cost for such products and perhaps also some minor inconvenience in having to locate animal products from ethically defensible sources and/or to abstain from eating animal products when non-IFAP-derived products are not available. This seems to be an even less significant interest than the interest at stake in avoiding animal products entirely.

A number of moral theorists have explicitly defended the rights of animals. To say that animals have rights is not to say which rights they have. It is conceptually possible to acknowledge very limited animal rights in a way that is consistent with the prevailing (or emerging) social ethic (e.g., the right to be spared pain and suffering in the service of trivial human goals), but as discussed above even these minimal rights seem sufficient to reject the defensibility of IFAP. Some philosophers, such as Tom Regan (1983/2004), Evelyn Pluhar (1995), and Mark Rowlands (Rowlands 2002), have argued for more robust animal rights, based on inherent value (Regan), a principle of rational altruism (Pluhar), or an amended version of Rawlsian contractarianism (Rowlands), coupled with a principle of EC covering all animals with desires or a welfare (which certainly includes farm animals). These rights typically include strong negative rights against the imposition of harm and the restriction of liberty and so would rule out most (perhaps all) animal agriculture and not just IFAP. While rights views and coherentist/common-morality views may sometimes part ways in normative justification (e.g., as concerns the sacrifice of one individual to prevent the death of many), as concerns IFAP these two approaches look very similar when based on a principle of EC.

Utilitarian critiques of IFAP have also been published (e.g., Singer 1980, 1993). These critiques typically emphasize that the harm perpetrated upon animals in IFAP systems greatly outweighs any benefit to humans such systems

provide, including the benefits of employment and the pleasurable taste of animal flesh. These critiques often compare the human interest in eating animal products with the human interest in eating plant products, noting that plant-based foods can be both tasty and nutritious and that any loss in utility incurred by depriving people of desired animal foods would be relatively small and greatly outweighed by the ending of animal suffering.

However, if the question at hand is the moral defensibility of IFAP as compared also to extensive animal agricultural systems, then again the significance of the human interest being sacrificed is even lesser. Furthermore, since extensive farming systems require more labor inputs and more husbandry expertise than intensive farming systems, the transition from IFAP to extensive animal agriculture may actually *create* jobs. The switch from IFAP systems to extensive animal agriculture would also likely entail a decrease in per capita meat consumption in developed countries, which would have health benefits for such persons (see Garrett 2007). Finally, switching from IFAP systems to extensive animal agricultural systems would decrease environmental pollution, increase the quality of life in rural communities, and decrease the risk of an influenza pandemic, further strengthening the utilitarian argument against IFAP.

The utilitarian case for vegetarianism is slightly less clear but still strong. Singer (1993, pp. 132–133; see also Singer and Mason 2006) argues that non-self-conscious animals do not have a preference interest in staying alive, that it is morally unproblematic to painlessly kill animals that have lived happy lives and replace them with other animals leading equally happy lives (the so-called replacement argument), and that, since such happy animals would not be brought into existence except to be eaten, utilitarianism may identify an extensive animal agricultural system providing for excellent animal welfare as the moral ideal. This is a controversial argument, but even if it is accepted, a utilitarian can recognize other reasons for moving towards a plant-based agricultural system, some of which Singer himself provides.

First, there is a slippery slope objection: if it is accepted that it is morally legitimate to kill animals for food – a trivial purpose when not necessary – then we will come to view them as objects to use as we please. In the face of ever-present market pressure for greater efficiency and lower cost, this attitude is likely to result in backsliding into industrialized agricultural systems (Singer 2002, p. 134). Second, it has been argued that as compared to a pasture-based animal agricultural system, a plant-based agricultural system would allow a greater number of animals to live happy lives, since a plant-based system would kill fewer animals and also allow land to revert to the wild state, thereby supporting wild animals that would not otherwise exist. Furthermore, it is argued that the welfare of animals accidentally killed in plant-based agriculture (e.g., by tractors) is overall better than the welfare of even extensively raised animals (Matheny 2003).

Third, since a plant-based agricultural system would allow an additional 840 million persons to be fed, there is (assuming appropriate distribution) an immense utility gain from this (see Pimentel and Pimentel 2003; Singer 1980). Finally, given the apparent health benefits of plant-based diets as compared to animal diets, it may be the case that population health would be maximized if everyone followed a plant-based diet, further increasing utility (Garrett 2007).

Finally, a number of feminist scholars have argued for either moral vegetarianism or a nonindustrialized animal agriculture that provides for better animal welfare than IFAP. Though there is diversity within feminist ethics, these conclusions generally seem to be reached through the advocacy of an "ethic of care," one which is contextualist rather than universalist, one which emphasizes personal relationships and responsibility over impersonal rights and obligations, and one which "requires a fundamental respect for nonhuman life-forms, an ethic that listens to and accepts the diversity of environmental voices and the validity of their realities" (Donovan 1990/2007, p. 75). Donovan asserts that "feminists must reject carnivorism" (1990/2007, p. 76), a conclusion also supported by some other feminist scholars (e.g., Gruen 2004/2007).

However, still other scholars accept the basic commitments of an ethic of care as sketched here, reject IFAP, but defend some consumption of meat and other animal products (George 1994). Nonetheless, most feminist scholars who write about animal ethics appear to be critical of IFAP.

New Directions for Critiquing IFAP

With the exception of utilitarian critiques, existing philosophical critiques of IFAP tend to focus on animal welfare, but as discussed in this essay, the negative effects of IFAP extend far beyond this. Hence a future direction for critiques of IFAP is to build these other negative effects into non-consequentialist philosophical critiques in a more developed way. Of course, a person could simply argue that we ought not to act when so acting brings about significant, bad consequences for the environment, for animals, and for present and future humans and where the action in question serves only to satisfy a trivial human interest. This argument seems plausible enough, but philosophers may press the critic of IFAP to address a number of philosophical issues, such as the distinction between intending and foreseeing harm, the distinction between acts and omissions, our moral obligations to future generations, and the intrinsic value of the environment. These issues cannot be pursued in detail here, but a few brief observations are noted.

First, human obligations to protect and preserve the environment might be accounted for by acknowledging and defending a human right to health, insofar as an unspoiled environment (however this is understood) is a necessary precondition for human health. Such an argument can be extended to critique IFAP, given IFAP's substantial contributions to environmental pollution and global climate change (Brei 2012). Second, biocentric theories that intrinsically value non-sentient individuals, species, and/or ecosystems (e.g., Varner 1998) also contain ample resources to reject IFAP. Notably, though it is sometimes held that biocentric theories are incompatible with individualistic theories, this need not be true: a person may acknowledge the value of sentient individuals as well as non-sentient individuals and wholes, such as species or ecosystems (Varner 1998; Jamieson 2003). Hence the recognition that the environment has intrinsic value can strengthen existing cases against IFAP, instead of being thought of as grounding an alternative case.

Third, a good case can be made for recognizing our obligations to future generations, and though establishing this leaves open the content of such obligations, IFAP's negative effects as concerns the environment, food abundance, and zoonotic disease are arguably significant enough to circumvent controversies regarding the strength of our obligations to future persons. If we have any obligations to future persons whatsoever, then arguably these would at minimum include obligations not to impose significant harm or risk upon them in order to serve the trivial interests of presently existing humans or to leave them a world in which they have a significantly harder time meeting their basic needs as compared to alternatives. Given world population growth and expected food demands, the threat of global climate change, worsening water shortages, and the increasingly concerning risk of a global influenza pandemic, it can be argued that IFAP's continuation would lead to exactly these consequences.

Defenses of IFAP

Just as striking as the many possible philosophical routes by which one might criticize IFAP is the lack of defenses offered for it. Some philosophers have questioned whether utilitarian commitments lead necessarily to vegetarianism (Frey 1983, Regan 1983/2004), but strictly speaking this is not an argument in defense of IFAP; even utilitarians who defend animal agriculture typically reject IFAP (see, e.g., Frey 1983). (In addition, arguments undermining a utilitarian commitment to vegetarianism may fail in their own right.) Some other philosophers who argue that animals have little or no moral status (e.g., Leahy 1993) seem to suggest that IFAP is not

morally defensible. Wesley Smith offers one of the few defenses of IFAP specifically that can be found in the published literature (Smith 2010). Smith's argument draws heavily from Carl Cohen (see Cohen 2001), who argues that animals do not have rights, but that humans have significant obligations to treat animals humanely; Cohen does not apply his arguments to agriculture, but Smith does. However, neither author has much to say about the content of our obligations to animals, and it is arguable that "humane" treatment is inconsistent with IFAP. (Cohen's argument is also vulnerable to a number of other criticisms; see Regan 2001 and Nobis 2004 for discussion.)

Furthermore, Smith's defense of IFAP specifically – as opposed to animal agriculture more broadly – is that it supplies cheap food to poor persons. This presumes, perhaps erroneously, that plant-based diets are significantly more expensive than animal-based diets; as already discussed, some studies suggest that such cost differences may be minimal. It also ignores the role that externalized costs (e.g., grain subsidies, environmental pollution) play in creating an artificially low market price for animal products. Moreover, though Smith defends human exceptionalism, his argument in favor of IFAP ignores the other costs that it imposes on present and future *humans*. Finally, given the other ethical objections that can be raised against IFAP, it seems wrongheaded to perpetuate it just to provide food for persons who otherwise cannot afford it. Presumably better options are available to satisfy this admittedly important goal, for example, ending grain subsidies and using such monies to directly subsidize food assistance programs.

Finally, the animal agricultural industry and organized veterinary medicine often fiercely defend IFAP from its critics, but for a variety of reasons, the arguments they typically make are problematic. First, these groups often commit themselves to highly contentious (if not dubious) claims, such as the claim that we lack sufficient evidence to causally link antimicrobial use in agriculture to antimicrobial resistance in human populations or the claim that intensive confinement is not detrimental to animals' welfare as compared to alternative housing systems (American Veterinary Medical Association AVMA 2005, 2009). Second, these groups often ignore or downplay some of IFAP's costs, such as its contributions to environmental pollution or global climate change. Third, these groups often emphasize that IFAP provides a safe, abundant, and inexpensive food supply (AVMA 2008; Animal Agriculture Alliance). However, some evidence suggests IFAP actually compromises food safety, and there is a lack of compelling reasons to think that alternative agricultural systems will produce an unsafe or less safe food supply (Pew 2008; Foer 2009).

As concerns food abundance, IFAP produces less food overall than a plant-based agricultural system or an agricultural system where animals are only pastured on lands unsuitable for crop production. The significance of IFAP's production of cheap animal products has already been discussed. Finally, these groups often make ad hominem attacks against their opponents, such as dismissing calls for more space for farm animals as "arbitrary and emotion based" (AVMA 2008). They may also respond disingenuously to criticisms, for example, by arguing that farm-animal housing is "species-appropriate" when responding to the criticism that farm animals are not provided enough space to move around (Animal Agriculture Alliance). These tactics raise concerns about bias and credibility.

Summary

Significant evidence supports the conclusions that industrial farm-animal production is highly detrimental to animal welfare; contributes substantially to anthropogenic greenhouse gas emissions, environmental pollution, and the risk of zoonotic disease; lowers the quality of life in rural communities; lowers the overall amount of food available as compared to alternative agricultural systems; and promotes a diet rich in animal products that is detrimental to the public's health. Moreover, IFAP can be and has been critiqued from a variety of normative

ethical perspectives, while arguments defending IFAP are both infrequently encountered and vulnerable to significant criticism. The conclusion that IFAP is morally indefensible appears overdetermined.

Cross-References

- ▶ Carnism
- ▶ Christian Ethics and Vegetarianism
- ▶ Environmental and Animal Pragmatism
- ▶ Meat: Ethical Considerations
- ▶ Vegetarianism

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Industrialized Slaughter and Animal Welfare

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Synonyms

Abattoir; Butchering; Factory; Killing; Meatpacking; Processing

Introduction

Following domestication approximately 10,000 years ago, the small-scale slaughter of animals for human consumption was performed on farms, in butcher shops, and even openly on city streets.

This began to change in the Western world in the nineteenth century. Increased urbanization, a growing demand for meat, and an increasing concern over public hygiene, along with a distaste for the sights, sounds, and smells of slaughter, led to the concentration of slaughter practices in public slaughterhouses (e.g., Fitzgerald 2010). The first public slaughterhouse opened in 1818 in Paris became a model quickly emulated across Europe.

Slaughter methods and practices used in these early slaughterhouses were primarily based on practicalities. For example, to prevent worker injury, cattle were restrained and immobilized with a blow to the head (typically from a poleax) before being bled out.

However, public concern for the welfare of animals increased, particularly during the development of the humanitarian movement, with the influence of philosophers such as Jeremy Bentham, who submitted that animals may be sentient (capable of experiencing pain). This led to the development of societies for the protection of animals – most notably, the SPCA, created in England in 1824 (now known as the RSPCA) – and the search for methods of stunning that would

render animals unconscious before butchering. Several such methods, developed during the latest part of the nineteenth century, included the use of electricity, carbon dioxide, and slaughter masks applied to the head of the animals to allegedly facilitate the accurate delivery of the stunning blow (MacLachlan 2008).

While butchering processes inside these early slaughterhouses remained largely unchanged, the Chicago Stockyard slaughterhouse, which opened in 1865 in the United States, developed industrial processes to increase productivity (Fitzgerald 2010). These processes included the compartmentalization of the butchering process with workers given specific, repetitive tasks. Industrialization considerably increased the number of animals that could be slaughtered, famously documented in Upton Sinclair's 1906 novel *The Jungle*. Sinclair described the disturbing effects the industrialized slaughterhouses had not only on the workers but also on the animals.

Today, industrialized slaughter methods govern the killing of animals by the meat, dairy, and egg industries in the Western world, where the vast majority of animals are increasingly killed in relatively few, large-scale slaughterhouses owned and operated by large-scale corporations. In Canada, for example, two massive, privately owned slaughterhouses in Alberta now account for the killing of nearly 90 % of the country's 5½ million cattle.

National slaughter regulations seek to minimize the pain and suffering of animals during slaughter. In addition, the Animal Health Organization (OIE) sets international standards for the transport, handling, and slaughter of farmed animals. These regulations and standards determine which slaughter methods are acceptable and typically include a requirement to immediately stun animals before slaughter to render them unconscious.

Animal welfare research, however, suggests that these regulations and standards may not be sufficient to protect animals at the time of slaughter, particularly in modern industrialized slaughterhouses with high line speed and worker turnover rates. In addition, some species may be excluded from protection (e.g., chickens, turkeys, ducks, and geese in the United States); ritual halal or shechita (kosher) slaughter methods, which are traditionally performed without stunning, are also often excluded. In these cases, loss of consciousness and death do not occur immediately and, therefore, are likely to cause fear, pain, and distress in animals. However, even when stunning is performed, fast-paced conditions may contribute to the cruelty routinely documented in slaughterhouses.

Killing with Prior Stunning

Most animal slaughter regulations dictate that all animals, except those killed according to halal or kosher standards, be rendered unconscious before being killed. Stunning, done by concussion, electrocution, or gassing, aims to render animals unconscious or insensitive to pain. Sticking, done by cutting the animals' throat horizontally or severing the major blood vessels arising from the heart, brings about death by exsanguination (OIE 2012). Animals are then skinned, disemboweled, and dismembered.

Regulations stipulate that to reduce pain and distress, loss of consciousness must occur immediately after stunning, and bleeding must cause death without risk of animals regaining consciousness. However, ineffective stunning and sticking procedures are common and can cause animals to experience fear, pain, and suffering.

Percussion Stunning and Animal Welfare

The purpose of percussion stunning is to cause head trauma with (or without) penetration of the brain. Penetrating percussion stunning is achieved through gunshot (most frequently, a 22-caliber free bullet) or penetrating captive-bolt devices, which fire a metal rod through the brain via a blank cartridge or pressurized air. The device is routinely used to stun cattle, goats, horses, sheep, and pigs. Non-penetrating, or mushroom-shaped, captive-bolt devices are used on cattle in addition to small animals like rabbits. These devices work by striking the animals' head with a non-penetrating bolt, causing concussion

as a result of the impact. Unlike the penetrating devices that damage the brain, non-penetrating devices cause temporary loss of consciousness, which can be reversed.

For percussion stunning to be effective, impact to the brain must occur in the area responsible for consciousness, the precise positioning of which varies between species. It also must have sufficient velocity to bring about concussion and loss of consciousness. In industrial slaughter with its focus on line speed, one or both of these requirements may not be fulfilled.

The effective stun spot within an animals' skull makes for a small target, and thus accurate placement of the stunning device or gunshot is critical. In large slaughter plants where line speed is fast and several hundred animals may be stunned per hour, the risk of mistakes and misplacement of the shots is high, particularly when fearful and trembling animals move or thrash about in an effort to avoid the weapon. These problems are compounded when workers are not properly trained or fatigued from long hours and redundant tasks.

Additionally, equipment failure presents a significant problem. During high line speed, penetrating captive-bolt devices may be used repeatedly before being cleaned. Multiple problems can occur as a result: the device may become jammed with brain matter and skull fragments, preventing the bolt from discharging or reducing the target accuracy and velocity. The fast-paced consecutive shots delivered by a penetrating, cartridge-powered stunning device produce heat, which may decrease the energy or velocity of the strike (Gregory 2008). In these cases, the failure to strike, loss in strike strength, and/or loss in strike velocity is likely to cause improper stunning. More than one shot may thus be required to stun the animals, and this may not be delivered due to high line speed.

After stunning, animals are shackled, hoisted by one hind leg, and moved to a bleeding area where their throats are partially cut. Animals who are improperly stunned, or who regain sensibility, experience a high degree of pain and fear during exsanguination. Incomplete or misplaced sticking prolongs the time required for sufficient bleed out to cause cerebral death, causing still-conscious animals to be suspended, bled out, and butchered. In her book *Slaughterhouse*, Gail Eisnitz, who conducted and compiled interviews with American slaughterhouse workers, reports that animals routinely exhibit signs of consciousness, such as blinking, kicking, or shrieking, during the butchering process.

Electrical Stunning and Animal Welfare

Birds

Electrical stunning, or electronarcosis, is commonly used to stun birds (chickens, turkeys, ducks, and geese). While handheld electrical tongs applied to the head of each animal may be used, this method is not practical in slaughter plants processing tens of thousands of birds a day. In these facilities, birds are instead shackled upside down by their feet on a moving rail to have their heads dragged through a water bath stunning system. Many welfare issues are tied to the use of these systems.

Prior to stunning, birds are at risk of receiving painful pre-stun shocks if splashed before being submerged or if the tips of their wings dip into the electrified water – a problem particularly common with turkeys as their wings hang lower than the heads, but also frequent with broiler chickens. A recent study found that pre-stun shocks significantly affect meat quality by causing burns to the birds' wing tips, fractures to their breastbones, and bleeding in their wings, shoulders, and breasts (Rao et al. 2013). Panicked birds who raise their heads or attempt to raise themselves are at high risk of missing the stun bath completely.

Improper or ineffective stunning can also occur even with birds whose heads are properly submerged in the electrified water bath. The waveform and frequency of the current, how much the animals are subjected to, and each bird's resistance determines the efficiency and duration of the stun. For instance, low current frequencies (50–60 Hz) may induce fibrillation of the heart (cardiac arrest) and cause death. By contrast, higher frequencies may only momentarily disrupt brain activity in what can be compared to an epileptic seizure and therefore must be

applied for a longer period of time in order to induce proper stunning. It should be noted that in most slaughterhouses today, electricity is used only to stun the animals, not kill them. Birds who are effectively stunned may still recover before fully bleeding out.

Research indicates that the voltage required to achieve an effective stun must be a minimum of 120 mA per bird and that currents under 75 mA per bird should never be used (Gregory and Wotton 1990). High voltage, however, is costly and has been linked to meat quality issues, such as broken bones, broken capillaries, and blood spots. Because of this, most slaughterhouses deliberately keep voltage levels low, gaining in meat quality but greatly sacrificing animal welfare. The problem can be amplified in slaughterhouses that stun birds of differing sizes and characteristics together in multi-bird stun baths as they may have different tolerances to electricity. While some birds may present physical signs of consciousness, others may be indiscernible as improper stunning can result in the paralysis of muscles.

After stunning, the birds have their necks cut, either by automatic spinning blades or manually by workers. Un-stunned birds, and those who have regained consciousness, continue to move by lifting their heads or flapping their wings. As a result, their neck may be only partially severed, or not severed at all, by the blades.

The length of time required for bleed out is dependent on the effectiveness of the cut and whether both carotid arteries are cut. Failure to cut both arteries can add up to 2 min to the time needed for brain failure to occur; severance of only one carotid can leave the birds conscious and suffering for up to 8 min (Gregory 1984). Birds that fail to properly exsanguinate are plunged into the scalding defeathering tank before breathing has stopped. These birds are scalded or drown to death, their blood vessels bursting, turning their skin bright red (referred to as "red skins" or "cherries" by the meat industry).

As a result of these myriad welfare issues, the government of the Netherlands has set proscriptive regulations around the use of the electrified stun bath for birds. Because of this, most poultry slaughterhouses in the country have converted to gas stunning or killing of the birds. Regardless, electrified stunning continues to be the primary means of stunning birds in most industrialized slaughterhouses.

Mammals

Electronarcosis as a stunning method is also frequently used on mammals (pigs, sheep, and calves, in particular). In the case of pigs and sheep, an electrical current is manually applied through handheld tongs by placing the paddles on each side of the animal's head ("head stunning") to induce a seizure which disrupts brain function and brings about insensibility. The process, however, is reversible.

"Stun kill" can also be performed by applying one paddle on the animal's head and the other over the animal's heart ("head to heart stunning"). Head to heart stunning causes electricity to pass through both the brain and heart, leading to both stunning and cardiac arrest, killing the animal. Head to heart stunning is thus preferable from an animal welfare perspective, but because it can lead to carcass damage is typically ignored in favor of head stunning.

As with birds, a major welfare concern with this form of electrical stunning is the risk of failing to deliver a current high enough to ensure proper stunning. This risk is significant when animals are stunned in groups and voltage is lowered to ensure the safety of the workers. A higher voltage may be used when animals are brought to the stun operator by a conveyor system which restrains their movements; however, even an adequate current does not necessarily ensure a proper stun. If the tongs are applied while the current is flowing or if they are improperly applied, the animals may be subjected to painful electrical shocks. These animals may become paralyzed, but remain conscious, or they may be stunned but regain consciousness.

An additional concern is the short duration of the stunning effect, even for properly stunned animals. Following seizure, pigs and sheep can regain consciousness in just 30–60 s. Often, the time to irreversible loss of consciousness by bleeding is longer than the duration of

insensibility produced by stunning. This means that to ensure a less painful death, the animals must be stunned, shackled, stuck, and have bled to the point of irreversible brain death before stunning wears off and the animal regains consciousness. This requirement for prompt actions might not be easily realized, even in the most industrialized of slaughterhouses.

Gas Stunning and Animal Welfare

Gas stunning may help minimize some of the stress associated with handling. Many gas stunning systems for chickens are designed such that birds enter the gas chamber in their transport crates, thus obviating the need for unloading and live hanging. Handling can also be improved for pigs as most gas stunning or killing systems allow the animals to be moved as a group into the gas chamber. Insensibility, however, may take longer than with other stunning methods, thus causing longer periods of distress, depending on the gas and concentration used.

