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Death-Free Dairy? The Ethics of Clean Milk

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Abstract The possibility of “clean milk”—dairy produced without the need for cows—has been championed by several charities, companies, and individuals. One can ask how those critical of the contemporary dairy industry, including especially vegans and others sympathetic to animal rights, should respond to this prospect. In this paper, I explore three kinds of challenges that such people may have to clean milk: first, that producing clean milk fails to respect animals; second, that humans should not consume dairy products; and third, that the creation of clean milk would affirm human superiority over cows. None of these challenges, I argue, gives us reason to reject clean milk. I thus conclude that the prospect is one that animal activists should both welcome and embrace.

Keywords Milk · Food technology · Biotechnology · Animal rights · Animal ethics · Veganism

Introduction

A number of businesses, charities, and individuals are working to develop “clean milk”—dairy products created by biotechnological means, without the need for cows. In this paper, I complement scientific work on this possibility by offering the first normative examination of clean dairy. After explaining why this question warrants consideration, I consider three kinds of objections that vegans and animal activists may have to clean milk. First, I explore questions about the use of animals in the production of clean milk, arguing that its production does not involve the violation of

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animals' rights. Second, I explore the claim that humans should not consume milk, arguing that there is nothing *inherently* wrong with eating and drinking dairy products, assuming that they are acquired in respectful ways. Third, I challenge the claim that producing cows' milk, but not human breastmilk, through biotechnological means affirms human superiority over cows, and indicate that we actually have good reason to develop biotechnological means to produce human breastmilk. I close by exploring what it would mean for vegans to support clean milk. My conclusion, to anticipate, is that clean milk is something that animal ethicists and activists should embrace; it is a product about which they should have few, if any, ethical qualms.

Animal ethicists have made no secret of their concerns about the dairy industry.¹ Such challenges arise primarily from concern about harms to animals,² though animal ethicists, environmental ethicists, and others also raise various anthropocentric challenges to the industry.³ My own sympathies in this debate lie with approaches to animal rights framed within liberal political philosophy, and especially with those approaches utilising interest-based rights (e.g., Cochrane 2012; Donaldson and Kymlicka 2011; Garner 2013). Like many other approaches in animal ethics, this perspective subjects the dairy industry to serious moral censure; more than this, however, it will likely frame the industry's practices as deeply unjust. Arguing for these claims is not my present aim. Instead, I seek to show that even those already highly critical of the contemporary dairy industry—whether for

¹ Welfarists (e.g., Singer 1995) argue that dairy cows live lives of suffering, including both physical pain (caused by the likes of mastitis, a painful inflammation of the udders) and emotional distress induced by, among other things, the separation of cow and calf. "Excess" calves, unneeded for milk, are killed or used for veal; the associated industry has been a recurring target for welfarists, who characterise it as particularly problematic. Proponents of animal rights (e.g., Francione 2007; Regan 2004), in addition to raising concerns about animal suffering, challenge the slaughter of dairy cows at the end of their optimally productive life (around a quarter of their "natural" lifespan), perhaps also raising concerns about cows' confinement, use, and status as property. Marxians (e.g. Stuart et al. 2013), meanwhile, characterise the dairy industry as alienating cows from their products, productive activities, species being and other beings, while critical feminists challenge the objectification of cows' reproductive processes and the subversion/abuse of the mother-child relationship (Adams 1990; Cusack 2013; Gaard 2013). On such accounts, one simply needs to be a feminist to object to the dairy industry; a recognition that animals are owed duties of justice is not required.

² I here use *animal* to refer to animals-excluding-human-animals. Though I will talk exclusively about cattle, what I say will apply to other animals actually or hypothetically used for milk production.

