

Article

Religion, Animals, and Technology

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Abstract: Most beef cattle in the United States start their lives on pasture and finish them in crowded feedlots, releasing hundreds of pounds of the greenhouse gases methane and nitrous oxide, before they are transported to a slaughterhouse, where they are killed and their bodies are sliced into steaks and ground into hamburgers. Until recently, the alternatives to this system were either meat produced in the less sustainable but more humane method of raising cattle solely on pasture and utilizing smaller-scale slaughterhouses or plant-based meat substitutes. The development of the first cultured beef burger in 2013, produced through tissue engineering, raised the possibility of a newer and better alternative. In this article, I use the example of cultured meat to argue that religion and technology are co-constitutive, that they shape and reshape each other, and that the intersection between religion and technology in meat production has had and continues to have a direct impact on animals raised for meat. Kosher meat, industrial or cultured, exemplifies the complexities in the relationship between religion, technology, and animals and will serve as the example throughout this article.

Keywords: animals; cultured meat; technology; Judaism



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1. Introduction

On 6 October 2021, the United States Department of Agriculture announced a USD 146 million investment in sustainable agricultural research projects, which included a USD 10 million award for Tufts University to establish the National Institute for Cellular Agriculture, “a flagship American cultivated protein research center of excellence” ([USDA Hands out Funding for National Institute for Cellular Agriculture 2021](#)). David Kaplan, a cultured meat expert and professor at Tufts University, will lead the institute’s research, which seeks to “expand the menu of climate-friendly protein options and improve food system resilience” ([USDA Hands out Funding for National Institute for Cellular Agriculture 2021](#)). Congresswoman Rosa DeLauro, a democratic representative of Connecticut and Appropriations Committee Chair, commented on the announcement: “I am pleased that USDA’s leadership continues to recognize the important role these technologies can play in combating climate change and adding much needed resiliency to our food system” ([USDA Hands out Funding for National Institute for Cellular Agriculture 2021](#)). Congresswoman Katherine Clark, who represents the district where the Tufts University resides, was also enthusiastic: “This is a major step forward in our work to tackle climate change, infuse resiliency into our food systems, and build a stronger, more sustainable future” ([USDA Hands out Funding for National Institute for Cellular Agriculture 2021](#)).

Although cultured meat has been developed with innovative technology, it fits into a broader context wherein meat is necessarily created by an intersection between at least animals and technology and quite often religion, animals, and technology. In other words, all meat is animals plus technology, though the technologies and even the meaning of “animal” may differ.¹ Most beef cattle in the United States today start their lives on pasture and finish them in crowded feedlots, releasing hundreds of pounds of the greenhouse gases methane and nitrous oxide, before they are transported to a slaughterhouse, where they are killed and their bodies are sliced into steaks and ground into hamburgers. Technology has shaped every step of this process, from the amount of time they spend on grass before

being moved to feedlots, the nutritional elements of the feed, the antibiotics and other antimicrobials used to keep the cattle healthy, to the precision and efficiency of the slaughter line. Until recently, the alternatives to this system included plant-based meat substitutes or meat produced in the similarly unsustainable but more humane method of raising cattle solely on pasture and utilizing smaller-scale slaughterhouses.² The development of the first cultured beef burger in 2013 raised the possibility of a newer and better alternative, and as the proliferation of startup companies in this sector and the recent government investment shows, there is substantial optimism in this alternative.

Cultured meat, which “involves applying the practice of tissue engineering to the production of muscle for consumption as food,” produces beef without live cattle, though animal cells and materials are utilized (Stephens et al. 2018). Cultured meat production could eliminate animal suffering and reduce agricultural land use, but it also requires energy, which may mean that the climate impact of cultured meat is similar to or only minimally better than factory-farmed beef (Lynch and Pierrehumbert 2019). Cultured meat is also known as in-vitro meat, lab-grown meat, synthetic meat, cellular meat, slaughter-free meat, and clean meat (Jiang et al. 2020). Scholarly consensus appears to be forming around the term cultured meat, so, in this article, I will use the term cultured meat, except when quoting directly from sources that use a different term.

As startup companies and scholars developed the technology used in cultured meat production with private and government funding, the potential impacts on animals and the environment were emphasized. Some attention has been paid to the potential viability of cultured meat in observant religious communities, but cultured meat also exemplifies the ways that religion and technology intersect and influence each other in moments of innovation and experimentation. In this article, I use the example of cultured meat to argue that religion and technology are co-constitutive, that they shape and reshape each other, and that the intersection between religion and technology in meat production has had and continues to have a direct impact on animals raised for meat. Kosher meat, industrial or cultured, exemplifies the complexities in the relationship between religion, technology, and animals and will serve as the example throughout this article.³ I will use the development of industrial meat production and processed foods to elucidate the ways that religion and technology have co-constituted the kosher industry, and I will then turn to the example of kosher meat to illustrate where the Jewish legal conversation is as this development continues. Jewish law already has an outsized influence on food production because the perception that kosher food is cleaner or healthier has pervaded the marketplace, which has led to the kosher certification of millions of products, many of which required ingredient and additive changes before certification (Fishkoff 2010, pp. 4–7). And, in the case of cultured meat, a significant number of cultured meat companies are located in Israel, where questions of Jewish law are more familiar and more relevant. Relatedly, cultured meat is on the minds of more Jewish leaders because of these companies, so these technological developments are also shaping Jewish law as rabbis rethink ancient principles to figure out whether stem cells are an animal, whether cultured meat is meat, and whether cultured meat is kosher. I will focus on cows and cultured beef here in particular, because, in addition to animal welfare concerns, the environmental impact of beef is significantly higher than that of other animal products and, for this reason, cultured beef has been at the center of this technological development.

The particular impact of cattle on the climate also raises a key downside to cultured meat development. As the investments pour into cultured meat production and startups working to develop marketable products proliferate, real cattle embedded in the industrial meat production system graze on newly cleared land, contribute to greenhouse gas emissions, suffer on feedlots, and die in slaughterhouses. And while cultured meat promises an end to all of this, plant-based meat substitutes are dismissed by some of those most enthusiastic about cultured meat because they are not meat. This suggests that humans may not actually be looking for a sufficiently meaty substitute for meat but, rather, a sufficiently promising but not yet fully operative technology to point to as an excuse to maintain the

status quo and continue consuming industrial meat at an unsustainable rate. In other words, consumers of industrial meat feel that they do not need to develop new habits, like shifting to plant-based meat proteins, because they can just wait for cultured meat technology to fix the system without any need to change their behavior.

