Islamic Legal Perspectives on Genetically Modified Food

Anke Iman Bouzenita

Abstract

Genetically modified food (GMF) is part of our reality as consumers worldwide. The techniques and possibilities involved require an Islamic legal (*fiqhi*) study in order to determine the assumptions underlying its consumption, production, and related research. This paper places the study of GMF within a holistic context by taking into consideration the societal background and rationale within which it has been developed. It investigates the possibility of transferring such *fiqhi* devices as *istihalah* (chemical transformation), *istihlak* (extreme dilution), and others to GMF in regard to combining genetic material from permissible and non-permissible sources; raises several questions and concerns about using the *maqasidi* scheme; and discusses GMF's permissibility under the aspects of changing creation or "harnessing nature."

Introduction

The acronym GMF stands for genetically modified food products of either animal or plant origin with an "engineered" genetic blueprint. The possibilities of recombined DNA in the realm of food and pharmaceutical production are vast and have only begun to be explored. What has already been genetically modified and devised, and what can be devised in the future, raise various questions and concerns. From the Islamic legal (*fiqhi*) perspective, the legally responsible person (*mukallaf*) is asked to follow Islamic

Anke Iman Bouzenita is assistant professor at the Department of Fiqh and Usul al-Fiqh, International Islamic University, Kuala Lumpur. She obtained her M.A. and Ph.D. from Ruhr-Universität Bochum, Germany. Her publications and research interests cover the history of Islamic law, Orientalism, international relations, and Islamic perspectives on bioethics. She can be contacted at bouzenita@iiu.edu.my.

legal rules with every action he/she takes. This applies to researching, producing, and consuming GMF as well as to any other human activity. This paper attempts to assess the reality of such food and examine the Islamic legal reasoning and concepts that may be applied to it.[1]

Inserting new characteristics into an organism requires that its DNA be altered. The technique involved, referred to as "recombinant DNA," consists of combining DNA molecules from different sources into one molecule to create a new set of genes. This DNA is then transferred into an organism, thereby giving it modified or novel genes.[2] Recombinant DNA techniques may involve bacteria or viruses as vectors to carry recombinant DNA.[3]

The Reality of GMF

GMF has already become an aspect of our daily life as consumers. In most parts of the world, people are – usually without knowing – already consuming it. Genetically modified organisms (GMOs), on the other hand, developed for human consumption have been vehemently rejected in a number of European countries. Consumer protests have resulted in an initial ban on GMF in some countries (e.g., Austria), although we can perceive that the initially quite restrictive policy is currently being loosened. Other major industrial countries, such as the United States and China are, in general, more GMO industry friendly in their legal and economic policies.

Currently, various transgenic plants and livestock designed for human consumption, as well as highly processed foods containing genetically modified products, are already on the market; others are still in the trial stage. Transgenic plants incorporate potatoes, tomatoes, corn, soy, and others; medical applications (e.g., producing transgenic animals that produce medicine, enriched milk, or eggs) are still under development. Transgenic plants that are engineered to produce some type of medication include tobacco leaves (CropTech Corporation), corn producing human monoclonal antibodies against rheumatoid arthritis (Biolex Therapeutics), and trypsin for the biomedical research market (ProdiGene). Other trials for medical purposes can be added.[4] Transgenic bananas containing inactivated viruses that cause cholera, hepatitis B, and diarrhea are currently under evaluation. Consuming these bananas would immunize the consumer against these illnesses.[5]

Pathogen resistance seeks to engineer resistance to viruses. A transgenic variety of papaya known as UH Rainbow, which is now produced in Hawaii, has been engineered to be resistant to the papaya ringspot virus.[6] In the field of agricultural production, genetically modified plants and, to a lesser extent,

genetically modified livestock are already a reality. Globally, 50% of all soybeans are transgenic. In the United States, 90% of all soybeans and 75% percent of all corn are genetically transformed.[7] The traits engineered into the crops, which incorporate qualitative and quantitative changes,[8] can be summarized as falling under the classification of resistance against insects and pathogens, herbicide tolerance,[9] and faster growth. In the realm of livestock, Aqua Bounty Technology's transgenic salmon, which has a faster and higher growth rate, has been strongly criticized because it decimates the natural fish population by outcrossing.[10] Several companies are currently developing transgenic faster growing sheep, pigs, turkeys, and other animals.[11]

The leading nation in the field of GMF is the United States; China is, however, aggressively promoting the market with new developments. In fact, as of 2005 China claimed 141 types of transgenic crops with 65 field trials.[12] Europe has seen consumer activists protest GMF and is generally more sensitive to the issue. Malaysia was the first ASEAN member state to approve the importation of herbicide-tolerant soybeans for use as food[13] and declare biotechnology a national priority.

Contemporary *Ifta'* and the *Maqasid* Scheme

Contrary to the unanimous prohibition of human cloning, most *fuqaha'* do not advocate a ban on cloning or the use of genetic engineering on animals and plants. Here, increasing agro-economic production and "improvement of the kind," exactly the same argument raised against human cloning, is praised and presented as the benefits of genetic engineering.

In 1997, The Islamic Fiqh Academy in Jeddah issued the following statement:

> It is legally permissible (in Islam) to make use of the techniques of cloning and genetic engineering in the fields of bacteria and other microbiological organisms as well as animals and plants, in the framework of the Islamic legal (*shar`i*) rules, in what realizes benefits and turns away harm.[14]

Since the first steps in genetic engineering have been undertaken, a number of reputable scholars have announced their rulings on related questions. Syrian scholar Wahbah al-Zuhayli clearly advocates the benefits that this kind of cloning promises to humanity, among them increasing plant productivity and using animals for pharmacological aims. Reproducing animal or plant cellular material in the lab, changing the qualities of their genes, and

removing genetic defects are all permissible, for doing so either benefits humanity or removes a particular harm from people, provided that research abstains from playing with creation and avoids things that are of no benefit.[15] Nasr Farid Wasil, former chief Mufti of Egypt, expounds on the permissiveness of anything that benefits humanity (e.g., healing incurable diseases, increasing the water supply, and fighting poverty) but does not involve experimenting on human beings. Such measures are demanded by Islamic law (*matlub shar`an*).[16]

More often than not, the question of biotechnology in food and elsewhere is answered on the basis of a scheme of benefit (*maslahah*) and harm (*madharrah*).[17] It is quite striking that the *fiqhi* discourse on GMF remains in the generality of this paradigm without going into the details of *shar`i* benefits and harms, assessing their authenticity and conditions with regard to GMOs, and weighing them. As a matter of fact, a close scrutiny of some cases reveals that the paradigm itself runs the risk of being superseded by a rather materialistic value system, for whatever is considered a "benefit" within a system based on profit maximization is not necessarily "beneficial" in the sense of *maqasid al-shari`ah*. Negative side effects like free and uncontrolled plant mutations, not to mention the possible effects on human health or the equilibrium of creation, are hardly discussed as potential "harms." Another striking characteristic in the scholarly discussion to date is the almost complete absence of any consideration of the probability factor, which is inherent to experimental sciences. What *might* accrue in terms of benefit is often treated as a real or existent benefit, whereas the potential dangers remain unconsidered.

In the field of genetic engineering generally and GMF particularly, *ifta'* (the process of giving Islamic legal verdicts) hardly evaluates holistic considerations. There are several reasons for this: *Ifta'* generally relates to an individual case and is thus an isolated legal statement on a particular case. Furthermore, it is commonly enacted as a reaction to cases arising from a non-Islamic background and, in the absence of Islamic governance, mistaken for policy making. It may well be that a mufti looks at a particular genetically modified potato and, after investigation, finds no reason to declare its consumption *haram*. However, he ought to be aware of the economic and political rationale for this product's existence *and* the implications of his fatwa. If he simply declares the end product *halal*, he automatically gives the green light for its import, trade, production, and research. These diverse fields, however, may be subject to different considerations. In other words, before declaring it *halal* we should ask some questions: Why should anybody

genetically modify this potato? What is the underlying rationale? What procedures are involved? What consequences will it have on the environment, human health, and the local and global economies? After considering all of these factors, even consuming this potato may deserve a second and third thought. Reducing *fiqhi* deliberations on GMOs to *ad hoc* fatwas that are separated from the larger context may be harmful.

