

## SURVEY OF RECENT HALAKHIC PERIODICAL LITERATURE

### STEM-CELL BURGERS

Environmentalists, conservationists, economists and nutritionists – not to speak of those who express concern for animal welfare or who subscribe to vegetarianism for ideological reasons – have long decried present levels of meat consumption as unhealthy as well as a wasteful and profligate squandering of resources. Many have urged substitution of other sources of protein in the human diet both for promotion of wellbeing and as a means of husbanding natural resources.

Use of cultured meat in lieu of livestock would greatly reduce use of water, land and energy and would serve to reduce emissions of methane and other greenhouse gases. At a news conference in London early this past August, Dutch scientists unveiled a single hamburger made from beef cultured in a petri dish. The *in vitro* beef was developed by a team led by Dr. Mark Post, a professor of physiology at the University of Maastricht, at a cost of 250,000 euros that was defrayed by Sergey Brin, one of the founders of Google.

The cultured meat was produced from stem cells derived from the shoulder of a slaughtered cow. The cells multiplied in a nutrient solution of cow serum and were transformed into muscle cells that formed themselves into tiny strips of muscle fiber. The cultured meat, which contained no fat, was mixed with breadcrumbs used as a binder and salt to make a five-ounce patty having the texture of raw ground beef. Red beet juice and saffron were added to give the patty a pink hue. The burger was then fried in a copious quantity of sunflower oil and butter (and thereby undoubtedly undoing the health benefits of cultured meat). Although the taste of the prototype stem-cell burger lacked the intense flavor typical of beef, the researchers are hopeful that, over time, that problem can be ameliorated.<sup>1</sup>

The *kashrut*-observant would-be consumer is fascinated by the question of the *kashrut* status of a burger derived from a small quantity of non-kosher stem cells, or possibly even a single such cell, and is likely to speculate whether

<sup>1</sup> See Henry Fountain, “Building a \$325,000 Burger,” *New York Times*, May 14, 2013, pp. D1 and D7; Shirley S. Wang, “Scientists Cook Up Lab-Grown Beef,” *Wall Street Journal*, August 6, 2013, p. A9, col. 2; and “Has the Era of the Kosher Cheeseburger Arrived?” *JTA World Report*, August 8, 2013, pp. 3-4.

or not a slice of cheese may be placed on top of the patty in order to produce a kosher cheeseburger. With further scientific and technological strides, perhaps an even more intriguing question will be posed regarding the permissibility of a laboratory-produced pork chop derived from the stem cell of a pig.

## I. Non-Natural Meat

The halakhic status of meat devolves only upon a substance derived from an animal. A synthetic substance produced from vegetable matter or from inert chemicals in a laboratory is not meat. A living animal, in turn, has the status of an animal only if it is the offspring of an animal. An animal is endowed with the halakhic status of an animal by virtue of its descent from a line of ancestors traceable to a primordial progenitor. Thus, for purposes of Halakhah, an animal appearing *sui generis* is not an animal and its flesh is not meat.

That principle is reflected in latter-day rabbinic discussions of two separate biblical narratives. Abraham showered hospitality upon visiting angels disguised as human wayfarers. He served his guests cream and milk and prepared a calf on their behalf. Abraham, whom the Sages, *Yoma* 28b, portray as having observed not only the commandments of the Torah in their entirety long before they were revealed at Sinai but rabbinic enactments as well, is incongruously depicted in Scripture as providing his visitors with dishes containing milk and meat at the same meal!

In his commentary on the Pentateuch, R. Meir Leibush Malbim points to the usage of the verb “*la’asot* – to make” in the verse describing Abraham’s preparation of a calf to be served to his guests, “and he hastened *to make* it” (Genesis 18:7), as well as the past tense of the same verb in the subsequent verse “and he took cream and milk and the calf that he *made*” (Genesis 18:8). Malbim interprets those words quite literally: the calf was not a naturally born animal; it was *made* by Abraham on the basis of information recorded in *Sefer Yezirah*, the *Book of Creation*, a work whose authorship is ascribed to Abraham himself. Instructions provided in that work call for invoking Divine Names or combinations of the letters of those Names in triggering a process that results in creation of a calf *ex nihilo*. The Gemara, *Sanhedrin* 65b, reports that R. Hanina and R. Oshia similarly made use of *Sefer Yezirah* every Friday in order to provide themselves with meat for the Sabbath meals.<sup>2</sup> Meat produced in that manner, contends Malbim, does not have the halakhic status of “meat” and hence may be consumed without qualm together with dairy products.