Gas stunning is conducted either with a high concentration of carbon dioxide, or with inert gases (argon or nitrogen, in particular), or a combination of carbon dioxide and inert gas. Animals react differently to different gases and concentrations. Birds and mammals react aversively to high concentrations of carbon dioxide as chemical receptors in their brains recognize overabundance of the gas, triggering a pain response and suffocation. In birds, this presents as wing flapping, convulsing, gasping, neck stretching, or head shaking, which often lead to broken wings and blood spots. Pigs' responses include hyperventilation, intense vocalization, and escape attempts.

In an effort to reduce losses from meat damage, some chicken and turkey slaughterhouses first introduce birds to lower levels of carbon dioxide. Observers of such systems, however, have reported the same aversive behaviors when the birds reach the higher concentration of carbon dioxide. The level of the birds' consciousness in these low to high systems remains unclear.

The use of inert gases, however, alone or mixed with low carbon dioxide concentrations, appears to provide some improvements from both animal welfare and meat quality perspectives. These gases are not recognized by chemical receptors in the brains of birds and mammals, and thus the states of anoxia (lack of oxygen) or hypoxia (low levels of oxygen) are not experienced as painful.

Dr. Mohan Raj, a veterinary scientist at Bristol University, conducted experiments which indicate that the use of inert gas (argon or nitrogen), or a mixture of carbon dioxide with inert gas, effectively stunned birds and pigs without causing distress to the animals. In one experiment, pigs entered and reentered a chamber filled with a mixture of argon and carbon dioxide to look for apples. These animals lost consciousness while eating without presenting any stress behaviors (Raj and Gregory 1995). Studies with chickens and turkeys have similar results: the process causes no sign of respiratory discomfort or other signs of distress (Raj 1996), eliminating the incidence of broken bones, bruises, and hemorrhages. When using a mixture of inert gas with less than 2 % residual oxygen, animals are irreversibly stunned in what is known as controlled atmosphere killing (CAK), eliminating the risk of recovery during bleed out.

In most slaughter plants using gas stunning, however, carbon dioxide alone is the method of choice. Reasons cited include prohibitive cost and reduced availability of inert gases, as well as worker safety concerns prevailing over animal welfare considerations.

As a result, animals stunned through gassing typically experience protracted pain before loss of consciousness is achieved, the duration of which varies between individuals. Therefore, in large commercial slaughterhouses, it is impossible to ensure all animals leaving the gas chamber are properly stunned.

Killing Without Prior Stunning

While the majority of modern industrial slaughter plants use a two-step stunning and killing process to slaughter animals for food, halal and shechita slaughterhouses (which kill according to Muslim and Jewish laws, respectively) kill animals by

slicing the throat through a single incision without prior stunning. Defenders of halal and shechita slaughter state that the process is humane, claiming it is fast and that the single incision does not cause acute pain. Both statements, however, are debatable.

Brain function does not immediately cease following a cut to the throat. The time required to lose consciousness through bleed out may take up to 2 min for cattle. In addition, a "ballooning" mechanism may occur where blood clots form at the severed ends of the carotid arteries (Gregory et al. 2008). These clots obstruct blood flow, slowing blood loss from the brain and extending the length of time required for animals to lose sensibility. Depending on the location of the cut, loss of consciousness might occur only after several minutes.

The cut itself is also likely to cause pain and suffering. The presence of pain receptors in the area of the cut suggests that throat incisions can "result in very significant pain and distress in the period before insensibility supervenes" (FAWC 2003). In addition, animals may experience fear and panic as they consciously choke to death, aspirating blood into their lungs and respiratory tracts in an effort to breathe (AHAW 2004).

Concerns about animal welfare during slaughter have led countries such as the Netherlands, Norway, Switzerland, and Sweden to ban killing without prior stunning. While such decisions are often criticized, some religious authorities have proposed that stunning animals does not contradict religious precepts. Imam Al-Hafiz Masri, for instance, argues in his book *Animals in Islam*(Al-Hafiz Masri 1989) that the volume of blood draining out of the body after an animal has been stunned is no smaller than the volume of blood draining from un-stunned animals – one of the main beliefs impeding the implementation of stunning in halal slaughter.

The welfare concerns surrounding ritual killing continue to gain exposure as meat and poultry not labeled as halal or kosher are increasingly shown to derive from animals that have not been stunned prior to slaughter. It is believed commercial factors may be responsible as abattoirs without stunning facilities may be less expensive to run. Thus secular consumers, believing they are buying meat from animals who were stunned before being stabbed and bled out, may be supporting a practice they otherwise would not.

Fish

Fish have traditionally been killed by asphyxiation after being removed from water, but with the recent rise in factory farming of the animals, they are increasingly being killed in other ways, with or without prior stunning (Yue, N.A.).

Fish (salmon, in particular) may be stunned manually via a blow to the head with a club or "priest." As with concussion stunning of mammals, the blow must be positioned correctly and done with enough force to ensure proper stunning, which is often difficult with moving fish and when repeating the action over a period of time. The use of mechanical percussive systems addresses the problem of workers' fatigue and provides a more consistent blow, but cannot ensure that all animals, particularly those with nonstandard sizes, be properly stunned.

Electrical or gas stunning may also be used. As with birds and mammals, electronarcosis can be ineffective, producing effects unlikely to last long enough to prevent fish from regaining consciousness before they bleed out to the point of insensibility (Benson 2004). Fish subjected to gas stunning show aversive behavior when exposed to high levels of carbon dioxide in the form of hyperactivity, leading to injuries (Yue, N.A.). With both electrical and gas stunning therefore, fish may be subjected to distress and possibly pain for several minutes before losing consciousness.

Killing by exsanguination without prior stunning may be performed. In this case, fish, which have their gills or tail blood vessels cut or their heart perforated, are left to bleed before further processing. Inaccurate cutting can be prevented by the fish movements, prolonging the duration of the bleeding and delaying the loss of consciousness.

Finally, some fish slaughterhouses may butcher and process fish without any attempt at rendering them unconscious. This practice was exposed in a Mercy For Animals investigation in Texas in 2010, where catfish were cut into,

skinned, suffocated, and dismembered while fully conscious (http://www.mercyforanimals.org/fish/).

Worker-Inflicted Cruelty

A number of studies have shown that the work of killing animals in an industrialized system may have social and psychological consequences for workers (e.g., Fitzgerald et al. 2009). The intensive, production-based nature of slaughterhouses forces workers to suppress natural feelings of empathy, desensitizing them to the fear and pain of animals. Numerous documented cases of malicious and intentional cruelty at slaughterhouses have been exposed by animal advocacy organizations worldwide. These include the beating, stomping, throwing, dragging, electrocuting, stabbing, mis-shooting, and mutilation of fully conscious animals.

While it is impossible to quantify the extent of animal abuse in slaughterhouses, conservative estimates by University of Colorado professor of animal science Dr. Temple Grandin indicate that "only about 20% of animal slaughter facilities operate within acceptable humane guidelines and the rest slip into bad practices, with a full 10% intentionally treating animals cruelly" (2011 Summit of the Horse, Las Vegas).

Summary

Food safety concerns, as well as urbanization and increased consumption of animal products, led to the mass concentration of killing of animals in large, industrialized slaughterhouses in the Western world.

The so-called humane regulations attempt to minimize the pain and suffering experienced by animals during slaughter, yet numerous deficiencies exist. In particular, ineffective or improper stunning is common in all forms used: percussion, electrical, and gas and can cause animals to experience fear, pain, and suffering.

Additionally, halal and shechita slaughter are typically performed without stunning; however, the process arguably causes acute and protracted pain and suffering.

Worker-inflicted cruelty is increasing in the public eye, and research has shown that the intensive, production-based nature of slaughterhouses forces workers to suppress natural feelings of empathy, desensitizing them to the fear and pain of animals.

Because of these significant welfare concerns, modern slaughter methods can hardly be considered humane, and their employment should elicit further ethical debate into the mass consumption of meat and its production through industrial slaughter methods.

Cross-References

- ▶ Animal Welfare: A Critical Examination of the Concept
- ▶ Islam and Food
- ▶ Judaism and Food
- ▶ Meat: Ethical Considerations
- ▶ Vegetarianism

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Infant Feeding

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Synonyms

Food safety; Industrially manufactured foods; Natural foods

Introduction

Food studies generally ignore infant and young child feeding practices in favor of adult eating. Human infants are totally dependent on others for their food, and they survive primarily on one food – milk; however, the bioethical issues concerning infant and young child feeding are seldom explored. Food activists usually focus on adult foods, not baby foods; policy makers concerned with food security ignore breastfeeding because breast milk is neither produced agriculturally nor industrially. Because human milk is produced in the bodies of individual women, it is a greater challenge to relate it to global food issues. Infant and young child feeding is also different from adult eating because the person being fed, the baby, is not making the decisions about what, how, and when to feed. The decision on what to feed an infant is not a lifestyle choice dependent on trends and fashions, but one with vital short- and long-term health implications for both mother and baby. This entry examines the ethical, economical, ecological, and health issues implicated in the feeding of human newborns, infants, and young children.

The Ideal Diet

The first nutrients to nourish new humans pass from mothers' blood through the amniotic fluid into the umbilical cord to the fetus before birth. As the fetus floats in the amniotic sac, the surrounding amniotic fluid carries the tastes of the foods consumed by the pregnant woman available to her in the world outside the womb. After birth, babies take in their first foods by mouth. As with all mammals, the product designed to be that first food is colostrum followed by human milk.

Newborns, infants, and young children are at a vulnerable stage of development. They are exposed to harmful bacteria, viruses, and parasites and in their first months of life have few or only weak defenses to fight them. Before birth the unborn child receives protection from the

mother's antibodies. Breastfeeding provides not only the first food but also the first medicine. The antibodies in human milk help protect against diseases, and breastfeeding boosts the maturation of the infant's immune system. As the Deputy Director of UNICEF states "Breastfeeding is a baby's 'first immunization' and the most effective and inexpensive life-saver ever" (UNICEF 2013). Breastfeeding enhances child survival, encourages healthy growth and development, saves on health costs, and is far more economical for the family budget. In addition, breastfeeding increases child spacing, and for many women it is the only method to plan their families when contraception is unavailable, unaffordable, or unacceptable for religious or cultural reasons. Unlike diverse and culturally shaped adult diets, there are universal agreed upon standards about the ideal diet for human infants – human milk. The World Health Organization (WHO) and UNICEF define the standards for ideal infant feeding in the Global Strategy for Infant and Young Child Feeding (2002): babies should receive breast milk exclusively for the first 6 months of life. After 6 months, babies should be introduced to appropriate and adequate complementary foods, with continued breastfeeding for up to 2 years and beyond. Infants have the right to special protection so that they survive, grow, and achieve their "highest attainable standard of health," in order to realize their full potential.

"Children who are exclusively breastfed are 14 times more likely to survive in the first 6 months than non-breastfed children. Starting breastfeeding in the first day after birth can reduce the risk of newborn death by up to 45 %" (UNICEF 2013). Unfortunately, despite these evidence-based arguments and the well-documented benefits of breastfeeding worldwide (WHO 2006), "only 39 % of children aged less than 6 months were exclusively breastfed in 2012" (UNICEF 2013). This means that only about one third of the 136.7 million babies born annually are exclusively breast-fed for the first 6 months of life. The high rates of child malnutrition in many countries suggest that infant and young child feeding is far from ideal.

History

Throughout human history, women have always had access to alternatives to maternal breast milk, including wet nursing and the use of animal milks served in horn or terra-cotta feeding bottles. However, any alternatives to maternal breastfeeding were universally recognized as dangerous. Animal milks often played an important role in feeding babies, and many European orphanages kept goats for rearing infants. Wet nurses were carefully vetted, on the assumption that the characteristics of the nurse would be transmitted through the breast milk. However, most alternatives to breast milk used in the past were nutritionally inadequate and contributed to high rates of infant mortality (Van Esterik 1989).

In the fifteenth century in Europe, the first books appeared to provide advice on infant feeding, around the topics of breastfeeding, wet nursing, dry nursing or feeding an infant by hand (artificial feeding), and weaning (Spaulding and Welch 1994, p. 8). One authority, writing in 1804, began his advice on preventing childhood disease assuming that many women were not able to breast-feed their own children because of their delicate constitutions, low spirits, hysteric fits, or other nervous disorders; but he later revised his thinking, claiming that "*many* mothers *will not* nurse, few *cannot*" (Spaulding and Welch 1994, pp. 16, 17). Wet nursing was generally considered the best way to feed an infant if the mother could not or would not breast-feed her child.

It is likely that women were well aware of the child spacing effects of breastfeeding, although social pressure to have large families may also have influenced their infant feeding decisions. Aristocratic women in Britain and France used wet nurses to avoid the child spacing effects of breastfeeding. These women were required to have numerous male descendants to carry on the family name and property. If they did not breast-feed, they became pregnant again much more quickly (cf. Fildes 1986; Spaulding and Welch 1994).

Historically, the difference between commercial breast milk substitutes and other foods has not always been clearly defined. Semisolid

mixtures of grains, often mixed with animal milk or water, were given to infants to replace or supplement breast milk. These mixtures were fed through feeding devices made of horn or ceramic and were difficult to keep clean. It is only in the last century that improvements in commercial breast milk substitutes permitted many infants to survive without human milk.

The first milk-based commercial breast milk substitute was developed by Nestle in 1867. Early milk-based formulas often included cereals and were marketed as foods and not as liquid breast milk substitutes. These proprietary milk products competed alongside condensed and evaporated milks and custom-made preparations around the end of the century. In 1928, Gerber developed and marketed specialty foods for babies such as strained vegetables and fruit. In the 1930s, strained baby foods were sold in patented vacuum-sealed clear glass jars, replacing lead-soldered metal cans. Commercial baby foods, often called "solids," were frequently used as breast milk substitutes and were given too early, replacing more nutritious breast milk. Since their development, there has been a steady decrease in the age of introduction of solids to infants. In North America, parents often take pride in seeing infants eat commercial baby foods at increasingly early ages. In France, doctors advised giving artichoke purée to infants at the age of 6 weeks to develop their gastronomic discernment – breast milk was thought to be too monotonous and bland!

Over the next 20 years, the use of commercial baby food increased in middle- and upper-income North American homes, where it was used not just to supplement but also to substitute for breast milk. Specialty products such as preterm infant formula were developed in the 1960s. The 1980s saw the development of fortifiers to adapt human milk for low-birth-weight infants for use in intensive care nurseries. Mothers' own milk is now recognized as the standard of care for premature infants, with pasteurized or fresh donor human milk used when mother's own milk is not available. More recently, soy-based products have come onto the market, along with follow-on formulas for older infants. Since 1980, companies have been trying to add components to create the impression of improving infant formula and making it closer to human milk. These include probiotics, which are live bacteria that colonize the infant's gastrointestinal tract and are said to provide benefits. However, in their review and comment, the Committee on Nutrition of the European and American Societies for Pediatric Gastroenterology, Hepatology and Nutrition states: "At present, there is insufficient data to recommend the routine use of probiotic- and/or prebiotic-supplemented formulae." The Committee noted: "Because most of the trials were company funded, independent trials, preferentially financed jointly by national/governmental/European Union bodies and other international organisations, would be desirable" (ESPGHAN and NASPGHAN 2011).

Global conditions of food production and distribution have increased households' access to commercial breast milk substitutes around the world. In spite of breastfeeding protection, support, and promotion efforts by governments and civil society, the sale of commercial breast milk substitutes and baby foods has steadily increased. The global market for baby food is projected to reach USD 63 billion by 2017, after growing from USD 28 billion in 2007 to USD 41 billion in 2012 (2011 Baby Food and Pediatric Nutrition Market).

Ethical Dimensions of Infant Feeding

Infants have no responsibility for the decisions made about how they are fed. Mothers usually bear the brunt of the blame for any infant feeding problems. But society needs to take responsibility to ensure that the next generation is adequately fed and nurtured. It falls on the state to deal with failures when neither families nor communities take responsibility to make sure every child has the best possible start in life. Ideally, then, infant feeding should be guided by collective ethics. This would include the right to factual, unbiased information about breastfeeding, commercial breast milk substitutes, and other methods of infant feeding.

Ethical Complexities of Breastfeeding

Support for breastfeeding mothers should be a matter of public policy, including the right to feed in public without harassment or undue attention. Expecting women to breast-feed without providing the necessary supports, including good maternity entitlements, is unethical. It is ethically responsible to provide mothers with accurate information about breastfeeding, including the existence of chemical residues in their milk, remembering that all living beings carry a body burden of industrial chemicals (IBFAN 2013). Women should not be told that breastfeeding is instinctive, natural, or always problem-free, but be provided with access to the means to solve occasional problems such as mastitis or poor positioning. A few women have difficulties with their milk supply, even with frequent breastfeeding, but as WHO explains: "Exclusive breastfeeding from birth is possible for most women who choose to do so. It is recommended for all children except for a few medical conditions, such as maternal medication and radioactive substances. Exclusive breastfeeding as often and as long as the baby wants results in ample milk production" (WHO/UNICEF 1993; WHO 2006). Ignoring or discounting the difficulties that some Euro-American mother-infant pairs have with breastfeeding may increase the guilt mothers feel when they fail to breast-feed their infants exclusively or bottle-feed in public. This is not the intention of groups who promote breastfeeding, who need to be sensitive to the conditions that make it impossible for some women to breast-feed, such as some breast reduction surgery and active tuberculosis. Since chemotherapy drugs pass through mother's milk, mothers must make difficult decisions when cancers are discovered during pregnancy. Until recently mothers who were HIV positive were advised not to breast-feed, but recent WHO policy directives acknowledge that exclusive breastfeeding provides the best option for infants of HIV-positive mothers who cannot use commercial infant formulas safely (WHO 2010a and b).

Another ethical dilemma concerns the use of human milk, donated by mothers for sick and premature infants, but sold by companies or used to make products for sale for infant feeding – or to make exotic items such as ice cream and cheese made from human milk. Recent attempts by commercial companies to patent the constituents of human milk are more sinister. Advocates have petitioned to stop companies from patenting human milk components, many of which use genetic engineering techniques to genetically modify animals or plants to produce human milk components such as lactoferrin (ICDC 2013).

It is unethical to experiment on breastfeeding mother-infant pairs to conduct randomized clinical trials with control groups, when there is already agreement that human milk is best for infants. But without such clinical trials, breastfeeding research is often criticized for being unable to separate the effects of parental behavior from the effects of breastfeeding or the effects of breast milk.

It is important to guard against arguing that if breast milk is good for babies, then it is the mother's responsibility to provide the milk. Women have prime responsibility for childbearing, birthing, and then caring for, nurturing, and nourishing infants. But to what extent are mothers responsible for decisions they make, given the lack of objective information to make an informed decision, the social pressures and criticism ("your milk is too thin, too bluish, too watery," etc.), as well as the marketing strategies ("your formula-fed baby will be smarter, have better eyesight, have more developed brain, have whiter skin," etc.)? It is also important to examine more carefully the role of male medical experts in framing medical knowledge about breastfeeding. Is it unethical for males to tell women they must breast-feed for the sake of their infants while ignoring the expertise of generations of mothers? This question suggests the importance of peer support from experienced breastfeeding mothers.

Ethical Implications of Feeding Breast Milk Substitutes

The regular use of commercial breast milk substitutes or routine artificial feeding instead of

maternal breastfeeding constitutes the largest in vivo experiment in human history, yet the risks inherent in the use of these products are rarely discussed even by health professionals. There is no way to know the full effects of raising human infants without human milk. This is ethically irresponsible and raises questions about what level of risk society is prepared to accept.

Baby food companies have an ethical responsibility to their shareholders and investors to maximize profits and thus shareholder dividends. To accomplish this, companies scale up their product promotions to enlarge and create new markets, increase market share, and boost sales. Their market share increases when fewer mothers breast feed for shorter durations. These industries are in the wealth creation business not the health business. Their behavior is acceptable to many people who argue for regulation-free markets and the right of consumers to choose from a wide range of commercial baby foods. But these companies should have no place in making health policy when prioritizing their profits and dividends may compromise infant health.

The companies (manufacturers and distributors) that manufacture and distribute commercial breast milk substitutes have created these vast global markets by using promotional strategies, such as advertising and discounts, augmented by apparent endorsement by the medical profession. Health professionals need protection against aggressive and subtle promotional practices.

Commercial breast milk substitutes are also far from ideal products, but their risks are not widely known. Bottles of infant formula have to be correctly prepared in hygienic conditions using clean equipment and boiled water. Feeding bottles and teats are extremely difficult to keep clean; feeding bottles, the water used to prepare the feed, as well as the powdered formula itself may be contaminated by harmful bacteria. In addition, infant formula is easily (and often) overdiluted because parents cannot afford the high cost of commercial breast milk substitutes, and this can lead to undernutrition, stunting and wasting, and increased vulnerability to diarrheal and respiratory infections. In the 1978 Kennedy Hearings in the American Senate, this was referred to as "commerciogenic malnutrition." Drinks with low nutrient value, such as tea, coffee, sugary drinks, and carbonated soda pop, are unsuitable for infants and young children but have been used inappropriately as breast milk substitutes.

Industrial accidents in the production of infant formulas and baby foods are not uncommon and require costly recalls; recent cases include baby rusks with pesticide traces; plastic and glass shards in jars of baby food and cans of infant formula; cadmium-laced carrots; soy formula labeled as soy but containing cow's milk; excessive amounts of vitamin D, aluminum, lead, iodine, and melamine; as well as insufficient amounts of other nutrients in infant formula (Ljung et al 2011).

The Codex Alimentarius Commission, a joint program of the UN World Health Organization (WHO) and the UN Food and Agriculture Organization (FAO), identified harmful bacteria such as species of *Salmonella* and *Cronobacter sakazakii*, formerly known as *Enterobacter sakazakii*, found in unopened tins of powdered infant formula. Recent outbreaks of infections have confirmed that the problem is not always in the mode of preparing and filling bottles, but may be intrinsic to the industrial processing of powdered infant formula itself. Infections caused by these bacteria can be fatal for vulnerable newborns and infants or may cause lifelong disabilities (WHO 2007). The bacteria might enter infants by three routes: first, from the raw materials used in the production of the infant formula; second, from contamination by probiotics or vitamins which are added following pasteurization; and third, during reconstitution.

When soy-based formulas are made from genetically modified soy (GMO soy), concerns have been raised that the arsenic-rich poisons used in the pesticides required for their production, in combination with the phytoestrogens in soy, might increase risks for cancers. Critics of breastfeeding advocacy claim that the risk of using milk- or soy-based infant formula is overblown; *Cronobacter sakazakii* and *Salmonella* species are evidence that the risks are real. Efforts to improve infant formula are commendable

harm reduction strategies, valuable as long as they are evidence based, not accompanied by health claims, and applicable across the board; that is, if a constituent is found to be useful, it is added to all brands of infant formula, not just one brand.

Product labels are also important to consider, since instead of alerting product users to the risk of intrinsic contamination by harmful bacteria, the baby food industry often tries to make unfounded health and nutrition claims for their products. These claims can be based on misleading and unsubstantiated statements. For example, many brands introduce ingredients such as probiotics derived from animal bacteria. Even company-funded trials show no differences in growth between infants fed with supplemented and non-supplemented products. In fact, it is difficult to know what bacteria are the best probiotics, and "There is insufficient evidence to recommend the addition of probiotics to infant feeds for the prevention of allergic disease or food reactions" (Cochrane Summaries 2009). When research results are provided, they are usually from industry-funded research, another complex ethical dilemma concerning conflicts of interest.