Another reason concerns the contemporary bodies involved in *ifta'*. Generally, we can say that they lack the necessary scientific expertise. With knowledge becoming more and more specialized, scholars involved in the various scientific fields and subfields must exchange their knowledge, as has been demanded repeatedly.[18] Given that a holistic understanding all of the related issues related is needed before an appropriate legal ruling is announced, those involved must understand the Islam and science paradigm as well as the now-predominant secular model of science. They need to realize that new developments like biotechnology have emerged from and are developed within a non-Islamic model. Without being aware of the differences between these models, they run the danger of applying Islamic principles extracted from the context of their sources, rationales, and objectives.

The rationale for biotechnology's existence as regards food, as well as its objectives, need to be evaluated along with the relationship between Islam and science and its contemporary actualization. Therefore, this paper deliberates the Islamic legal perspectives on GMF while incorporating these holistic aspects.

The main feature of the prevalent secular (capitalist) model is the separation of life from any relation to the Hereafter. Capitalist concepts of life overemphasize materialism, which turns into both hedonism and exploitation. Happiness is defined as accumulating an ever-increasing amount of material assets and satisfying artificially created needs. Globalization has finalized the proliferation of a politico-economic model that had already started in the wake of colonization. In contrast to this, the *Islamic model of science* may be described as *science as developed within the framework of an implemented Islamic reference system*.[19] It is not necessarily a scientific model derived from the Qur'an and Sunnah, but rather a model that develops within the framework of their rules and guidelines and does not contradict their implications. Muslims and non-Muslims working within this framework and observing Islam's commands can make specific contributions. Research findings or techniques that do not contradict this framework can be incorporated. Research questions and applying the results of research are in line with the macro framework and conditions, as specified by Islamic law.

The realization of this model is not part of our contemporary reality. In the best case, an individual Muslim scientist will be aware of the need to check the Islamic suitability of his/her research. The public discourse is still characterized by the paradigm of reacting, either positively or negatively, to what has been developed in a different framework.

The secular model's separation of this life from the Hereafter clearly undermines any sense of responsibility when dealing with resources, the environment, and human and animal life, an attitude that is in diametric opposition to Islam's commands. Science takes place in this system, and no scientist working within this globally predominant model is isolated from the value, political, and economic systems surrounding him/her, be it in the originally non-Muslim countries or the Muslim-majority countries of today. The impact on research can be twofold: (1) there are very practical limitations in terms of research funding and (2) the scientist might already have self-censored his/her intellectual creativity by "streamlining" his/her research or considering a research result's marketability first. Within this system, Allah's creation is no more than an asset, an exploitable resource. If we do not recognize the function and impact of the value system underlying the prevalent societal model, we run the risk of remaining in its paradigm.

The Underlying Rationale for GMF

With all the variety of provisions (*rizq*) that Allah has provided in the manifold kinds of permissible food, vegetables and fruits, meat, cereals, dairy products, and others, why should people try to genetically modify what is already available in abundance? The industries involved claim that improving the quality and quantity of food suits the demands of an ever-growing world population: Vitamin A-enriched rice to fight the consequences of malnutrition among Third World children, the faster growing of fish or chicken, pesticide-immune maize plants to feed the growing world population – all of these, and many other reasons, are presented as part of this inspired agenda. Or are they? Some critical scientists beg to differ.[20]

Upon closer scrutiny, we observe that most of the engineered characteristics (viz., faster growth, herbicide tolerance, insect and pathogen resistance, and longer shelf life) are either expressions of trying to overcome the side effects of aggressive and highly exploitative monocultural farming methods, as used in or promoted by the industrialized nations, or are otherwise embedded in a system of profit maximization. Herbicide tolerance, for

instance, is engineered because herbicides are vital to increasing the output of crops in monocultural farming. In addition, herbicide-tolerant crops can withstand huge amounts of herbicides that would kill any "traditional" crop.

This kind of profit-maximizing engineering does not consider how overusing herbicides affects the environment and the ground water, the consumer who involuntarily takes in even larger amounts of chemicals with his/her regular diet, and the emergence of superweeds due to outcrossing (viz., transferring genetic modifications to wild plants or other crops). Given that the monopoly on these transgenic herbicide-resistant plant seeds will belong to the same monopolist who provides the matching herbicides, the circle of dependence is closed. In other words, genetic modification here stands for the attempt to amend the mistakes of an aggressive non-sustainable agricultural system with an even larger mistake, the effects of which on the natural order of creation cannot be estimated.

Monocultures are prone to be a favorite feeding and breeding ground for highly specialized insects, which then turn into pests. Insect resistance is engineered into agricultural plants with genes from other species that produce biotoxins, which eventually pass into the plant's tissue and cause larvae feeding on it to die at an early developmental stage. Among the negative effects of this "pest protection" is that the targeted insects develop resistance over time. The total amount of insecticide released into the environment is not reduced, and useful insects are also among the victims. It is also to be expected that if this characteristic is outcrossed, the overall plant-insect equilibrium will be affected.[21] People ought to be aware, however, that crop heterogeneity and alternative agricultural methods may offer natural pest control alternatives.[22]

Another genetic modification that speaks of changing creation in favor of a particular economic system is prolonging the shelf life of certain crops, such as tomatoes.[23] It bears repeating that such modifications are designed to suit the demands of profit maximization within a capitalist economy; they do not feed the poor or enhance the quality of life.

In the end, genetic modification in agriculture offers expensive non-sustainable solutions to problems caused by a non-sustainable agricultural system and is very quick to offer the same kind of problem-creating "solutions" to those problems caused by the initial ones. Sonja Schmitz, a molecular biologist who left her position with DuPont, writes: "Agricultural biotechnology is producing commodities whose sole purpose is to profit the industry that makes them."[24]

Islamic Legal Deliberations

Muslim scientists should look into the permissibility of GMF from the angles of research, production, and consumption. The reason for this division lies in the fact that although consuming some GMFs (e.g., tomatoes that incorporate fish DNA) may lack enough evidence to justify prohibition, this does not necessarily mean that Muslims should begin researching and producing these foods. Unfortunately current rulings focus upon consumption, and thus do not spend any time deliberating the issues of research and production, which means that it is conceivable that the verdict related to consumption will be extended to other fields as well.

From a Muslim consumer's perspective, the first thing to be subject to scrutiny would be the kind of genetic manipulation involved. Given Islam's dietary rules, the first question to be asked is whether any non-*halal* substance is involved "in the making" of a particular product. On this basis, I will look into the *consumption* of GMF first.

The *a priori* rule on all substances, including food, is their permissibility (being *halal*) and purity (*taharah*), unless there is evidence in the Qur'an and Sunnah that prohibits them. The legal maxim for this guideline is *al-asl fi al-ashya' al-ibahah ma lam yarid dalil al-tahrim*, upon which the majority of scholars agree.[25] This general guideline goes back to several Qur'anic verses, among them: "He is the One who created for you whatever is on Earth" (2:29) and "Did you not see that Allah made subservient to you whatever is in the heavens and Earth?" (31:20). Therefore, all substances are permitted unless explicitly prohibited (e.g., pork, spilled blood, meat not slaughtered Islamically, and impure animals [e.g., mice, animals and birds of prey, domesticated donkeys, and others]).

Whatever food is publicly available in Islamic countries is considered *halal*, for it is presumed that slaughtering, production, and processing follow Islamic rules. But with the large amount of food and processed ingredients being imported from non-Islamic countries, not to mention the laxity or negligence in controlling these products, the question needs to be raised as to whether this original general permissibility still applies. Can we suppose that it applies to GMFs, given that they may combine the DNA of various *halal* or *halal/haram* organisms?

It seems that most of the fatwa councils worldwide have pronounced GMF permissible, provided that no *haram* substances have been used. The major *halal* certifying institutions have accepted this ruling, among them the Islamic Jurisprudence Council (IJC) and the Islamic Food and Nutrition Council of America (IFANCA).[26] The Indonesian Ulema Council has also

agreed, "as long as it comes from plants."[27] Concerns have been raised, however, about GMFs incorporating genetic material of non-*halal* origin. I will look into some aspects directly related to consumption that seem to have been neglected in these fatwas so far.

Upon first sight, a genetic combination of a fish and a tomato may, from a formalistic legal viewpoint, seem unsuspicious. But even if the consumer does not sin by consuming GMOs, the question remains as to whether their consumption is recommendable for Muslim or non-Muslim consumers alike. To illustrate further, eating the fish-tomato GMO product does not compare to eating a tomato-tuna salad. In which ways, we should ask, might this GMO affect the consumer, and what are the potential harms? Might the potential harms inherent to these GMOs be so overwhelming that their consumption ought to be restricted or banned?