<sup>2</sup> For a discussion of why such activity does not constitute a prohibition as a form of sorcery see R. Moses Sofer, *Teshuvot Hatam Sofer, Orach Hayyim*, no. 197.

Much earlier, R. Isaiah Horowitz, *Shenei Lubot ha-Brit (Shelah)*, *Parashot Va-Yeshev, Mikez, Va-Yigash: Derekh Hayyim Tokhahat Mussar*, sec. 57, propounded the same thesis in explaining a different aggadic comment. Genesis 37:2 records that “Joseph brought evil report of them [his brothers] to their father.” *Shelah* interprets the phrase “evil report of them” as an accusation leveled by Joseph charging his brothers with partaking of a limb severed from a living animal and alleging that they had committed acts of sexual immorality. Many commentators have been troubled both by the notion that the righteous sons of Jacob might be suspected of such conduct and by Joseph’s recklessness in bringing malicious gossip to the attention of their father. *Shelah* asserts that there was indeed verisimilitude between entirely innocuous acts performed by Joseph’s brothers and the infractions Joseph attributed to them. *Shelah* explains that the brothers employed *Sefer Yezirah* to produce both animals and maidens. The animals did not have the halakhic status of animals and hence the meat prepared from the flesh of those animals was not prohibited as the product of vivisection. The similarly created young women did not enjoy the status of either humans or beasts and hence the brothers were not guilty of sexual promiscuity. Joseph, ignorant of his brothers’ ability to harness powers described in *Sefer Yezirah*, assumed that both the animals and the women in question were of natural birth and hence, in good faith, he charged them with serious transgressions.

The Gemara, *Sanhedrin* 59b, declares that “an impure entity does not descend from Heaven.” The import of that statement is that information gleaned from *Sefer Yezirah* cannot be utilized for producing non-kosher species or foodstuffs. Rashi carefully adds that if an entity or creature possessing non-kosher characteristics should somehow appear it would be regarded as pure despite the presence of such characteristics. Assuredly, foodstuffs produced synthetically rather than miraculously are similarly permissible despite their non-kosher characteristics and appearance. Since, however, the widely publicized stem-cell burger was neither miraculously nor synthetically produced, the above-cited discussions do not cast light on the present-day quandary.

## II. Subvisual Origin

The question of the *kashrut* of stem-cell burgers might be dispelled if it were to be established that the original stem cell derived from an animal was microscopic in size. Even if – as is highly likely – the original stem cell or cluster of stem cells was visible to the naked eye, that contingency must nevertheless be explored because of the distinct possibility of future enterprises utilizing other non-kosher sources that are minuscule in nature.

Halakhah, to be sure, does not take cognizance of subvisual phenomena, e.g., it does not regard ordinary drinking water as non-kosher because it teems with “creeping” organisms perceivable only under a microscope.<sup>3</sup> Similarly, if the stem cell from which the meat is cultured is microscopic – and hence of no halakhic consequence – it might be argued that the resultant food product must be deemed to have come into existence spontaneously insofar as its halakhic status is concerned. Accordingly, its consumption would be permissible even if the original stem cell was derived from a non-kosher animal.

However, the concept of perceivability by the naked eye requires further elucidation. R. Iser Zalman Meltzer suggests that human eyesight was far more keen in ancient times than at present. The Mishnah, *Bekhorot* 54b, states that animals roaming in open places may be regarded as members of a single group for purposes of tithing so long as the animals are all present within a limited, specified area. As Rashi explains the Mishnah, that area is defined as the area in which the animals can pasture under the supervision of a single shepherd. That, in turn, is defined by the Mishnah as an area having a radius of sixteen *mil*. The Gemara explains that the key to establishing that radius is the ability of a single shepherd to see, and hence to safeguard, the entire group of animals. As expressed by the Gemara, *ad locum*: “The Sages determined that the eye of a shepherd can master sixteen *mil*.”<sup>4</sup> Accordingly, Rabbi Meltzer concludes that, over the ages, our sense of sight has become dulled. He attributes that phenomenon to widespread reliance upon artificial illumination which, he opines, has caused natural eyesight partially to atrophy. In support of that opinion he comments, “We know that, even today, the Bedouin who do not use our lamps can see very far.”<sup>5</sup>

Thus it is certainly arguable that the organisms denoted by Leviticus 11:10-11 are those that were perceivable at the time the commandment was announced and that those organisms remain forbidden even if, in our age, they are no longer visible to the naked eye. However, this is not to say that microscopic organisms are forbidden. Even the shepherd of antiquity did not enjoy omnivision; after all, he could see only a distance of sixteen *mil*. Since that time there has been, at worst, only limited optical

<sup>3</sup> For a discussion of subclinical entities and phenomena in Halakhah see this writer’s *Contemporary Halakhic Problems*, VI (Jersey City, New Jersey, 2012), 211-217.