A further risk concerns obesity and overnutrition; while baby foods and commercial breast milk substitutes can be overfed, even force-fed by hand or bottle, it is impossible to overfeed a breastfed baby. The sugar content of many infant formulas is exceptionally high, and labels carry a bewildering number of different names for types of sugars. Concerns about childhood obesity have drawn researchers to examine television advertising for high-fat, high-sugar snack foods targeting toddlers, since young children cannot always distinguish advertising messages from cartoon characters. Thus, food advertising to young children, both directly and through the food provider, is a subject of ethical complexity. Although direct advertising for infant formula was prohibited under the International Code of Marketing of Breast-Milk Substitutes (WHO 2006), advertisements for infant formula regularly appear on North American television.

Solving Problems: Improving Infant Feeding

In the twentieth century, parents turned to expert authorities to help them feed their infants. The decisions of North American parents were shaped by advice books such as Dr. Spock's *The Common Sense Book of Baby and Child Care* (1946), by instructions from the emerging specialty of pediatrics, and by advertising for commercially produced baby foods. However, infant feeding decisions need to be based on objective and up-to-date information from independent unbiased sources; these are not really choices in the sense of choosing between different brands of ordinary consumer products such as ketchup in a supermarket. Legislation is needed to protect baby foods. The cultural perception that artificial infant feeding carries no risks is maintained very effectively by promotional material given to mothers and health professionals.

The development of mass produced baby foods has been profitable, but not problem-free. It is important to protect the growth and development of infants and young children through appropriate policy measures to guarantee the safety of their food. But as Senator Edward Kennedy asked in the opening of the 1978 public hearings in the US Senate:

> Whose responsibility is it to control the advertising, marketing and promotional activities which, in and of themselves, may create a market in spite of public health considerations? When economic incentives are in conflict with public health requirements, how shall that conflict be resolved?

One answer is that governments have a duty to fulfill every child's right to the highest attainable standard of health, as stated in Article 24 (d) of the Convention on the Rights of the Child, the most widely ratified UN Convention in history (UNICEF 1990). Mothers are not mandated to breast-feed, but governments are mandated to provide accurate information about how to attain this high standard of health. This may include education and support from all sectors of society, including information about milk banks and donor milk, a critically important product for premature infants.

In addition, parents and carers bear responsibility for reading the instructions to prepare commercial breast milk substitutes as safely as possible and feed their infant consistently. However, if the product label is in a language that is not used in the region or country or if they cannot read, are they still responsible? Formulas are expensive and if parents cannot afford the quantities needed to feed their infant and dilute the formula so that it is thin and watery and the baby becomes malnourished, is this also their responsibility?

Although some infants are at severe risk of morbidity and mortality (disease and death) resulting from the use of breast milk substitutes, unlike tobacco, these products are not lethal to a large percentage of their users. There is clearly a need for nutritious and safe formulas based on cow or soy milk for those infants and young children who cannot be breast-fed, including mothers with TB and cancers requiring chemotherapy.

Commercial baby foods are made by companies that are under no ethical obligation to promote child health – a public good. The food industry expects to make profits from the food it produces and markets to the general population, and baby food is no exception. Although many argue that foods for infants and young children should be exempt from market forces, realistically, this is unlikely to happen, considering the profitability of the market for baby foods.

There is no way to ensure safe formula feeding, only safer formula feeding. Advocates for improved infant feeding have been seeking strategies to improve the safety of baby food. These include making the dangers of infant formula more widely known to parents and health professionals, mandatory labels on products to warn that powdered formula is not a sterile product, and explaining how to prepare formula more safely by mixing powdered infant formula with water which has first been boiled and then cooled to a temperature of no less than 70 °C before further cooling to feed the infant. This is the lethal or decontamination step which is required to inactivate any harmful bacteria. WHO guidelines explain: "Powdered infant formula, PIF, has been associated with serious illness and death in infants due to infections with *Enterobacter sakazakii* and *Salmonella enterica*. This is because, using current manufacturing technology, it is not feasible to produce sterile PIF. During the preparation of PIF, inappropriate handling practices can exacerbate the problem" (WHO 2007).

Often companies elaborate their own ethical codes of practice, usually voluntary, which spell out the company's duties, rather than the consequences and impact of their products. There are no public sanctions for infringement against the company, only private sanctions against workers and management: http://investopedia.com/terms/c/code-of-ethics.asp. The shared responsibility for infant feeding requires more than a voluntary code of ethics; it requires international standards and enforceable national legislation. To address the problem of the aggressive and unethical promotion of commercial breast milk substitutes, WHO/UNICEF hosted an international meeting in 1979 on infant and young child feeding which called for the development of an international code to regulate the promotion and marketing of baby foods. Representatives of governments, technical experts, nongovernmental organizations, the infant food industry, and scientists working in infant nutrition attended the meeting, which led to the International Code of Marketing of Breast-Milk Substitutes, adopted at the World Health Assembly in 1981 as a recommendation of the highest policy-setting body in the field of international health. The recommendations for industry, health workers, and governments apply to the promotion of bottles, teats, and all breast milk substitutes, not just infant formula. But the international code was a compromise at the global level and considered a minimum requirement (Shubber 2011).

The 14 subsequent WHA resolutions "have further clarified or extended certain provisions of the Code" (WHO 2006); they require that complementary food and drinks not be marketed in ways that undermine breastfeeding (WHA 49.15, 1996). Complementary foods should not

be labeled, advertised, or commercially promoted as suitable for infants under 6 months of age (WHA 39.28, WHA 54.2, 2001) "All governments should adopt the Code into national legislation. Since 1981, 81 countries have enacted legislation implementing all or many of the provisions of the Code and subsequent relevant World Health Assemby resolutions." (UNICEF 2011). The baby food industry is obligated to comply with these regulations even when national legislation has not been implemented.

Efforts to limit the marketing and promotion of commercial breast milk substitutes provide an example of how public advocacy has actually changed policies with regard to the role of the food industry in policy making, pointing out, for example, the conflict of interest inherent in the food industries' participation in public-private partnerships to "solve" infant and young child hunger problems.

Summary

Infant feeding practices are important for the sake of child survival, growth, and development and also for their far-reaching effects on adult health, including chronic diseases. They are a collective responsibility for all members of global society. While maternal breastfeeding is the ideal and normal way to feed and nurture an infant, efforts continue to make commercial breast milk substitutes safer and to bring the conflict of interest of baby food companies to public attention. For example, exciting new research on biome mapping of gut bacteria and viruses is intimately connected to improving infant feeding. But who should fund such research? Industry-funded research is suspect, but should tax payers' money be used to research constituents for infant formula rather than to offer support services for breastfeeding mothers? A safer pollution-free environment for breastfeeding mothers benefits everyone. Monitoring regulations on food safety and minimizing conflicts of interest benefit everyone. Infant feeding should matter to us all.

Cross-References

- ▶ Child Nutrition Guidelines and Gender
- ▶ Corporate Social Responsibility and Food
- ▶ Feeding Children

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Informed Food Choice

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Introduction

An informed food choice is an informed choice made about food consumption. It is a choice that is not made blindly. It is an enlightened choice made by the individual based on information, which has been obtained by the consumer.

When consumers make choices about buying something or not, or choose between different foodstuffs, information is believed to give clarity to the options. The aim of disclosing information is to increase the transparency of the food market, which is believed to enable consumers to judge, compare, and choose foodstuffs according to the values and preferences they find relevant.

Informed food choice is an ethical concept based mainly on two ethical principles: autonomy and integrity. The idea of autonomy emphasizes the consumers' rights to noninterference and self-governance. Informed food choice is a concept that relates to and to some extent is based on the ideas of informed consent and voluntary consent to be found within medical ethics. Common to all these concepts is the principle of autonomy as a basic value to be respected. In an ideal world, informed food choices are believed to be autonomous and voluntary decisions that are neither manipulated by others nor coerced. Informed choices are, in opposition to coerced actions, based on liberty and freedom.

However, as food choices and consumption are closely entangled with social life, culture, and identity, food choices are not only about self-governance. Indeed, freedom to choose cannot be seen as an unconditional ideal when it comes to food choices. The principle of integrity refers to the life coherence of the consumer of which food culture and consumption is often a central part. Food choices are associated with caring for relatives, friends, and others and as such not independent but relational. The idea of integrity gives priority to the social, cultural, religious, and environmental contexts in which food choices are made and on which they depend.

It is common to analyze compound notions by breaking them down to basic components. This entry follows that tradition by analyzing the concept of informed food choice by examining the meanings of *choice* and *informed* in the light of the principles of autonomy and integrity.

Food Choice and Autonomy

The emergence of a massive consumer culture in affluent societies and a strong emphasis on individuality has contributed to a focus on *individual choices* (see, for instance, Taylor 1991, pp. 37–38). This development is reflected in the number of theories on choice: rational choice

theory, public choice theory, social choice theory, and economic models of consumer choice. Food choice has also been theorized (see, for instance, Hausman 2012), often with the aim to map determinants in food choices. The accent on choice in theory and also in liberal rhetoric is not only a sign of a stronger emphasis on the freedom and rights of individuals. It is also a "mise en discours" or verbalization of the duties and responsibilities of the individual: the individual and consumer rather than society and the government are through the rhetoric of free choice and informed choice made responsible for that food choices are sound, healthy, sustainable, etc.

Central to the idea of informed choice is the concept of individual freedom, which is based on the normative idea of individual autonomy. Autonomy (Greek: *auto–nomos*) literally means self-rule, self-determination, or self-government, and in this sense it was originally used normatively in the description of sovereign (autonomous) nations. With the German philosopher Immanuel Kant, the concept was given a strong twist toward the individual. The idea of individual autonomy is normative in the sense that it is not something naturally given; it is a description of a vision of ideal decision-making. Autonomy is not something inherent in man; it is rather something to strive for and which is facilitated through education and cultivation (German: *Bildung*). As is the case with autonomy, we can also say that informed food choice is not something inherent or given; it is rather something to strive for and which must be facilitated through education in food literacy.

As part of the vision of the good life, the normative concept of autonomy is based on the negative experience of personal infringement or injustice when being forced or determined by external conditions against one's own will. Individual autonomy, as one of the oldest and most fundamental principles of civil rights, is intended to protect against infringements; it is the right of the individual to make decisions without coercion. Therefore, at a very general level, an autonomous choice is a voluntary action, which is not being forced upon one by external conditions. Hence, independence is traditionally considered a core value of autonomy. Autonomy then becomes the capacity for independent decisions, choices, and actions, which implies independence from others or from others' views or preferences (O'Neill 2002). This is often referred to as negative freedom or liberty: the freedom from interference by others. Therefore, choosing and free choice have traditionally been hailed by liberal thinkers, emphasizing the value of noninterference.

Based on the idea of autonomy, informed food choice entails protective arguments and productive arguments. Protective arguments are concerned with the protection of consumers from fraud, deception, manipulation, and health risks. Productive arguments may, for instance, be concerned with specific qualities of food or production practices, like organic or free-range products, which are made known to consumers (see Rippe 2000 on protective and productive arguments as well as negative and positive liberties within food consumption). In both cases, communication and the disclosure of information to consumers are the keys to enable selection of products in accordance with specific consumer demands and thus to ensure some level of consumer autonomy. Hence, the autonomy of consumers should be understood not only as a substantive right, that is, as the right to simple non-coerced free choice, but also as a procedural right for consumers with regard to access to impartial and reliable information on food and the production of food.

The autonomy of food choices can be situated between the following poles: (1) voluntary/independent actions and (2) coerced actions. These poles are extremes and are also rare positions. Food choices are usually situated somewhere in between. Choosing food is a complex act as many factors influence food choices. Attempts to map determinants of food consumption choices are numerous and so are attempts to influence food choices. Marketing techniques are used to increase sales by specific product placements in shops and supermarkets, by the use of attractive packaging, advertisements, promotion campaigns, sales, and so forth. Healthy diets can be promoted by campaigns, nudging, taxation,

prohibition, or by other means. Choices are often analyzed from three perspectives: persuasion, manipulation, and coercion.

A person can be *persuaded* or convinced by arguments to buy or eat certain kinds of food. This implies that choice is based on some level of independent and voluntary reflection. It also implies that some information is shared and may be even negotiated.

A person can be *manipulated* through, say, advertisements to buy and eat certain kinds of food, which implies that information given on the food is partial and may be incorrect.

A person can also be *forced* to eat certain kinds of foods. It is not uncommon that children dislike some kinds of foods. However, parents may ask and sometimes force them to eat it anyway. Another kind of coerced food choice can be found in some institutions, like prisons or even hospitals, where people have no choice than to eat what is served. Poor people may likewise have no other opportunity than to buy the cheapest available food.

Information and Integrity

Basically, food choices occur in two main settings: (1) shopping for food (or when growing food for oneself) and (2) eating and drinking. In both settings food choices might be made by oneself and for oneself. However, food consumption is rarely a completely solitary activity but in fact a social activity. As much as food is shared in communal eating during meals, much food shopping is not only shopping for oneself but also shopping for others. The relational aspect of food shopping comes about when, among other factors, other peoples' food preferences are taken into account (Coff 2013). Food shopping choices are thus not made in a vacuum but in social settings, where others' views and preferences are taken into consideration.

Likewise, participants in social meals care for social relations and other peoples' reactions. It is common that food manners require that food served by the host is not rejected – even in situations where the guest may not find the food tasty or edible – as this might be seen as a sign of lack of appreciation and community feeling. This relational aspect of food consumption often emphasized by food sociologists indicates the limits of the idea of autonomy and the need to supplement it with other ethical notions. The concept of integrity can be used to normatively describe the relational aspects of food consumption. Integrity can be both a virtue describing the honesty and reliability of a person as well as describing life coherences of a person, which should not be manipulated or destroyed (Rendtorff and Kemp 2000, p. 39). The life coherence of a person is the life story of that person and the relations that person has. Because food choices and consumption do have consequences for others and the environment, food choices and consumption can be seen as expressions of relations to other people as well as to the environment (see Coff 2006 for a detailed description of the relational dimensions of food consumption).

The idea of informed food choice is that food consumers should be informed about food in order to respect consumers' integrity and autonomy and thus to enable consumers' consent. Beauchamp (2010, p. 56) states that in general the literature on informed consent proposes five elements as the analytical components of informed consent: competence, disclosure, understanding, voluntariness, and consent. This approach can be used in the analysis of what informed food choices entail on the informational level by asking the following questions:

- What are the competences needed by food consumers?
- What information should be disclosed about food?
- How should consumers be informed about food in order to enhance their understanding?
- What makes an informed food choice voluntary?
- What do food consumers want to consent to?

To begin with the questions on what information to disclose and what food consumers want to consent to, it is important to note that the idea of informed food choice concerns a specific kind of information, namely, information about the food product itself – and usually not on the food

Informed Food Choice, Table 1 Ten consumer concerns about food production (Coff et al. 2008, p. 11)

1. Animal welfare
2. Human health
3. Methods of production and processing and their impact (e.g., environmental, landscape)
4. Terms of trade (fair price, fair working conditions, fair salaries, etc.)
5. Working conditions
6. Quality (intrinsic qualities such as taste, composition, etc.)
7. Origin and place
8. Trust
9. Voice (participation)
10. Transparency

preferences of someone else that one is shopping for. This is important as it shows something about the nature of the information to be disclosed. Mapping of consumers' concerns about food shows what kind of information food consumers find relevant as issues, i.e., the issues that consumers want to be informed about, respond to, and eventually consent to. Table 1 shows a list of major consumer concerns about food. These concerns can be considered as major issues driving the demand for informed food choice. The first seven concerns can be described as substantial and the last three concerns can be classified as procedural as they refer to how information is shared and decisions are made.

The list shows the embracing character of food consumption (see also entry on Food Policy and Ethics for the embracing character of food policy). Consumers may ask for or demand informed food choice to assist them in decision-making in relation to a number of issues: avoiding or reducing health-related risks; comparing products for culinary qualities; estimating ethical aspects of a foodstuff like environmental impact, working conditions, or animal welfare; or simply to enhance trust in the food consumed. The list of consumer concerns given here is not complete, and it is most important to understand that consumer concerns are dynamic and vary among people. This means that the issues to be informed about are indeed not static but are under constant development.

Choosing food can be a highly reflective activity, based on careful judgments and evaluated arguments, which take several consequences of food consumption into consideration. Many of the issues mentioned in Table 1 are captured in the concepts of political and ethical consumption. Political and ethical consumption is a reconfiguration of the consumer's role, merging it with the citizen's role, which has lead to the term citizen-consumer (Korthals 2004, p. 149). Surely, few consumers are seriously concerned about all the issues mentioned in Table 1. It is more common to be concerned about a few of the issues mentioned and take action on these or to be only superficially concerned and not take any action on it.

The issues mentioned in Table 1 can be considered as what consumers might want to consent to in relation to food. If, for instance, novel foods and other new food processing practices pose new risks to health, consumers may want to be informed about it in order to consent to it or not. The comparison of informed food choice with informed consent used in medical ethics seems especially appropriate when it comes to the consequences of food intake on health. Frewer et al. (2002) confirms that in general people want to be provided with information on food risks in an understandable and intelligent way in order for them to make informed choices about exposure to food risks.

In view of the ten concerns listed in Table 1 and given the fact that food choice is embedded in cultural, social, biological, ethical, religious, and commercial contexts, it is obvious that informed food choice can be a demanding process. Judgment of food qualities in relation to the ten concerns requires a high level of competence among food consumers. However, consumer competences vary a lot, and their ability to understand information on food can be limited by, for instance, immaturity, irrationality, or lack of interest. Food policies improving food literacy have been proposed and adopted in several countries in order to enhance consumer competencies. However, the idea of informed food choice in itself should also help competent and interested consumers to enhance their level of understanding and improve the process of decision-making.

The question on how to inform consumers is intriguing and challenging. The amount of information that can be communicated about foodstuffs is potentially enormous. Scientific uncertainty when it comes to, for instance, health claims and the environmental impact of different kinds of food production practices like organic farming and conventional farming contribute further to the opacity of information about food. The effort needed by consumers seems intimidating and immense in the light of the endless number of food products and the complex consequences that food production and food consumption have on health, environment, fair trade, etc. Furthermore, poor communication between producers and brokers in the food sector makes it even harder for consumers to find wanted information on food.

Food labels have been introduced to reduce complexity and make choices easier for consumers. However, labels have also been accused for being too reductionist: Klompenhouwer and Van den Belt (2003, p. 548) argue that labels and claims (and also advertisements) about food health run the risk of being quite superficial and also that the actual wording of a claim can be interpreted in different ways.

At the other end of the spectrum, much more detailed information on food can be presented by the use of the Internet. Codes, like the QR codes, presented on the packaging can make information on food products easily accessible for consumers by the use of QR scanners in smartphones or computers (Beekman et al. 2008, p. 289). This approach can be characterized as user-friendly as it potentially allows consumers to search for specific information relevant to them, and thereby sorting out irrelevant information. On the other hand, this approach runs the risk of information overload, which is known to reduce consumer engagement.

If informed food choice is to be of any value, it is paramount that the information provided on the food is trustworthy. To ensure trustworthy information impartial third parties can be asked to control and guaranty that disclosed information is correct.

The voluntariness of consumers' informed food choice is ensured when no unwanted influence is exerted and when consumers are not controlled or manipulated by other persons or institutions. A kind of coerced consumer choice can occur when only one product or brand is available. In the case of market monopoly, consumers may be "forced" to buy a specific brand of, for instance, milk as the only alternative is not to buy any milk at all.

Critique of Informed Food Choice

Individual choice has been used in liberal and market-oriented rhetoric to describe in positive terms the emancipation of the individual from social ties. In this context, the word choice embodies the freedom to choose one's own individual lifestyle. In affluent, market-oriented societies, consumption choices are seen as a means for the realization of the self and for the creation of personal identity. There are, however, also critical positions deploring the development of the consumer society and the culture of choice.

Baudrillard (1998) describes what he calls a "phenomenology of consumption," pointing to the shallowness and fragility of consumption cultures. For Baudrillard consumption is characterized by self-interest and hence ignorance of the surrounding world. His phenomenology of consumption describes how attention and concern are turned toward individual consumption and satisfaction at the expense of care for other human beings and the common good.

Another critic of free choice is Schwartz (2004). According to him free choice is hailed in liberal cultures as the new dominant ideology: "[O]ur culture sanctifies freedom of choice so profoundly that the benefits of infinite options seem self-evident." However positive freedom of choice may seem, it has several ramifications on the more philosophical, existential, and psychological aspects of life. When it comes to food, the number of choice opportunities in supermarkets is enormous. As a consequence the time spent on shopping for food is increasing, as it is time-consuming to seek information and compare food products. Comparison of foodstuffs and considering alternatives may lead to other anxieties: for what if the choice made is not the

best, but turns out to be the worst choice? This is referred to as the tyranny of comparison or the tyranny of small decisions, which instead of making consumers happy makes them worried and anxious. According to Schwartz (2004, p. 221) "having too many choices produces psychological distress, especially combined with regret, concern about status, adaption, social comparison, and perhaps most important, the desire to have the best of everything – to maximize."

Other critics of the informed choice rhetoric have argued that it is used as a liberal pretext to shift responsibility from the political system to individualized consumers, thereby making peoples' individual lifestyle responsible for health, environmental sustainability, etc. An example of a health policy that emphasizes informed food choice and lifestyle can be found in the UK government's White Paper on public health (HM government 2004) in which it is argued that "people want to be able to make their own decisions about choices that impact on their health and to have credible and trustworthy information to help them do so."

Another critique stresses that not all issues are suited to individual choices. Some issues are too complex for consumers to take a stand on – such issues should therefore be regulated by public authorities. Food safety has been mentioned as being such a highly complex issue that should not be left to individual choice but rather regulated by public authorities. Scientific uncertainty, for instance, about the health effects of foodstuffs, has also been mentioned as a worry that makes individual choice by consumers inappropriate.

To carry out informed food choices is demanding in terms of knowledge, competences, and intellectual capacity. Informed food choice favors educated and enlightened people and especially those who are in possession of food literacy. Critics argue that less skilled people are unlikely to use disclosed information about food in their food choices.

Finally, the information overload of consumers is seen to be a general problem of informed food choice as consumers only have a limited amount of attention for food (Berg and Gornitzka 2011). Labeling as a strategy to reduce information to easily recognizable symbols like organic labels or animal friendliness is widely used in the food sector. However, as the number of informative labels increases, food labels may also add to the lack of transparency on the food market.

Conclusion

Food production and consumption influence health, environment, social structures, etc. For this reason consumers are increasingly interested in information about these effects. Disclosure of information about the consequences of food production and consumption is essential for the idea of informed food choice. An informed food choice is an enlightened food choice made by the individual based on the information made available. Food choices are made when shopping for food or when eating/drinking, and information is believed to give clarity to the options by increasing market transparency, supporting rationality (the best choice), consumers' self-governance (autonomy), and life coherence (integrity). On a practical level, informed food choice remains an ideal to strive for, as information on food often is inadequate.

Cross-References

- Food and Choice
- Food Waste and Consumer Ethics
- GMO Food Labeling
- Political Consumerism: Consumer Choice, Information, and Labeling

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Institute Technology-Theology-Natural Sciences (TTN), Munich

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History of the Institute

The Institute Technology-Theology-Natural Sciences (TTN) is an independent affiliated institute for applied ethics at the Ludwig Maximilians University of Munich. It aims to promote a constructive discussion on ethical issues in sciences and technology, with particular focus on the interdisciplinary dialogue between natural sciences, humanities, and theology.