Although the *fuqaha'* refer to the *maqasidi* scheme of benefits and harms, there are certain flaws in applying it, such as most of the possible harms remain unmentioned and the economic benefits of a restricted group may be mistaken for authentic *shar`i* ones. As our immediate question here is the possible health effects on the consumer, it may be most appropriate to start with the legal maxim *al-darar yuzal* (harm should not persist), which has its root in the Prophet's hadith: "There shall be no harm nor reciprocating harm." According to al-Suyuti, one of this hadith's subordinate guidelines is: "Warding off harm has priority over attracting benefits" (*dar' al-mafasid awla min jalbi al-masalih*). "If benefit and harm are opposing each other, warding off the harm is mostly preferred, as the preoccupation of the Lawgiver with things He has forbidden is stronger than His preoccupancy with what He has ordered."[28]

On this basis, I take a closer look at the benefits and harms of GMOs for human consumption. In the Islamic context, the considered benefits (*masalih*) have to be established as *shar`i* benefits, namely, that the texts testify to their authenticity and thus accord with the higher purposes and limits set by the Lawgiver. Al-Ghazali (d. 1111) emphasizes the difference between the Lawgiver's intended benefits, which need to be observed, and the benefits defined as such by human beings.[29] As the preceding chapters have shown, the real purposes and rationale behind GMOs are not necessarily valid *shar`i* benefits. Further scrutiny may show that there are texts establishing the benefit involved as nullified (*mulghat*), for example, as an imaginary benefit that the Shari`ah has already ruled out and, therefore, must be discarded.[30]

If we were to classify the benefit involved in this case as one that does not originate in the texts, either in its positive or negative (unrestricted ben-

efit/*maslahah mursalah*) aspect, and wanted to follow al-Ghazali's criteria for the acceptance of such,[31] we would conclude that (1) the benefit involved does not qualify as a necessity (*darurah*), in the sense that GMF meets none of the Shari`ah's established objectives (viz., protecting religion, life, intellect, offspring, and property) on an essential level; (2) it is not definitive (*qat`i*), for its realization is anything but certain; and (3) it is not universal (*kulli*), as it has neither cured world hunger nor benefited humanity, as propagated; rather, it has turned out to be an economic asset for a limited number of multinational companies. With patenting and copyright rights being active, it has already proven to be yet another means to curb, rather than enhance, development for those who need it most: the developing countries.

Enacting the Shari`ah's objectives requires that its first and primary objective – implementing the Islamic way of life – be realized, a fact that is often neglected. If this is the case, and if Islam's value system and legal rules were enacted *in toto* so they could serve as a basis for Islamic ethical considerations, it might be possible to determine the benefit or harm of a particular case according to an Islamic basis. With the absence of the Islamic model and the prevalence of the secular capitalist worldview, however, any evaluation of what is considered as a benefit or a harm runs the risk of remaining within the confines of a materialistic value system that considers "beneficial" to be that which yields material profit and "harmful" to be whatever stands in its way.

GMF advocates and others often argue that no substantial evidence exists to prove that GMF is dangerous for human consumption. As a matter of fact, such evidence demands independent long-term research, for any ensuing negative health effects may only appear after decades. But the question remains as to whether these effects could be traced back to their origin, given the growing complexity and interdependence of the mechanisms involved.

Side effects on the consumer have either not been sufficiently researched or the research has been carried out by the very companies that advocate GMF usage. Independent research hardly exists as critics, mainly in NGO platforms, frequently comment.[32] While some negative side effects are distinguishable, others will probably only materialize after years of consumption. In addition, such research will naturally focus on what is already known. We should not forget that since GMF is a new phenomenon, science may not know which side effects to search for in the first place, so that some phenomena appearing decades later may not be linked back to it at all. Prior to the arrival of GMF on the scene, human cultural history recorded mani-

fold changes in our diet. Humanity has had ample opportunity to gradually adapt to these changes. The quantitative changes in nutrition introduced by GMF, however, have no historical precedent, and the knowledge about possible side effects is with Allah alone.

It is to be expected that transgenic food products, especially when not labeled, make people more susceptible to allergies.[33] The case of the Brazil nut allergy may serve as an example here: The gene for the allergenic trait has been introduced unintentionally into soy beans, together with the intended characteristic, with the result that people allergic to Brazil nuts have proven to be allergic to soy beans, although no previous allergy to this latter product existed.[34] The consequences for those affected are immense, as soy and its derivatives are found in a large quantity of industrial food products – very often without being labeled as such.

Toxic effects as well as antibiotic resistance are other immediate health issues that may be added to the negative list.[35] British scientist Arpad Pusztai, who examined the effects of genetically modified potatoes on animal nutrition and the environment, found harmful effects on the experimental rats' guts, bodies, metabolism, and immune system. He was forced to retire after publicly articulating his concerns by remarking that he would not eat GMF and found it "very, very unfair to use our fellow citizens as guinea pigs."[36]

As a matter of fact, GMF is still in a trial phase. We do not know which changes in our food's genetic material may occur that have not been deliberately "engineered" as side effects, or how they may change or influence our own genetic setup and metabolisms.[37] Is it justifiable to expose millions of consumers to a gigantic field trial with nutrition when the negative effects and possible harm to our health, not to mention the environment and the ecosystems, are unknown?

Some countries have banned GMOs for human consumption but allow it as animal feed. With human beings standing at the top of the food chain, the possible negative side effects of this decision will be retarded or delayed – but not prevented. In this respect, we may think of the effect of critical animal feed in the dissemination of mad cow disease, officially known as Kreutzfeldt-Jakob's disease.[38] As for consuming GMF that incorporates only *halal* substances, this may be considered permissible on a superficial level. The consumer who knowingly consumes such food does not sin by doing so. In light of impeding health dangers, however, a conscious consumption of GMOs ought to be avoided and the relevant authorities should do what they can to protect consumers from all expected and unexpected side effects.

At this point in time, a great deal of insecurity surrounds GMOs for human consumption. In the absence of hard data as to such food's effect on human health, they ought to be treated as doubtful and avoided, just like any other harmful food. The case may be different if the food in question has proven to be so harmful that anyone who knowingly and intentionally exposes his/her life and health to it may suffer major harm. In this case, a straightforward prohibition would be appropriate.

Importing such GMOs into the Islamic world ought to be restricted as much as possible. The relevant authorities should take all necessary steps to enforce labeling laws and leave the final choice to the informed consumer. Again, the initial question should be that of the rationale for GMF's existence. Is there an authentic need to produce such food, or is the "need" no more than pursuing the material interests of the producers involved?

GMOs Incorporating Non-*Halal* Substances

In an Islamic context, non-permissible organisms and substances (e.g., pigs, dogs, mice, birds and animals of prey, or even animal droppings and other waste products) cannot be used to produce food. At this point, the different models and approaches of science and their embeddedness in a particular way of life come to bear. The question remains, however, as to whether Muslims may consume GMF that contains genetic material from such non-permissible organisms and substances, given that a great number of processed foods, fruits and vegetables, dairy and meat products sold in the Islamic world are produced in and imported from non-Islamic countries. The scenario of GMF combining non-*halal* substances is far from being unreal. In 2000, a mono-sodium-glutamate product on the Indonesian market had to be withdrawn after the multinational company was accused of having used porcine-derived enzymes.[39]

In answering this case, different approaches have been alluded to in the relevant literature. It seems, however, that a substantial *fiqhi* research on GMOs that goes beyond a very general *maqasid* scheme is so far lacking. For this reason, I will expound on some related *fiqhi* principles and mechanisms and discuss their transferability to this case.

Istihalah, according to the *fuqaha'*, is "the change of the substance or transformation of its reality into a different reality."[40] According to a more modern specialist definition, it is "the change of a substance into another, different substance, with different physical and chemical characteristics, as a result of chemical changes in the elementary structure of the substance."[41]

The chemical transformation of a substance has been described by the *fuqaha'* with regard to wine (*khamr*) turning into vinegar. According to the majority view, alcohol is considered impure (*najis*) but may become pure by being transformed into vinegar. Decisive for vinegar's permissibility is that, first, the prophetic hadiths testify to it, and, second, the *`illah* (rationale) for prohibiting alcohol, its intoxicating quality, is not found in vinegar. As "the legal rule (*al-hukm*) turns with the rationale (*`illah*) in presence and absence," vinegar is therefore not forbidden. It would be prohibited, however, if the transformation took place via an external influence, for instance by inserting bread, salt, or other substances into the wine or moving it from the sun into the shadow or vice versa.