<sup>4</sup> For a discussion of the length of a *mil* see *Contemporary Halakhic Problems*, VI, 211, notes 21 and 22.

<sup>5</sup> See note authored by R. Iser Zalman Meltzer appended to R. Yechiel Michel Tucatzinsky’s *Bein ha-Shemashot* (Jerusalem, 5689), p. 153. See also R. Moshe Sternbach, *Mo’adim u-Zemanim*, II, no. 124 and VIII, addendum to Vol. II, no. 124.

degeneration. Perhaps in antiquity the average man possessing eyesight of the quality common among his peers could see with his naked eye even that which is visible to us only upon two, three, or even ten-power magnification. Consequently, organisms that are but marginally subvisual may well be forbidden but those that can be seen only with a microscope rather than with a magnifying glass could not conceivably be within the ambit of the prohibition. Accordingly, unlikely as it may seem at present, one must consider the possibility of future development of foodstuffs from non-kosher sources that are truly infinitesimal.

At issue is the nature of the principle that subclinical phenomena are to be disregarded. The concept can be understood in two distinct ways: 1) The Torah simply ignores any and all subclinical entities and phenomena and regards them as nonexistent. If so, that notion parallels the legal principle “*De minimis non curat lex* — the law is not concerned with trifles.” The notion, then, parallels the position of Resh Lakish, *Yoma* 73b, who maintains that a quantity of food less than the minimum for which statutory punishment is prescribed is entirely permissible according to biblical law because, in effect, the Torah completely disregards its existence. 2) The phenomena are indeed recognized as veridical but, since the Torah was given to human beings rather than to angels, no mandate or stricture can be attendant upon such entities or phenomena unless and until there is perceivable evidence of their existence.<sup>6</sup>

Arguably, choice of one or the other of those two possible analyses of the principle has halakhic ramifications. According to the second analysis, it is not the case that the law ignores subclinical contingencies but that such a degree of meticulousness could not be demanded of human beings. “The law was not given to ministering angels” (*Berakhot* 25b; *Yoma* 30a; *Kiddushin* 54a; and *Me’ilah* 14b) and humans cannot be held responsible for taking cognizance of what they cannot perceive upon gross examination.

There may indeed be circumstances in which one of the theories may be germane but the other irrelevant. It is one thing to say that humans cannot be held responsible for imbibing creatures they cannot possibly see or for writing letters in a Torah scroll without microscopic gaps between droplets of ink but quite another to absolve them from responsibility for being attentive to subclinical phenomena whose occurrence can be deductively confirmed by ordinary means. For example, only a “swarming thing” that actually “swarms,” i.e., that engages in locomotion, is

<sup>6</sup> For a discussion of a possible third understanding of this concept see *Contemporary Halakhic Problems*, VI, 273, note 59.

prohibited. A mature worm that has developed within the narrow confines of a fruit has no room in which to move. But in its early stages of development in which it is infinitesimally small it is capable of locomotion. At that early stage the creature is capable of at least minimal movement within the fruit. According to R. Jonathan Eibeschutz, *Kereti u-Peleti, Peleti, Yoreh De'ah* 84:5, movement by a “swarming creature” while yet subvisual renders the organism a prohibited creature once it does mature and become visible. Earlier motion is deductively demonstrable and hence cannot be disregarded by human intellect.