2. Religion, Animals, and Technology

My argument here, that religion and technology are co-constitutive and that this is visible in the conversations around cultured meat, builds on previous work that has expanded our understanding of the intersection between religion and technology beyond an instrumentalist understanding. In the introduction to the volume *Deus in Machina*, editor Jeremy Stolow argues that it is no longer useful to understand religion and technology as “ontologically distinct areas of experience, knowledge, and action” (Stolow 2013, p. 2). Stolow suggests that where religion is often associated with the “intangible realms of ritual expression, ethical reasoning, affect, and belief,” technology is understood as mechanical operations, the human knowledge that creates them, and “the very tangible domains of nature and society” (Stolow 2013, p. 2). But this binary breaks down on both sides. Religion is often tangible and technology is often intangible, or at the very least inaccessible to the average person. Stolow considers earlier work on religion and technology and notes that much of the work in this area was “instrumentalist” because it dealt with the addition or subtraction of technology in analyses of religion (Stolow 2013, p. 8). So studies tend to consider what religious actors have done with or without technology to accomplish religious outcomes (Stolow 2013, p. 8). Stolow suggests that technology’s predecessor, magic, was disavowed “for the sake of the integrity of religion,” and this caused the segregation between religion and technology that resulted in the idea that religious actors can only ever approach technology from the outside (Stolow 2013, p. 9). But Stolow contends that magic remains in between religion and technology and complicates this supposed binary. The magic that resides there is what Stolow calls “Deus in Machina” (God in the machine) and his framework enables a reconsideration of what a “religious instrument” is (Stolow 2013, p. 10). A religious instrument is not just a technology used for a religious purpose, but is often a technology imbued with just enough “magic” to be considered religious unto itself by those who use it, the same way that cultured meat promises effortless salvation.

For historical and even contemporary industrial kosher meat production, the instrumentalist framework is an acceptable method for understanding the religiosity of slaughter. A religious actor, a *shochet* (kosher slaughterman), uses a simple but technological tool, a knife, to kill an animal in a prescribed manner that renders the meat from that animal kosher, or fit to eat, which is a religious outcome. So, meat was the result of animals plus technology plus religion. But the process of cultured meat production complicates every aspect of this process and blurs any boundaries that may have existed between the categories of religion and technology. Cultured meat production raises questions about kosher meat that require a reconsideration of what the kosher system is and what it was meant to do. Cultured meat presents an opportunity to have kosher meat that requires no slaughter, but the viability of this product requires some attention to the question of what constitutes an animal and how religious ideas about animality relate to conversations not only about whole animals, but also about animal cells.

In addition to his reconsideration of religion and technology, Stolow also argues that, rather than thinking of humans and instruments as distinct, we might instead focus on the ways that technologies “define the horizons of human action,” as well as the ways that humans define ourselves and our “others” (Stolow 2013, p. 15). Stolow suggests placing humans and technologies in a “shared framework of traffic between and among humans and other actors” and recommends that we abandon our sense of self and attend “to the human/nonhuman hybrids that are generated in the traffic” (Stolow 2013, p. 15). This is a useful framework for thinking through the fuzzy boundaries between human and technology but it is also informative for the case of cultured meat, where the boundary

blurred is that between technology and animal, and perhaps even technology and the divine, as animal flesh grows into meat in a lab.

Jenna Supp-Montgomerie uses the work of Karen Barad to describe what she suggests is an entanglement of networks and religion in her book on the telegraph and the origins of network culture (Supp-Montgomerie 2021, p. 9). Supp-Montgomerie argues that “networks and religion are inextricably bound up in each other” and that, because of this entanglement, looking at elements individually is not comprehensive but that it “will help explain how they constitute each other” (Supp-Montgomerie 2021, pp. 9–10). This is a useful framework for considering the ways in which religion and technology are entangled in cultured meat production. It is not possible to consider them separately, when religion is informing the processes and materials being used in the labs and the technology being developed is influencing the ways that religious people define meat, kosher meat, and their relationship with nonhuman animals. Supp-Montgomerie also points to the ways that an understanding of religion through Protestant frameworks as a phenomenon of the individual related to their beliefs has masked the ways that religion has shaped “US public culture” (Supp-Montgomerie 2021, p. 10). She enacts a broader understanding of religion, which includes analysis of “institutions, identities, and beliefs,” but also things like religious processes and logics (Supp-Montgomerie 2021, p. 10). She considers “religion as a part of infrastructure” because religion is lived so it shapes worlds in ways that are not always systemic or even recognizable (Supp-Montgomerie 2021, p.11). I will build on her framework for understanding the role of religion in communication networks in the United States to consider the ways that religion shapes the public and consumer culture in both the United States and Israel, where cultured meat is being developed. In essence, the startup companies developing cultured meat do not generally invoke religious language or beliefs in their public-facing marketing materials and they may not see themselves as religious people. But they will inevitably be influenced by the religious processes and logics that surround them. And some of those religious processes and logics are therefore likely to end up embedded in the infrastructure they are building.

Coca-Cola is a good example of how religion and technology became “inextricably bound up in each other” in an earlier era and how religion is now part of the infrastructure of a popular global product (Supp-Montgomerie 2021, pp. 9–10). Roger Horowitz described this relationship in his book *Kosher USA*, where he notes that Abraham Goldstein, an Orthodox Jew and chemist, “devoted his life” to helping Jewish organizations understand the scientific processes used in food manufacturing to help Jews observe kosher law (Horowitz 2016, pp. 25–29). Goldstein founded Organized Kashrus (OK) Laboratories to advise rabbis on modern food science methods and to test food for them (Horowitz 2016, p. 28). Horowitz suggests that, through his efforts, Goldstein established a “relationship between modern food science and traditional kosher law” that remains in place today (Horowitz 2016, p. 29). This relationship was bolstered by the findings of Goldstein’s contemporary Tobias Geffen, an Orthodox rabbi from Atlanta (Horowitz 2016, p. 19). Geffen received inquiries from rabbis in other cities about the kosher status of Coca-Cola, which was produced in Atlanta, and so he promised confidentiality, gained access to the manufacturing operations, and had samples tested by chemists (Horowitz 2016, p. 21). Geffen found that Coca-Cola was produced using glycerin, a chemical byproduct of soap production, and determined that the factory that produced glycerin slaughtered both kosher and non-kosher animals and used bones, fats, and other parts of the animals to produce the oil that then produced soap and glycerin. For this reason, Geffen determined that glycerin was not kosher (Horowitz 2016, p. 23). As a result of his ruling, Coca-Cola worked with their glycerin supplier, Proctor & Gamble, to source glycerin derived from cottonseed oil instead of animals. With kosher glycerin in place, Geffen endorsed Coca-Cola as a kosher product in 1935 (Horowitz 2016, p. 25). With the complex relationship between religion—in this case, Judaism—and technology untangled, it becomes clear that religion shaped the manufacturing process of Coca-Cola and developments in food processing shaped Jewish conversations around what it meant to keep kosher in the early to mid-twentieth century.

And, relevant to the example of cultured meat, a rabbinic ruling on the kosher status of a chemical ingredient used in the manufacturing process ended up changing this process for all Coca-Cola, not just kosher Coca-Cola. In the case of cultured meat, the manufacturing process is still being developed and rabbis are engaged in conversation on the topic, so this entanglement between religion and technology is poised to continue to shape food production and the inclusion and exclusion of animal products in interesting and important ways.