The majority of scholars agree that inducing the transformation process artificially does not render the resulting vinegar pure (*tahir*), for (1) the prophetic hadiths testify to the prohibition of *inducing* this process (even for the property of orphans, which usually is to be safeguarded under any circumstances); (2) the inserted matter, like a piece of warm bread, would become impure; and as it stays in the liquid even after its transformation into vinegar, it reciprocally renders the liquid impure[42]; and (3) inducing this process would involve acquiring material benefits from an unlawful substance: alcohol. Furthermore, they disagree on the purifying effect of transforming impure substances other than alcohol. Hanafi, Maliki, and Zahiri schools answer this question in the positive, whereas the Shafi`i and most Hanbali scholars, and the (Hanafi) Abu Yusuf do not.[43] Abu Ishaq al-Shirazi's (d. 1083) Shafi`i *fiqh* compendium *Al-Muhadhdhab* states that only two things become pure by *istihalah*: the skin of an improperly slaughtered animal and wine when it turns into vinegar naturally.[44]

The first view is supported by several arguments, the most important being (1) issues of permissibility (*al-hill*) and prohibition (*al-tahrim*), as well as of purity (*al-taharah*) and impurity (*al-najasah*), are linked to the realities of a particular substance. If these realities disappear, the legal rule also disappears. Accordingly, substances that transform from one characteristic to another assume the legal rule of the substance into which they have transformed, and (2) Allah has permitted good and pure things (*al-tayyibat*) and prohibited impure things (*al-khaba'ith*). Whatever goes through the process of transformation, like a dog that falls into a salt mill and turns into salt or impure grease thrown on the ground that then nourishes plants, does not fall under the rule of impure and prohibited substances.[45]

In this context, it may be worthwhile to look at two important representatives of this view. Ibn Hazm (d. 1064), the famous Zahiri scholar, says:

> The legal rules are according to what Allah s.w.t. has ruled with regard to whatever the name falls on which Allah has addressed us with. If that name is dropped, the legal rule is dropped with it, as it does not come under what Allah has legislated on it ... If the characteristics (*sifat*) of an impure or forbidden substance are transformed, then the name with which this rule (of impurity or prohibition) has come is not applicable any more, and it (the substance) has changed to another name which comes under the rule of being *halal* and pure. It is not that impure or prohibited substance any more, but rather has become something else, under a different rule. The same applies in reverse when the characteristics of a permissible and pure substance have changed (...).[46]

The Hanbali scholar Ibn Qayyim al-Jawziyyah (d. 1350) proclaimed a similar view:

> It is to be rejected that the rule of the impure should remain if its name and characteristic have already disappeared, as the legal rule follows the name and the characteristic turns with it in presence and absence. The texts dealing with the prohibition of improperly slaughtered meat (*al-maytah*), blood, pork, and wine do not deal with seeds, fruits, ashes, salt, dust, and vinegar, neither in meaning, nor as an explicit text, nor in analogy.[47]

The principle of *istihalah* has recently been applied to the legal status of porcine-derived gelatin. Some contemporary scholars, among them Yusuf Qaradawi, have declared its consumption permissible on the basis of the chemical transformation of the porcine material.[48] Food products containing gelatin derived from non-*halal* sources have accordingly been legalized without questioning the rationale behind it: Why should products with this substance be consumed by Muslim consumers or imported by Muslim countries if there is always an alternative? The recommendation of the Eighth Fiqhi Medical Congress (1995) generalizes the principle of *istihalah* on the transformation of any unlawful substance with a complete change in characteristics into pure and lawful substances.[49]

Given that, and only for the purpose of further discussion, we agree with the possibility of transformation in the case of substances other than wine. Thus, is this transformation comparable and transferable to genetic modification incorporating non-*halal* substances?

In the first place, it may be useful to consider the role of the rationale or reason for legislating a particular rule. The rationale for prohibiting alcohol, as agreed upon by the *fuqaha'*, is its intoxicating effect. But as this effect is

lost during its transformation into vinegar, the description of both Ibn Qayyim and Ibn Hazm of a substance acquiring a new name and new characteristics do apply.[50] But can our porcine-DNA example be evaluated on the same grounds?

Porcine DNA is made up of a huge variety of genetic information that is, to a large extent, identical with other organisms whose consumption is *halal*.[51] As the particular gene used for the genetic modification process is not necessarily responsible for the pig's "pigness," as the argument goes, there is no problem with its usage and transference to another organism's genetic information. This argument, in my opinion, is faulty for a variety of reasons. First of all, the Islamic legal (*shar`i*) rule on using and consuming any porcine product is clear: It is prohibited. All *fuqaha'*, regardless of their legal school (*madhhab*) agree on this.[52] Qur'an 6:145 describes pork as impure (*rijs*), a term that is equivalent to *najis*.[53] A pig is considered impure in its own right (*li `aynihi*), which means that none of its parts are fit for human consumption, usage, or profiting. Some Maliki *fuqaha'* have declared the hair, saliva, and sweat of a living pig pure,[54] but this ruling seems not to be of concern to our case.

Al-Kasani (d. 1189) states that the rationale behind prohibiting pork is its impurity.[55] With regard to the genetic makeup and use of porcine DNA, some relevant questions would be: Is this characteristic genetically traceable? Do some porcine genes carry the genetic information of impurity? Can we claim that the gene responsible for growth is not part of this impurity? If the "filthiness" were related to the pig's eating and living habits only, then consuming pork would be allowed if the animal were kept and fed in a "clean" manner, as its reality would already have changed. But this is not the case. In other words, *rijs* cannot be allotted to particular bodily parts or characteristics, as the entire animal is affected. Ibn Hazm states: "The entire pig is *rijs*, and *rijs* must be avoided."[56]

If we conclude that a non-*halal* substance is not prohibited due to a particular characteristic that may be genetically isolated, every single one of its parts – and every gene, protein, and even smaller components – has to be considered non-*halal*. This assertion is based on the prior assumption that the pig's biochemical components shall be treated as pertaining to this original substance (*`ayn*) and that they shall assume the same rule as the substance of origin itself. The implication here is that even if we knew (and, as a matter of fact, we generally do not know) the particular characteristic responsible for prohibiting a particular type of food (*sifat al-`illah*), the idea of isolating it genetically or of using those characteristics that are not part of

it may be impossible to achieve, because our knowledge of the combination of the different characteristics in genes remains very limited. Moreover, we do not know whether science will ever achieve complete knowledge in this field.

The discovery that certain genes are responsible for certain characteristics is only at the beginning. As a matter of fact, one gene usually has a combination of characteristics and there may be surprises as to the characteristics that are unknowingly inserted into an organism's genetic information along with the targeted trait. Although we may conjecture that scientists have decoded the secrets of creation, we should never forget that we are still at the very beginning of understanding only a one-millionth part of one piece of a puzzle. Scientists may be able to duplicate or imitate certain procedures, but, not being in the position of the Omniscient Creator, they will never be able to produce the same result. Cloned animals, as we have seen, are still prone to abnormal development, malfunction, and disease.[57]

The same may be true for the nutritional value of GMF as compared to authentic (i.e., non-engineered) food.[58] Even if this supposed gene were eventually located, the problem of using, and thereby benefiting from, a prohibited organism remains. Moreover, as mentioned above, the *fuqaha'* considered the artificial induction of the transformation process as an obstacle to rendering the result pure (*tahir*). Transferred to our initial question, this would be another strong argument against the transferability of *istihalah* to GMF, as the intentional induction is its main *raison d'être*. Even if we agree on the possibility of impure substances being chemically transformed into pure substances (in other than wine transforming into vinegar), the above explanations may have shown that, as a legal mechanism, this process cannot be applied to GMOs that incorporate substances of non-*halal* provenience.