Were it the case that Halakhah did not at all take cognizance of subclinical phenomena, any movement that cannot be perceived by the naked eye should not meet the requisite criterion of “movement.” If, however, the underlying rationale is that only angels can perceive such movement and hence humans lacking such perception cannot be held accountable for failing to be aware of that phenomenon, the opposite conclusion must be reached. Upon observing the mature worm, every intelligent person can immediately deduce that, at its earlier state of development, the worm was quite capable of locomotion. It would not be at all unreasonable to hold a human being responsible for making that deduction and to hold him responsible for ingesting “a swarming thing.” *Kereti u-Peleti*, in formulating his restrictive ruling, must have rejected the notion that the underlying principle is *de minimis non curat lex* in favor of an explanation focusing upon cogency with regard to responsibility and hence concluded that people can be held responsible for recognizing subclinical phenomena when gross examination yields evidence that such phenomena have actually occurred.<sup>7</sup>

Another possible ramification of these two differing analyses of halakhic disregard of subvisual phenomena lies in the area of genetic engineering. R. Shlomoh Zalman Auerbach, *Minhat Shlomoh, Tinyana* (Jerusalem, 5760), no. 100, sec. 7, addresses the issue raised by the fact that genetic engineering involves manipulation of material that is not visible to the naked eye and dismisses that consideration with the remark that “since people engage themselves (*metaplim*) with these particles and transfer them from one species to another, this must be considered as visible to the eyes.”

<sup>7</sup> Rabbi Halberstam, *Ayin Lo Ra'atab* (Brooklyn, 5744), p. 23 and p. 35, goes beyond the position of *Kereti* in ruling that a minuscule creature designed to develop and reach a recognizable state is forbidden even while yet subvisual. Cf., R. Samuel ha-Levi Wosznar, *Teshuvot Shevet ha-Levi*, VII, no. 122. That position seems incompatible with the thesis that subclinical phenomena and entities are defined as nonexistent. See *Contemporary Halakhic Problems*, VI, 271, note 57.

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According to a literal reading of Rabbi Auerbach's analysis, even random tinkering with genetic material for no practical or scientific purpose would trigger halakhic cognizance.

Rabbi Auerbach's cryptic statement, presented without sources or argumentation, is rather novel and, in a certain sense, halakhically counterintuitive. Conventional understanding of the principle under discussion is the common sense notion that the commandments of the Torah are to be defined in terms of phenomena that are perceivable and thus within the ken of those addressed. Rabbi Auerbach introduces a new element, *viz*, a *de minimis* notion defined other than in terms of perception. His argument certainly begs for elucidation.

It might be argued that Halakhah disregards subclinical phenomena only when they are free-standing. A microorganism will never be more than a microorganism; a subvisual gap in a letter will never become anything other than a subvisual gap in a letter. Rabbi Auerbach seems to assert when such subvisual phenomena serve as causal factors that will eventually yield readily perceived effects, cognizance must be taken of such phenomena because they are, in reality, recognized in their effects.

Rabbi Auerbach focuses not simply upon grossly apparent effects but also upon intentional harnessing of subclinical phenomena in order to produce a desired effect. A theory ascribing halakhic cognizance based upon the intention or purpose of a procedure is, at least distantly, related to the halakhic category of *ahshaveih*, i.e., the principle that, when applicable, declares that an object lacking intrinsic value becomes endowed with value because of the act or intent of a person who utilizes the object for a subjectively valued purpose.<sup>8</sup>

This formulation of Rabbi Auerbach's argument ascribes halakhic cognizance to subclinical phenomena when a goal-oriented procedure is involved. The term "*metapplim*" employed by Rabbi Auerbach often has

<sup>8</sup> E.g., transporting a minimum quantity of a substance from a private domain to a public thoroughfare on *Shabbat* is a culpable offence. The minimum quantity for which culpability is incurred is defined in terms of "significance" and varies from substance to substance as prescribed by statute. However, if the object is transported for use as a medicament or for certain other purposes culpability is incurred for transporting even a lesser quantity because the substance acquires "significance" by virtue of the principle of *ahshaveih*. See *Shabbat* 90b. Similarly, benefit may be derived from charred *hamez* on Passover because it is no longer fit for consumption. However, if eaten, there is culpability because the act of consumption demonstrates that it has been accorded significance as a foodstuff by the person consuming it. See *Rosh, Pesachim* 21b and *Taz, Orach Hayyim* 442:8.

that connotation in modern Hebrew usage. Understood in this manner, Rabbi Auerbach's argument commends itself for two reasons: 1) It narrows the area of halakhic innovation. 2) More significantly, it presents the argument as mirroring and applying a well-known halakhic concept, *viz.*, *ahshaveih*.