In Munich in May 1992, a group of experts in the field of sciences and representatives of the churches and the economy founded an organization to promote communication and understanding between the areas of technology, theology, and natural sciences. The ambition of the society (including, e.g., the protestant theologian Trutz Rendtorff and the geneticist, biochemist, and later president of the European Research Council Ernst-Ludwig Winnacker) was to deepen the interdisciplinary dialogue concerning the ethical aspects of technological, scientific, and economic development. One year later, the Institute TTN (in German: Institut Technik-Theologie-Naturwissenschaften) was founded, and the senate of the Ludwig Maximilians University accepted it as an attached institute. The Institute TTN is nowadays supported by more than 200 members, both individuals and institutions. The Institute is mainly financed via project fundraising within the framework of research promotion and via the Evangelical Lutheran Church of Bavaria as one important member of the association.

Managing Directors of the Institute TTN

Church Councillor Erhard Ratz (1993–1997)
Dr. Roger J. Busch (1997–2008)
Dr. Stephan Schleissing (2008-today)

Chairman of the Association TTN

Prof. Dr. Ernst-Ludwig Winnacker (1992–1998)
Prof. Dr. Trutz Rendtorff (1998–2003)
Prof. Dr. Friedrich Wilhelm Graf (2003–2007)
Prof. Dr. Christian Albrecht (2008-today).

Major Areas

The Institute TTN takes an interdisciplinary approach to ethical questions concerning a broad range of topics: agricultural ethics, genetic engineering in medicine and agriculture, bioethics, medical ethics, ethical questions of energy supply, etc.

Approach

(a) Interdisciplinary research: The goal of TTN as an institute of ethical research is to encourage the interdisciplinary dialogue of natural sciences, humanities, technology, and theology on questions of societal concern. The design of TTN's projects invites different disciplines to take part in discussions and developing processes of ethical assessment. The interdisciplinary approach is understood as the most appropriate way of dealing with modern society's ethical issues and contributing to social consensus.

(b) Ethical approach: Discussions on controversial questions are often characterized by mixed judgments and general opinions on the consequences and goals of scientific innovations in society. In this situation the researchers of the Institute TTN pursue the target to differentiate between conflicts of interests, conflicts of values, and conflicts based on different scientific evaluations and in a second step to find the right place of their respective discussion. Therefore, TTN intends to gain an access to ethical problems primarily not in a normative, but in a descriptive perspective. This does not exclude, but include a way of dealing with moral questions in a critical-constructive reference to the Christian "ethos" of liberty, individuality, and understanding of human dignity and human life.

(c) Protestant tradition: As a scientific institute, TTN is doing its work in complete intellectual independence. Scientific freedom does not mean, though, having no position. The values of the liberal Protestant theology have characterized the self-conception of the Institute since its founding. The Institute TTN understands the Protestant tradition as open to dialogue, seeking the dialogue with specific expertise, supporting compromises wherever that can be done, and being aware of the rich Christian heritage.

(d) Dialogue with society: One main goal of TTN's work is promoting the dialogue between science and society free of suspicion. This relationship is permanently challenged through new technologies, risk assessments, questions of public understanding of scientific results, or questions of trustworthiness. TTN follows the approach that in order to discuss questions of technological development, the provision of scientific information is necessary, but not sufficient. Any "real" dialogue has not only to offer (scientific) facts, but has to integrate values, attitudes, and cultural traditions as well. TTN makes every effort to engage in a broadened dialogue between science and society and to bridge the gap between the discourses.

(e) Promotion of young scientists: Last but not least, TTN sees itself as a place where young scholars of varying academic backgrounds have the opportunity to work in an interdisciplinary setting and get in touch with expertise of other disciplines in order to shape their own scientific work.

Landmark Contributions

(a) One core task of the Institute is the discussion of ethical implications of genetic engineering in agriculture. TTN is one of the rare institutions in Germany that brings critics and supporters to the discussion table without the usual polemics. In 2002, TTN released its study "Green genetic engineering – a model for evaluation" (Cf. Busch et al. 2002). An interdisciplinary group of experts discussed specific examples of biotechnology in agriculture. The "decision tree" used in this process allows the reader to understand the argumentation and to independently evaluate the scenarios. In 2008 and 2012, interdisciplinary conferences were held discussing the

social debate on green genetic engineering (cf. Busch and Prütz 2008) and the role of scientific freedom in the context of biotechnology in agriculture (cf. Grimm and Schleissing 2012). One core point is that the conflict on green genetic engineering is not only about benefits and risks of the technology but also about social impacts or general questions in regard to the relationship between man and nature (cf. Dürnberger 2012). More specific the debate is not least the product of different cultural concepts of "nature" (cf. Dürnberger 2011).

In 2013, an anthology about the role of different concepts of nature and agriculture in the debate on green genetic engineering will be published (cf. Meyer and Schleissing 2014), including an interpretation of environmental debates in the light of utopian and dystopian thinking (cf. Dürnberger 2014).

(b) A key topic is the discussion of ethical aspects of modern energy supply. For 3 years, the Institute TTN cooperated with the Technology and Support Center in the Competence Center for Renewable Resources in Straubing in order to develop an ethical discussion model for bioenergy (cf. Dürnberger et al. 2010; Zichy et al. 2011). The model is a guideline to make independent judgments on scenarios and integrates not only ethical criteria like well-being and autonomy of persons concerned but also works out the importance of cultural concepts such as landscapes as cultural possessions, the symbolism of specific cultivated plants, or the ideas of agriculture as idyll.

(c) A further main field of activity is the ethical reflection on questions of the relationship between man and animal. The study "Living with and from animals" (cf. Busch and Kunzmann 2006) discussed questions of animal husbandry and tried to bridge the gap between agricultural practitioners and consumers.

(d) The so-called Escalation Model is a well-known study for the ethical evaluation of gene therapy and cell therapy. In 1997 a committee (founded on a proposal made by TTN's Advisory Board) published the report to classify and evaluate genetic techniques used in modern medicine. The latest version, including recent developments, appeared in 2009 (cf. Hacker et al. 2009). Gene and stem cell medical interventions – as discussed in the model – can only be carried out by physicians. Therefore, the physician as the executing and fully responsible subject is the starting point of study. His ethos forms the framework for biomedical interventions in humans. Relating the fundamental ethical elements (such as autonomy, adequate risk-benefit ratio, therapeutic indication, doctor-patient relationship, and research that is open to the public) to the medical application of gene and cell technology creates more specific criteria as risk of interventions, reversibility of interventions, proliferation of altered cells, and emerging legal and ethical conflicts, which will serve as an indicator for public approval of such interventions. On the basis of these criteria, the "Escalation Model" grades the medical applications of gene and stem cell technology into four levels. In a nutshell, they escalate from "ethically unproblematic" (level 1) to "ethically not justifiable" (level 4). The latest version of the model was developed in cooperation with the chair of Systematic Theology and Ethics (Prof. Dr. Friedrich Wilhelm Graf) at the University of Munich. The project was funded by the Bavarian State Ministry for Science, Research and the Arts.

Major Activities

TTN organizes regularly conferences and round table discussions on ethical issues in sciences and technology. For example, the Institute initiated the conference series "Forum Ethik interdisziplinär" (Forum Interdisciplinary Ethics) in cooperation with the Protestant Academy of Tutzing. Within the scope of this series, topics like green biotechnology in the context of world hunger are discussed as well as questions like the

role of ethics for policy advising. Furthermore, several discussion groups are working on social implications of the German "Energiewende" (the targeted turnaround in energy policy) on ethical and legal questions of reproductive medicine and on the future of biomedicine in society. TTN publishes regularly anthologies and twice each year the information brochure "TTN Info."

Cross-References

- ▶ Agricultural Ethics
- ▶ Biofuels: Ethical Aspects
- ▶ Biotechnology and Food Policy, Governance
- ▶ Environmental Ethics
- ▶ Industrial Food Animal Production Ethics

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Institutional Food Service

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Introduction

Institutional food service can be defined as entities that provide meals at institutions including schools, colleges and universities, and hospitals, as well as correctional facilities, public and private cafeterias, nursing homes, and day-care and senior centers. Interest lies in their potential roles in sourcing food from regional farmers, ranchers, and processors, thereby contributing to the development of regional food systems through farm to institution (FTI) or farm to cafeteria programs, of which farm to school (FTS) is the best known case. These programs combine local food procurement and experiential education to forge closer ties between farmers and consumers.

These programs are large in number. As of March 2013, the National Farm to School Network estimated there were more than 12,000 FTS

programs, existing in all 50 states and reaching 5.7 million schoolchildren. Programs and organizations such as the National Farm to School Network, Real Food Challenge, and Health Care Without Harm support these efforts in other types of institutions nationwide. The School Food FOCUS project has collaborated with large US-based K-12 schools to address procurement issues unique to schools with 40,000 or more students.

Institutions provide a potentially large market outlet for US farmers: the USDA Economic Research Service estimates that $36.5 billion was spent on food at schools and colleges in 2010, equaling 6 % of all away from home food purchases. In comparison, the 2007 Census of Agriculture reports $1.2 billion in annual sales of food direct from farmers to consumers in the USA. Furthermore, combined with the experiential education, farm to institution programs can potentially encourage healthy eating habits, increase access to healthy foods, create loyal customers, and support rural communities (Bagdonis et al. 2009; Vallianatos et al. 2004).

There are several other reasons why scholars and practitioners are interested in institutional food service and FTI as a food system development strategy. First, they purchase food in fairly large and predictable quantities, unlike high-end restaurants or retailers, for example, whose demand fluctuates with economic cycles to a greater degree. Many institutions have educational missions, using food service operations to enhance food, agriculture, and nutrition lessons. Finally, on the whole, individual institutions, particularly schools, are not direct competitors; unlike supermarket retailers or restaurants, sharing information or best practices with another institution does not risk customers leaving to eat in another location. The plethora of support organizations and their willingness to share information is further evidence of this.

K-12 schools are a large and important sector of institutional food service. K-12 school meals are governed by the USDA National School Lunch Program. This program, founded in 1946, provides money and food to participating schools. Funding for these programs comes from periodic reauthorizations of the Child Nutrition Act. As of the 2012–2013 school year, schools receive up to $2.86 per meal served (USDA Food and Nutrition Service 2009). Despite the best efforts of this program, two principal intended outcomes, farm profitability and childhood health, remain elusive. According to the 2007 Census of Agriculture, the majority of US farms earned negative net income. Childhood obesity remains a persistent problem.

There are, generally speaking, three models by which food service operations can procure food. First, in the farm-direct model, institutional buyers purchase directly from farmers: farmers to deliver to schools or schools pick up from farms. Second, they can buy from one or more types of intermediary, such as a distributor specializing in locally grown foods or food hub. Third, buyers can purchase from a broadline distributor, who delivers fresh and processed (e.g., canned, frozen) food items as well as nonfood supplies such as paper products. For institutional buyers, the farm-direct model offers the closest connection farmers, the most information about how the food was produced, and the greatest opportunity for experiential education. Farmers receive 100 % of the food dollar.

As discussed below, high transaction costs of this model limit the quantity of product procured farm direct. At the other end of the spectrum, broadline purchases offer buyers the least connection to farmers and opportunity for experiential education. Farmers only receive a percentage of the food dollar, as distributors charge for their services. Given its efficiency, reliability, and low transaction costs, this model is well suited for routine high-volume purchases. A primary challenge of institutional food service in general and school lunch in particular is to supply healthy foods that provide connections to and support local farms in an affordable way. This task imposes a number of trade-offs, as discussed below.

Transaction Costs and School Food

Institutional food service procurement strategies are explained by transaction cost theory in supply

chain analysis. Transaction costs are those needed to seek out and negotiate prices and ensure quality of a good or service. Transaction cost theory is based in large part on Coase's seminal paper (Coase 1937) and has been applied to many industries including manufacturing and food distribution. Following Coase (1937), a firm faces the choice of procuring inputs in-house (make) or acquiring inputs by contract or on spot markets (buy). The higher the transaction costs, Coase argues, the more likely the firm will make rather than buy. Subsequent studies have framed the issue as a continuum of models for procurement (Dyer 2000; Hobbs 1996). At one end of a continuum is vertical integration or hierarchy, where a firm produces its needed inputs in-house or otherwise exerts a great deal of control over the process. At the other end of the continuum is the use of arm's-length spot markets, where the firm shops for the best price each time it purchases inputs. In the middle of this continuum are many possible means of coordination, including partnerships, where the firm buys from a limited number of preferred suppliers often creating long-term strategic relationships with them.

The literature on transaction costs and economics suggests circumstances when each model will prevail (Dyer 2000; Hobbs 1996; Kumar 1996). The vertical-hierarchy model – the "make" option – is used when inputs are highly differentiated or of high quality: control over inputs is needed to ensure quality. Spot markets or contracts – the "buy" option – are used for frequent and highly routinized transactions of homogeneous or low-quality inputs. The same input is available many places, so the buyer can afford to simply choose the one with lowest cost. Strategic partnerships occupy a middle ground in this continuum. Partnerships are best used when vertical-hierarchy arrangements are too slow to adapt and innovate, but arm's-length suppliers are not willing to invest in equipment or share information needed to achieve needed innovation (Dyer 2000; Kumar 1996).

In practice, institutions utilize procurement and preparation options on various points of this continuum, many residing along the "buy" side. For example, K-12 schools are required to utilize an open bidding process for many food items, which may take a number of forms. Closest to the "buy" end of the spectrum is competitive sealed bidding, which entails creating specifications for desired products and then publically inviting sealed bids and choosing the bidder able to provide needed products at the lowest price. This option is best when specifications are complete and easily communicated and when price will be the only dimension of variation, and it is believed many potential firms are willing and able to provide the items. In this case, transaction costs are embodied in the specification and request for bids, with price being the only decision factor.

In the middle of the continuum, competitive proposals can be solicited to achieve objectives (more loosely defined than specifications), and institutions choose a vendor who best meets objectives, with price being an important but not the sole criterion. Finally, institutions can negotiate with prospective vendors to meet objectives, which may be achieved in several possible ways. These options add complexity and transaction costs to the process and require some element of partnership but are still largely arm's length and use a formalized and regulated mechanism: the institutions exert little control over production or distribution once basic terms are set.

K-12 schools are able to procure limited amounts ($100,000 is the federal threshold, although states may require lower ones) of fresh, unprocessed locally grown produce under the geographical preference provision: this exception to formal procurement practices is critical for FTS programs. Institutions are able (but not required), at their discretion, to contact vendors directly to solicit bids and arrange for delivery rather than publicly advertise and accept bids from anyone. Clearly, this approach may require greater transaction costs in order to procure more specialized and differentiated products – locally grown and often with the farmers' name and story attached, for example.

Finally, an institution may choose, on a limited basis, to produce food itself, such as in a school garden or school farm. In this case, the

product is very specialized – grown by the students themselves – and requires a great deal of control on the part of the schools, in the form of specialized training protocols and employee oversight. The value of school garden or school farm food is generally educational rather than being efficient method for school food procurement.

Institutions also have a number of options regarding preparation of food. Institutions can take a more vertically integrated approach, utilizing scratch cooking in either institutional kitchens or central commissaries: this option has high costs of organizing production (labor, equipment, management) but permits a great deal of control over product ingredients, for both nutritional and educational purposes. Scratch cooking can produce high-quality and highly specialized meals. In contrast, institutions can serve highly processed, heat-and-serve meals in which the costs of organization are borne by manufacturers; in this case, the institution has little control over ingredients.

Institutions even face the "make or buy" trade-off in the overall decision of who will operate the institutional food service. A school district, for example, may choose to be "self-operated," in which the district organizes all activities using its own capital, management, and labor: those preparing and serving the meals are public school district employees. On the other hand, many institutions choose to "buy" their food service outright from a contractor, inviting bids from food service management companies and choosing largely on price and then having the contractor organize all procurement and production activities.

Institutions other than K-12 schools face similar trade-offs in transaction costs and the make or buy decision. On the most basic level, they may be self-operated (make) or use a food contractor (buy). Michigan State University is self-operated, for example, while the University of Vermont uses a contractor. Institutions that receive no public money face less stringent requirements to use competitive bidding for procurement decisions and therefore have more flexibility. These institutions are able to incur higher transaction costs and serve more locally grown or other specialty foods if they are able to pass the costs along to their customers.

Motivations and Perceived Barriers of Supply Chain Actors

Previous studies have identified a diverse set of actor motivations and perceived barriers in farm to institution markets. Farmer motivations to participate include a mix of economic factors like the ability to diversify markets with those which offer reliable, consistent volume and the ability to sell #2 grade product, as well as social factors like the desire to feed children healthful food and contribute to their communities (Conner et al. 2012; Conner et al. 2011; Izumi et al. 2010b). Distributors cite their relationships and willingness to work with local farmers as conferring an advantage in the face of growing demand for locally grown food (Izumi et al. 2009). Food service buyers cite a number of benefits such as improved food quality (and concomitant increases in meals sold/served), support for local farmers, and greater buy-in from school employees and community members (Izumi et al. 2010a; Vogt and Kaiser 2008; Feenstra et al. 2011). Relatively low volumes (compared to sales to major retailers or brokers), arduous paperwork, and low prices are commonly expressed barriers to farmers. Distributors and buyers mention a suite of barriers around logistics, reliability, availability, and consistency (Vogt and Kaiser 2008).

Lessons Learned and Keys to Success

First, a common theme in lessons learned is the need for a champion, someone within the institutional food service operation to begin and sustain FTI efforts. Key roles of champions include linking stakeholders, providing energy and momentum, and providing a go-to person to navigate logistical issues. Practitioners can help to foster FTI through efforts to discover, recruit, mentor, publicize, and otherwise support champions.

Second, relationships among supply chain actors are critical to create transparency and trust and to allow for creative problem solving of logistical issues. These relationships are often built on shared values such as concern for childhood nutrition, community economic development, farmer well-being, and food system education. Third, economic self-interest matters. Social motives alone are not usually sufficient to encourage farmer participation; concomitant economic benefit is needed. Many supply chain actors express instrumental value in their ability to source and serve locally grown foods as providing a differentiation strategy for their businesses. Schools with FTI programs cite both increased participation rates (the percentage of students eating school meals) and increased community support. Finally, support organizations, particularly those able to assist with procurement (helping food service buyers find locally grown foods) and educational activities (developing and sharing materials to link food with local farmers), are critical to FTI success. Education linking the farmer to the food has promise to improve dietary habits (Izumi et al. 2010a; Roche et al. 2012).

Lingering Barriers

Several factors will likely continue to inhibit FTI growth. Institutions, especially K-12 schools, face severe budget constraints; to the extent that local foods cost more, institutions' ability to buy more than token amounts will be limited. Certain institutions, especially colleges, universities, and some hospitals, may be less cost constrained. Second, in many areas, seasonality limits the times in which fresh produce is available; indeed, for many (e.g., schools, colleges, and universities in the USA), the period in which produce is most available is the time in which the fewest students are attending classes. Season extension technologies (flash freezing, high tunnels) can help address this. The final barrier is the financial status of support organizations. Many of these are grant-funded; while FTI efforts are in the spotlight and receiving support now, these organizations must seek long-term funding to continue operations when grant funds dry up.

Summary

Institutional food service is comprised of entities that serve food at schools, hospitals, and other institutions. Interest in these programs lies in their ability to contribute to food system development goals, particularly childhood nutrition and farm viability. This entry discusses the difficult options institutions face in procuring locally grown foods within a transaction cost theory framework and then highlights supply chain actors' motivations and obstacles. It concludes with lessons learned and lingering barriers.

Cross-References

- ▶ Civic Agriculture
- ▶ Local and Regional Food Systems
- ▶ Local Food Procurement

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Intellectual Property and Food

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Synonyms

Patents and copyright

Introduction

Many foods and food crops are covered by intellectual property rules. Intellectual property laws allow people to protect ideas and inventions by preventing other people from copying, using, imitating, importing, or selling the protected subject matter. These protections come in several different varieties, including patents, trademarks, and copyrights, as well as trade secret protections. These rights provide those who possess them, for a limited time, with exclusive claims that cover inventions, discoveries, or original expressions. Intellectual property protections originally applied primarily to mechanical inventions – new machines for moving stones or weaving cloth. As intellectual property law has grown, it has expanded to new areas, to cover different forms of creativity and different products, including foods, agricultural crops, and even living (nonhuman) animals. At present, US law supports intellectual property protection for bacteria, food crops, animals, and recipes, provided that the inventor can show that the covered subject matter meets other requirements. In the case of patent protection, the covered subject must be *nonobvious*, *novel*, and *useful*. While these laws protect people's interests in ideas – "intangible subject matter," as it is called in legal jargon – not all ideas are eligible for protection. No intellectual property protection can be given for mathematical formulae, even though they may be difficult to prove. No intellectual property protection can be given for discovery of fundamental laws of nature, even though their discovery may take brilliance and creativity. Several different forms of intellectual property protections cover food or food ingredients, including plants, animals, recipes, and food additives. The following section will discuss different kinds of intellectual property and the different levels of protection they afford.

This entry begins with a brief outline of different forms of intellectual property and the different protections they provide. The second section reviews the major lines of argument that have been employed to justify and defend the various institutions of intellectual property protection. Special controversies that arise in the case of intellectual property protections for foods and crop varieties are considered in the third section, followed by a brief discussion of

alternatives to patent and intellectual property protections for food and agricultural products.

Types of Intellectual Property Protection

Intellectual property law includes rules covering patents, trademarks, copyright, and trade secrets (Schechter and Thomas 2003).

Trade secrets include information that an individual or company might wish to keep private, often because this information provides a strategic market advantage. For example, the recipe for a popular food or drink might be protected as a trade secret, because the manufacturer hopes to prevent others from producing and selling an identical product. Trade secrets receive minimal protection, but are often covered by nondisclosure agreements that constitute a legal barrier to workers who could otherwise sell or reveal the protected information.

Copyright allows authors or publishers to prevent others from making and selling unauthorized copies of written material. The associated rights also include the creator's right to be identified as author of the work and to determine who may revise, adapt, or perform it. For example, most cookbooks are protected by copyright. The associated rights afforded to the copyright holder do not include the right to decide who may use the recipes, but do typically include the right to prevent others from *publishing* the copyrighted recipes.

Trademarks, borne by many food products, are a recognizable sign that uniquely identifies products as being from a particular source. Trademark protects a manufacturers' exclusive right to prevent others from using a designated "word, phrase, symbol, or design, or a combination [thereof], that identifies and distinguishes the source of the goods of one party from those of others" (US Patent and Trademark Office). Trademark protection is not available for generic food terms – for example, one could not get trademark protection for the word "pasta" or "hamburger" – but may be gained for names that are used to distinguish one brand from another, like "Barilla" or "The Fighting Burrito."

Patents are similarly designed to protect against unauthorized copying, but apply to inventions or discoveries that are useful, nonobvious, and novel. A patent holder has the right, for a limited time (often about 20 years), to prevent others from copying or possessing a copy of the patented item. In return, the patent holder is obliged to *disclose* the invention, by providing a full explanation of its nature and the process by which it can be produced. The scope of patent law has broadened over the course of recent decades to include genes, cells, and organisms as well as more ordinary inventions. These extensions are controversial, but have been widely supported by courts in many countries. Most agricultural food crops grown in the United States either are patented or include genes that are covered by patent laws.