3. Cultured Meat

Cultured meat offers a particularly peculiar engagement with the technology-plus-animals-equals-meat equation. In his book *Meat Planet: Artificial Flesh and the Future of Food*, Benjamin Aldes Wurgaft described watching a 2013 event with Mark Post, a medical doctor and professor of physiology, revealing the burger he created in his lab by growing cells and shaping them into muscle and eventually meat (Wurgaft 2020, p. 2). Wurgaft narrated his experience watching the event and considering the “meat’s utter weirdness,” because it was meat that had never had parents or died (Wurgaft 2020, p. 2). Wurgaft suggested that this meat “could utterly transform the way we think of animals, the way we relate to farmland, the way we use water, the way we think about population and our fragile ecosystem’s carrying capacity of both human and nonhuman animal bodies” (Wurgaft 2020, p. 2). The meat that Wurgaft describes as potentially transformational was made by Mark Post using a process developed by the embryologist Ross Harrison in 1907 known as tissue or cell culture (Wurgaft 2020, p. 1). Tissue engineering is used to produce muscle, which can then produce “beef without live cattle” (Stephens et al. 2018).

Today, there are three systems in development to produce cultured meat. In the first, microcarrier-based culture, microcarrier beads, often made of polystyrene, are used to grow cells. As the beads float in a medium, they are agitated by an impeller, and gases and nutrients are mixed to enable cell growth. In this system, there is a benefit from the spherical beads, which have a large surface to volume ratio that enhances cell growth (Jiang et al. 2020, p. 6). The second system, culture via cell aggregation, works similarly, with clusters of cells grown in an impeller-mixed medium. In this system, the high density in the cluster of cells enhances cell growth (Jiang et al. 2020, p. 6). In the third version, cells are cultured in bioreactors. There are many types of bioreactors, but one example is a “packed bed type” in which cells attach to microcarriers to form the bed of the bioreactor and then the growth medium flows through in all directions, causing a thorough mixing of gases and nutrients. In this system, the high cell density results in a high output, which makes this system easier to scale-up (Jiang et al. 2020, pp. 6–7). Though these systems were developed in academic laboratories, many of the subsequent technological advances have been made by private companies, including Mosa Meats, which was founded in part by Mark Post, who remains one of the leading scientists in the field (Wurgaft 2020, p. 17). A number of companies in the San Francisco Bay Area have become prominent in the field, including UPSIDE Foods (formerly known as Memphis Meats), which has developed samples of chicken strips and meatballs, and JUST (formerly known as Hampton Creek), which is known best for their plant-based egg substitute, Just Egg (Wurgaft 2020, p. 17).

Israeli Companies

In his book *Billion Dollar Burger*, Chase Purdy explains that while the United States is home to eight cultured meat companies, and Japan home to one, three up-and-coming cultured meat companies are headquartered in Israel: Aleph Farms, SuperMeat, and Future Meat Technologies (Purdy 2020, p. 114). Purdy explained that Israel, which relies on imported food, funds innovation in this area because of concerns about the impact of climate change on their ability to access food. Purdy suggests that this differentiates the Israeli companies from the American companies, which are driven by “vegan ambitions” rather than “long-term self-preservation” (Purdy 2020, p. 116). Israel also has the highest proportion of vegans in the world, so “vegan ambitions” may be a factor in Israel as well

(Berger 2018). In addition to the motivational difference and the prevalence of vegans and vegetarians in Israel, the location of three cultured meat startups in Israel also means that conversations about the kosher status of cultured meat are prevalent in the industry.⁴

Aleph Farms was co-founded by a biomedical engineering researcher, Shulamit Levenberg, and Didier Toubia, and after visiting their laboratory, which is in the same building as SuperMeat, Purdy found that there is also a difference in the product being developed in the two countries (Purdy 2020, p. 114). Purdy notes that American companies like JUST and UPSIDE Foods are focused on “growing cells in a liquid suspension system,” but Aleph Farms is working on growing beef as a “3-D structure” (Purdy 2020, p. 116). In other words, instead of working on producing ground beef, Aleph Farms is growing steak using a system that mimics the process inside living animals. In this system, “a man-made blood-vessel-like vascular system” actually “pushes liquid medium to the cells,” which provides the nutrients they need to grow (Purdy 2020, p. 117). Purdy says this method might mean it takes Aleph Farms longer to get their product on the market, but the additional time will allow them to make “a more complex cut of meat” (Purdy 2020, p. 117). Future Meat Technologies is also pursuing a different method focused on growing connective tissue instead of muscle cells, which requires “fewer ingredients and less liquid medium”, according to Purdy (Purdy 2020, p. 118). Future Meats Technology also hopes to be a “business-to-business company” and plans to sell knowledge and machinery to other companies, rather than selling actual meat (Purdy 2020, p. 119). Meanwhile, SuperMeat opened the first cultured meat restaurant in the world in November 2021. Their eatery is called “The Chicken,” which is a reference to the classic question of whether the chicken or the egg comes first (Liphshiz 2020). The menu includes two burgers made out of “crispy cultured chicken fillet,” and CEO Ido Savir told *The Jerusalem Post*, “the taste is indistinguishable from that of slaughtered animals” (Liphshiz 2020). The restaurant is mainly geared towards consumer testing and it is currently one of the only places in the world where consumers can try cultured meat (though they have to apply for a table). So, again, the location of cultured meat companies in Israel means that Israeli consumers, many of whom are likely to be Jewish, will have a disproportionate influence on the development of cultured meat technologies. The presence of these Israeli companies means that Jewish dietary laws are likely to be considered as cultured meat technologies are being developed and consumer products are being tested, just as they were with Coca-Cola in Atlanta.⁵ Relatedly, there is more awareness of cultured meat development in Jewish communities because of the location of some of these startups in Israel, which triggered an ongoing conversation in Jewish legal circles about the potential kosher status of cultured meat.

4. Jewish Approaches to Cultured Meat

While many religious people are inclined to consider the benefits to animals and the environment, for Jews who keep kosher, there is more work to be done to determine whether cultured meat is a viable alternative. And, as is often the case in Judaism, even with this new technology, there are already diverse and divergent opinions on the kosher status of cultured meat. There are differences of opinion on whether it is meat, whether it should be derived from kosher cells, and whether it should be granted kosher certification. Many of these particularities may only seem relevant to Jews but, in fact, these issues are likely to be raised by religious and non-religious people, particularly those who are vegetarians and vegans, as well. Though the rabbis discussing these issues dive into ostensibly obscure details using rabbinic principles, the central question at the heart of all of their queries is whether cultured meat is meat and whether the bovine stem cells used to produce it constitute an animal. As rabbis work through the details of what counts as an animal to determine what counts as meat, they are dealing with nothing less than the question of what counts as an animal life. And because humans encounter animals most when they appear on their plates, the questions about this developing technology are poised to reshape the entire relationship between human animals and non-human animals.