Rabbi Auerbach's position, however understood, does not seem to be compatible with the theory that subclinical phenomena are halakhically non-existent. It is, however, compatible with the view that only angels could conceivably be held responsible for awareness of such phenomena. Such is the case with the generality of subclinical phenomena; it is arguably not the case with regard to intentional subclinical manipulation, particularly when that manipulation is goal-directed.

Application of laboratory procedures to a microscopic stem cell of non-kosher derivation for purposes of producing meat resulting in production of a readily visible food product is quite certainly a form of "*metapplim bo*." Hence, neither according to *Kereti* nor according to Rabbi Auerbach can a stem-cell burger be regarded as having arisen spontaneously.

### III. Preservation of Identity

The crucial issue in determining the *kashrut* of the stem-cell burger is a question of identity. Does the meat acquire the halakhic identity of the stem cell from which it is derived or is it to be regarded as a novel, and hence neutral, entity? It is the notion of identity as a member of a species, rather than external physical criteria, that establishes the kosher or non-kosher status of an animal. Rumination and presence of a split hoof serve only to define the *kashrut* of a primordial animal. The progeny of that animal are kosher, not because they share the defining characteristics of their progenitor, but simply by virtue of their ancestry. Thus the Mishnah, *Bekhorot* 5b, declares that the scion of a kosher animal endowed with the phenotype of a non-kosher animal is entirely kosher; inversely, the scion of a non-kosher animal endowed with the phenotype of a kosher animal is itself not kosher. Identity as a member of a species is determined solely on the basis of lineal descent.

The same principle applies to the growth and development that takes place as a neonatal animal grows to maturity. A piglet with a birth weight not exceeding several pounds grows to become a several hundred pound swine. Consumption of any portion of the flesh of the adult pig is prohibited and results in imposition of the statutory punishment. Tissues within the pig reproduce themselves and expand; the new and expanded tissue



has the same halakhic identity and status as the tissue from which it arises. These concepts are deduced from analysis of the biblical description and prohibition of forbidden species. Quite obviously, the Torah forbids non-kosher animals in their entirety, including the portions of the animal representing post-natal gain of weight. “Of their flesh you shall not eat” (Leviticus 11:8) denotes all portions of flesh of even adult animals, including later developing flesh that was not present at birth.<sup>9</sup> Moreover, the Torah certainly did not intend to prohibit only non-ruminant or cloven-hoof animals extant at the time of revelation at Sinai. The progeny of those animals were also included in the prohibition. Analysis predicating species identity upon identity of the progenitor rather than upon phenotype leads to ramifications regarding a kosher-appearing animal that emerges from a non-kosher animal and *vice versa*.

The above-cited Mishnah in *Bekhorot* employs the term “*yozei* – that which emerges” to depict the concept of identity as a member of a species. It may be convenient to describe this category as “*yozei*<sub>1</sub>” in order to distinguish it from a different category of *yozei* to be described presently and which may be labeled “*yozei*<sub>2</sub>.”<sup>10</sup>

*Yozei*<sub>1</sub> as applied to growth, i.e., accretion of tissue and the enhanced bulk of a mature animal, serves as a halakhic categorization of a living animal and of its descendants. There seems to be no source that would serve to extend that concept to some hypothetical post-mortem synthetic growth of additional non-kosher animal tissue or to tissue (or cells) plucked from a living animal and made the subject of artificial reproduction in its severed state.

The foregoing is not to say that meat artificially produced from non-kosher stem cells is *ipso facto* kosher. Rather, it implies that the status of such meat is governed by a different set of halakhic principles which require further explication.

#### IV. *Zeh va-Zeh Gorem* – Dual Causes

The primary application of the second category of *yozei*, or *yozei*<sub>2</sub>, occurs with regard to food products, such as milk and eggs. Milk and eggs produced by members of kosher species are, of course, kosher. When produced

<sup>9</sup> See this writer’s *The Philosophical Quest: Of Philosophy, Ethics, and Halakhah* (Jerusalem, 2013), pp. 284-297.