³ Dairy, like other forms of animal agriculture, requires substantial land and water use. It is inefficient, with dairy cows often being fed foodstuffs that could be fed directly to humans, or else fed food that has been grown on land that could instead grow food for humans. Similar issues are raised concerning the use of water in dairy production. Perhaps the most problematic environmental impact of dairy comes from greenhouse-gas emissions, which contribute to global warming. A report from the Food and Agricultural Organization of the United Nations found that global milk production contributed 2.7% of anthropogenic greenhouse-gas emissions in 2007, while the inclusion of the raising of surplus calves for meat upped the total contribution to 4% (Gerber et al. 2010). This suggests that a reduction in dairy consumption or changes to the dairy industry could play a part in limiting states' contributions to harmful global warming. Another anthropocentric challenge to the dairy industry concerns public health: not simply the effect of dairy on individuals, but the public health risks posed by pollution, zoonoses, and heavy use of antibiotics, which leads to antibiotic-resistant "superbugs". These are foreseeable (likely inevitable) consequences of the intensive confinement of so many animals. For more on the environmental impacts of animal agriculture, see Steinfeld et al. (2006). For more on the public health impacts of animal agriculture, including the environmental impacts, see Deckers (2016), chap. 1.

reasons grounded in liberal animal rights or otherwise—should be attracted to, and support, the prospect of a clean dairy industry.

Both liberal political philosophy and interest-based rights have been central, prominent features in the recent “political turn” in animal ethics (Milligan 2015), and have been characterised as an appropriate means by which to develop an animal-rights-based approach to food (Milburn 2016a). In such an approach to food, I have argued (2016a, 288–291), consideration of alternative ways to source animal products are central; moral and political philosophers need to entertain the possibility of a non-vegan but animal-rights-respecting state. The present exploration can be understood in this context. Nonetheless, my conclusions do not lean heavily on either claims about liberalism or interest-based animal rights, meaning that the arguments of this paper should be amenable to people who are not already predisposed to liberalism and/or animal rights, interest-based or otherwise.

Despite this, it is worth highlighting two features of liberal political philosophy that are particularly helpful for making sense of the following analysis. The first is the difference between the right and the good. We may have moral reasons not to do things that justice permits us to do, meaning that some things that are not morally ideal should, nonetheless, not be banned. The second is the difference between ideal and non-ideal theory. There are many approaches to these methodologies, but I take it that the difference essentially comes down to the question that one is asking.⁴ Ideal theory starts with justice, and attempts to design a society that is perfectly just, given (real or counterfactual) hard constraints. Non-ideal theory begins with injustice in a real or imagined state, and offers means to reduce or resolve that injustice. In this sense, I am here engaging in non-ideal theory. I begin with the injustice of the dairy industry in the world today, and seek a way to end this injustice. Vegan individuals, states, and societies provide the obvious answer. But it may be that other alternatives—namely, biotechnological means offered by the prospect of clean dairy—could prove more efficacious.

To be clear, I do not envisage the primary target of this paper to be those theorists who argue that the consumption of “facsimiles” of (certain) animal products may be problematic in-and-of-itself (e.g., Fischer and Ozturk 2017). My primary, much broader, audience is animal ethicists and animal activists generally. It is animal activists to whom I will explicitly appeal later in the paper, and I particularly hope to speak to those grassroots activists who object to clean milk. Speaking anecdotally, I have seen many vegans and animal activists respond in a negative way to the prospect of clean milk, with emotions ranging from suspicion and frustration to horror. Indeed, again speaking anecdotally, this is much the same response that many have to the prospect of clean (that is, in vitro, or lab-grown) meat. It is my intention to demonstrate that clean milk is not something that they should oppose.

There are at least two things that I offer to this group. The first is an explicit decoupling of the ethics of clean milk from the ethics of clean meat; it is, I hold, plausible to support one but not the other. There is a developed literature on the

⁴ I defend this view of non-ideal theory, and offer a non-ideal account of justice for animals, in Milburn (2016c). For the most developed published discussion of animals and non-ideal theory, see Garner (2013).

ethics of clean meat, but we cannot simply assume that all of the claims made about clean meat straightforwardly apply to clean milk. Second, I will challenge those activists who—implicitly or explicitly—attempt to shift perceptions of milk away from milk-as-food. In a move that may seem contrary to my own vegan commitments, I argue that the consumption and production of milk is not *inherently* problematic—instead, its problematic nature arises from the practices associated with its production.