There are also practical considerations since Jews are not the only consumers of kosher products. As Joel Kenigsberg and Ari Zivotofsky suggest in their article, “A Jewish Religious Perspective on Cellular Agriculture,” though Orthodox Jewish consumers are the primary audience for questions about kosher certification, there is a wider applicability because of the effects of a kosher certification on “broader regulatory and health and safety concerns” (Kenigsberg and Zivotofsky 2020, p. 1). And, because the kosher market now makes up a significant portion of the broader American market for packaged goods, it is worth paying attention to the conversations happening around the kosher status of new foods. In her book *Kosher Nation*, Sue Fishkoff estimates that somewhere between one third and one half of the food for sale in typical American supermarkets is kosher, despite the fact that less than 2% of the US population is Jewish and only a small percentage of the Jewish community keeps kosher (Fishkoff 2010, p. 4). A significant portion of the consumers purchasing kosher food items do not keep kosher, but think that “kosher food is cleaner, safer, better” (Fishkoff 2010, p. 7). As Sarah Zhang explained in her article in *The Atlantic* on the potential kosher status of cultured meat, because people believe kosher food is higher-quality (though they are often wrong, as noted above) and the market share of kosher foods far exceeds the population share of kosher keeping Jews, “it’s good business sense for manufacturers” to certify their products (Zhang 2016). For this reason, Zhang ends her article by saying that “the concerns of Jewish dietary law could very well shape where the ingredients of lab-grown meat come from” (Zhang 2016). Therefore, the Jewish example is convenient because it is an active conversation, but it is also relevant because of the influence of kashrut on the food industry and instructive as the cultured meat sector continues to grow and questions about the nature of meat and, subsequently, animals abound.

5. Cultured Meat and Jewish Approaches to Animal Welfare

Industrial meat production, which sits at the intersection between animals and technology, has been covered by journalists, scholars, and activists at least since the publication of Upton Sinclair’s *The Jungle* in 1906, which offered an early window into the horrors of industrialized slaughter (Sinclair [1906] 2001). Though Sinclair’s book resulted in improved sanitary and safety conditions, technological improvements have only worsened the lives of animals raised for meat. Today, the overwhelming majority of cattle begin their lives on pasture, spend the last few months before their slaughter eating grains in Concentrated Animal Feeding Operations (CAFOs), and are slaughtered and packaged so efficiently that the products on the shelves of grocery stores are both fresh and unrecognizable as “cattle.” Timothy Pachirat, author of *Every Twelve Seconds*, based the name of his book about industrialized slaughter on the pace of killing in the slaughterhouse where he conducted ethnographic research (Pachirat 2011, p. 9). Pachirat also describes the effects of industrialization on consumers. He argues that it enables people “to eat meat without the killers or the killing” and without the animals themselves (Pachirat 2011, p. 3). He suggests that this is what enables companies to kill millions of cattle each year for meat in the United States. He includes specific figures for the year 2009, in which 944,200 calves were killed (Pachirat 2011, p. 3). Many of the proponents of cultured meat argue that the same packaged meat could be available to consumers without the mass death of animals.

Many consumers believe kosher meat is better, as discussed above, but Aaron Gross disproved this in his book, *The Question of the Animal and Religion* (2015). Gross described inhumane practices that were occurring in the AgriProcessors kosher slaughterhouse in Postville, Iowa in disturbing detail, including the controversial “second cut”, where the tracheas and esophagi of cattle are removed immediately after slaughter and, in 20% of cases, “while the animals were still sensible and often in visible agony” (Gross 2015, p. 31). Despite this gruesome information, kosher meat still represents a disproportionate share of the market because of a “halo effect” that leads consumers to believe kosher food is healthier and safer (Jeong and Jang 2020). Kenigsberg and Zivotofsky offered an overview of the current kosher meat market in the United Kingdom in order to discuss the potential

implications of a shift from animal meat to cultured meat. They explain that, each year, around 90,000 cattle are slaughtered for kosher consumption in the United Kingdom, out of a total of around 2.6 million cattle slaughtered for human consumption (Kenigsberg and Zivotofsky 2020, p. 2). This means that 3.4% of the cattle in the United Kingdom are killed for kosher consumption annually, despite the fact that only an estimated 0.43% of the population of the United Kingdom is Jewish.⁶

A great deal has been written about the ways that religion has shaped human understandings of non-human animals, and though it won't be possible to provide in-depth coverage of that literature here,⁷ there is a relevant Jewish value related to animals, which impacts Jewish approaches to cultured meat. This Jewish value is called *tza'ar ba'alei chayim*, which translates as "the suffering of living creatures" but refers to a prohibition against the unnecessary suffering of animals. Gross suggests that Jewish animal rights advocates tend to elevate the status of *tza'ar ba'alei chayim*, while leaders in kosher certification organizations tend to "deflate its importance" [emphasis in original] (Gross 2015, p. 48). Whether *tza'ar ba'alei chayim* is minimally or maximally important, what is clear is that there is a Jewish imperative to avoid the unnecessary suffering of animals. Theoretically, if a variety of cultured meat products were developed and became widely accessible, most slaughter, and especially industrialized slaughter, could be considered unnecessary because meat eating would no longer require animal suffering, at least at the same scale.

Rabbi Daniel Nevins discussed animal welfare as one of the main ethical implications of cultured meat in his responsum for The Committee on Jewish Law and Standards of the Rabbinical Assembly, the legal body of the Conservative Movement of Judaism. He argued that cultured meat has the potential to be "compassionate" because "cultured meat would not involve a nervous system, and thus there would be no animal suffering" (Nevins 2017, p. 2). He also noted a benefit to wildlife due to "the reduction of herds and flocks raised for meat" and because many animals are killed when hay is harvested to feed livestock (Nevins 2017, p. 2). Wurgaft also picked up on this point about cultured meat benefiting wildlife. He explained that if conventional animal agriculture was replaced by cultured meat, "the earth's biomass would be transformed in the process. The bulk of that biomass consists of domesticated creatures living and dying in our food system" (Wurgaft 2020, p. 20). To underline this point, because livestock raised for meat constitutes the vast majority of mammals and birds on the planet, the development of cultured meat has the potential to fundamentally reshape the ecology of the planet, in addition to ending the suffering of millions of animals who are presently embedded within the industrial meat system. In both cases, there are Jewish values that not only support but may even require a shift to cultured meat.

6. Cultured Meat and Jewish Approaches to Climate

Interestingly, sustainability shows up more frequently than animal welfare in the literature on Jewish perspectives on cultured meat thus far. It is possible that in the case of cultured meat, the benefits to animals seem obvious and therefore aren't mentioned, but authors do feel the need to draw a connection to the environmental benefits. This trend seems related to an awareness that humans need to reverse their detrimental effect on the planet to survive. This focus on the environment also allows Jewish leaders who are invested in assuring their communities that factory-farmed kosher meat is acceptable to avoid the issue of animal welfare, which is often paired with environmental sustainability as one key benefit of cultured meat. It also enables the Jewish community to continue eating factory farmed meat while they await consumer-ready cultured meat. Chase Purdy discussed cultured meat with Rabbi Menachem Genack, CEO of the kosher division of the Orthodox Union kosher certification agency. Genack praised cultured meat's promise "for the environment during a time in which climate change has understandable become a source of anxiety" and noted his excitement about the transformational potential for the cattle industry and the meat industry (Purdy 2020, pp. 190–91). He named climate change as a primary concern and followed this with enthusiasm for the potential to change the

cattle industry, but he wasn't quoted as having anything to say about the benefits to actual cattle. Similarly, the Kenigsberg and Zivotofsky article contains a section on sustainability but the authors don't dedicate the same space to animal welfare. Interestingly, despite this focus on the environmental benefits, the scientific literature on cultured meat finds these benefits to be far less clear than the benefits to animals.