<sup>10</sup> Although he uses different nomenclature, the distinction between these two types of *yozei* is delineated by R. Chaim ha-Levi Soloveitchik, *Hiddushei ha-Grah al ha-Rambam, Hilkhot Ma’akhalot Assurot* 3:11. See *The Philosophical Quest*, pp. 287-288.

by members of non-kosher species such products are non-kosher. Neither milk nor an egg produced by a non-kosher animal is regarded in the same light as the flesh of that animal, with the result that partaking of such foodstuffs does not entail the statutory punishment, *viz.*, lashes, attendant upon consuming meat of a non-kosher animal. The meat of the animal is an integral part of the animal; the milk and eggs of an animal are produced by the animal but do not share in the identity of the animal. The latter foodstuffs are banned by a less severe prohibition as derivatives, *i.e.*, *yozei*<sub>2</sub>, of a non-kosher animal.<sup>11</sup> The prohibition against consuming eggs of a forbidden species as a form of *yozei* is derived by the Gemara, *Hullin* 64b, on the basis of talmudic interpretation of Leviticus 11:16.<sup>12</sup> The Gemara, *Bekhorot* 6b, derives the prohibition against drinking milk of a forbidden species from a pleonasm present in Leviticus 11:14. The same talmudic discussion asserts, on the basis of exegetical interpretation of Leviticus 11:31, that the principle of *yozei*<sub>2</sub> confers non-kosher status upon any food product secreted or otherwise brought into existence by an entity that is itself non-kosher.

But what is the status of an entity whose existence stems from two antecedent causal entities, one kosher, the other non-kosher? Does the identity of each of the joint causes carry over and become manifest in the ensuing effect with the result that the jointly produced food product must be regarded as non-kosher? Or is the identity of the non-kosher causal entity nullified or suppressed by virtue of the presence of the second kosher, and hence innocuous, cause? That phenomenon is termed “*zeh va-zeh gorem* (this and this is a cause)” and the status of the resultant product is the subject of controversy in the Gemara. The normative rule is that an entity produced by such dual causes, *i.e.*, by *zeh va-zeh gorem*, is permissible.

Examples of *zeh va-zeh gorem* abound. Examples presented by the Gemara, *Avodah Zarah* 49a, include produce of a field fertilized with manure previously employed in an idolatrous ritual and a cow fattened by consuming beans offered as a sacrifice to a pagan deity. No benefit may be derived from entities or materials used in idol worship. The manure and the beans depicted by the Gemara were of that nature. But

<sup>11</sup> See Rambam, *Hilkhot Ma'akhalot Assurot* 3:6.

<sup>12</sup> The Hebrew text reads “*bat ha-ya'anah*.” That term appears in standard English translations as the “ostrich.” The Gemara understands the term “*bat*” literally as meaning a “daughter” and queries, “Does the *ya'anah* have a daughter?” The Gemara then proceeds to interpret the term “*bat*,” or “daughter,” as referring to the egg which is a *yozei* of the prohibited bird.

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manure is not the sole cause of the resultant crop; nor is the grain fed to a cow the sole cause of its weight gain. In both cases there is an additional, entirely permissible, cause. Thus the resultant crop or added weight is not the product of a single cause but of a plurality of causes and hence both the produce and the cow are permissible. The added weight of the cow has the species identity of the original animal but the food consumed is one of the causes of the enhanced physical mass coming into existence.

Cultured meat derived from stem cells of non-kosher origin, since it is not the product of natural development of the animal, is not *yozeil* and hence it does not automatically acquire the identity of the animal from which the stem cell was derived. The principle of identity earlier described as *yozeil* is limited to the growth and development of a living organism and is the basis of identity as a member of a particular species. Meat cultivated in a laboratory is akin to milk produced by an animal. The milk of a non-kosher animal has the species identity of the animal from which it emerges. The original stem cell is indeed the cause of the newly developed cells to which it gives rise; however, the cultured meat cells are not produced by a living animal whose identity can be transmitted in the manner of *yozeil*. The cultured meat cells are indeed produced by a forbidden substance, *viz.*, the non-kosher stem cell. Were the non-kosher stem cell the sole cause, the cultured meat cells would be forbidden as *yozeil*<sub>2</sub>. But those meat cells are the resultant effect of dual causes, *viz.*, the stem cell and the nutrients introduced into the petri dish in order to make cell division possible. Moreover, the nutrients do not function simply as catalysts that are not present in the effect; rather, the nutrients are physically integrated into the newly produced cells. It therefore follows that the cultured meat is the product of *zeh va-zeh gorem* and hence permissible.