Foundations of Intellectual Property Rights

Intellectual property laws are intended to spur innovation and to give inventors control over the fruits of their creative efforts. Some legal systems incorporate the idea that inventors and creators have special *moral rights* to control their creative products. There is a philosophical debate between those, on the one hand, who think that creators have underlying moral rights that are secured by these legal institutions and others who regard intellectual property rights to be entirely created by the laws that are used to enforce them. If the reasons supporting intellectual property rights are *moral reasons* such as justice or fairness, then presumably the rights in question are moral rights as well as legal rights. If the reasons supporting these rights are merely based on expediency or utility, this is sometimes taken to undermine the claim that there are underlying moral rights to be secured.

Intellectual property rights are typically defended on three different grounds: first, they are sometimes defended as *Lockean* rights, following the theory of property described by John Locke in Chapter V of his *Second Treatise of Government*. Second, they are often defended in

terms of the "personality interest" that creators have in the control of their creations. Third, these rights are often given a utilitarian defense. Utilitarians urge that the protection of these rights promotes public welfare (Moore 2011, 2008; Hughes 1988; Hettinger 1989; Kuflik 1995).

The *personality defense* of intellectual property begins with the idea that people have a moral claim to their talents. When people invest their creative efforts in the development of new works or ideas, they have, it is argued, a special claim to control the results. Artists, for example, have an interest in defining, within reasonable limits, the uses to which their artworks can be put, an interest which is set back if they have no control over their works. In a similar vein, new recipes invented by creative chefs may be works of art into which the creator has a personality interest, like any other artist. The personality defense of intellectual property is founded on the view that creators invest their personalities in the works they produce, giving them a right to control these works.

The *Lockean defense* of intellectual property is based on the idea that individuals are entitled to the products they create and in which they invest their labor. Locke argued that, because people have a right to their own bodies, when they improve something's value by investing their own labor into it, they acquire a property right to that thing which justifies excluding other people from using it. However, such property rights only accrue to things that were previously unowned. Thus, on Locke's view, a person who collects pecans from under an unowned tree in the wild would acquire a property right in them, but someone who collects nuts under a neighbor's tree would be a thief.

Finally, the *utilitarian defense* urges that legal regimes that protect intellectual property are good policy because they promote social welfare. They do this, principally, by providing an extra incentive to reward creative work. In many cases, the development of new products requires a significant investment of time and money for research. Protection of intellectual property rights gives creators a period during which they can hope to regain the costs of development and to profit from their creative efforts. By providing an incentive for creative work, an intellectual property regime promotes the development of valuable and welfare-enhancing products and ideas. Some people also see intellectual property rights as a safeguard against people who might "free ride" on the creativity of others by using others' inventions without payment or consent. This view, however, is by no means universal. Other writers, including Thomas Jefferson, have argued that it is a virtue of invention that one person may use another's invention without imposing disadvantage on the inventor. From the utilitarian perspective, wider dissemination of valuable inventions is a good thing. From the perspective of the *personality defense*, however, such dissemination might be interpreted as unjustified theft.

Some forms of intellectual property protection are expressly designed with these utilitarian considerations in mind. Patents, for example, are often described in terms of the expectation that patent protection represents a mutually beneficial exchange between an inventor/patent holder and the public at large. The patent holder receives, for a limited time, an exclusive right to license and the patented item and to prevent others from making and selling it. (A patent right does not include a positive claim to make the patented invention: where inventions are dangerous or otherwise regulated, even the patent holder may not have a right to make the item.) The period of patent protection is supposed to provide the patent holder with the ability to recover research and development expenses and to make a profit. The public receives, in return, access to creative products that would not otherwise be available and free access to the information necessary to produce them. As part of the patent process, the patent holder must *disclose* the invention, by providing complete instructions sufficient to allow another person to make copies of the patented invention. After the patent expires, the invention is in the public domain, freely available for use by anyone.

The alternative different defenses of intellectual property, variously based on personality, labor, and utility, are not mutually exclusive:

one might accept that each provides relevant reasons to protect and respect intellectual property rights. But different reasons may be relevant to different circumstances. The personality defense is most plausible for artworks and for other creative products in which creators have invested personal meaning. The Lockean argument is most plausible for creations that can be framed as the fruit of the creators' labor.

The utilitarian argument may be the broadest of all, but has its most central application to inventions that promote the public good. Critics of intellectual property laws often argue that these laws fail to promote public welfare since they prevent people from using valuable information. Defenders urge that the information that is constrained would, in at least some cases, not have existed at all but for the incentive effect of intellectual property law. This incentive effect and the fact that intellectual property rights are typically time-limited are important aspects of the case for the claim that these rights promote public welfare. After the time limitations on these rights expire, the protected ideas are in the public domain and can be used freely by anyone.

The disclosure requirement, for patents, is another important element of the utilitarian defense. Unless the invention is otherwise regulated, a patent holder typically has an exclusive right to license and sell patented goods and to prevent others from making, selling, or using the patented subject matter without permission or payment. In return, the patent holder must *disclose* the invention by publishing a full account of the invention, including instructions for making it. When the patent expires, other people can use this account to make, use, and sell the item. The idea behind this policy is that inventors invest money, effort, and creativity to develop new technologies. The period of patent protection enables them to earn back that investment and to make a profit on their creative efforts. Inventors are advantaged because they have exclusive rights in their patented subject matter. The public is advantaged because the patented technology is available and publicized. In the absence of patents, inventors might keep their inventions secret to prevent others from copying. Such secrecy is worse for the public, because secret inventions are usually less widely used. And it is worse for the inventor because secret inventions often cannot be sold or produced without disclosing the secret. Critics of intellectual property rights sometimes overlook the fact that keeping information secret is a likely outcome for some products and inventions and that secrecy will often be advantageous when other forms of protection are not available. In such cases, it can be argued that the elimination of intellectual property rights would not immediately make information public and available. Instead, it would drive information underground.

This case may be undermined, however, if there is evidence that intellectual property protections are not being used in the way projected by the laws. Sometimes, for example, people have tried to take out patents on technologies that would otherwise have been available in any case or to patent inventions created by other people. Attempts have sometimes been made to patent ideas that are widely used and understood. And sometimes, patent protectors become "trolls," the term used for people making money by suing people who use the technology covered by their patent, without marketing the patented product themselves. In such cases, intellectual property protections can lock up inventions by moving them out of the public domain, preventing or slowing creativity instead of promoting it.

Intellectual Property Controversies in Food Ethics

Some of the earliest examples of intellectual property protection covered food items. Moore (2011) reports that "chefs in the Greek colony of Sybaris were granted year-long monopolies for creating particular culinary delights." Presumably, the purpose of this brief protection was to provide an incentive for creative cookery. More recently, there has been a surge in intellectual property protection for foods, especially patents on mass-marketed food products. US patents have been granted for foods with novel

properties, including longer shelf life, flavor, nutritional value, appearance, and many others. Some of these patents are controversial for one reason or another. Sometimes patents are granted for information that should properly be in the public domain, in which case the patented item can no longer be freely used. Some people have other reservations about patented material, arguing that some kinds of things – including some intangible subject matter – should not be privately owned. Some people object on moral grounds to the technologies that are covered by patents. And it is sometimes argued that intellectual property protections improperly give to corporations or individuals control over food or agricultural production.

Patenting in the Public Domain? If the material is already in the public domain, it is not properly patentable subject matter. Patent law was not intended to remove valuable intellectual property from the public domain, but sometimes patent examiners make mistakes. Examples of errors, in this case, are controversial, but sometimes errors are recognized, and patent protection is rescinded.

For example, one highly controversial patent (US Patent Number 6004596) covers:

> A sealed crustless sandwich for providing a convenient sandwich without an outer crust which can be stored for long periods of time without a central filling from leaking outwardly. The sandwich includes a lower bread portion, an upper bread portion, an upper filling and a lower filling between the lower and upper bread portions, a center filling sealed between the upper and lower fillings, and a crimped edge along an outer perimeter of the bread portions for sealing the fillings therebetween. The upper and lower fillings are preferably comprised of peanut butter and the center filling is comprised of at least jelly. The center filling is prevented from radiating outwardly into and through the bread portions from the surrounding peanut butter.

This patent covers peanut butter and jelly sandwiches with certain special properties: to violate the patent, a sandwich must have its crust removed and edges crimped. In addition, there must be two separate layers of peanut butter to prevent the jelly from coming in contact with the bread, making it soggy. The examiner who approved this patent must have judged that this technique would not be obvious to experts "skilled in the art" of sandwich making. Nonobviousness of this kind is a requirement for patent eligibility. The fact that crustless peanut butter and jelly sandwiches are common in lunch boxes around the country has been cited as evidence that this patent was improperly granted (Jaffe and Lerner 2004).

Another similarly controversial case involves US Patent 5894079 issued to cover a species of bean called by the patent holder as the "Enola bean" (Wolf 2007). The patent identified the bean by its species and color, but it was later discovered that beans with the same properties had been in use in the United States prior to the issuance of the patent and that they had been in use in Mexico for hundreds of years. The Enola bean patent was challenged and rescinded, but the process required to challenge patents is expensive and time-consuming. Unless people are willing to spend the necessary resources to challenge them, such patents are likely to remain in effect.

Patenting what "should not be owned." It has sometimes been argued that plants and crop species should not be patented, because, as some people believe, they should be regarded as part of the common heritage of humankind (Magnus 2002, Ossorio 2007). The claim is that plants and living organisms are automatically in the public domain so that private appropriation of them is a kind of theft. This argument is more tenuous when it is applied to crop varieties that have been carefully developed, whether by selective breeding or by direct genetic manipulation. In such cases, the organism developed may be quite different from the original, and there are good reasons to think that the kind of development work undertaken by plant breeders and geneticists is just the kind of work intellectual property rights is intended to promote.

Patenting controversial technologies. Some critics of agricultural patents, however, regard some of the patented products to be morally questionable whether they are properly regarded as inventions or not. Critics of agricultural biotechnology, in general, and genetically engineered food crops, in particular, often argue

that these technologies should not be covered by intellectual property rights because they are dangerous to humans or to the environment or because they find such technologies to be intrinsically wrong. Under US law, however, the claim that a technology is morally reprehensible is not regarded as a legitimate reason not to issue a patent. If patented subject matter is *dangerous* or if its production would violate other people's legal rights, then the state may prohibit the patent holder from making the invention covered in the patent. For example, a chef who invented a new recipe for cooking endangered animals might be able to get a patent on the recipe, but no right to possess or kill or serve the endangered plant or animal. In such a case, the fact that the recipe cannot legally be made would not necessarily prevent a patent from being issued. But in general, the fact that a technology is regarded to be morally questionable is not a valid legal reason to deny patent protection. One might find this to be at odds with the thought that patents and intellectual property rights in general are supposed to incentivize the development of valuable new technologies: how can patenting immoral inventions promote the public good? But in a pluralistic society, different people hold different moral values and might not agree on which inventions are morally questionable. Patent examiners are not qualified to make judgments about the morality or immorality of the inventions they review.

Patents and the control of food and agriculture. Still others regard agricultural and food patents to be morally problematic because they enable corporations to control the behavior of farmers, cooks, and eaters. Still others worry that agricultural patents may leave people hungry or otherwise exacerbate food security concerns, since they constitute a kind of proprietary control over the food supply (Tansey and Rajotte 2008).

One context where this problem arises is *seed saving* by farmers. Before agricultural varieties were patentable, farmers were able to save seeds from one year to the next and did not rely on corporations to provide seed. Those who grow crops covered by patents or other intellectual property protections, however, cannot save and replant seeds without violating the terms of the patent. Farmers can still grow non-patented seed varieties, which are in the public domain. But patented crop varieties often have features farmers want, including pest or herbicide resistance, higher yields, or other desirable agronomic properties. Defenders of patents note that these desirable properties are present because of the research and development done in pursuit of the patent. The crop varieties that possess them, therefore, are significantly different from the varieties that are in the public domain.

It is a different matter if the patented crops or traits were developed, in part, at public universities with public funding. In such cases, it may be inappropriate for a private individual or corporation to gain control over the patented variety, since this would involve the conversion of public funding for private benefit (Streiffer 2006).

Agricultural patents have changed the power relations involved in food production in other ways as well. At one time, farmers were mostly independent, reliant only on their own resources and the fertility of soil and weather. Present market conditions have been significantly created by intellectual property laws, and farmers must work within these strictures. The existing system allocates enormous market power to large agribusiness companies and less power to farmers. Some people urge that this situation renders farmers vulnerable to exploitation or that it is an intrinsically unjust distribution of power.

One major issue involves the containment and "adventitious presence" of patented crop varieties. When patented crops migrate and replant themselves, who should be held responsible? Current patent law regards possession of patented subject matter as sufficient for the charge of patent violation, even in cases where the patented item was not used. This provision makes sense for machines and software and in general for inventions that do not replicate and distribute themselves. It is much more controversial in the case of plants. In a widely discussed Canadian Supreme Court case, Monsanto vs Schmeiser (2004), Percy Schmeiser, a Saskatchewan canola farmer, was sued by Monsanto corporation for patent violation when patented glyphosate-resistant

canola plants were found in his field. He argued that the patented material arrived on his field by pollen drift and that he had never used the protected patented trait. The Canadian Supreme Court noted that possession of patented subject matter constitutes violation even in the absence of use. In such cases, the law does not distinguish cases where the possessor of the patented item intentionally acquired it or acquired it involuntarily, as Schmeiser claimed. The court sidestepped the issue, however, ruling that Schmeiser had taken positive steps to acquire Monsanto's patented product and that he had used glyphosate expressly to select for the patented trait. Current US and Canadian laws leave open the possibility that land owners may be liable for patent violation when patented plants migrate onto private property. Some commenters are undisturbed by this feature of patent law and note that involuntary patent violators might have a cause of action against their neighbors in such cases. They recommend that the possibility of involuntary patent violation should not motivate a change in patent law. (Janis 2002) It would be a significant disadvantage for property owners, however, if they must endure a lawsuit from a patent holder, even if they can regain some of the loss by suing the neighbor whose field was the source of the patented germplasm. It is likely that patent law will continue to evolve in response to these problems involved in the containment of patented crop varieties.

Alternatives to Intellectual Property

Where intellectual property protections are not available, innovators have three choices: (1) they can make their creative products freely available to everyone, in the public domain; (2) they can keep their inventions secret; or (3) they can find alternative means to control their products.

Public domain. If new products immediately enter the public domain, this would undermine the incentive effect of intellectual property law, which is intended to spur creative invention. But, while intellectual property laws provide an incentive for both creativity and disclosure, there is no reason to think that creative efforts would cease if these laws were not in place. Some kinds of creative work, however, require many years of costly investment in research and development. For example, the development of a new crop variety typically requires 10–15 years for development, and the research involved may cost millions of dollars (Sease and Hodgson 2006, p. 350). Creative efforts that impose these heavy costs might be less likely in an environment where protections are not available.

Secrecy. Critics of intellectual property sometimes argue that ideas should be freely available to everyone, but the elimination of the laws protecting intellectual property would not immediately make ideas free. Some inventors would simply keep their inventions secret. Many creative products are already maintained as secrets, instead of being made available in the public domain. Secrecy is not necessarily better than public disclosure: patented creations are available for others to study, even during the period when they are protected as private property.

Alternative means. In the absence of intellectual property laws, it is sometimes possible for people to protect their creative products in other ways. Some seed companies include license restrictions on seed bags that itemize restrictions on replanting or require growers to sign a technology agreement when purchasing seed. In this way, they are able to use contract law to restrict growers' legal right to save seed and replant. While contract law can be used to replicate *some* features of intellectual property protection, however, it cannot replicate them all. Contractual agreements apply only to those who sign or otherwise consent to their terms, while standard intellectual property protections imply obligations for everyone, not just to consenting contractors. But some crops are effectively protected when desirable traits are not heritable by the next generation or when biotechnology is used to restrict the possibility of seed saving and subsequent planting. For example, hybrid crop varieties are effectively protected since seeds saved from hybrids will not grow into plants that have the desirable agronomic traits and

high yields of the originals. And some companies have worked to develop "genetic use restriction technologies" (GURTs) that effectively accomplish the same thing. The so-called "terminator" technology makes next-generation seeds sterile, insuring that farmers cannot save and replant patented seeds. This technology is highly controversial and is not presently in use.

Summary

Because intellectual property rules allocate advantages and constraints, they will always be controversial. Since some ways of distributing these advantages and constraints are morally better than others, the problem is one of ethics and justice, not just efficiency. These rights are designed to reward creativity and to provide incentives to promote research and development of new ideas. Some ethical controversies associated with intellectual property law arise when the laws are misused. Other ethical controversies arise as a result of the way the institutions are structured. Food is a fundamental human need, and agricultural food production is an enormous undertaking. For this reason, it is especially urgent to ensure fairness and equity in the distribution of intellectual property rights in these areas.

Cross-References

- ▶ Biotechnology and Food Policy, Governance
- ▶ Fair Trade in Food and Agricultural Products
- ▶ Food and Agricultural Trade and National Sovereignty
- ▶ Food and the Avant-Garde
- ▶ Food Ethics and Policies
- ▶ Food Legislation and Regulation: EU, UN, WTO and Private Regulation
- ▶ Free Trade and Protectionism in Food and Agriculture
- ▶ Intellectual Property Rights and Trade in the Food and Agricultural Sectors
- ▶ Recipes
- ▶ Saving Seeds

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Intellectual Property Rights and Trade in the Food and Agricultural Sectors

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Synonyms

IPR; Patenting

Introduction: New Agro-technologies Require New Legal Protection

For thousands of years, new seeds and new foods have been exchanged and traded without any legal regulation of intellectual property. Huge improvements in seed breeding resulting in increased harvests (like the ones resulting from the so-called Green Revolution in the 1960s) have been achieved just by "brown bagging," sharing, experimenting, sometimes stealing, and imitating. However, at the end of the 1970s, biotechnology was increasingly perceived by governments as an exciting field of technological innovation that would lead to renewed economic growth and restore international competitiveness for western countries. The huge economic potential of this new field of technology would however only be unlocked, so it was thought if biotechnological inventions were to receive proper legal protection. In the landmark case of *Diamond v. Chakrabarty* concerning the patentability of a genetically modified oil-consuming bacterium, the US Supreme Court ruled in 1980 that "anything new under the sun that is made by man," whether living or nonliving, can be patented. In subsequent years, US jurisprudence explicitly extended patentability to multicellular organisms like plants (1985), oysters (1987), and mammals (1988). Other western countries ultimately followed the American example, albeit with some delays and hesitations. In 1988, the patent offices of the USA, the European Union, and Japan proclaimed the new policy line that DNA sequences and genes would also be eligible for product patents. Their justification was that sequences and genes, when isolated and purified, would be essentially different from their natural counterparts and therefore qualify as inventions rather than discoveries. However, soon many raised ethical objections against this type of legal protection because it implies an unacceptable form of exclusion of the many poor farmers that cannot afford to pay for the patents.

Globalization of Breeders' Rights and Patents

In a parallel move, the legal protection of plant varieties resulting from conventional breeding by so-called plant breeders' rights would also be tightened up. In 1961, a handful of western (mainly European) countries had concluded the first international agreement on plant variety protection, called UPOV, after its French acronym (*Union internationale pour la protection des obtentions végétales*). This agreement gave the originators exclusive rights on commercializing their plant varieties, but granted other breeders the right to use these varieties as starting material for further breeding (breeder's exemption) and left farmers the freedom to save seed from their harvest for the next planting season (farmer's privilege). In 1991, a new international agreement was concluded (referred to as UPOV 1991), which drastically curtailed the breeder's exemption and virtually annulled the farmer's privilege, bringing plant breeders' rights more in line with patent law.

In the eyes of its main beneficiaries, the intellectual property regime also needed to be globalized. Driven by an influential business lobby in the pharmaceutical, biotech, and entertainment industries, the US and European governments used their clout in international trade negotiations to "persuade" reluctant developing countries to accept the (for them often disadvantageous) terms of the *TRIPS agreement*, which was concluded in 1994 as part of an overall WTO

package. The TRIPS agreement (standing for *Trade-Related Aspects of Intellectual Property Rights*) sets worldwide minimum standards for the protection of intellectual property rights (including patents, copyright, and breeder's rights). It mandates that, with few exceptions, "patents shall be available for any inventions, whether products or processes, in all fields of technology" (art. 27.1). Countries are allowed to exclude plants and animals (other than microorganisms) from patentability, but "Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof" (27.3b). Breeder's rights are an example of a sui generis system of plant variety protection. Many developing countries have meanwhile joined the UPOV 1991 agreement to fulfill their TRIPS obligations. In the USA and the European Union, genetically modified crops may even be doubly protected by patents and by plant breeder's rights.

Criticism: IPRs and Food Security, Traditional Knowledge, Environmental Sustainability, and Social Justice

Particularly in the life sciences, IP rights regulate objects such as food and medicines that are key to securing human rights, especially the right to adequate food and the right to health (Universal Declaration of Human Rights, UDHR 25.1). Consequently, IP serves private and public interests. The private interest consists in being able to enjoy the fruits of one's labor, and the public one is about the provision of current and future public goods. Extensive research and development (R&D) enterprises are made profitable as rights holders can market their products exclusively, securing the existence of new commodities and due to the temporary nature of IP, also the provision of future public goods, as the invention becomes part of the public domain. Nevertheless, criticisms abound.

Firstly, the current IPR regime provides according to many insufficient incentive for providing innovations that will alleviate the problems that predominantly affect the poor and to make those innovations widely accessible. European states have a long-standing tradition in securing for their citizens the minimum requirements for an adequate living standard. The success of eradicating extreme poverty in Western Europe has not only lead to viewing this harm to human welfare as something that is unacceptable but also as preventable. As the sums needed to alleviate this welfare burden globally are relatively low compared to other expenditures made in developed countries, not helping is seen as an unacceptable moral menace by a growing percentage of the citizens of developed and developing countries.

With the excessive income inequalities all over the world, it is evident that if the economically worse-off people, such as farmers, are not allowed to make use of the technological innovations of developed countries, they will end up even poorer (Korthals 2010). Furthermore, objects predominantly needed in resource-scarce markets will not be developed, as R&D expenses cannot be recovered (DNDWG 2001; CIPIH 2006)

The right to adequate food and the right to health (Universal Declaration of Human Rights (UDHR), article 25.1) are not the only two human rights that collide with liberties granted by the use of exclusive rights secured by IP regimes. There is a strong plea for a democratization of science, a demand for openness and inclusion, both in active participation and decision-making, elements that in the human rights discourse are encompassed in the right to share in the advancement of science (UDHR, article 27.1). There is a widespread indignation about the way the current IPR regime restricts freedom to operate and a perception that high-level science is treated as a luxury reserved for the developed world alone.

Secondly, as costs of bringing out a saleable product in the life sciences have constantly risen, a stricter market orientation has become even more mandatory, with the effect that industry mergers were seen as necessary in providing goods in the food and health sector. Patents have actually been key drivers behind the increasing economic concentration (and vertical integration) of the global agrifood industry

(Glenna and Cahoy 2009). Often, goods that were formerly free, like seeds, have now to be paid for by end users due to high product development expenses. The current system has the unintended consequence that increasingly larger-scale players dominate the markets, with a foreseeable adverse effect on the rate and quality of inventions and the survival of small and medium-size enterprises. Here, particularly newcomers from the developing world face a difficult start.