Contemporary Jewish environmentalisms often highlight Jewish ideas that encourage Jews to be good stewards of the Earth. The Jewish value of *bal tashchit*, which means "you shall not destroy," is based in the Book of Deuteronomy, where Jews are prohibited from cutting down fruit trees during a siege (Krone 2020, p. 283). This biblical commandment has been used in the Jewish environmentalist movements of the recent decades to emphasize the responsibility Jews have to preserve, rather than destroy, the Earth. For this reason, it is also central to Jewish arguments about climate change. And almost 80% of Jewish Americans consider climate change a crisis or a major problem according to a Public Religion Research Institute and American Academy of Religion survey from 2014 (Jones et al. 2014, p. 12). This concern about climate change in the American Jewish community indicates a receptive audience for climate mitigation strategies. Kenigsberg and Zivotofsky argue that because cultured meat "carries the potential for profound benefits both from an ecological and societal perspective," supporting the growth of cellular agriculture would align with Jewish values like *bal tashchit*, which is often interpreted as a requirement to preserve the environment and avoid unnecessary waste and damage to the world (Kenigsberg and Zivotofsky 2020, p. 3).

Christopher Bryant and Julie Barnett note that "consumers in the West are unwilling to reduce their meat consumption" (Bryant and Barnett 2018, p. 8). But it is also clear that meat consumption cannot continue at its current rate without a significant and ongoing impact on the climate, particularly because of the impact of meat production on greenhouse gas (GHG) emissions. Guihun Jiang, Kashif Ameer, and Honggyun Kim et al. explained, in their article about strategies for replacing livestock meat, that "livestock production is considered to be a large contributor to climate change accounting [for] up to 14.5% of all anthropogenic GHG emissions" (Jiang et al. 2020, p. 1). Hanna Tuomisto and M. Joost Teixeira de Mattos suggest that the base number is higher, at 18%, and break down GHG emissions related to livestock production, noting that 34% are due to deforestation, 25% are methane emissions from ruminants, and 31% are related to manure management (Tuomisto and Teixeira de Mattos 2011, p. 6117). The methane emissions that they mention are specifically related to beef production, as methane is emitted in the flatulence of cattle.

In both articles mentioned above, the authors went on to explain that beef production is the most problematic of all livestock because cattle require a disproportionately large number of resources and more land compared to other meat sources (Jiang et al. 2020, p. 1). Tuomisto and Teixeira de Mattos write, "30% of global ice-free terrestrial and 8% of global freshwater" is used by livestock raised for meat (Tuomisto and Teixeira de Mattos 2011, p. 6117). Jiang, Ameer, and Kim argue that despite the effects of livestock production on GHG emissions, the energy sector has been the primary focus of climate mitigation (Jiang et al. 2020, p. 1). They suggest that, in addition to the potential benefits on GHG emissions, cultured meat could also reduce the land and water footprint of the agricultural sector (Jiang et al. 2020, p. 6). Similarly, Tuomisto and Teixeira de Mattos found that "cultured meat production emits substantially less GHG emissions and requires only a fraction of land and water compared to conventionally produced meat" (Tuomisto and Teixeira de Mattos 2011, p. 6120).

In his response on cultured meat, Daniel Nevins notes the potential for energy efficiency in cultured meat production in addition to the reduction in GHG emissions: "Cultured meat would be cleaner to produce because there would be no excrement or emission of methane," an issue particular to raising cattle for meat (Nevins 2017, pp. 2–3). Nevins also mentions that "vast tracts of land and quantities of freshwater currently dedicated to livestock production could instead be used to cultivate diverse fruits and vegetables" and that, in some cases, "fields could also be fallowed and returned to nature" (Nevins 2017,

p. 2). This argument once again connects a shift to cultured meat to Jewish environmental values. This interest in the environmental impact of cultured meat is driving a lot of the enthusiasm for cultured meat in the Jewish community, but cultured meat also raises significant questions that are instructive for a consideration of cultured meat in Jewish, religious, and non-religious communities.

7. Cultured Meat Technology, Animals, and Kashrut

Before diving into the entanglement of religion, animals, and technology in cultured meat production, it is worth noting that there is no clear universal Jewish perspective on the kosher status of cultured meat, because there is rarely a clear universal Jewish perspective on any topic. As Benjamin Wurgaft noted, “the potential status of cultured meat products remains ambiguous, and the rabbinic community has been polyvocal rather than unanimous” (Wurgaft 2020, p. 155). And because the technology is still in development, rabbis are weighing in on multiple versions of cultured meat production as they consider whether this product would be considered kosher and whether it would be considered meat. Kenigsberg and Zivotofsky summarize the three options for how the cells used to start cultured meat and therefore cultured meat might be understood in Jewish law. They may be considered “meat or a meat derivative,” a “non-meat derivative from the animal species,” or a “non-food substance/insignificant” (Kenigsberg and Zivotofsky 2020, p. 4). These categories are based in Jewish legal approaches that have been applied to cultured meat thus far. It is also not clear yet how exactly these rabbinic conversations will shape the future of cultured meat, but previous examples like Coca-Cola suggest that it is worth paying attention to the conversations happening in Jewish legal circles, because they are likely to affect the development of cultured meat technologies in ways that are both seen and unseen.

One of the most comprehensive Jewish treatments of cultured meat is J. David Bleich’s “Survey of Recent Halakhic Periodical Literature,” where he raises broad, hopeful claims made about cultured meat on the first page. He argues, “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 gasses” (Bleich 2013, p. 48). It is worth mentioning here that animal welfare didn’t make this list, likely for the reasons mentioned above. Bleich goes on to explain that kashrut-observant consumers have been “fascinated by the question of the kashrut status” of cultured meat and the implications of that status (Bleich 2013, pp. 48–49). For example, could they get around the kosher prohibition against mixing meat and dairy by making a cheeseburger with cultured meat and dairy cheese? For Bleich, the answer to this question is clear: “for the purposes of Halakhah, an animal appearing *sui generis* is not an animal and its flesh is not meat” (Bleich 2013, p. 49). Bleich explains that, in Jewish law, meat is only meat if it is “a substance derived from an animal” and living animals are only living animals if they are “the offspring of an animal” (Bleich 2013, p. 49). So, meat produced in a lab “from inert chemicals” results in the unique production of a meat-like substance from animal cells but there was no living animal, so there is no meat. Bleich bases his determination on interpretations of two biblical narratives and a number of rabbinic principles. The texts and principles he cited show up throughout the other sources on Jewish approaches to cultured meat, and this discussion will incorporate those sources alongside Bleich’s more comprehensive treatment.