This conclusion is correct only if the nutrients are derived from kosher sources. The recently produced burger was the product of non-kosher stem cells that were placed in a nutritional medium consisting of cow serum derived from cows that had not been rendered kosher by means of ritual slaughter. With regard to those stem cells, both causes, *i.e.*, the nutrients as well as the stem cells, were non-kosher. Moreover, serum, which is essentially blood, even if derived from a kosher-slaughtered cow, is non-kosher and hence the principle of *zeh va-zeh gorem* would not apply to any stem-cell burger for which animal serum was used as the nutritional medium. Nevertheless, with further scientific advances, the time may come when kosher nutrients might effectively be used in culturing meat cells. At such time the principle of *zeh va-zeh gorem* would become applicable.

### V. *Davar ha-Ma'amid*

There is yet another factor that, if germane, may impede both the operation of *bittul*, i.e., nullification, and of *zeh va-zeh gorev*. A “*davar ha-ma'amid*” – a forbidden substance that serves as a “support” for the food product to which it is added – is not subject to nullification. Jelling and solidifying agents as well as emulsifiers and some enzymes are of that category. The essence of nullification is suppression of the identity of the small quantity of the prohibited substance and a merging of its identity into the identity of the overpowering majority substance.<sup>13</sup> A *davar ha-ma'amid*, when present, is deemed to be discernible with the result that, as a recognizable substance, it cannot be nullified. That notion parallels the principle that a non-kosher substance whose taste can be perceived in a mixture does not become nullified because its taste is deemed to reveal the presence of the forbidden substance and any ingredient that remains perceivable does not lose its identity through nullification.<sup>14</sup>

The crucial problem is the precise definition of a “*davar ha-ma'amid*.” One can endeavor to arrive at a general definition only by examining examples of ingredients labeled as belonging to that category. A commonplace example is the small quantity of rennet employed in the process of turning milk into cheese. Without additions of the enzymes present in rennet, milk would not become cheese. Those enzymes cause casein-proteins present in milk to coagulate. The milk then curdles and turns into cheese. Cheese possesses distinctive characteristics quite different from those of milk. Since those characteristics are visible and attributable to the rennet, the presence of rennet is deemed to be perceived in all portions of the cheese. Accordingly, non-kosher rennet is not subject to nullification regardless of how small the quantity of rennet used for that purpose may be.

There is some disagreement with regard to whether the residue that remains in brewing beer after the liquid is strained from the mash and which is then used in production of mead is considered to be a *davar ha-ma'amid*. The residual mash apparently serves as a source of carbonation and produces a change in the taste of the honey beverage to which it is added but no visually perceived change occurs in the beverage. The authorities who permit consumption of mead into which residual mash containing a forbidden substance has been introduced maintain that a *davar ha-ma'amid* renders the mixture forbidden only if the presence of the *davar ha-ma'amid* can be detected visually. However, when the beer residue is

<sup>13</sup> See Rambam, *Hilkhos Ma'akhalot Asurot* 15:4.

<sup>14</sup> See *Shulhan Arukh, Yoreh De'ah* 88:1 and 96:1-4.

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used for the purpose of fermenting and effecting a change in taste and not simply to cause bubbling all agree that it constitutes a *davar ha-ma'amid*.<sup>15</sup>

Each of the ingredients described in halakhic literature as a *davar ha-ma'amid* appears to serve as a catalyst effecting perceivable chemical and physical changes. Stem cells employed for the production of cultured meat seem to function in an analogous manner. The stem cells interact with nutrients that cause the cell to divide; each of those cells again divides and so on *in seriam*. The original cells constitute only an infinitesimal portion of the resultant corpus of cells but, since each of the cells produced is a physical replica of the original cell, the presence of the original cell is readily deduced on the basis of visual phenomena. Accordingly, it would seem that, if the original cell is non-kosher, it does not become nullified and the resultant laboratory-produced meat must be non-kosher as well.

Some authorities maintain that the rule of *davar ha-ma'amid* applies to substances employed in pagan offerings that are not subject to nullification. Other substances in the nature of a *davar ha-ma'amid*, they maintain, become nullified provided that the taste or flavor of the prohibited *davar ha-ma'amid* cannot be detected.<sup>16</sup> Accordingly, if the cultured meat has the taste and flavor of the original stem cell, all would agree that such laboratory-produced meat is forbidden.

If, however, the original stem cells are derived from a kosher animal and the nutrient medium is also composed of kosher ingredients, the resultant meat would certainly be kosher. Moreover, since the original cell

<sup>15</sup> See *Encyclopedia Talmudit*, VI (Jerusalem, 5714), 561.