Thirdly, there are up to this moment unresolved issues like how indigenous knowledge should be treated and in what way biodiversity should be maintained, as well as questions concerning the regulation of biosafety dossiers. It has to be assessed to what extent those issues should be addressed by IP regimes themselves, or in how far the existence of these regimes has created a situation that demands those issues to be dealt with. The first two subject matters are often brought under one umbrella as interests of the developing world. Biodiversity is often seen as something that is vital, but there are insufficient empirical studies that provide clear evidence that industry needs biodiversity as much as commonly stated. Success in conserving (or even enhancing) biodiversity depends very much of the outcomes of such studies, as such evidence is a huge leverage for bargaining deals for its protection and the establishment of proper incentives therefore. Something similar holds for traditional knowledge. Stating its importance as cultural heritage of mankind might not be enough to find sufficient infrastructural support – studies showing how industry has benefited from traditional knowledge will help to gather a much wider involvement in initiatives that seek to conserve and recognize indigenous scientific practices and knowledge.

Fourthly, evidence on the possible negative effects of the current IP regime and on the potentialities is difficult to acquire. One of those negative effects is that the system of protecting intellectual property has become extremely expensive, in its demand of researcher's time and resources. A wide contingent of legal experts has to be financed by reallocating funds originally destined for research and development. Another regards the one-size-fits-all approach propagated with the TRIPS agreement, which might be less suitable for innovations in the life sciences than for promoting research and development in the electronic, chemical, or mechanical industry. Inventing around is in many cases not possible due to the very nature of life organisms. As inventions in this area could help to secure the human rights to adequate food and health, optimizing the incentive system is imperative. Here, one cannot just trade off business opportunities lost in one area against other ones; a detailed assessment on the unused potential to secure human rights has to be made. Many important stakeholders feel that their interests and voices are not being taken into sufficient consideration in negotiation rounds and the drafting of IP laws. Justice demands more than a fairer distribution of objects of innovation and the availability of biotechnological solutions for the problems that the poorest people in the world are predominantly confronted with. Being able to participate at all levels of the innovation process and having a say on research agendas are something completely out of reach for most of the world's population. For some human rights advocates and scientists, wider participation cannot be even sacrificed for higher efficiency in making technologies available to more people, this coming in line with what is known as the right to share and participate in advancement and benefits of science in the human rights discourse.

Patenting and the Global Spread of GM Crops

Transgenic crop varieties were first commercialized in 1996. Since then, a suite of different GM crops have spread to different parts of the world in a rather uneven pattern, determined by varying socioeconomic and agroecological conditions but also by different regulatory frameworks and intellectual property arrangements. The area planted with biotech crops has increased 94-fold from 1.7 million hectares in 1996 to 160 million hectares in 2011 (ISAAA 2011). The two traits

that have most often been inserted into GM varieties are herbicide tolerance and insect resistance. The main agricultural crops involved are soybean, canola, maize, and cotton. Transgenic crops are mostly grown in North and South America and in Asia (especially China and India), while Europe and Africa are the continents with a very low adoption rate in terms of the number of approved varieties as well as of planted area (Wallace 2010). Adoption may be influenced by the vicissitudes of intellectual property protection and biosafety regulation, as is illustrated by the case of GM soybeans in South America. At an early stage, Argentina eagerly adopted the so-called Roundup Ready soybean, which had been developed by the US company Monsanto as a GM variety resistant to its proprietary herbicide glyphosate (trade name "Roundup"). The variety was actually without legal protection in Argentina and therefore formally in the public domain, as Argentine law did not allow patents on plants, and Monsanto had failed to apply for a plant breeder's right (Correa 2006). This did not prevent Monsanto to claim royalties from Argentina for the use of its "proprietary technology." The US company even went so far as to seize shiploads of Argentine soy meal in European ports and sue for patent infringement there (in the end, European courts rejected Monsanto's claims). Through illegal smuggling from Argentina, glyphosate-resistant soybeans also reached farmers in Paraguay and Brazil, where the new GM variety had not yet been approved by the regulatory authorities. Widespread adoption by farmers in those countries created a fait accompli, which was subsequently legalized by a formal approval not based on a careful biosafety assessment. Something similar happened in India with insect-resistant Bt cotton (containing a gene from *Bacillus thuringiensis* that produces a toxin against insects). This variety had been developed by Monsanto and its Indian subsidiary Mahyco. These companies proved unable to retain their intellectual property control over the new variety, after Gujarat farmers had somehow appropriated the transgenic seeds (possibly from testing fields), crossed it out with indigenous varieties, and in the process created a huge market for "stealth seeds" (Herring 2007).

Tangible Property and Intellectual Property

Biotech companies attach great importance to *respect for intellectual property*. For them, patents and plant breeder's rights are a just reward for their inventive efforts and allow them to recoup the costs and expenses incurred in creating new GM varieties. Hence, they very much lament any unauthorized use of "their" technologies, for example, by farmers who grow "pirated" GM crops without paying them any royalties. Although patents, plant breeder's rights and other intellectual property rights are territorially based, it is striking that companies tend to see their inventions as proprietary also in those countries in which no patents or breeder's rights have been filed. Thus, Monsanto claims royalties on the use of GM soybeans in Argentina even though their invention is not legally protected in that country. It is also not unusual for biotech companies to magnanimously "donate" their technologies to humanitarian initiatives for use in countries where they have no markets (as with the WIPO Global Responsibility Licensing Initiative), but what exactly do they give away if they have no patents in such countries in the first place? For farmers, property rights are also at stake, but their concern is rather that modern *intellectual* property threatens to erode their *tangible* property. In the old days, when a farmer bought seed from the seed merchant, it truly became his property, that is, he could do with it whatever he liked. He could use it to grow his crop and save seed from the harvest for replanting in the next season (or he could exchange it with his neighbor or even sell it on the market). New interpretations of patent law, followed by a drastic revision of plant breeder's rights (UPOV 1991), no longer allow on-farm seed saving. When a farmer buys GM seed from a biotech seed company, it no longer becomes his full property because he no longer acquires the right to make use of an inherent biological

characteristic of the seed, i.e., its natural capacity to reproduce itself. In fact, it would be more appropriate to say that the farmer "rents" the GM technology incorporated in the seed for the duration of only one growing season.

While biotech companies demand respect for intellectual property, others fear that the *autonomy* and *independence* of farmers will be increasingly undermined by more stringent IP restrictions on saving seed. The famous report on the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) expresses "concern about present IPR instruments eventually inhibiting seed-savings and exchanges" (IAASTD 2008, p. 42), thereby restricting the capability of farmer communities to develop locally adapted varieties and to maintain gene pools through in situ conservation – essential to local practices that enhance food security and sustainability.

Patents, the Herbicide Treadmill, and the Shrinking of the Public Domain

There is a further reason to be cautious about claimed and expected public domain benefits of patenting GM crops. That reason may be summed up in the slogan: *Nature fights back*. One of the first things biotech companies did was to develop crops that would be resistant to their proprietary herbicides, a strategy that makes economic sense given the patentability of both GM crops and herbicides (Harhoff et al. 2001). Thus, Monsanto created GM "Roundup Ready" varieties of canola, maize, and soybean that tolerate its registered herbicide "Roundup" (glyphosate), a strategy that was quickly followed by its competitors Syngenta, DuPont, Bayer, and BASF. Continued and widespread use of certain herbicides, however, acts as a selection pressure favoring the spread of resistant weeds. What is currently happening in US soybean and maize cultivation is a case in point. Monsanto's "Roundup Ready" (glyphosate tolerant) crops have been immensely successful in the USA, where they currently cover 90 % of the soybean area and 80 % of the maize area. In comparison with some older and more aggressive herbicides, glyphosate is relatively benign in its effects on wildlife. Many successive years of glyphosate use, however, have now resulted in at least 9 nasty weed species that have gained immunity to this herbicide. The expectation is that by 2015, some 40 % of the cultivation area will harbor resistant weeds. Farmers have to resort to older and less ecologically benign herbicides such as 2,4-D and dicamba, in addition to using Roundup, to kill the new invaders. Agrochemical and biotech companies are meanwhile developing new herbicide-tolerant varieties of soybean and maize with "stacked" transgenes that will not only tolerate glyphosate but also other herbicides. This ongoing "arms race" between biotech and nature may not be too bad for some of the biotech companies involved, but illustrates that environmental benefits of agricultural biotechnology are sometimes only temporary rather than durable or truly "sustainable." A cynic might even argue that the evolution of weed resistance makes highly successful herbicide-tolerant cultivars obsolete over time, thus clearing the way for new cultivars to enter the market and decreasing the chance that an effective invention reaches the public domain as a generic cultivar after the end of the patent term. For a company like Monsanto, of course, the emergence of glyphosate-resistant weeds when its patents on glyphosate-tolerant crops are about to expire is not something to be deplored (although company scientists had earlier dismissed this possibility as highly improbable). This process of creative destruction favors private "innovation" (for a similar view that antibiotic resistance favors pharmaceutical innovation, see Outterson 2009). Industry scientists claim that the use of new transgenic crops with stacked tolerance traits for glyphosate and other herbicides like 2,4-D and dicamba is not likely to accelerate the evolution of multiply resistant weeds, but other researchers argue that sooner or later the emergence and spread of such superweeds are precisely an outcome that is to be expected (Mortensen et al. 2012). The whole agricultural system seems to be set on "accelerating the transgene-facilitated herbicide

treadmill" (*ibid*., 83). Unfortunately, the knowledge infrastructure needed to practice Integrated Weed Management, which would enable farmers to escape from this treadmill, is simultaneously atrophying because the relevant type of knowledge does not lend itself to being packaged in patentable and saleable products (*ibid*., 81–82).

The emergence of resistant weeds as a "natural" response to the widespread use of herbicides on herbicide-tolerant GM crops and the concurrent atrophy of Integrated Weed Management thus call the rationale of the patent system into question. The obsolescence of transgenic crops at the end of the patent term due to the evolution of weed resistance also vitiates a key justification for the protection of intellectual property. The underlying idea of the so-called patent bargain is that in applying for a patent, the inventor receives a *temporary* monopoly on exploitation in return for disclosing his invention and that after the expiration of the patent term his invention will fall into the public domain. It now transpires that once it becomes available for free public use, the invention may have almost entirely lost not only its economic value but also its technical efficacy. Even more, a patent may induce its owner to socially *waste* a finite resource, to wit, the depletable effectiveness of means for crop protection.

Patents and Climate-Ready Crops

A special case, because of its urgency, is the role of patents regarding the innovation process of crops that can accommodate or even reduce climate change. As is well known, most poor countries are more vulnerable to climate change than the rich ones, due to their location but also due to the fact that they are more dependent on agricultural production in earning their livelihood. Developing new technologies for pro poor innovation requires focusing on crops that are important in the poorest parts of the world, such as sorghum, millet, chickpeas, and groundnut; however, research agendas of industrial companies have neglected these almost entirely for understandable economic reasons. The current IPR regimes determine research agendas that are not conducive in reducing poverty and accommodating to climate change in the poorer areas.

Alternatives for the Current IPR Regime and Unfair Trade: Open Source, Open Access, and Food Impact Fund

There are at least three alternatives (or complements) to the current IPR regimes covering production, participation, and consumption of knowledge. "Open innovation" does not mean for free, but free in the sense of being transparent and unrestricted – business models are compatible with open innovation. The question if more openness leads in itself to fairer distribution is something that remains unresolved until further research. Many emphasize the role of commons for the future production of knowledge and their potential to rebalance uneven power relations (Jefferson 2006).

The second, "Open Access" (Krikorian and Kapczynski 2010), covers two currents in the access to knowledge movement, one that aims to build an information society where knowledge is openly available without restriction at all and the second that seeks a general expansion of the public domain. These currents are in particular relevant for initiatives for protecting traditional knowledge through exclusive rights. The attempt to protect traditional knowledge by exclusive rights is at odds with approaches based on sharing rather than appropriating knowledge. The compatibility of predominantly western conceptions of intangible property with customary laws and the extent to which they adequately consider the static and dynamic nature of traditional knowledge are rather unclear.

The third approach aims at an "Impact Fund" (Pogge 2008). Linking profits to positive impact on alleviating an urgent problem is of particular interest for targeted products not covered sufficiently by market incentives, such as medicines for so-called neglected diseases or improvements in seed varieties especially targeted for the needs

of the poor. The idea behind the fund is to offer a reward to companies that aim at maximizing quality-adjusted life years (QALY) of people suffering a disease or disorder. While retaining its IP rights, the company has to commit itself to sell the medicine at cost price in order to be rewarded monies proportional to the impact in increasing QALY its medicine has. The main criticism of the impact fund idea questioned the prerequisite of patents for fund rewards and its maintaining of current power relations.

Summary

The patenting of biological inventions thus raises special ethical issues. The main issues are:

(a) What can be the socially desirable balance between types of exclusivities innovative enterprises require and the inclusive public goods protection it is said to serve? How is this proper balance to be achieved?
(b) What old and new ideas (such as Open Source and the Access to Knowledge movement) about exclusivities such as protection and property and their optimal integration with the public good of human welfare, fair trade, and fair invention are interesting and worthwhile for debate and experimentation? What pilot studies should be pursued?
(c) In what way can an intellectual property rights system become inclusive, not only listening to the voices of patent holders but also to those stakeholders that are affected by the patent system?
(d) How can inventions be stimulated that are specifically designed to alleviate urgent problems and to reach global targets, such as the millennium development goals and caps in climate change gases emissions?
(e) Why are the flexibilities of TRIPS agreement regarding human welfare (TRIPS, art. 6) not often used in national regimes, and why does the full potential of TRIPS seem to be underused? Which steps can be taken to ensure better use of those flexibilities?
(f) How can ethical principles and values of a nation or a group of nations be protected, and what does this mean with respect to a broad interpretation of *ordre public* and public policy exemptions to patentability (TRIPS, art. 27.2 and 27.3)?

Cross-References

- ▶ Fair Trade in Food and Agricultural Products
- ▶ Saving Seeds
- ▶ Trade and Development in the Food and Agricultural Sectors

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International Food Quality Standards

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Synonyms

Codex alimentarius; Food safety; WTO

Introduction: Why and Who?

Various aspects of food quality can be controlled, coordinated, certified, and communicated by government agencies, third parties, supply chain contracts, and voluntary standards. Such quality standards can increase the value, volume, and nature of agricultural and food trade across international borders. Indeed, certain ingredient supply chains or stages of processing may span multiple countries. Imports and exports might be inspected and acknowledged to meet a particular standard, highlighting a product quality attribute or a process step. Any such coordination of national-level food quality standards can be called *rapprochement* (Hooker 1999). Regulatory rapprochement is the process of attempting to establish harmonious intergovernment relationships. The goal is, at best, freer trade without sacrificing consumer protection or, at least, the prevention of food quality standards from becoming a serious point of contention and conflict in international trade.

The World Trade Organization (WTO) uses two key trade agreements (Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT)) to facilitate such regulatory rapprochement. These agreements recommend the increased use of guidelines adopted by international food quality standards organizations such as Codex Alimentarius (Codex), the International Plant Protection Convention (IPPC) and its regional affiliates (e.g., the North American Plant Protection Organization (NAPPO)), and the International Office of Epizootics (OIE). Countries then have the ability to set stricter food quality standards if they have sufficient scientific evidence that such measures are justified and notification is provided to other countries. This places the burden of proof on the importing country. Conversely, in proving the equivalency (in terms of the resultant food quality target) of differing national-level regulatory regimes, the burden of proof is placed on the exporting country.

The SPS Agreement of the WTO captures this in an important statement of principle:

> Reaffirming that no Member should be prevented from adopting or enforcing measures necessary to protect human, animal or plant life or health, subject to the requirement that they are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between Members where the same conditions prevail or a disguised restriction on international trade. (GATT-SPS 1994, p. 1)

The issue of dynamics in international food quality standards is critical. The ultimate goal is to adjust each food quality standard as more scientific evidence, production or processing innovations, and customer and consumer acceptance allows. Discussions of standard levels, the manner that standards are updated, and comparisons of national standards should be done in light of an increasing knowledge of the food quality assurance and management capabilities and the scale of international trade impacted. Demand for higher-quality food products expands as national income rises, leading to calls for stricter standards, suggesting one dynamic that must be accommodated. However, "luxuries" of high-income countries may be at the expense of

lower-income countries. For example, trade between developed countries could be well in excess of a minimal (e.g., Codex-based) standard but at the Codex level for goods traded between lower-income countries. Thus agri-food products crossing international borders may still be of very different quality with little more than a "harmonized" minimal standard for a limited volume of trades. This affects each nation's welfare differently. Higher-income countries rarely accept imports of a lower standard than currently found domestically or from other imports, whereas lower-income countries may see their domestic food quality standards dramatically rise to maintain export income from food trade. Alternatively, a segmented market may see high-quality products exported with lower-quality foods remaining for the domestic market. This may be at the expense of many local inhabitants, incurring high compliance costs. Therefore, an adjusted international food quality standard though of little or no significance to developed nations could dramatically affect developing countries (Otsuki et al. 2001).

Food Quality Targets: What and Where?

Food quality is multidimensional, made up of a bundle of characteristics or attributes that determine the product's performance relative to its price. There is no definitive list of food attributes; important product and process characteristics vary across food categories, consumers, and nations due to risk and preferences. Several important subsets can be identified: Safety attributes include foodborne pathogens, heavy metal and pesticide residues, food additives, naturally occurring toxins, and veterinary drug residues. The second set of attributes relates to the nutritional profile of the product and includes aspects such as fat content, calories, fiber, sodium, vitamins, and minerals. A third subset is value attributes. This is a diverse list that includes characteristics of the product itself that are of value to the consumer but are not food safety or nutrition attributes. Examples are purity (lack of nonhazardous contaminants), compositional integrity (i.e., lack of economic adulteration – replacing cheaper ingredients without notification), size, appearance, taste, and convenience of preparation. The fourth subset is package attributes, which includes package materials, labeling, and other information provided. A fifth subset groups quality attributes that arise from the manner of production and processing of the food or agricultural ingredients. Frequently controversial, these attributes include biotechnology, organic, sustainable, nanotechnology, and irradiation.

As noted, this classification is neither definitive nor exhaustive but is intended to be useful in discussing food quality issues. Particular international food quality standards may embody characteristics from more than one attribute subset. For example, organic food may be appealing to some consumers for its real or perceived safety, nutritional, value, and process attributes. These foods can be identified via package information disclosures supported by traceability regulations (whether mandatory or voluntary) throughout the supply chain. Third-party certification organizations in the source or destination nations may be public or private entities. Important institutional and supply chain differences exist in the nature of international food quality standards targeting raw agricultural ingredients and consumer-ready food products and traceability (Souza Monteiro and Caswell 2010). Generally, as a product moves from bulk to packaged form, more international food quality standards likely play a role. This attribute language highlights the interaction and interdependency of the various aspects of international food quality standards.

Many recent developments in the adoption of food quality management systems represent a switch toward the application of joint or holistic metasystems and meta-standards where one certificate assures compliance with a set of food quality standards (Caswell et al. 1998). This follows similar trends in other nonfood industries, with efforts focused on reducing product waste, complying with contractual requirements, responding to consumer demands, managing risk, and demonstrating that technical product and process standards are being met. A common

though not exclusive incentive for adoption of these systems in the food industry is the management of food safety attributes particularly when traded internationally. Such food quality metasystems include those mandated by governments through regulatory requirements, those adopted voluntarily by companies, and a third type of system – quasi-voluntary. The latter systems are those that are required by such a large proportion of the market as to become de facto required standard operating procedure. These systems are quasi-voluntary in that a supplier can choose not to comply and simply not do business with the buyer. However, if they are widely used or are used by important buyers, suppliers may have little choice in whether to produce or process to the specifications.

When considering the role of international food quality standards, it is important to recognize the role of information asymmetry. Product quality can be usefully categorized as search, experience, and credence in nature. Search attributes (product size, ripeness, price) can be fully determined prior to purchase or use and therefore easily controlled, certified, and described via value attributes such as standards of identity, ingredient minimum standards, or labeling. In an international trade context, the role of food quality standards addressing search attributes is to assure that the claimed food quality is correctly presented prior to purchase or progression through the supply chain. The true presence and extent of experience attributes, alternatively, can only be determined after consumption or use, whether by a downstream customer such as a food processor or the final consumer. Examples include taste, shelf life, and the presence of large physical contaminants and certain forms of economic adulteration. Elements of international food quality standards that attempt to minimize the role of experience quality uncertainty across national borders include audits of the production/processing environment by government or third-party agents and random compliance checks to "test" product quality (if this can be used to determine a valid representative sample of the batch or shipment). Whereas search quality uncertainty suggests the primary role of international food quality standards is to ensure all salient information is complete and accurate and made available prior to purchase, for experience uncertainty the goal is to strengthen trust and credibility through guarantees of quality assurance, consistency, and remediation in times of poor quality. Finally, credence quality uncertainty cannot even be resolved after use or consumption. Common examples lie within food safety and nutrition characteristics. Microbial pathogen or pesticide residue content cannot be determined without complete product destruction. International food quality standards attempting to mitigate credence uncertainty are traditionally in the domain of mandatory, public, and direct regulation (Caswell 2012).

Types of Food Quality Standards: How?

In the context of international food trade as well as the domestic level, a clear delineation of the goal of a regulatory regime, third-party certification system, or voluntary standard greatly facilitates discussion and analysis. Here, too, there is no definitive list or approach. The most common food quality regulatory regimes are those that focus on process and product performance standards. Further distinctions include input or ingredient standards and information requirements (see Van Camp et al. 2010, for an example of the US National Organic Program). A range of quasi-voluntary approaches have emerged from incentive or market-based, co-regulation, information/education, and industry self-regulation (Caswell 2012). Following the product through to the consumer, food quality standards may also target conditions of distribution and sale (e.g., temperature of refrigerated display cabinets) or services at the point of sale and conditions of use (e.g., nutrition disclosure at point of sale for food service operations). As requirements are implemented closer to the consumer, the potential for multiple international food quality standards to play a role greatly increases. For example, European grocers were concerned about the production environment for fruit and vegetables which are often imported. Efforts to

document food safety, value, and production attributes throughout supply chains led to the development of traceability and certification systems based on Good Agricultural Practices.

Focusing on the international context of the management or regulatory rapprochement of differences between national-level mandatory controls leads to two major questions. The first is the legitimacy. In other words, does the national government have a valid reason to regulate a particular food quality attribute, and if so, is the regulatory regime it has chosen appropriate for achieving this goal? Under several trade agreements, the food quality standards set by international bodies (e.g., Codex) are the benchmarks (Hooker 1999; Hooker and Caswell 1999). The second question is how differences in regulation are managed to facilitate trade:

Harmonization: standardization of regulations in identical form

Mutual recognition: acceptance of regulatory diversity as meeting common goals (sometimes called reciprocity or equivalency)

Coordination: gradual narrowing of relevant differences between regulatory systems, often based on voluntary international codes of practice (sometimes called alignment)

The continuum begins with no regulatory rapprochement and moves to coordination, which is a broad range of weak forms of cooperation; then to mutual recognition; and finally to the strongest level of rapprochement, harmonization. Harmonization has most often been applied via minimum input, process, or product performance standards for particular sets of food quality attributes. It can be applied across the full attribute space for these products. Mutual recognition involves agreement among a group of countries that a good legally produced within the bloc will be legal for sale throughout the bloc regardless of whether it meets the host country's domestic standards. It has most often been applied to value attributes because countries frequently do not like to give up control over food safety attributes in particular, although it may be applied across the attribute space. Coordination covers a wide variety of efforts to align policy through interagency consultations, adoption of voluntary standards, the provision of information through supply chains in traceability systems, and other means. It too may be applied across the attribute space. A total lack of rapprochement is possible, but increasingly rare as international food quality standards take on growing importance for all countries.