7.1. *Sefer Yezirah and the Ex Nihilo Creation of Animals*

Many of the Jewish deliberations about cultured meat begin with the question of what it means for humans to create meat themselves. Just as Jeremy Stolow highlighted the times when God is actually in the machine, considerations of whether cultured meat counts as an animal product often start with a discussion of the ways in which humans have been empowered to utilize a bit of divine magic to create life, just as God does. In the biblical Book of Genesis, Abraham is visited by angels disguised as travelers and treats them to supreme hospitality, including a meal of cream, milk, and a prepared calf. In other

words, Abraham served his guests milk and meat in the same meal, which defies the kosher prohibition of mixing meat and dairy. There has been a great deal of rabbinic discussion about what exactly Jews are meant to make of this non-kosher meal served by the father of their people. Bleich cites Rabbi Meir Leibush Malbim, who emphasized the use of the verb *“la’asot—to make”* in this verse to suggest that when the text of Genesis (18:7) says that Abraham made the calf, he actually created a calf himself. Bleich reports Malbim’s suggestion that Abraham used information from *Sefer Yezirah*, the *Book of Creation*, which Abraham is said to have authored, to create a calf *ex nihilo* (from nothing) through the invocation of Divine Names (Bleich 2013, p. 49). Patrick Hopkins and Austin Dacey also suggest that cultured meat may be also be categorized as something created without an animal in their article on “vegetarian meat” (Hopkins and Dacey 2008, p. 594). They go so far as to suggest that “in this new technological situation,” it may be possible to completely divorce meat conceptually from animal (Hopkins and Dacey 2008, p. 594). So, even outside Jewish communities, cultured meat is seen as something that is created without animals and the resulting meat is separate from animals.

Wurgaft also raised this consideration of created meat in his discussion of the kosher status of cultured meat. He and Bleich both include discussion of Rabbis Hanina and Oshia, who are described in the Talmud (*Sanhedrin* 65b) as creating meat every Friday for their Sabbath meals using *Sefer Yezirah*. Wurgaft considers the opinion of the late sixteenth/early seventeenth century Rabbi Yeshaya Halevi Horowitz that the “manmade calf may not have been a ‘real animal’” (Wurgaft 2020, p. 154). Similarly, Bleich turns again to Malbim, who ruled that meat created through use of *Sefer Yezirah* “does not have the halakhic status of ‘meat’ and hence may be consumed without qualm together with dairy products” (Bleich 2013, p. 49). Wurgaft also raised the opinions of other authorities, who suggested that Hanina and Oshia’s failure to perform *shechitah*, kosher slaughter, on the animals they created was a violation. It was not a violation because the meat was meat, but because of the principle of *marit ayin*, which requires “the avoidance of actions that might appear improper even though they are not actually improper” (Wurgaft 2020, p. 154). In other words, the issue is not about performing kosher slaughter, which would not be required on meat that isn’t meat, but rather that others might have seen Hanina and Oshia eating meat that they knew was not slaughtered in the proper manner. This might leave people confused and potentially in danger of slaughtering animals improperly and eating unkosher meat themselves. So, Wurgaft suggests, “this is a story about keeping up appearances, but also about the treatment of animals, and the relationship between meat and the cycle of animal life” (Wurgaft 2020, p. 154). This issue related to the appearance of eating meat is relevant to the issue of cultured meat and will be discussed further below.

Based also in the Book of Genesis, though this time in the story of Noah, Wurgaft raises the issue of the biblical prohibition against consuming *aver min hachai*, “a limb from a living animal” (Wurgaft 2020, p. 157). In other words, it is not permissible to remove part of a living animal and consume it. Wurgaft points out that should rabbis judge the tissue biopsies from donor animals used to collect the cells for culture part of that animal, they might also consider the meat grown from those cells part of an animal that is still living, and therefore forbid it (Wurgaft 2020, p. 157). And if an animal has to be killed to collect the cells, it would negate some of the positive effects of cultured meat on animals while also raising again the question of whether a kosher slaughter is required for the donor animal (Wurgaft 2020, p. 157). Kenigsberg and Zivotofsky discussed this principle as well and raised the opinion of Rabbi Yaakov Ariel, who thought it would be a problem if the cells were viewed as a “fleshlike entity,” while another rabbi, Rabbi Zvi Ryzman, felt that the cells were “too small and dissimilar to actual flesh for the prohibition to apply to it” (Kenigsberg and Zivotofsky 2020, p. 4). Nevins also cites Ryzman and notes the comparison he made to a human fetus, noting that the cells are “simply water” during the first forty days of gestation. Ryzman argues that this principle, used most frequently in Jewish legal rulings to permit abortion, would also apply to the stem cells taken from a cow to start cultured meat (Nevins 2017, p. 13). Nevins disagrees because the stem cells harvested via

biopsy for cultured meat come from a live animal, not a gestating fetus (Nevins 2017, p. 13). So, while there is no agreement on this topic, the procedure for collecting cells is likely to affect any potential kosher certification of cultured meat.

Bleich discussed this same prohibition in relation to the story of Joseph, who brings an “evil report” of his brothers to their father (Genesis 37:2), which the same Rabbi Horowitz mentioned by Wurgaft interprets as a reference to the brothers consuming a limb severed from a living animal and committing acts of sexual immorality (Bleich 2013, p. 49). To explain this odd reference to the fathers of the Israelite nations committing evil acts and Joseph gossiping to their father about it, Horowitz suggests that Joseph was not aware of his brothers’ ability to use *Sefer Yezirah* to create both animals and women, whose status as created beings and not beings who enjoyed the “status of either humans or beasts,” which meant they were not guilty of the evil acts Joseph presumed they had committed (Bleich 2013, p. 50). In other words, the brothers were not eating the limb from a living animal—they were eating the limb from an animal they created using *Sefer Yezirah*, so it therefore didn’t have the status of an actual animal.

Though Bleich presented this biblical evidence that would suggest that cultured meat is not meat, he ended his discussion of *Sefer Yezirah* with an ominous note that these rulings are not enough to solve this contemporary issue because this meat “was neither miraculously nor synthetically produced” (Bleich 2013, p. 50). In other words, it is not produced using the *Sefer Yezirah* and it is not entirely man-made. So, while all of this discussion of animals created ex nihilo is fascinating, it is likely irrelevant to the discussion of cultured meat, which is made by humans who benefit from technological advancement but not the ancient wisdom of Abraham or the power of the Divine Names. It is, at the very least, real meat that contains some cells of a real animal. For this reason, the next issue raised in Jewish discussions of cultured meat is often related to the amount of animal tissue used and the potential of that animal tissue to be nullified in the production process, such that the issues raised above related to the animal tissue are no longer of concern.