One also has to consider the principle of *istihlak* (extreme dilution) and its applicability to GMOs. There is a strong relationship between *istihlak* and *istihalah*, in as far as the dissolved substance may also be said to have been transformed in terms of developing into a different substance with different characteristics. The term *istihlak* comprises two meanings: (1) using or consuming property and (2) mixing a substance with another one in a way that causes its inherent characteristics to vanish. In other words, they may be said to have been "consumed" by the other substance's properties and characteristics.[59]

The implication of this *fiqhi* principle is as follows: If a substance that is forbidden (*muharram*) for consumption or is impure (*najis*) in small quantities is mixed with a pure and permissible substance, with the result that

the mixture shows none of the impure substance's properties as regards taste, color, or smell, the characteristics of impurity and impermissibility are considered to have been removed. Thus, as the substance displays none of the properties that would lead to its prohibition, it becomes permissible to use or consume.[60] This *fiqhi* principle is based on the following hadith: Ibn `Umar said: "I heard the Prophet, when he was asked about any water source which is being frequented by animals of prey and other animals, say: 'If water reaches (the amount of) two jars (*qullah*), it does not carry any impure substance.'"[61]

According to Ibn Taymiyyah (d. 1328), the large quantity here can be taken as an indicator that the reason for establishing the rule of prohibition is that the impurity is generally apparent. If it is consumed (by mixing), then it is no longer apparent and thus is no longer prohibited.[62] By analogy, this rule has been extended to all liquids. According to Ibn Hazm, if anything impure or impermissible falls into a liquid (e.g., fat, milk, honey, or soup), the entire substance becomes prohibited if it changes the liquid's taste or color. If this does not happen, the liquid remains permissible.[63]

We may, therefore, conclude that if an impure substance is – rather accidentally – mixed with a pure substance, it does not render the result impure, provided that a total reversion has taken place. This would also apply to small amounts of alcohol being mixed into a liquid if the final product does not show the characteristic of intoxication.[64]

It seems to me that the scholars' intention in such rulings was to safeguard people's property from destruction. The examples given, however, seem to relate to the accidental or unintentional mixing of lawful with unlawful substances – the scholars usually refer to donkeys, pigs,[65] or dogs[66] falling into salt (mills), ashes of waste attached to bread,[67] mice falling into grease,[68] and other very practical real life incidents of their times. This has led Ibn `Abidin (d. 1252) to opine that they are, on the surface (*`ahiran*), based on necessity (*darurah*) due to the prevalence of these and comparable incidents, "and the essence of this is that their prevalence (*`umum al-balwa*) is the rationale (*`illah*) for choosing to state (their) purity which has been rationalized with the transformation of the substance."[69]

From this perspective, does the same principle relate to or legitimize the intentional mixing of these substances? Even more so, does it do so on a large scheduled industrial scale, for this is the underlying rationale of genetic engineering. Using this analogy, can we say that a porcine or other enzyme from a non-*halal* source inserted into the DNA of a *halal* organism is present in such a minimal amount that the end product, the GMO, has been purified due

to *istihalah* or *inqilab al-`ayn*? Particularly as the end product, for example, a chicken incorporating porcine-derived genetic material that ensures faster growth still looks and tastes like a chicken. In other words, can we apply the above-mentioned statements of Ibn Hazm and Ibn al-Qayyim in that the rule follows the characteristics of the substance in this case? If it looks like a chicken, does it assume the rule of a chicken, even if it contains porcine or other non-*halal* genetic material?

Here we need to look at the notion of "minimal substance." A gene, enzyme, or protein may be seen as a marginal substance in relation to the organism; however, we must not forget that it interacts with this organism and thus is indeed part and parcel of its structure. In other words, it is not going to dissolve without leaving a trace; rather, it is going to determine an entire organism's traces and characteristics, some of which may or may not be visible in outward appearance. Again, we are not talking of simply mixing two material substances, both of them having a discernable appearance, taste, and smell; rather, we are talking about changing a living organism's genetic blueprint and bringing about a new organism with no precedent in biological history.

Even the smallest change in genetic material may interact in totally unexpected ways. Which methodology would allow us to assess this GMO's characteristics and reality so as to state its reality? The whole procedure actually raises more questions. Who can be regarded as the gene's owner, as in transferring genes from a bacterium into yeast, or from human cells to pig cells or vice versa? Is the owner in these cases the bacterium or the yeast, the human being or the pig?[70] Should the GMO take the rule of the majority DNA-provider or that of the non-*halal* provider, in case any is involved? Should it be assessed according to the outer appearance? What if several different organisms have "contributed" their own DNA?

These questions, in addition to the points raised above, show the difficulty of working out an analogy between GMOs and known cases of mixing pure and impure substances. The main concern, however, should be: Is it really in line with the Shari`ah's oft-quoted objectives to intentionally use prohibited substances only to refer to the principles of *istihalah* or *istihlak* for posterior legitimization?

The *fuqaha'* have discussed yet another principle, that of *jallalah*, and its permissibility within the context of an animal that feeds on unlawful substances (here: *jallah*).[71] Are its meat and products, such as eggs and milk, permissible for consumption? The opinions of the *fuqaha'* as to exactly when an animal comes under the rule of *jallalah* differ. The Malikis say this occurs

when any amount of *jallah* is consumed; the Shafi`is say it occurs if the smell of impure food is found in its sweat or otherwise (meaning that the actual amount of *jallah* taken in is not relevant); and the Hanafis, Shafi`is, and Hanbalis state that the animal comes under this rule when most of its fodder consists of *jallah* (in this case, its meat changes and its consumption is considered disliked [*makruh*]).[72] As for consuming something considered *jallalah*, Malik (d. 795) and al-Hasan al-Basri (d. 737) declare this to be permissible because the animal does not become impure by consuming impure food. This view is based on the analogy that the body of someone who drinks wine does not become impure and that a non-Muslim who eats prohibited food is not considered impure in himself/herself.[73]

The second view, advocated mainly by the Hanafis and some Shafi`is, is that such consumption is discouraged. The third view, propounded by al-Shafi`i (d. 820), Ahmad (d. 855) (in one transmitted view), and al-Thawri (d. 778), states that the meat of such an animal may be consumed only after a period of confinement, which may last as long as the smell is present or for three days (the practice of Ibn `Umar) for birds and other animals alike; or a confinement according to species: three days for birds, seven for sheep, and forty for camels and cows (according to Ahmad and A`ta'); or, according to the Hanafis, forty days for camels, twenty for cows, ten for sheep, and three for chickens.[74] Ibn Hazm, who confines the rule of *jallalah* to camels and excludes birds due to the scriptural evidence,[75] ruled: "If any animal permissible for consumption were to eat forbidden food stuff, it remains *halal* to consume, as is the case with chickens, ducks, etc. And if a lamb were to suckle the milk of a swine, its consumption would be permissible."[76]

Again, as some contemporary voices may refer (or already have alluded to)[77] to this principle, we ought to look at its transferability to GMOs. First and foremost, feeding on impure foodstuff cannot be compared to changing its genetic blueprint. The impure food remains in the animal's system for a certain period of time and then disappears, along with any trace of its smell, taste, or otherwise. There is no exchange or mutation in the genetic blueprint of either the impure food or the animal that feeds on it. As a precautionary measure, some *fuqaha'* have asked for a particular period of time to consume the products of this organism in an attempt to ensure that any non-*halal* substance has completely vanished from its system. To apply *jallalah* to using non-*halal* organisms in the production of GMOs is indeed an improper analogy (*qiyas ma`a al-fariq*).

The *fuqaha'* have formulated other principles that may be of relevance to our case. Among them is the principle "When *halal* and *haram* are mixed,

the *haram* is predominant." (*Idha ijtama`a al-halal wa al-haram, ghalaba al-haram*).[78] Al-Suyuti (d. 1505) mentions some examples:

> When properly slaughtered meat is mixed with improperly slaughtered meat (*maytah*), or cow milk is mixed with donkey milk, or water with urine, none of this can be consumed, not even by *ijtihad*, as long as (the substances) are not kept in different containers, because of their being mixed with what is *haram*.[79]

This principle seems to be more relevant to GMF, as we may be unable to define the GMO's apparent characteristics and evaluate the possible changes and their results. If we evaluate the case of GMOs incorporating substances from non-*halal* organisms on the basis of this principle, then we would consider them *haram*. The Malaysian National Fatwa Council for Islamic Affairs has adopted this position. During a special meeting held on 12 July 1999, it concluded that "products, foods and drinks processed by involving swine DNA is against Islamic law and considered *haram*."[80]

Accordingly, consuming the end product would fall under the same rule as consuming pork itself. Although using pork and its derivatives will definitely be the most common case of non-*halal* substances, as well as the one that this paper expounds on the most, the list does not end here. I suggest that whatever organism comes under the rule of *haram* would fall under the prohibition of usage in combination with other *halal* organisms. The end product would be permissible only in a case of utter necessity (*darurah*), when one is allowed to consume otherwise prohibited food, as in the case of starvation. This exception does not apply in the *manufacturing* of food.