Quasi-voluntary standards include those managed by government agencies (such as the National Organic Program in the USA), supranational groups (such as ISO), NGOs, or businesses. They are characterized as necessary conditions to be a member of a particular supply chain, often involve experience or credence quality uncertainty and information asymmetry, but are more structured than voluntary international food quality standards.

Private certification programs, such as the Global Food Safety Initiative (GFSI), add another layer to the picture of international food quality standards worldwide. Such systems can be voluntarily adopted as a source of viable third-party certification that may back up or even replace government regulation of some quality attributes, most frequently value and production attributes. Increasingly, food safety attributes are being integrated within broader meta-standards (see, for example, Souza Monteiro and Hooker 2012, for an introduction to the role of third-party audits in the *Food Safety Modernization Act* in the USA). They are also playing an increasingly important role in contractual agreements, with many food processors and retailers requiring certification for all of their input suppliers. If these trends continue, they will soon evolve into quasi-voluntary international food quality standards.

Summary: So What?

International food quality standards play a critical role in facilitating agricultural and food trade. Standards can be narrow or broad; are designed and managed by government agencies, third-party certification organizations, or business; are intended to minimize or mitigate search, experience, or credence information asymmetry and uncertainty; and focus on product or process attributes and/or information. Ideally standards continue to evolve in response to

a diverse and dynamic set of stakeholder beliefs and needs. Concerns remain that despite efforts to enhance regulatory rapprochement, certain international food quality standards are used to impede trade and provide protection to domestic industry. This blocks the benefits of freer agricultural and food trade, creating ethical dilemmas.

Cross-References

- ▶ Fair Trade in Food and Agricultural Products
- ▶ Food and Agricultural Trade and National Sovereignty
- ▶ Food Legislation and Regulation: EU, UN, WTO and Private Regulation
- ▶ Food Risks
- ▶ Food Standards
- ▶ Free Trade and Protectionism in Food and Agriculture
- ▶ Multilateral Trade Organizations, Food, and Agriculture

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Islam and Food

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Synonyms

Islamic landscapes for food practice; Muslim identity through food practice

Introduction

An exploration of food and Islam must begin with food's role in the Qur'ān, Islam's holy book. For Muslims, this book is the record of divine revelations made to the Prophet Muhammad, intended to guide humanity. The Qur'ān describes how food originates, what it signifies, and what foods are allowable or prohibited, which inform Muslim identities and Islamic theology, law, ethics, and aesthetics. In addition, Muslim food practices follow from traditional stories (*ḥadīth*) about the Prophet Muhammad and his companions. Islamic legal prescriptions not only identify what foods are religiously sanctioned for Muslims but also the manner of their preparation. After discussing what Muslims are prescribed to do with respect to food, this entry examines practices observed around the world, which show the importance and incorporation of food for ritual occasions, holy festivities, and commemorations. Finally, the entry briefly considers animal rights and vegetarianism, agricultural sustainability and the issues brought about

by food industrialization and globalization, and the scriptural connection of food with paradise.

Food as Blessing and Reward

> Let people consider their food: We [God] pour down water abundantly and cause the soil to split open. We cause grain to grow out of it, and vines, edible plants, olive trees, date palms, gardens dense with foliage, fruits and herbage, all for you and for your livestock to enjoy. (Qur'ān 80:25–32)

Drawn from the Qur'ān, the epigraph above depicts food as a divine blessing for humans and livestock to enjoy. The provisions that God has set on earth are an indication of God's wisdom, reminding adherents that God is without equal, incomparably wise, and generous (Q. 2:22). Food makes its appearance in paradise (*al-jannat*), in which the original couple, Adam and his wife, are directed to enjoy food from the plenteous garden wherever they find it, but not to approach a certain tree, lest they become tyrannical or wrongdoers (*ẓālimīn*) (Q. 2:35). They partake of it nonetheless and are thus banished from the garden, after being forgiven and counseled to follow God's guidance (Q. 2:38). Sometimes human beings are tested by hunger, loss, or meager harvest, but those who respond with patience and assert that they are from God, to whom they will return, are divinely blessed (Q. 2:155–157). God provides succor when asked, as when Moses prayed for water for his people and was directed to strike a stone with his staff, at which instant 12 springs appeared (Q. 2:60), as a reminder to live a life of righteousness. Believers who do righteous deeds will secure a place in paradise, where waters flow and gardens grow and where they will be offered fruit (Q. 2:25).

Lawful and Prohibited Foods

The theme of not approaching, that is, not partaking of the fruit from a certain tree, continues in the Qur'ān in Chap. 5, appropriately titled "The Table Spread" (*al-mā'idah*). This entry identifies foods (*ṭa'ām*) that are prohibited (*ḥarām*) and foods that are permitted (*ḥalāl*). The list of *ḥalāl* or "lawful" foods includes grazing livestock (Q. 5:1) and animals hunted while not in a state of *iḥrām* (the state observed during the time of pilgrimage (*ḥajj*), whether minor (*umrah*) or major (*ḥajj*), during which a pilgrim performs rituals of purification and wears prescribed clothing) (Q. 5:2 and 22:29). In addition, "the food of those who were given the Scripture" (Q. 5:5) is permitted, as is the food of the Muslim permitted to other scripturists, usually interpreted as Christians and Jews. Prohibited or *ḥarām* foods include blood, dead animals (*maytah*), the flesh of swine, animals offered in sacrifice to other than God, or animals that have been gored and killed through strangulation or a violent blow or remnants from what wild animals have eaten. However, God gives mercy and forgiveness to a person who partakes of any of these without the intention to sin due to severe hunger (Q. 5:3; see also 2:173, 6:145, and 16:115). Consequently, due to the emphasis on the manner of an animal's killing, Islamic law requires that animals be killed in a prescribed way, such that its blood drains out. Q. 6:118–121 further specifies, "And eat of that [meat or food] over which the name of God has been mentioned. . .and do not eat from that over which the name of God has not been mentioned, for indeed, it is grave disobedience." Wine (or more accurately, intoxicants, *al-khamr*) is also forbidden (Q. 5:90). Although specific interpretations may vary (below), most scholars agree that alcohol, pork, blood, and carrion meat are prohibited.

Islamic Legal Prescriptions

The Qur'ān provides compelling passages about food, and Islamic legal scholars engage with food and eating with attention to *sharī'ah*, the term for Islamic legislation, which literally means the path to the watering hole. Thus, jurists present Islamic law as a means for quenching the thirst for divine order and justice. Daily activities, such as prayer and charitable acts, show piety and submission to God's laws, as does the food one partakes of daily. Islamic law concentrates considerable

attention on food, particularly defining what is lawful (*ḥalāl*) and prohibited (*ḥarām*). The term *tayyib* is useful for describing good and wholesome food. In addition, the Prophet Muhammad is considered the exemplar of correct behavior in accordance with the belief that as God's Prophet, he was divinely guided. The Prophet's words and actions are paradigmatic, as are those of his closest companions. Such exemplars are recorded in a body of literature known as the *ḥadīth* or traditions. When scholars describe Muhammad's fasting or his meals, these *hadīth* stories offer prime examples for Muslims to emulate. For example, the Prophet was known to wash his hands before a meal and to break his fast with dates. Food is among the characteristics defining a Muslim in a *ḥadīth* ascribed to Muḥammad, in which he said, "Whoever recites our prayers and worships in the direction of our *qiblah* [facing the Ka'ba, the sanctuary in Makkah (Mecca)] and eats the meat of our slaughtered animals, that person is a Muslim who has the protection of God and the protection of His Messenger" (*Ṣaḥīḥ al-Bukhārī*, 1:82–83, cited in Freidenreich, 144).

The Arabic term *ḥalāl* is broader in scope than simply describing food restrictions. *Ḥalāl* refers to what is lawful or permissible, more generally, in contrast to *ḥarām*, the unlawful. In Islam, any action may be placed within one of five legal-ethical categories: *ḥarām* (forbidden), *makrūh* (reprehensible), *mubāḥ* (neutral or indifferent), *mandūb* or *mustaḥabb* (recommended or commendable), and *wājib* or *farḍ* (required). Islamic law regulates meat more carefully than other foods. These laws deal with the raising and slaughter of food animals, and many authors highlight the humane treatment of animals exhibited in the Qur'ān on account of creatures constituting communities, as do humans (Q. 6:38). Q. 5:3's reference to "a proper act of slaughter" entails that God must be invoked and, to avoid prolonged suffering, a carotid artery and the trachea must be cut with a sharp knife. There is a specific way of naming God for animal slaughter, first stating intent (*niyyah*) to begin the ritual act of slaughter, followed by invoking God according to this formula: "In the Name of God, God is most Great," in Arabic "*Bismillah, Allahu akbar*." Meat prepared from an animal thus slaughtered is known as *dhabīḥah*. Both the Torah and the New Testament prohibit eating blood, a prohibition that is also found in the Qur'ān and links the Muslim community to the shared divine covenant with the peoples of the Book (commonly understood to be Jews and Christians). The blood of the slaughtered animal is allowed to drain before the meat is prepared for consumption.

Halāl and *ḥarām* foods are elaborated in multiple schools of Islamic law, which are based on the Qur'ān but also draw heavily on the *sunnah*, both oral and written record of the practice of the Prophet Muḥammad and his close companions. Thus, al-Ṭabarī (d. 923) permits the meat of slaughtered animals prepared by the peoples of the Book (Jews and Christians), but not that prepared by polytheists and worshippers of images and statues. The Sunni and the Shi'i jurists, both of whom commonly appeal to the Qur'ān but otherwise appeal to different sources of authority, differ in their views on whose meat is permissible to Muslims. Sunni jurists such as Ya'qūb Abū Yūsuf (d. 798) also forbid eating the meat, but not other foods, of Zoroastrians (Magians), even though they are otherwise in all respects to be treated as peoples of the Book, as it entails the act of ritual slaughter in which the animal is offered to many deities. Ibrāhim al-Nakhā'ī held that eating meat over which a Christian butcher had invoked Christ was reprehensible. However, even though ostensibly Christians invoke Christ, rather than God, when slaughtering animals for food, Sunni jurists such as Abū Bakr Muḥammad Ibn al-'Arabī (d. 1148; not to be confused with Muḥyi al-Din, the famous Ṣūfī) calls upon God's making permissible meat prepared by the peoples of the Book sufficient divine generosity to justify eating their meat, despite their Qur'ānically unacceptable elision of Christ with God. Ibn Hazm in his chapter on animal slaughter ruled that Zoroastrians were to be treated as peoples of the Book, implying that all foods prepared by them were allowable. In contrast, Shi'i jurists such as Muḥammad b. al-Ḥasan al-Ṭūsi (d. 1066/7) allowed for grain and other foodstuffs prepared

by non-Muslims, but not meat slaughtered by them. This prohibition occurred despite the concession granted to peoples of the Book by Q. 5:5 and despite the permission, provided the name of God had been recited over the animal slaughter, granted by Zayd b. ʻAlī (d. 740), whose lineage traced directly back to ʻAlī, the first Imām of the Shiʻah (and hence considered by the Shiʻah to have inherited the Prophet's spiritual and temporal authority). Interestingly, the authority of the sixth Imām (sixth for Ithnā ʻAsharī or Imāmī Shiʻites; the fifth for Fāṭimīd Shiʻites), Jaʻfar, is invoked to argue opposing positions. On the one hand, his authority is invoked to suggest that only the name of God invoked by monotheists, understood by those who interpret the text restrictively as Muslims, can be trusted. On the other hand, his authority is cited to suggest that meat prepared by any butcher who invokes God's name properly, irrespective of faith, is permissible to eat, invoked by Fāṭimid Shiʻites also. Thus, for some Muslims, all foodstuffs with the exception of grains and the like (i.e., unprocessed foods) are rendered impure (*najis*) for consumption when prepared by non-Muslims. The goal here is to distinguish Imāmī Shiʻis from Sunnis in the latter's acceptance of foods from scripturalists. Such food restrictions are deployed as a strategy to draw a line in the sand separating Imāmi Shiʻis from all other faith communities. Dietary restrictions established by religious groups as a mode of distinguishing self from other are visible in non-Muslim religious settings, as well. Clearly, such distinctions both within the Qur'ān and outside it have much to do with setting the terms on relations with other religious communities as a mode of self-identification. Among Muslims, these prohibitions extend from the idea that unbelief and impurity – exemplified through the holding of false beliefs – can be communicated through touch.

Feasting and Fasting: Food and Ritual Occasions

Feasting and fasting are both religious prescriptions that mark ritual commemorative occasions, which remind adherents about their sacred history. Feasts and fasts are junctures at which one may reflect upon and strengthen one's faith. While designated times of feasting are usually joyous occasions, they sometimes follow periods of privation, often expressed through fasting, that allow for introspection, prayer, heightened moral reflection, and charity and goodwill toward others.

Ramadan

One of the *arkān* or pillars of Islam is fasting (*ṣawm*) during the Islamic month of Ramadan, prescribed in Q. 2:183–185. In the lunar calendar, Ramadan is a month when Muslims practice fasting from dawn (*fajr*) to dusk (*maghrib*) to strengthen their religious commitments. Due to the difference between the lunar and solar calendars, the month of Ramadan shifts each solar year, slowly transitioning from one season to another. The fast consists of refraining from food, drink, and intercourse during daylight hours, breaking the fast (*ifṭār*) each evening after dusk and beginning the day before dawn with a small meal (*suḥūr*). The predawn morning meal is generally lighter, since some believe a heavy meal will inspire more thirst during the day's fast. Just as the pilgrimage to Mecca (*ḥajj*) is both an outer and inner journey to God's abode, the fast at Ramadan serves inner and outer functions. The Ramadan fast involves the physical discomfort of hunger and thirst, which encourages self-restraint, compassion toward those who live with daily hunger or want, and gratitude for having sustenance. It also entails cultivation and control of the mind, beginning with expressing the *niyyah* or intention to fast, restraining oneself from coarse speech and quarrelsomeness, avoiding lustful and avaricious thoughts, and encouraging an attitude of benevolence toward others, often through acts or gifts of charity. Remaining steadfast in God's requirements despite discomfort may be purifying to the mind and body. This is also a time for each fasting Muslim to spend in prayer and meditation, renewing faith, increasing moral self-awareness, and considering his or her life purpose. When people are unable to complete their fast during

Ramadan due to temporary illness or travel, the fast may be completed later. If fasting presents extreme difficulty, a Muslim may compensate by feeding someone in need (Qur'ān 2:184). Pregnant women and young children are exempt from fasting. Also Muslims tend to visit their place of worship more frequently.

During the month of Ramadan, fasting Muslims eat after darkness falls before performing the sunset prayer (*ṣalāt al-maghrib*). The daily fast closes after sunset with dates or fresh fruit, followed by *iftār*, the evening meal after the day of fasting. Eating dates is associated with the Prophet Muhammad, who reportedly loved dates and broke his fast with dates and water. Because Ramadan is the most significant time of year in Islam, the Prophet's practices become more important for expressing religious commitment. Camel meat is another food associated with the Prophet and his family and thus eaten more frequently in Ramadan evening meals. Many *iftār* dishes vary regionally, depending on local food preferences and lore regarding which foods and drinks are best for delighting the palate, strengthening the body, and quenching thirst. *Rooh Afza*, for instance, is a nonalcoholic drink concocted by Hakeem Hafiz Abdul Majeed in 1906 in India, consisting of a medley of herbs, fruits, vegetables, flowers, and roots, that is now sold as a syrup to be added to water, ice cubes, sugar, milk, and cinnamon and prepared in India and Pakistan as a drink to be served during *iftār*. Indonesians prepare desserts such as *kolak*, made with palm sugar, coconut milk, pandanus leaf, mung beans, and fruit, to which optionally tapioca or cassava may be added, cooked, cooled, and served during the month of Ramadan. *Läghmän* noodles, derived from *lamian*, a type of Chinese noodle, are favored as *iftār* dishes in Central Asia and Chitral, while in places such as Trinidad and Tobago, local fare such as roti with curried chicken, goat, duck, and chickpeas is served at the masjid or mosque as part of a communal *iftār* meal. Russian Muslims drink *kvass*, whose low alcohol content classifies it as a nonalcoholic beverage. *Kvass is* made from fermented rye bread and mixed with fruits and/or mint as it is thought to staunch thirst.

The month of fasting ends with a celebration held on the first of the following month, Shawwāl, the 'Īd al-Fiṭr (festival of breaking the fast), in a show of gratitude. Fasting is not permitted on this day, which begins with a small breakfast that often includes dates before the performance of special prayers, sermons exhorting good deeds, new clothing, and family meal gatherings. Countries such as Egypt declare the occasion fit for a 3-day holiday to allow families restorative time to gather, share meals, and celebrate.

'Īd al-'Aḍḥā

This feast day or *'īd* (Eid), occurring on the 10th of the Muslim lunar month Dhū al-Ḥijja, commemorates the Prophet'Ibrāhīm's (Abraham) willingness to sacrifice his son Ismā'īl (Ishmael) and marks the end of the annual *ḥajj* or pilgrimage to Makkah (Mecca). It is a time when special Eid prayers are recited, new clothes are worn, and gifts are given, especially to children. Families and friends gather for a meal usually consisting of an animal that has met certain age and quality standards, who has been ritually slaughtered for the occasion, to mark the replacement of Ismā'īl with a ram as he was about to be sacrificed. Pilgrims participating in the pilgrimage make this sacrifice in the valley of Mina. At least two-thirds of the animal is to be shared with the community, one-third is retained by the family, one-third given to extended family and friends, and one-third given in charity so that no one is left without the means to commemorate this occasion.

The Saudi Project for Utilization of Hajj Meat (www.adahi.org) reports close to a million heads of sheep, and 3,000 heads of camels and cows were utilized during the 2011 *ḥajj* season. The Kingdom of Saudi Arabia established this organization, which now employs close to 40,000 people, approximately 20 years ago to serve several functions: to distribute meat to the poor in Makkah, as well as to needy Muslims around the world; to ensure the fulfillment of religious and health regulations for animals; to ensure environmental protection around the holy sites of pilgrimage; and to distribute the proceeds from the sale of offal to the poor in Makkah. A map shows

recipients of meat ranging from places in West Africa to the Sudan, Mozambique, and Tanzania to regions further east in Azerbaijan, Pakistan, and Bangladesh. The organization's stated objectives reflect some awareness of the environmental costs of the ritual practice of slaughtering animals for Eid in asserting that no such meat should be wasted. However, animal rights organizations such as Animals Australia (www.animalsaustralia.org) protest the exportation of live animals to Muslim-majority countries such as Turkey, Indonesia, Kuwait, Egypt, and Pakistan on the grounds that the animals are treated cruelly and as part of their larger campaign to stop animal exportation and to encourage people to adopt vegetarianism to reduce the water and other resources needed to raise livestock. Increasingly, Muslims themselves are asking whether the custom of commemorating the Eid continues to justify the scope and scale of the practice, on moral and environmental grounds; however, serious debate and reflection have yet to be undertaken. The Saudi Project for the Utilization of Meat announces the message of the project on its website thus:

> "Exhort all men to make pilgrimage. They will come to you on foot and the backs of swift camels from every distant quarter (Q. 22:27); they will come to avail themselves of many benefits to pronounce on the appointed days the name of Allah over the cattle, which He has given them for food." "Eat of their flesh, and feed the poor and the unfortunate." (Q. 22:28, 36) "Their flesh and blood does not reach Allah; it is your piety that reaches him." (Q. 22.37)

Is it possible to theologize constructively about animal sacrifice at the time of pilgrimage bearing in mind the tremendous moral and environmental costs of observing a ritual whose scale has gone far beyond that at the time the Qur'ān was revealed? While these verses proclaim that pilgrims are to offer animals in sacrifice, they do not require that Muslims not on pilgrimage do so as well, while the final verse invoked here opens up the possibility that the animal sacrifice could be offered symbolically, since God is the recipient of piety and not the flesh and the blood of the animal.

Muḥarram Rites

The first month of the lunar year is Muḥarram, considered by early Muslims to be one of the sacred months during which no blood could be shed, including the hunting of animals. The 10th of Muḥarram is called 'Āshūrā', and the traditions (*ḥadīth*) relate that upon being told that the Jews fast on this day to commemorate the day when God parted the Red Sea to let Moses and his people pass in order to rescue them from the Pharaoh, the Prophet told his people to fast for 2 days, on either the 9th and 10th of Muḥarram or the 10th and 11th. This fast is considered recommended, not obligatory, by Sunni Muslims, having been replaced by Ramadan as the obligatory period of fasting. Fasting Muslims in Egypt will prepare a pudding called Ashura made from wheat, nuts, raisins, and rosewater to be had after dinner on that day.

For Shi'ah Muslims, the month of Muḥarram is a time of intense sadness and mourning. On October 10, 680 CE (10th of Muḥarram, 61 AH; anno hijri (AH) marks the commencement of the Muslim lunar calendar dating from the flight or *hijra* of Muslims from Makkah to Madinah in 622 CE), the Prophet's grandson, Ḥusayn b. 'Alī, was massacred on the battlefield near Karbala (in present-day Iraq) by Ibn Ziyād, governor of Kufa, whose forces were allied with Yazīd I, the Umayyad caliph. Significant in this narrative is that Ḥusayn's small band of followers and family was cut off from access to water from the nearby Euphrates River. Ḥusayn's grave became a pilgrimage site. Shi'ite tradition holds that Ḥusayn's sister Zaynab began a period of mourning for her brother, which Shi'ites observe to this day in *'āzā dārī* (mourning) rituals and gatherings (*majālis*) at which sermons are made recounting the events leading up to the massacre, elegies recited, prayers offered, and lamentations expressed, alongside processions during which participants, mostly men, will express their grief through *matam*, consisting of rhythmically striking their chests or their backs with chains or with small sharp blades. The Shi'ite period of mourning, commencing with the sighting of the crescent moon announcing the first of Muḥarram (the Islamic calendar counts its days from sunset

rather than sunrise), lasts to the fortieth day (*Chehellum*) after the 10th of Muḥarram, and during this period of mourning, joyous occasions such as weddings and birthdays are not observed.

In Karbala-related mourning rituals in South Asia, meat is avoided during the Muḥarram month because of its association with times of celebration and joy; most Shi'is observe the tenth of Muḥarram not as a fast, a *roza*, connoting auspiciousness, but as a day of *faqā*, poverty and hunger, in emulation of and solidarity with Ḥusayn and his retinue's hunger and thirst in the 3 days preceding their martyrdom. Tradition also holds the occasion of the massacre was utilized by Ibn Ziyād and his troops to denote a time of auspiciousness. Hyder writes: "The meal on the tenth of Muḥarram consists of *khichṛī* (rice cooked with lentils), *khaṭṭa* (tamarind soup), and *buttī* (yoghurt rice); butti, though a staple in many South Indian households, is eaten in most Shii Hyderabadi households (sic) only during this Muharram meal." (Hyder 2006) Majlis attendees are given *tabarruk*, consecrated food, which varies from region to region depending on local cuisines. An ethnographic account from Karachi, Pakistan, notes that the distribution of food such as *halīm*, made of wheat, barley, lentils, and spices, with or without meat such as beef, mutton, or chicken, and water is held by many Shi'is to recompense for the oppressed who died while hungry and thirsty. *Sabils* (or stalls for the distribution of water by children to passersby) acknowledge the thirst of those on the battlefield who were cut off from water. Here, the breaking of the day of hunger and thirst, the 10th of Muḥarram, was observed with *halīm*, *roti* (a kind of round flatbread made with wheat flour), milk, and water (Schubel 1993).