7.2. Size Matters: Cultured Meat and Nullification

Technological developments have made rabbinic rulings on food complicated, as the case of Coca-Cola showed. Rabbis have had to develop a discourse around the status of microscopic things, because we are now able to see things, aided by tools like microscopes, that were invisible to the rabbis of the Talmud. Bleich explains that if the original stem cells were “miniscule in nature,” there are other aspects of kosher law that would come into play (Bleich 2013, p. 50). If the cells were microscopic, and therefore insignificant according to halakhah, “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” (Bleich 2013, p. 50). But the stem cell clusters used to make cultured meat are unlikely to be invisible to the naked eye. Bleich also considers the argument of Rabbi Shlomoh Zalman Auerbach, who assigned halakhic status to microorganisms that are involved in “a goal-oriented procedure” because, even if the microorganism is not visible, the effects of the procedure would be perceptible, so the microorganism has halakhic significance and couldn’t be ignored for being invisible to the naked eye (Bleich 2013, pp. 53–54). Bleich then considers the question of the identity of the cells, which is where many of the rabbinic conversations about cultured meat are focused.

Bleich considers a term from the Mishnah, *yozei*, which he defines as “that which emerges,” and suggests that this term is what identifies an animal as a member of a species (Bleich 2013, p. 56). Bleich, considering the kosher status of a potential cultured pork product, explains that this term applies to animals and their descendants, but it does not extend to “some 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” (Bleich 2013, p. 56). So cultured beef may not be the same as meat produced from a living animal, but its animal components—cells—remain. And

the source of those cells is therefore relevant to conversations about the kosher status of the final product.

7.3. Cultured Meat and Transformation

One issue that comes up often in rabbinic discussions of cultured meat is the possibility that this technology could completely transform something that is animal—cells—into something that is not—cultured meat. This particular take on the technological possibilities of cultured meat is often related to the consideration of cultured pork. This is a particularly popular topic among rabbis and there is, predictably, some agreement and some disagreement on the kosher status of cultured pork (which, like cultured beef, does not yet exist in any marketable form). Chase Purdy provides an overview of the opinion of the Modern Orthodox Rabbi Yuval Cherlow, who lives in Israel and helped to found Tzohar, “a religious organization that seeks to find common ground and strengthen ties between religious and secular Jews” (Purdy 2020, p. 189). Purdy explains that in an interview with the Israeli news organization *YNet*, Cherlow suggested that cultured meat from a pig would be acceptable because “the cell in fact loses its original identity,” so the resulting meat would no longer be pork (Purdy 2020, p. 189). This is based on a principle described by Wurgaft, because it was also raised by one of the cultured meat startups, SuperMeat. The hope there is that rabbis will concur with the approach Cherlow offered and consider cultured meat through the lens of a principle called *panim chadashot*, “a new face” (Wurgaft 2020, p. 158). This principle of kashrut means that substances, when “radically transformed,” can lose their status as an unkosher ingredient and become kosher in a new form (Wurgaft 2020, p. 158). This principle of transformation would mean that cultured meat derived from any animal cells, not just kosher animal cells, could be considered kosher. This principle may also extend to vegetarians and vegans who might be willing to consume cultured meat if the amount of actual animal tissue used was insignificant. This is also a case where one of the cultured meat companies has already expressed awareness of rabbinic conversations and hope for a particular outcome.

7.4. Dual Causes: Mixing Kosher and Non-Kosher

Adding to this discussion of the identity of the stem cells used in cultured meat production, Bleich considers another possible path for non-kosher ingredients to become kosher through the phenomenon of *zeh va-zeh gorem*, which Bleich translates as “this and this is a cause” or “dual causes” (Bleich 2013, p. 57). According to this principle, a final product created through the combination of a non-kosher entity with a kosher entity results in a permissible kosher entity (Bleich 2013, pp. 57–58). So, if non-kosher stem cells were combined with nutrients that made cell division and growth possible, the resulting cultured meat would be the product of *ze va-zeh gorem* and it would be kosher as long as the nutrients used were “derived from kosher sources” (Bleich 2013, p. 58). Bleich cautions that the burger created by Mark Post was made from non-kosher stem cells and the nutritional medium that enabled growth consisted of cow serum from animals that did not undergo kosher slaughter, so the resulting burger was not kosher according to this principle (Bleich 2013, p. 58). Wurgaft echoes these concerns, explaining that, for cultured meat to be kosher, “the growth medium used to feed the cells, the scaffolding on which they grew, and the original cells themselves would all require inspection” (Wurgaft 2020, p. 158). Recent developments, like an animal-free cell growth medium developed by UPSIDE Foods, have the potential to provide options for kosher cultured meat production without some of the complications that come with components derived from animal products (Kayser 2021).

Bleich also considers the case of *davar ha-ma’amid*, “a forbidden substance that serves as a ‘support’ for the food product to which it is added” (Bleich 2013, p. 59). As Wurgaft explains it, “the presence of a nonkosher element in a kosher food or liquid can be negated if the ratio between the two is 1:60 or greater” (Wurgaft 2020, p. 159). This issue is frequently discussed in relation to cheese because rennet, an enzyme, is often used to induce the coagulation of the proteins in milk that turn it into cheese. The effects of rennet are visible

in the final product, so rennet cannot be considered nullified and cheese made with rennet is usually not considered kosher (Bleich 2013, p. 60). Bleich suggests that if a substance could not be nullified and was visible or detectable in the flavor of the final product, it would therefore not be kosher (Bleich 2013, p. 60). So, if the cultured meat tasted like an original non-kosher stem cell, as in the case of a porcine stem cell, it would not be kosher. These issues raise questions about not just the stem cells but also the other materials used to grow cultured meat and indicates that there is more to consider if kosher certification is a goal.

So where does this leave us? The rulings so far are nearly unanimous that cells and additives from kosher sources are the best path forward. Bleich concludes that if cultured meat is derived from entirely kosher sources, it could easily be certified kosher (Bleich 2013, p. 61). Kenigsberg and Zivotofsky similarly suggest that the best way to ensure kosher certification would be to harvest “cells from a kosher species, only after ritual slaughter” (Kenigsberg and Zivotofsky 2020, p. 5). Nevins offers a more definitive version of this, saying “*Simply put, cells from a non-kosher species may not be used to produce kosher food*” [emphasis in original] (Nevins 2017, p. 7). But, because cultured meat has not been fully developed, it is unclear whether the use of kosher animal cells and kosher growth agents will be practical or possible.