Another approach would be to look at the GMO's outward appearance. If it looks like a tomato, it would be given the rule of one even if it contains porcine DNA. A GMO that looks like a chicken or that has a majority of chicken characteristics, even though its genetic blueprint contains porcine DNA, would be treated as a chicken and therefore considered *halal*. The *fuqaha'* have discussed the status of animals and plants that contain a mixture of lawful and unlawful organisms with different results. Al-Suyuti remarks, while discussing the legal principle of "The original status of things is their permissibility, until an evidence proves their prohibition" (*al-asl fi al-ashya' al-ibahah hatta yadulla al-dalil `ala al-tahrim*), that:

> What comes under this (maxim) is the animal that has an unclear status. There are two views here. The more correct one is that it is permissible, as al-Rafi`i said. Under this principle are also plants, the names of which are

> unknown. Al-Mutawalli said that their consumption is prohibited, but al-Nawawi disagreed with him (...).[81]

As in the cases discussed above, various incongruities may stand against the simple transfer or analogy to GMOs. From the outset, we know that genetic material belonging to unlawful organisms has been inserted *deliberately*. In this case, the evidence of prohibition is already there, given that knowledge of this manipulation is transparent and accessible. The above-mentioned examples of evaluation may be considered by the consumer who intends to buy a chicken and is unaware or unable to assess its non-*halal* genetic components – given that genetic manipulation is not labeled. It does not serve as a guideline to work out an original rule on the GMO's procedure, production, and status.

And then there is the principle of *darurah*, which may be defined in *shar`i* terms as the state in which something prohibited is acquired, as when the legally responsible person fears that he/she will otherwise die or suffer substantial harm in his/her body, property, or honor.[82] This principle has been derived from a number of scriptural evidences, among them the verse: "And who has been force (by necessity) without wanting it or transgressing, there is no sin on him/her" (2:173).[83]

The basic idea behind *darurah* is that the Lawgiver considered it an exceptional state that removes the original legal rule of prohibition. But before making this determination, one needs to meet two conditions: (1) all available legal ways of overcoming this state have been exhausted and thus there is no choice but to engage in the prohibited action. Should there be any other alternative(s), the case and thereby the rule does not apply; and (2) *darurah* is to be measured according to the minimal limit necessary to ward it off (*al-darurah tuqaddar bi qadriha*). One does not indulge in it, but rather consumes or uses only as much as is needed to deal with the immediate emergency.[84]

In the framework of the contemporary discussion of food shortages and increasing prices, voices may be raised to apply the rule of "necessity renders the prohibited lawful" (*al-darurah tubih al-mahzurah*) to GMF consumption and production. The are several problems here. First of all, the idea of a food shortage is based on a misconception of current global economics in the agricultural sector. Food is available in adequate quantities; however, it is not accessible to growing numbers of people due to market manipulation, over-export, and high prices – in other words, man-made factors.[85] Second, are genetic manufacturing technologies an answer to this

problem? Due to the research and development costs, these technologies used to produce food actually make the end product more expensive and thereby even less affordable. In other words, the producers do not seek to increase food's availability at all. As they are subject to the same economic rules, it is rather to be expected that a larger share of GMF products on the market would only aggravate the current problem of food's accessibility. Third, it ought to be noted that patenting GMOs for consumption will lead to an even more dominant monopolization of the food market, which will have dire consequences for producers and consumers alike, mainly in the developing world.

The applicability of *darurah* to GMF is, therefore, more than limited; in fact, it actually applies only in the case of GMOs that are prohibited in nature being available when one is confronted with immediate starvation – and only in as far as it covers the immediate need. The production and research on GMF incorporating non-*halal* substances is not covered by this principle. All the same, *darurah* would not serve as an argument for producing GMOs incorporating only *halal* substances – there is no case for *darurah* in advance planning.

Based on the information presented so far, any assessment of whether the above-discussed principles and guidelines can be transferred to a GMO product under Islamic law must, above all else, take into account the underlying *rationale* of using non-*halal* substances. From an Islamic point of view, using these substances for any product, be it destined for consumption or usage, is unacceptable, for the *fuqaha'* do not consider using an unlawful substance or accruing material benefits from it as a lawful endeavor.

I suggest that enzymes, proteins, and other genetic or biochemical material should be regarded as part of the substance or organism to which they belong and from which they have been taken from, even if they are, to a large extent, identical with matching materials from other organisms.[86] As such, they would take the rule of the organism from which they have been taken. As we have seen, *istihalah*, *istihlak*, and *al-jallalah* are not transferable to GMOs. Both *istihlak* and *istihalah* rely on the substance's change or transformation due to the loss of its characteristics. If the characteristics of the prohibited substance, or rather the characteristics that are responsible for its being prohibited, are no longer identifiable in the end product, the latter would take the rule of permissibility.

Both principles rely on the distinctiveness of the apparent attributes that are identifiable as constituting the substance's impurity. If the rationale and its apparent characteristics underlying the substance's prohibition are

unknown (viz., cannot be established through the known methodology to which the *mujtahid* usually refers), these principles may not be applicable at all. But even if the rationale is known, locating the characteristic responsible for the prohibition (*sifat al-`illah*) to genetic information is not – or not yet – possible.

The insertion of one organism's genetic material into another organism is done only to bring about a genetic combination without precedent in biological history, one that would not have occurred naturally. It is not comparable to just mixing two different substances. Even if an enzyme's quantitative role seems negligible, its qualitative function surely is not. Also, the intentional induction of the mixture would defy the usage of both *istihlak* and *istihalah* to legitimize the end product. The principle of *jallalah* seems to be non-transferable for the reasons stated above. The same applies to that of *darurah*, with the knowledge that consuming a GMO, should it come under the rule of prohibition, would be permissible only in the case of starvation.

Again, judging from the GMO's outward appearance – in case it is a developed animal or plant – may serve as a guideline for a consumer who does not know and cannot verify whether the GMO in question incorporates any non-*halal* DNA. In this case, the consumer can indeed only judge from the outward appearance. However, if such knowledge is provided, I conclude that judging from the outward appearance is not an option.

Of all the principles discussed above, it seems to me that the only applicable one is the guideline that if *halal* and *haram* are mixed, the latter carries more weight than the former. On this basis, any GMO destined for human consumption that incorporates haram substances in its DNA should be considered *haram*.

Harnessing Nature or Changing Creation?

Based on the previous elaborations, I have already ruled out the use of non-*halal* genetic material in consumption and production. Does this imply that we may embark on the production of GMF if only *halal* substances are used?

The production of GMF involves changing the genetic structure of living organisms. Such changes, it has to be stressed, would never have occurred on their own. Naturally, genetic information from a fish would never have found its way into a tomato – with biotechnology, however, it did. Once these changes become active in the natural reproductive environment, they can

never be taken back. Their negative effects on species diversity and ecosystems have already been observed; the long-term effects of mutating organisms remain unknown. The primary question to be asked, then, is whether it is legally permissible, from an Islamic point of view, to change a living organism's DNA in a way that would never occur naturally?

One of biotechnology's supporting arguments, not only as regards food, is that it is acting to improve nature, to "harness" it. It is vital to scrutinize the underlying concept and understanding of life that emerges from a materialist understanding of the world around us. Nature, being the result of a merely coincidental development of matter, can be improved upon by humanity, who can make this imperfect world more "perfect" by manipulating the hereditary information of its bio-organisms. From this point of view, humanity is considered to be nature's exploiter, not its guardian or educated and responsible user.

This underlying idea is absolutely unacceptable to the Islamic worldview for, as the Qur'an states, Allah has created the world in a perfect, balanced system: "He has created everything and has measured it exactly according to its due measurements" (25:2) and "Verily, all things have We created in proportion and measure" (54:49). Any change to this system introduced by human manipulation, particularly on a microbiological level, may cause effects that are unforeseeable in their consequences. Allah also stated that no human being will ever be able to act as a creator, for the prerogative of creation, in the sense of bringing about something from nothing (*ijad al-shay' min `adam*), is for Allah alone:

> O people, an example has been given to you, so listen to it. Verily, those whom you call upon other than Allah will never create a fly, even if they joined their efforts (in the purpose). And if the fly were to take away anything from them, they would not be able to restore it from her. The seeker is as weak as what he sought for. (22:73)

Humanity's role is restricted to making use of the creation provided: "Did you not see that Allah has made subservient to you whatever is in the heavens and Earth?" (31:20).