Navrūz

The festival of Navrūz, "New Day," occurs at the spring or vernal equinox and marks the beginning of the Persian New Year. It has been celebrated from ancient times to the present in Persian civilization and is observed by Shi'ite communities influenced by Iranian culture as well as other faith communities in the Persianate world. The Achaemenid (559–330 BCE) and Sassanian (226–652 CE) kings celebrated the festival with public feasts and the giving of gifts, while the populace built fires and sprinkled water on each other. Among the customs observed by these pre-Islamic dynasties, the number seven figured prominently, and this ancient memory is still preserved in contemporary Shi'ite celebrations of Navrūz in the *haft-sīn* laid out on the table. The *haft-sīn*, "seven [items beginning with the letter] 's'," are *sabzeh*, wheat, barley, mung bean, or lentil sprouts specially sprouted for Navrūz, symbolizing rebirth; *samanū*, a wheat germ pudding symbolizing prosperity; *senjed*, dried silver berry or oleaster, symbolizing love; *sīr*, garlic, symbolizing medicine; *sīb*, apples, symbolizing health; *sumāq*, sumac, symbolizing sunrise; and *serkeh*, vinegar, symbolizing maturity and patience.

Navrūz marks new beginnings for both natural and spiritual worlds, just as springtime is essential for new growth, and divine revelation is essential for spiritual growth. This theme of renewal is expressed through growing sprouts from grains or lentils in small containers, and the resulting *sabzeh* is placed on the Navrūz table. Other offerings include decorated eggs, fresh fruit, baked goods, a mirror, a copy of the scripture observed by the household (in the case of Muslims, the Qur'ān), a bowl of water in which leaves and flowers are set afloat, and sweets. The Navrūz "season" lasts 12 days, and on the thirteenth day, the *sabzeh* is cast into a river to symbolize the flowing away of the previous year's troubles. Among some Shi'ite communities such as the Ismā'īlis, small packets of grain are handed out on Navrūz to denote blessings for the year (Kassam 2006).

Animal Rights and Muslim Vegetarians

The Qur'ān affords rights to animals, including livestock. Livestock have rights to water, pasture, and fair treatment (Foltz et al. 2003). Animals are recognized to live in communities, thus using an otherwise human category to show the value and respect animals deserve, including recognition of their relationships to each other (Foltz et al. 2003) (Q. 6:38). However, vegetarianism has remained

unpopular, even receiving negative attention from major theological leaders. Nonetheless, certain poets and mystic-Sufi historical figures ate vegan or vegetarian diets. A tenth-century poet named al-Ma'arri who avoided eating meat was accused of "trying to be more compassionate than God" (Foltz 2006). This serious accusation is called *shirk*, or sharing God's identity, comparing oneself or anything less than God with the unmatchable, unique divinity of the one God. For contemporary Muslims in diaspora, the choice to eat vegetarian becomes important when faced with meat raised in an inhumane manner or with growing concerns about the environmental costs of raising livestock, in addition to traditional concerns discussed above regarding *halāl* and *dhabīhah* slaughtering methods.

Modernity, Western Cultures, Industrial Agriculture, and Globalized Food

In many Muslim societies, traditional techniques valuing flavor and quality have given way to some extent to the industrialized techniques found in Western nations emphasizing quantity and economic value. Like other modernizing influences, food transformations have included both enthusiastic emulation of a transnational, industrial cuisine, as well as return to and revival of perceived traditions and rejection of outside influence. Both sentiments underlie cultural commitments and elements between fantasies of modernizing improvements and nostalgic hopes for cultural continuity, as modernity itself can give rise to nostalgia. However, New World foods such as the tomato and contemporary techniques such as frying largely have been indigenized. Some scholars of Middle Eastern foodways argue that such transformations are inevitably political. For example, "food nationalism" uses foods and narratives of food origins in constructing national identity (Zubaida and Tapper 2011).

Since the 1970s, international fast food can be found in Muslim-majority regions, though these establishments ride the political tide of US popularity. Anti-Western and anti-American sentiment can be targeted at these chains; thus, branches may close when the United States or pro-American political groups ebb in political favor (Heine 2004). McDonald's fast food is exotic, more costly than local food, and tends to appeal to youth interested in modernity via Westernization (Heine 2004). On the other hand, *ḥalāl* consumption has been on the rise among young Muslims in France as a means of expressing identity (Bergeaud-Blackler 2006).

Meanwhile, the global *ḥalāl* market is burgeoning, becoming further mobilized and professionalized within international commodity trading and industrial business models. The international *ḥalāl* food market is sizable, but entrepreneurs have an eye to expanding its reach, rendering more of the world's approximately one billion Muslims into globally traded *ḥalāl* food consumers. *Ḥalāl* advertisements and educational materials appear on the Internet, some emphasizing social media connectivity, reflecting a highly technologized setting to market products in a global trade environment.

In global food production, genetically modified organisms (GMOs) are recent developments, thus without Qur'ānic precedent, but subject to contemporary legal interpretation or lack thereof. Some Muslims consider GMOs to be dubious, falling into either questionable or not permissible categories. Others have considered and approved use of GMOs, allowing anything not named *ḥarām* in the Qur'ān. The Islamic Jurisprudence Council decided that GMOs can be considered *ḥalāl*. Some scholars propose that if a GM animal or plant food derives from pork or other *ḥarām* (impermissible) foods, then the GMO will also be *ḥarām*. If not, then the GMO is acceptable. Ali Maarabouni reports that religious leaders considering GMOs emphasize human responsibility for nature's health (Maarabouni 2003). Reflecting appreciation for nature as God's gift, these leaders asserted that if GMOs damage nature, then they should be prohibited, thus rendering GMO food labeling relevant.

Against the background of GMOs and international trade in *ḥalāl* products, Muslim organizations have arisen to promote eating locally and humanely raised *ḥalāl* meat from farms with fair

labor practices. In the United States, for example, the agricultural models utilized by Taqwa Eco-Food Cooperative (now Whole Earth Meats) in Chicago, Illinois, and Norwich Meadows Farm in Norwich, New York, provide an alternative to industrial agriculture, which is pesticide and technology intensive. Taqwa leaders envisioned their more traditional agricultural model to resemble that found in the Prophet Muhammad's era, a contrast to the serious ethical challenges to animal welfare found in factory farms and the large-scale, commercial meat industry.

Ending in Paradise: "Perpetual Gardens Graced with Flowing Streams" (16:31)

In Islam, paradise is literally "the garden," a lush land gushing with streams of milk and honey. In this blissful garden, food and drink are rewards for good works and right living (Q. 16:30–32, 52:19). Food represents not only practical physical nourishment but also spiritual fulfillment. Not only food, but drink is plentiful in the forms of water, milk, honey, and wine, listed as gifts from God in addition to forgiveness (Q. 47:15). Wine is the only *ḥarām* item that appears in blessed abundance in paradise, though other passages name paradisiacal drink as nonintoxicating (Q. 52:23, 56:18–19). Interestingly, the well-watered paradise appears comparable to a well-managed garden subject to a sustainable land ethic, perpetually abundant.

In al-Bukhari's *Al-Adab Al-Mufrad*, a tradition (*hadith*) of the Prophet Muhammad instructs people as they face the Final Day, "If the last day comes and you have a sprouting palm in your hand, plant it." Thus, agriculture remains religiously relevant even to the end of time.

Summary

Islamic food practices derive from the Qur'ān and *ḥadīth* traditions depicting the Prophet Muhammad and his close companions, who offered the best examples of how to live a morally righteous life with specific directions relating to food and animals. Multiple Qur'ān passages show the importance of food practices, delineating foods that are lawful (*ḥalāl*) or unlawful (*ḥarām*). Islamic legal scholars have interpreted specific text passages, which then influence food traditions in various Muslim communities. These communities can differ in legal interpretation, though alcohol, pork, blood, and carrion are commonly understood as unlawful. Feasts and fasts are central occasions for expressing and reinforcing Muslim piety, particularly Ramadan, 'Īd al-Fiṭr, 'Īd al-'Aḍḥā, Muḥarram, and Navrūz. Though Muslim vegetarianism is uncommon, land and animal protection is encoded in Islamic scripture and law, if underutilized. Contemporarily, food's industrialization and globalization influence (1) the global *ḥalāl* food market, (2) fast food's social role in Muslim-majority regions, (3) the current Islamic legal conversation on genetically modified organisms (GMOs), and (4) religiously motivated movements in Western cityscapes that embrace sustainable, *ḥalāl* agriculture. Finally, the Qur'ān depicts paradise as a garden flowing with streams and abundant with fruit. This paradisiacal vision resembles the resplendent results of a well-managed land ethic, yet represents spiritual fulfillment and the rewards for moral living.

Cross-References

- ▶ Animal Welfare: A Critical Examination of the Concept
- ▶ Fasting
- ▶ GMO Food Labeling

References

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Islam and Food and Agricultural Ethics

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Synonyms

Allah/God; Hadiths; Quran; Sunna; The Prophetic Sunna; Umma/community

Introduction

The Islamic religious tradition was founded in western central Arabia by the Prophet Muhammad in the seventh century CE, based on oral recitations that he received which he and his followers believed to be from Allah/God. Islam is an Arabic word meaning "submission," in this context to Allah, whose recitations to Muhammad by means of the archangel Gabriel continued for some 22 years and were known as the "Qur'an," meaning divine "recitation." Although the Prophet Muhammad was himself not literate ("able to read"), his followers eventually gathered the recitation chapters, known as Suras, into a canonical ("official, sacred") text which has descended since the founding period as the principal resource for Muslims (those who have "submitted" to Allah) to understand and obey their branch of ethical monotheism preceded by Judaism and Christianity with all three tracing their lineages back to the Patriarch Abraham (see the biblical book of Genesis, beginning with Chap. 11, concerning his life and influence).

Although the Qur'an is the most authoritative source for Islamic doctrine, worship, and law, a second authoritative source was produced based on the Prophet Muhammad's life and teachings as the tradition's founding father. This source is known as the prophet's Sunna, meaning the "custom," "way of acting" of a person, particularly of the Prophet Muhammad in this context throughout his years of leadership of the early Muslim community in the Holy City of Mecca and later in the base of the developing Islamic government in the northern city of Medina, where Muhammad and his companions settled following their *hijra*, "emigration," in 622 CE. The Sunna of the Prophet Muhammad contains many individual "reports," "events," and "quotations," known in their original Arabic language as *hadīths*. While these reports do not have the status of divine revelation, which the Qur'an is believed by Muslims to be, they are nevertheless of central importance when they address subjects, situations, and detailed information about practicing Islam correctly but not contained in the Qur'anic text. And since the Qur'an does declare Muhammad to be Allah's "Messenger" (*rasūl*, e.g., in Sura 48:29), that means a great deal in how the developing Muslim community regarded him as a vital source of guidance.

In this entry on food and agricultural ethics in Muslim life and practice, it is important to understand that many of Islam's teachings and standards are based on the Qur'an, Islam's holy scripture, and the Prophet's Sunna as found in many *hadīth* reports from several influential collections that were shared and published over the first two centuries of Islam's development into a major tradition among the world's religions.

Food and Drinks Addressed in the Qur'an

Food and potable liquids (lawful and unlawful) and their consumption and use are treated in the Qur'an to some extent. In Sura 2:172–173 Allah declares: "O ye who believe! Eat of the good things that We have provided for you and be grateful to Allah, if it is Him ye worship. He hath only forbidden you dead meat, and blood, and the flesh of swine, and that on which any other name hath been invoked besides that of Allah" (all Qur'an translations by A. Yusuf 'Ali). There is some flexibility for persons who need nourishment in an emergency situation, as the second verse advises, "provided there is no willful disobedience, nor transgressing due limits – then he is guiltless. For Allah is Oft-Forgiving Most Merciful." The Qur'an requires Muslims to eat only meat that has been consecrated to Allah. There are also stipulations about how meat has been slaughtered, obtained, treated, and prepared. Generally, the Qur'an permits Muslims to eat food of the People of the Book – Jews and Christians – which "is lawful unto you and yours is lawful unto them" (5:5).

Pork is of course not permitted for either Muslims or Jews. In addition to the forbidden foods already mentioned, "Forbidden to you (for food) are . . . that which hath been killed by strangling, or by a violent blow, or by a headlong fall, or by being gored to death; that which hath been (partly) eaten by a wild animal. . ." (5:3). And wine or any kinds of intoxicants are not permitted for Muslims at all. The Qur'an states that intoxicants and gambling are part of Satan's plan to "excite enmity and hatred between you [i.e. Muslims] . . . and hinder you from the remembrance of Allah and from prayer: Will ye not then abstain?" (5:91).

There is a sense of the diets of Arabs in the dawn years of Islam's development by mention of specific foods in the Qur'an. In 2:61 the followers of Moses wandering in the wilderness with him and eating manna and quails saying: "O Moses! we cannot endure one kind of food (always); so beseech thy Lord for us to produce for us of what the earth groweth – its pot-herbs, and cucumbers, its garlic, lentils, and onions." The Qur'an mentions several fruits (e.g., pomegranates, dates, figs, grapes, and olives), not in a manner that might remind one of a cookbook but in symbolic ways bearing on the many wonderful "favors" provided by Allah for humans and whether they will be ungrateful, deny, or misuse them. Cow's milk and honey are mentioned (16:66–68) as valuable foods, but not to the extent of fruits. Land game is permitted generally for hunting and eating, but not for Muslims in sacred precincts such as Mecca and while wearing pilgrim garb (5:96). Catching "water game" (fish, water fowl, etc.) is permitted for Muslims whether at home or while traveling. In 6:141 there is a statement about wonderful foods that Allah has provided for humankind as well as for other living beings (by implication) ending with: "But waste not by excess: for Allah loveth not the wasters." (A generously detailed, sophisticated article by David Waines, about what has been discussed here, is cited in the Reference List following this essay.)

The Hadith on Food and Drinks

There is a considerable amount about foods and drinks and how they should be obtained and managed in the Hadith literature (the Prophetic Sunna) that reflects what is found in the Qur'an, except that in the Hadith literature it is found in considerably greater detail, extending to social etiquette. The following are some examples of this last category (all quoted from *A Manual of Hadith* 1988):

> 'Umar [a leading Companion] said, The Messenger of Allah (peace and blessings of Allah be on him) said: 'Eat together and do not eat separately, for the blessing is with the company.' (p. 356, no. 25)
>
> 'Umar ibn Abu Salamah said, 'I was a boy being brought up in the care of the Messenger of Allah (peace and blessings of Allah be on him) and my hand was active in the bowl, taking from every side.' So the Messenger of Allah (peace and blessings of Allah be on him), said to me, 'Boy! Say *Bismillāh* [In the Name of Allah.] and eat with thy right hand and eat from the side nearest to thee.' So this was my manner of eating afterwards. (p. 352, no. 16)

> Hudhaifah said, ... I heard the Prophet (peace and blessings of Allah be on him) say:'Do not wear silk or silk brocade, and do not drink in vessels of gold and silver, and do not eat in bowls made of them; for they are for them in this life and for us in the next. (p. 355, no. 22)

There are examples of Hadith literature elements of a social ethic that are found both in the Qur'an and the Prophetic Sunna traditions. As for Muslim teachings concerning agricultural ethics, there is a considerable concern for how Muslims should respect and cooperate for the general well-being of the Umma – the worldwide Muslim community – as well as for other peoples with whom they may be neighbors sharing lands, resources, markets, and social as well as political and legal situations and institutions.

Agriculture in the Muslim World

Ibn Khaldūn (1332–1406 CE) was a great Arab historian who traveled far and wide through the Muslim world of his era. He wrote a very influential three-volume work, the *Muqaddimah* ("Preface"), on how he viewed history, science, literature, and much else within the Muslim context. He had studied ancient agricultural texts extensively down to his era and considered *filāha* (agriculture) to be a branch of physics and needing to attend closely both to practical matters such as planting of crops and their treatment, as well as "their preservation from things that might harm them or affect their growth, and all things connected with that." He wrote that sufficient books "are available" to meet the peoples' needs in this critically important dimension of life. So, some sort of agricultural ethical discourse was clearly known to be essential in Ibn Khaldun's time and over many previous centuries in the Muslim world and beyond to ancient times.

Muslims profoundly revere their global faith community, known as the Umma, an Arabic term, and their worship practices reveal this by their relatively uniform character, which is set forth in the Qur'an. But the Qur'an has more to say concerning what can constitute an *umma*: "There is not an animal (that lives) on the earth, nor a being that flies on its wings, but (forms part of) communities [*ummam*, i.e. "ummas"] like you. Nothing have We omitted from the Book, and they (all) shall be gathered together to their Lord in the end" (Sura 6:38). Passages such as this open up the boundaries of what environmental ethics should consider, particularly when humans desire to accept Allah's invitation to be His vicegerents, "caliphs" (*khalīfa*) on earth. To be a caliph who applies Allah's environmental teachings in their stewardship on earth is a major commitment, indeed.

In the present era, there is ever-increasing attention being paid to agricultural and environment ethics by Muslims across the global Umma/community. Numerous websites address this in various ways with essays, reports, invitations to participate, descriptions of specific practices in widely diverse regions of the Muslim world, and much more. While Muslim websites show advanced awareness of and absolute need for contemporary scientific and technological developments and opportunities directed at protecting and conserving agricultural and indeed other important natural environments, as well, they often clearly state the Islamic religious and theological principles and practices that they are committed to as the most important factors in agricultural and environmental ethics. Central to an Islamic agricultural/environmental ethic is a strong commitment to ***stewardship*** as the means by which Muslims obey and live by Allah's commandments with respect to caring for the magnificent and life-sustaining natural world He created for us and all living creatures.

One website carries a perceptive article by Hanane Karimi that seeks to lead Muslims toward a "sustainable world" by means of an "ethical perspective concerning the environment." This is seen to be a "challenge initiated by eco-theology" based in thorough studies of religious and ethical "resources that make sense for the Believers." Although this website is directed principally toward Muslims, there is a strong sense of welcoming cooperation from dedicated "Believers" of neighboring faith traditions, as well. The author draws equally upon traditional Islamic ethics concerning stewardship of the environment but joins it with modern

environmental ethics, particularly as developed by the American environmental activist Aldo Leopold (1887–1948) whose pioneering ecological advocacy and writings, as Karimi remarks: "...put bio-centric ethics into practice, with the conviction that each organism is a teleological center of life of which the value is intrinsic" (Karimi, p. 1).

Another website provides a list of four "Islamic Agricultural Techniques," by Taylor Echols, that clearly belong in any discourse on agricultural ethics in Muslim contexts. The four techniques (all listed on the single page of the report) are as follows:

"**The Islamic Agricultural Revolution**." This is the range of processes that enabled the early developing Islamic civilization in the arid and high-temperature regions of the North African to Nile-to-Oxus regions of the world to develop such techniques as advanced irrigation systems, water storage, crop rotations, fertilizers, and related things. The traditional techniques are still of great value alongside modern techniques.

"**Water and Irrigation**." Continuing need and development, as always, in arid, high-temperature regions.

"**Advances in Islamic Agriculture**." Advanced tools and processes for cultivation and care of plants and animals. Factory farms are parallel to such increasingly influential developments in the rest of the world, as well. Increased populations generate growing demands for foods of many kinds and in large quantities. Genetically modified food crops are increasingly accepted by Muslim growers and their clients (more on this below).

"**Organic Islamic Agriculture**." Muslim nations are embracing organic agricultural techniques as is much of the rest of the world. Many Muslims do express concerns about possible violations of legally required *halal* purification practices, because of the potential threat in some organic technical processes in newly invented food product developments which may incorporate *haram* ("forbidden") elements (such as a chemical derived from a pork source).

GMOs: Genetically Modified Organisms in Muslim Contexts

Muslim populations across the Umma tend to permit the development and use of genetically modified organisms (GMOs) for the production of food. Ebrahim Moosa, in a well-researched survey article under the title "Genetically Modified Foods and Muslim Ethics," remarks that "What GMOs present are a whole series of challenges about which Muslim ethics is as ambivalent and undecided as other religious traditions. At best, Muslim ethics on a range of bioethical and scientific challenges can be described as a work in progress. Most surprising is the dearth of Muslim ethical deliberations on this topic" (Moosa 2009, p. 140).

Moosa discusses GMOs as "manageable risk," based on guidelines that the Saudi-based Council for Islamic Jurisprudence (CIJ), which has addressed GMOs since ca. 1998, has set forth. In the guidelines, CIJ declares: "It is permissible to employ genetic engineering and its attendant products in the sphere of agriculture and animal husbandry. This is allowed on condition that all necessary precautions be adopted in order to prevent any kind of harm – even on a long-term basis – to humans, animals and the environment" (Moosa 2009, p. 142). The CIJ insists that all products in the human food and medical chains that have been affected by "genetically engineered substances" should be clearly disclosed to consumers.

Moosa concludes his technically sophisticated article in an open-minded way: "Religious authorities take a very pragmatic approach in evaluating biotechnology associated with GMOs. Since there is no compelling evidence that GMOs can harm the body, coupled with the fact that it is rare that prohibited transgenes are used in food, Muslim religious authorities are willing to give GMO-producing bio-technology the green light. Whether the long-term environmental impact of frontier biotechnology will be subject to serious ethical and moral scrutiny within Muslim quarters is not always evident. However, there is some hope that those who adopt a precautionary approach might be

instrumental in expanding the parameters of the debate and thereby bring a larger set of issues and concerns into ethical and discursive purview" (Moosa 2009, p. 155).

Summary

This entry addresses in brief fashion how food and agriculture are understood, produced, and used within the spiritual, legal, social, economic, ethical, and cultural contexts of Islam, the monotheistic world religion whose name means "submission" to Allah ("God"), by the religion's followers, who are known as Muslims, meaning "those who have submitted." Islam has two principal textual sources for its teachings and practices. The scriptural book known as the Qur'an, which means "recitation," is the most authoritative source for Muslims who believe it descended from Allah to the human being Muhammad, who through this process became a prophet who spread Allah's divine message for His human creatures to follow and share. The second most authoritative sources are the reports of words and actions of Muhammad that were collected over time by the Prophet Muhammad's early companions and the steadily growing community of Muslims after the Prophet's passing. They were eventually compiled into a major collection known as the Sunna. This essay contains quotations on the subject from both the divine Qur'anic scripture and the deeply influential human words and deeds found in the Prophet Muhammad's Sunna. The essay then proceeds to describe and explain in general how Muslims over many generations have practiced agriculture and cared for the natural environment, which is believed by them to be a commitment to stewardship, caring for God's created world as His trusted agents. The essay concludes by addressing a revolutionary scientific development for agriculture in today's world, not only among Muslims but in the earth's diverse human communities across the global landscape. This area of interest and importance is the increasing use of genetically modified organisms (GMOs) for the production of food.

Cross-References

- ▶ Environmental Justice and Food
- ▶ Islam and Food
- ▶ Law and Regulatory Mechanisms for Food and Agriculture Research
- ▶ Water, Food, and Agriculture

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