<sup>16</sup> There is a significant controversy with regard to mixtures in which the *davar ha-ma'amid* is not itself an unadulterated prohibited substance but is an adulterated mixture several times removed from the original *davar ha-ma'amid*. For example, a baker may use a "starter" sourdough to cause his dough to rise. He then takes a small portion of the newly-produced dough and allows it to stand and the yeast to multiply so that the new dough itself becomes sourdough. That process may be repeated multiple times. With each successive repetition the quantity of the original sourdough present in the succeeding generation of sourdough becomes smaller and smaller but, presumably, will never reach zero. Since the principle of *davar ha-ma'amid* reflects the notion that the original sourdough remains recognizable, many authorities maintain that if the original sourdough was a forbidden substance all of the successive progeny are subject to the rule of *davar ha-ma'amid*. Other authorities maintain that only the first, second and third generation mixtures are forbidden by virtue of the presence of a *davar ha-ma'amid* traceable to a forbidden substance. According to those permissive authorities, cells derived from the culture of a culture of a culture containing the original non-kosher stem cell might be used to culture further cells to which the stricture concerning a *davar ha-ma'amid* would not pertain.

had been nullified, the resultant “meat” would be *pareve* as well, i.e., considered to be a neutral substance neither meat nor dairy, and suitable for consumption in the form of a cheeseburger. That is so because meat becomes neutralized in a mixture of other food sixty times as great as the meat component. That is true, however, only because of the presumption that the natural taste of a food product cannot be detected when mixed into a quantity of a different substance sixty times as great. However, the taste of pungent substances *le-ta’ama avida*, i.e., used for the very purpose of contributing a distinctive flavor, does not become nullified. Under such circumstances the original stem cells would not be nullified and the resultant product could not be consumed together with dairy foods. Of course, the possibility exists that the meat produced in a laboratory might be a bland tofu-like substance that may be artificially flavored to mimic the taste of meat. Such a product would be *pareve*. It is questionable whether the recently produced stem-cell burger had the taste of meat.

## VI. Kosher Certification

Quite obviously, cultured meat derived entirely from kosher sources presents no problem. However, when derived in part from a non-kosher source, the *kashrut* status of the product will depend upon applicability of principles of nullification in general and in particular upon whether the non-kosher entity has the status of a *davar ha-ma’amid*. Nevertheless, application of principles of nullification to meat derived from non-kosher stem cells does not necessarily yield the conclusion that a Jew may engage in the production of cultured meat and partake of the foodstuff he has produced. As recorded in *Shulhan Arukh, Yoreh De’ah 99:5*, a person may not intentionally nullify a forbidden foodstuff and, if he does so, he is not permitted to eat the resultant mixture. Moreover, if a person nullifies a forbidden substance on behalf of another party, the intended beneficiary of such nullification is also forbidden to consume the product even if the latter did not request that nullification be carried out on his behalf. *Taz, Yoreh De’ah 99:13*, limits the latter prohibition to members of the family of the person who engaged in the nullification and to others who were aware that nullification was carried out on their behalf. *Taz* maintains that the prohibition against benefitting from nullification does not extend to a person entirely oblivious to the nullification performed on his behalf.

R. Akiva Eger, in a gloss *ad locum*, citing *Teshuvot Rivash*, no. 498, addresses the situation of a producer or merchant who nullified a forbidden foodstuff, not for the benefit of a particular customer, but with intent to sell the mixture to any willing purchaser. Disagreeing with *Taz*, R. Akiva

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Eger asserts that, although the customer is entirely ignorant of what has transpired, he may not partake of the product.

Paradoxically, according to R. Akiva Eger, a product that otherwise would be permitted may become forbidden by virtue of the fact that it is certified as kosher. Products produced for the mass market are not produced for the benefit of Jews. Accordingly, if some small quantity of a non-kosher ingredient is present, but nullified, the product is permissible. The same product, if produced for a Jew, according to the opinion of R. Akiva Eger, even for an unspecified, anonymous Jew, is prohibited. Kosher certification is sought by a producer precisely because he wishes to market his product to the Jewish consumer. Targeting the Jewish consumer as a potential customer creates a situation in which nullification is carried out expressly for the benefit of a Jew and hence, according to R. Akiva Eger, a Jew may not benefit from such nullification. Accordingly, stem-cell burgers might be produced that are indeed kosher but they would become prohibited if labeled as such!