7.5. Cultured Meat and Kosher Consumers

Another lingering question about cultured meat is how consumers will react to the product. In Christopher Bryant and Courtney Dillard’s study, they found that over 64% of their participants were “probably or definitely willing to try cultured meat” (Bryant and Dillard 2019, p. 4). It is also worth mentioning that the Jewish legal understandings of cultured meat will not necessarily inform the opinions of Jewish consumers. Christopher Bryant conducted a survey of Jewish people and noted that 61% currently eat pork, which he connected to a prediction that religious people, including Jews, “are unlikely to be sensitive to religious rulings” when deciding whether to eat cultured meat (Bryant 2020, pp. 2–3). Purdy described conversations he had with Rabbi Menachem Genack of the Orthodox Union, wherein Genack expressed enthusiasm for cultured meat but did not go so far as to say that cultured pork would be kosher (Purdy 2020, p. 190). And, in fact, the Orthodox Union recently ruled that Impossible Pork, a plant-based product, was not kosher, and Genack was quoted in an article in *The Times of Israel* saying that, while it was kosher in terms of ingredients, they were not certifying it because of “sensitivities to the customer” (Gurvis 2021). Genack’s primary concern was the name, Impossible Pork, which he felt would confuse consumers. Given this ruling on a plant-based product, it seems unlikely that the Orthodox Union would certify cultured pork. Wurgaft discusses an example where a gelatin derived from collagen in pig skin was granted kosher status because it was determined that the final product was a completely different substance to the animal product that started the process. Wurgaft explains that even with rabbinic approval, this led to a scandal, and the producers of kosher gelatin switched to another source of collagen in the end. Wurgaft noted at the conclusion of this story that collagen is a potential ingredient for the scaffolding used to grow the tissue cultures required for cultured meat (Wurgaft 2020, p. 158). Nevins also raises consumer confusion as a potential area for concern. He explains, “we anticipate that it would be confusing for kosher consumers to differentiate between conventional pastured meat, which is ‘meaty’ and may not be mixed with dairy products, and cultured meat, which if deemed *parve*, could be mixed with any food” (Nevins 2017, p. 27). However, despite a final determination that cultured meat should be regarded as “meaty,” he also concedes that “kosher consumers have long since passed the stage of assuming that anything that looks like meat or milk is what it appears to be” (Nevins 2017, pp. 27–28). Given the influx of plant-based products that look both like meat and like dairy, this realistic perspective is worth considering.

8. Conclusions

The philosopher Michael Marder suggests using the term “meat without flesh” to describe cultured meat, rather than “meat without animals”, because cultured meat contains animal cells and therefore is animal, but it does not contain the flesh of animals (Marder 2016, p. 106). Marder also suggests that the ethics of eating cultured meat are similar to the ethics of eating plants because cultured meat’s production mirrors vegetal growth—it is outside the body of an animal and it grows in a linear fashion like plants. However, Marder notes a vital difference, which is that plant growth is determined and eating a plant means destroying an organic shape, where cultured meat grows in a more haphazard manner outside of living organisms so eating it would not destroy anything. In other words, cultured meat produced to be food is just that—food (Marder 2016, p. 107). In his responsum on cultured meat, Daniel Nevins concludes with a summary that is specific to Judaism, but he seems to share Marder’s optimistic outlook about cultured meat as a food that may not require destruction. He wrote, “If cultured meat fulfills the promises of being less cruel to animals, less destructive to the environment, and more healthful to consume, then it will not only be acceptable, but even preferable to eating conventional pastured meat” (Nevins 2017, p. 30). But Marder’s point about potentiality vs. actuality lingers despite his optimistic view on the ethics of cultured meat because, in reality, cultured meat is not yet widely available so it is not currently a realistic meat substitute or even a food at all.

In her book *Livestock*, philosopher Erin McKenna expresses a similar concern with the impulse she sees in the excitement around cultured meat to produce meat without animals and without death, instead of reducing meat consumption to sustainable levels (McKenna 2018, p. 222). Her concern here lies in the fact that humans are shaped by “shared dependencies and vulnerabilities,” and attempts to “master and control nature” deny our lived interdependent reality (McKenna 2018, p. 222). She also highlights the anthropocentric nature of technologies like cultured meat, which prioritize human consumption, and she raises the likelihood of unintended consequences (McKenna 2018, p. 222). With uncertain ramifications of cultured meat production on the horizon and the consequences of humanity’s past engagements with technology, animals, and agriculture fomenting in the climate crisis all around us, McKenna’s caution seems warranted. Patrick Hopkins and Austin Dacey also noted the opinion of some that see this technological solution as “moral cowardice” because the consumption of meat and the climate crisis are social problems. Hopkins and Dacey conclude that while it would be naïve to imagine that technology can solve these problems, technology is still a “powerful moral tool” (Hopkins and Dacey 2008, pp. 588–89). So, caution around technological solutions may be both inflated and warranted. Yes, it would be exciting if cultured meat replaced animal meat and less animals suffered and less land was destroyed. But there are plant-based options available in grocery stores right now that offer the same benefits.

It seems that a fair amount of the excitement around cultured meat comes from the fact that, as Marder points out, it is animal. The hope appears to be that people invested in eating animals, for cultural or religious or other reasons, will find that meat grown from cells in a lab suits their desire to consume meat. But there is evidence to suggest that this is too optimistic. As Christopher Bryant and Courtney Dillard showed, framing matters, so while their study found that over 64% of people surveyed would try “cultured meat”, a 2014 Pew Study found that 78% of Americans were unwilling to try “meat grown in a lab” (Bryant and Dillard 2019, p. 4; Smith 2014). In other words, framed as “cultured meat,” more people were willing to try it than when the product was framed as “meat grown in a lab.” And in another article, Christopher Bryant and Julie Barnett found that many consumers are willing to try cultured meat, but a much smaller percentage of consumers would choose cultured meat over conventional meat or plant-based meat alternatives (Bryant and Barnett 2018, p. 12). So, it is not a forgone conclusion that people will eat cultured meat even if it does mean decreasing animal suffering, land use, and environmental impact. And it may actually be the case that some of the appeal of meat lies in the fact that it is the actual

flesh of an actual animal.⁸ Cultured meat is being developed at a rapid pace, with a great deal of financial and media backing. And it may end up in grocery stores with a kosher certification on the label. But it is not clear that the introduction of cultured meat to the market will actually reduce the suffering of any animals, or the destruction of any land, or the mitigation of any greenhouse gases.

In the case of cultured meat, religion and technology are co-constituting a potential future where meat is produced sustainably, but these efforts and the optimism associated with them may actually be perpetuating animal suffering in the present. While bovine cells are swimming in baths of nutritious medium and multiplying into vast networks of muscle in pristine labs, and rabbis are considering whether these cells should have come from a properly shechted cow, real, live cattle are still grazing on cleared land, releasing greenhouse gases as they eat, and dying in slaughterhouses.

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Notes

- ¹ With gratitude to Shari Rabin, who clarified this important point in her feedback on a draft of this article.
- ² In regenerative agriculture systems with managed grazing, there is a reduced carbon impact, but even these systems require significant land and water usage.
- ³ There is also a growing body of research on Muslim approaches to cultured meat, which could be used as a similarly fruitful area for exploration. See (Hamdan et al. 2017).
- ⁴ Conversations about cultured meat's halal status are similarly prevalent.
- ⁵ Muslim dietary laws are similarly likely to influence cultured meat technology as it develops.
- ⁶ Many Muslims consume kosher meat and therefore account for some of the purchasing of kosher meat in the UK and elsewhere.
- ⁷ *A Communion of Subjects: Animals in Religion, Science, and Ethics*, edited by Paul Waldau and Kimberley Patton (Waldau and Patton 2006) and *Animal Liberation: The Definitive Classic of the Animal Movement* by Peter Singer (Singer [1975] 2009) both contain lengthy arguments for the importance of understanding religious attitudes towards animals.
- ⁸ See the Epilogue to *The Question of the Animal and Religion* by Aaron Gross (Gross 2015) for further discussion on this topic.

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