Creation can be used in two ways: permitted (within the confines of Islamic law) and forbidden (e.g., wastage and manipulation). The latter can manifest itself in different ways, such as changing the natural state (*fitrah*), order, and equilibrium in which organisms are created, and by crossing the borderline between species and bringing about hybrid creatures that would never have occurred in nature, even with the assistance of human selection.

It is generally known that the natural order of creation has erected cer-

tain barriers. For instance, we will never see a chicken mate with a pig. Where mating between related species occurs naturally, as between a horse and a donkey, the end product (hinny or mule) is sterile and does not pass on its hereditary information. Is it too difficult to understand that there surely is a divine wisdom behind this?

One argument in favor of biotechnology asserts that it is just another way of achieving what generations of farmers have always done since humanity became sedentary: improving the item by selecting and mating the best characteristics, introducing new productive races, and cultivating plants bearing higher yields. But is this argument viable? Is there any difference between the means of cultivation (e.g., artificial pollination, grafting, and animal husbandry) and genetic engineering? Grafting stands for the fusion of different plants with each other, like grafting lemon branches onto an orange tree. Is this considered a change of creation?

First of all, grafting is only possible within certain limits set by nature (and, thereby, the Creator): between related plant species (e.g., oranges and lemons). Also, fusion takes place in that usually one branch or part of a plant is of a related species. In other words, the genetic material of the orange and lemon trees is not affected. Crossing the boundaries between different species in a way that would never occur naturally, even with mechanical help (as in grafting), therefore has to be seen as a change in Allah's creation. Porcine proteins would never find their way into a chicken or salad naturally. Bioengineering has clearly brought about what no traditional method of selection and cultivation could have even after millions of years.

Disturbing the balance that Allah has created by deliberately and arbitrarily changing the genetic blueprint of living organisms will lead to unforeseeable and unchangeable consequences not only to individual consumers, but also to entire ecosystems. Allah explicitly warned us: "Do not spread mischief on Earth after its being intact" (7:56). To involve ourselves further in unnecessarily changing creation's genetic blueprint may amount to spreading mischief on Earth.

Conclusion

Research on GMF needs to be assessed and deliberated in its own right. Any research conducted within the described capitalist model of science, however, cannot realize Islamic values; rather, it will remain within a capitalist paradigm as regards its research questions, methodology, and use of the outcome. On these grounds, it will follow the research rationale for GMF as described above. Really sustainable solutions to world hunger and poverty

will not be developed within this framework. What remains to be answered is whether research on GMOs may be viable within an Islamic framework. Given that we have already identified the rationale for GMF's existence as what it is, and genetic modification as being a change of creation rather than a "harnessing" of nature, research on GMF as we know it now would not have been developed in an Islamic setting.

In this paper, I have shown that the current procedure of deliberation before issuing a ruling often acts outside of the Islamic context. *Fiqhi* deliberations on GMF need to take into account the rationale of its existence as well as the societal and scientific model under which it was developed. Contemporary references to *maqasid* often seems to mistake non-*shar`i* benefits for authentic benefits.

Even though there may be insufficient clear-cut evidence for prohibiting those GMFs that do not incorporate non-*halal* substances, the possible negative side effects on consumers as well as the proven effects on ecosystems render GMOs more than doubtful. The case of GMOs combining non-*halal* substances, however, seems to be clear: *istihalah*, *istihlak*, *jallalah*, and other related legal instruments cannot be transferred to this organism in order to legitimize an end product by deliberately inducing genetic material from non-*halal* sources. In my opinion, substances taken from prohibited organisms are to be placed under the same rule as the organism from which they have been taken, even on a microbiological level. According to that rule, a mixture of *halal* and non-*halal* substances would result in a non-*halal* product.

As for producing and researching GMOs destined for human consumption that combine only *halal* substances, I recommend that Muslims seriously reevaluate their participation in such activities, as both of them would come under the meaning of changing Allah's creation in unlawful ways. Consuming such products, even if the existing evidence is insufficient to declare it prohibited at this point in time, should be avoided as far as possible – for Muslim and non-Muslim consumers alike – due to their inherent and potential harm.

Endnotes

1. I do not analyze the usage of GMOs for medical and therapeutic application in this paper, as this needs to be investigated independently giving due appreciation to Islamic concepts applicable in medical treatments and their individual permissibility.
2. Online at www.wikipedia.org, "Genetically Modified Organism." Accessed on

12 January 2008.

3. Sharon Walker, *Biotechnology Demystified* (New York: McGraw Hill: 2007), 119f.
4. Ibid., 173
5. Ibid.
6. Ibid., 190.
7. Ibid., 188.
8. Mohammad Tarique al-Rahman, Abdullah al-Ma'mun, and Abu Saim Md. Shahabuddin, "Genetic Modification of Natural Products for Human Consumption: Islamic Perspective," *Proceedings of the International Conference on Biotechnology Engineering (ICBioE '07)* (Kuala Lumpur: IIUM Printing, 2007), 144.
9. Walker, "Biotechnology," 188.
10. Outcrossing is defined as "to cross (animals or plants) by breeding individuals of different strains but, usually, of the same breed." See http://dictionary.reference.com/browse/outcrossing.
11. Walker, "Biotechnology," 198.
12. Ibid., 188.
13. Ramli Abdullah and W. E. Wan Khadijah, "Ethics in the Biotechnology Century: The South and South East Asian Response – Malaysia," in *Bioethics Ethics in the Biotechnology Century*, ed. Abu Bakar Abdul Majeed (Kuala Lumpur: IKIM, 2002), 219f.
14. The announcement's full text is reproduced in Husayn Fadlallah et al., *Al-Istinsakh, Jadal al-`Ilm wa al-Din wa al-Akhlaq* (Damascus: Dar al-Fikr, 1997), 232ff; also online: "Resolutions and Recommendations of the Council of the Islamic Fiqh Academy 1985-2000," 12. Online at www.irtipms.iskandertech.com.
15. Ibid., 124f.
16. Husam al-Din Shihadah et al., *Al-Istinsakh bayna al-`Ilm wa al-Falsafah wa al-Din* (Damascus: Markaz al-`Ilm wa al-Dirasah wa al-Nashr, 1998), 126f.
17. The theory of *maqasid* (the higher objectives of Islamic law) has been formulated by outstanding scholars like Imam al-Shatibi in his *Muwafaqat*. In short, it postulates that Islamic law has been revealed to acquire this-worldly and other-worldly benefits and ward off harm from humanity. The main objectives, as authenticated by Islamic law, are described as "the religion of Islam" and "the Islamic way of life itself" (viz., religion, life, intellect, offspring, and property). Contemporary references to the higher objectives, however, often remain vague and decontextualized.
18. Shaikh Mohd Saifuddeen Shaikh Mohd Salleh, "Ulema Must Understand Biotechnology," *New Straits Times* (Malaysia), 13 Sept. 2003.
19. References to the Islamic model of science are based on my suggestion.
20. Charles Benbrook, "Who Controls and Who Will Benefit from Plant Genomics?" (paper presented at "The 2000 Genome Seminar: Genomic Revolution in the Fields: Facing the Needs of the New Millennium," 19 Feb. 2000).

Online at www.biotech-info.net/AAASgen.htm. Accessed 17 Dec. 2008. D. Boucher, *The Paradox of Plenty: Hunger in a Bountiful World* (Toronto: Food First, 1999) and F. M. Lappe, J. Collins, P. Rosset, and L. Esparza, *World Hunger: Twelve Myths* (New York: Grove Press: 1998), 224.

21. Ricarda A. Steinbrecher, "Ecological Consequences of Genetic Engineering," in *Redesigning Life? The Worldwide Challenge to Genetic Engineering*, ed. Brian Tokar (USA: Zed Books Ltd., 2001), 83f.
22. As stated with regard to a field trial in China's Yunnan province, in "Genetic Diversity and Disease Control in Rice," *Nature*, no. 406 (17 Aug. 2000).
23. California' Valgene company has developed genetically modified tomatoes under the name of Flavr Savr. The product was introduced to the market in 1994, but was later removed. "Genetically Modified Food," www.wikipedia.com, accessed on 17 Dec. 2008.
24. Sonja E. Schmitz, "Cloning Profits: The Revolution in Agricultural Biotechnology," in *Redesigning Life?*, 46.
25. See Nazi Hammad, *Al-Mawwad al-Muharramah wa al-Najisah fi al-Ghidha' wa al-Dawa' bayna al-Nazariyah wa al-Tatbiq* (Beirut: Dar al-Qalam, 2004), 13ff. See also Jalal al-Din `Abd al-Rahman al-Suyuti, *Al-Ashbah wa al-Naza'ir fi Qawa`id wa Furu` al-Shafi`iyah* (Beirut: Dar al-Salam, 2004), 1:66ff.
26. IFANCA certification is recognized and accepted by the Majlis Ulama Indonesia (M.U.I.), the Majlis Ugama Islam Singapura (M.U.I.S.), the Muslim World League (Saudi Arabia), and the Malaysian government. K. Hazzah, "Are GMO's Halal?" Online at: www.gene.ch/gentech/2001/Aug/msg00075.html, accessed July 2008.
27. Online at at: www.scidev.net/news/index.cfm?fuseaction=readnews&itemid=912&language=1, accessed July 2008.
28. Al-Suyuti, *Al-Ashbah*, 1:215.
29. Abu Hamid al-Ghazali, *Al-Mustasfa min `Ilm al-Usul* (Egypt: Dar Qadir, 1322 AH), 1:286f.
30. Ibid., 1:284ff.
31. Al-Ghazali, *Al-Mustasfa*, 1;296.
32. See Tokar, ed., *Redesigning Life?*, interim.
33. Abu Bakr Abdul Majeed, "Genethics: Integrating Ethical Reasoning and Scientific Findings," in Abu Bakr Abdul Majeed, ed., *Bioethics: Ethics in the Biotechnology Century* (Kuala Lumpur: Institute of Islamic Understanding Malaysia, 2002), 70f.
34. "Genetically Modified Food Controversies." Online at www.wikipedia.org, accessed 1 Dec. 2008.
35. Abdul Majeed, "Genethics," 71.
36. Mohideen Abdul Kader, "A Guide to Genetically Modified Foods in Malaysia," in *Food and Technological Progress*, ed. Shaikh Mohd Salleh Saifuddeen (Kuala Lumpur: Institute of Islamic Understanding, 2006), 136.
37. Rosli Omar, "Genetically Modified Organisms and Their Implications."

Online at: www.imase.org/images/stories/gmoimplications.doc.

38. The *fiqhi* implications of consuming the products of animals that feed on impure foodstuffs are treated under the principle of *al-jallalah.*
39. Indawati Gandjar and Noviar Andayani, "Ethics in the Biotechnology Century: The South and Southeast Asian Response – Indonesia," in Abdul Majeed, *Bioethics*, 183.
40. Muhammad Amin ibn `Abidin, *Hashiyah Radd al-Muhtar `ala Dar al-Mukhtar Sharh Tanwir al-Absar* (Beirut: Dar al-Kutub al-`Ilmiyyah, 1994), 1:520.
41. Muhammad Mahmud al-Hawari, "`Al-Ta`am wa al-Sharab bayna al-Halal wa al-Haram (paper presented at the Eighth Medical Fiqh Conference of the Islamic Organisation of Medical Sciences, Kuwait, 1995, 19); quoted in `Abd al-Ghafur ibn Bashir Azyuf, "Nazarat fi Mustajidat al-Ghadha' wa al-Dawa', Dirasah Tahliliyah Naqdiyah" (masters thesis, International Islamic University Malaysia, Kuala Lumpur 2004, 35).
42. For the detailed *fiqhi* discussion, refer to `Abdullah b. Muhammad b. Ahmad al-Tariqi, *Al-Idtirar ila al-At`imah wa al-Adwiyah al-Muharramah* (Riyadh: Maktabat al-Ma`arif, 1992), 183ff.
43. Azyuf, "Nazarat," 36ff.
44. Abu Ishaq Ibrahim `Ali al-Shirazi al-Fayruzabadi, *Al-Muhadhdhab fi Fiqh Madhhab al-Imam al-Shafi`i* (Beirut: Dar al-Fikr, 1999), 1:67.
45. Mas`ud al-Kasani, *Kitab Bada'i` al-Sana'i` fi Tartib al-Shara'i`* (Beirut: Dar Ihya' al-Turath al-`Arabi, 2000), 1:243; Abu Muhammad `Ali ibn Hazm, *Al-Muhalla Sharh al-Mujalla* (Beirut: Dar Ihya' al-Turath al-`Arabi, 2001), 1:164; Ibn `Abidin, *Radd al-Muhtar*, 1:519f.
46. Ibn Hazm, *Al-Muhalla*, 1:160 and 1:165.
47. Ibn Qayyim al-Jawziyyah, *I`lam al-Muwaqqa`in `an Rabbi al-`Alamin* (Beirut: Dar al-Jayl, 1973), 1:445.
48. Online at: www.infocusnews.net/content/view/15536/337, accessed 18 Dec. 2008.
49. *Majallat al-Buhuth al-Fiqhiyah al-Mu`asirah*, no. 31 (1417 AH), 27; quoted in Azyuf, "Nazarat," 38.
50. Fayruzabadi distinguishes between the possible transformation of wine and of other substances (e.g., waste that does not become pure by burning to ashes), as wine's impurity can be rationalized (i.e., there is a rationale for it). *Al-Muhadhdhab*, 1:67.
51. "For example, swine DNA in soy could make the soy product *haram*. This issue is still the subject of some debate among scholars and certifying organizations. For instance, biologists note that individual genes in and of themselves are not unique to their source. For example, one would find thousands of the same genes in swine as exist in lettuce. Yet, lettuce remains *halal*." Abdul Majeed, *Genethics*, 77.
52. Wahbah al-Zuhayli, *Al-Fiqh al-Islami wa Adillatuhu*, 4th ed. (Damascus: Dar al-Fikr al-Mu`asir, 1997), 1:302.
53. Al-Kasani, *Kitab Bada'i` al-Sana'i`*, 195.

54. Al-Zuhayli, *Al-Fiqh al-Islami*, 1:302.
55. Al-Kasani, *Kitab Bada'i` al-Sana'i`*, 1:195.
56. Ibn Hazm, *Al-Muhalla*, 1:158.
57. Joyce D'Silvia, "Animal Welfare Concern regarding Farm Animal Cloning," in *The Ethical Aspects of Animal Cloning for Food Supply. Proceedings of the Round-table Debate, Brussels, 24-25 September 2007* (Luxembourg: Office for Official Publishing of the European Communities: 2008), 18-20.
58. Al-Rahman et al., *Genetic Modification*, 146f.
59. See Hammad, *Al-Mawwad al-Muharramah*, 26.
60. Ibid.
61. Narrated by Abu Dawud, al-Tirmidhi, al-Nasa'i, and Ibn Majah. See Hammad, *Al-Mawwad al-Muharramah*, 27.
62. Quoted in ibid.
63. Ibn Hazm, *Al-Muhalla*, 1:164.
64. Al-Tariqi, *Al-Idtirar*, 227.
65. Ibn `Abidin, *Radd al-Muhtar*, 1:534.
66. Al-Kasani, *Kitab Bada'i` al-Sana'i`*, 1:243.
67. Ibn `Abidin, *Radd al-Muhtar*, 1:534.
68. Al-Kasani, *Kitab Bada'i` al-Sana'i`*, 1:207 and 1:225.
69. Ibn `Abidin, *Radd al-Muhtar*, 1:536.
70. Gandjar and Andayani, *Ethics*, 181.
71. Walid Khalid al-Rabi`, *Ahkam al-At`imah fi al-Fiqh al-Islami: Dirasah Muqaranah* (Amman: Dar al-Nafa'is li al-Nashr wa al-Tawzi`, 2008), 57.
72. Ibid.
73. Ibid.
74. Al-Rabi`, *Ahkam al-At`imah*, 57ff.
75. Ibn Hazm, *Al-Muhalla*, 8:53.
76. Ibid., 8:69.
77. Abdul Majeed, *Genethics*, 78.
78. Al-Suyuti, *Al-Ashbah*, 1:252.
79. Ibid., 1:254.
80. Abdul Majeed, *Genethics*, 78.
81. Al-Suyuti, *Al-Ashbah*, 1:167.
82. Hammad, *Al-At`imah al-Muharramah*, 35.
83. See also 5:3.
84. Hammad, *Al-At`imah al-Muharramah*, 35f; see al-Suyuti, *Al-Ashbah*, 1:212.
85. Mohammad Tariqur Rahman and Abu S. M. Shihabuddin, "Waste Not, Want Not," *Islamic Horizons* (March 2009): 64ff.
86. As a matter of fact, a protein or enzyme is still distinguishable as being of bovine or porcine origin.