Providing clear reasons that activists and academics concerned with animals' rights or welfare should be ready to support clean milk is thus a primary goal of this paper. One might question the purpose of offering a defence of clean milk given that high-profile animal activist groups already endorse clean animal products. This includes both those groups already dedicated to promoting these technologies—such as New Harvest and the Good Food Institute—as well as general animal welfare organisations, such as People for the Ethical Treatment of Animals. However, grassroots activists may be unengaged with, or even directly critical of, these organisations, and so it would be a mistake to assume that the organisations' endorsement should serve to repudiate activists' concerns. Nonetheless, this paper can offer something to those already supportive of these goals. This is an appropriate venue to provide a rigorous theoretical *underpinning* for the pro-clean-milk commitments of these activists/organisations.

However, a wider audience still may find value in the present enquiry. Though I will primarily present concerns from a perspective critical of harm to animals, it is my hope that the exploration will be of value for anyone concerned about the dairy industry, or concerned with the ethics of food technology—including regulatory bodies. Clean milk is a product worthy of serious attention: It is my view that *all* who have concerns about the dairy industry—whether animal advocates (from radical rightists to pragmatist welfarists), environmentalists, public health advocates, or those concerned about the economics of dairy—have reason to offer full support to the development of clean milk. As the benefits of clean dairy become better known, we could see the development of a wide cross-section of society offering support for the production of this foodstuff. This is part of the reason that I envision clean milk as a technological development with genuine radical potential. In this paper, then, I begin the scholarly conversation that would inevitably accompany such widespread support.

Clean Milk

The California-based start-up company Perfect Day has received a significant amount of press attention for its aim to develop clean milk—indeed, it claims to already be producing the product, which it aims to make commercially available in the near future. Perfect Day was established by Isha Datar—the president of New Harvest, a charitable organisation devoted to the production of cultured (“clean”) animal products—and the biochemists Perumal Gandhi and Ryan Pandya. Unsurprisingly, clean milk has become associated with clean meat, but, in some ways, this is regrettable. Home biohackers have also experimented with creating

dairy without cows, and individuals associated with the California-based hackerspaces BioCurious and Counter Culture Labs have come together to collaborate on the Real Vegan Cheese project, which aims to develop dairy cheese suitable for vegans, and has been offered modest support through crowdfunding. Other groups are likely to arise in time.

To my knowledge, there is no published peer-reviewed research outlining the means by which Perfect Day's clean milk (or any clean milk) is produced, and so any explanation of the method must be pieced together from editorials, interviews, and the like (e.g., Perfect Day n.d.; Pandya 2014; Datar et al. 2016). The following explanation can thus be taken only as preliminary, and is to provide a background for the subsequent philosophical argument, and not to provide substantive claims about cellular agriculture.⁵ Even if clean milk is not near to production, this description may serve to identify a *possible* means of creating clean milk.

Clean meat, in its current iterations, involves taking cells from animals and growing them outside of the animal. Perfect Day's method for clean milk, on the other hand, is fermentation-based. Perfect Day presents the following process: Genes associated with the production of casein and whey proteins are identified in bovine DNA, and are artificially created, after which they are added to yeast. This yeast, dubbed "Buttercup", is then added to a mix of water and plant-based sugars. The yeast then ferments the sugars, creating whey and casein proteins. The yeast is then filtered from the resulting mixture—it is the proteins, not the yeast, that go on to the final product. Plant-based fats, sugars, and nutrients are then added to the water-and-proteins mixture, and the result is something that, physically, closely approximates milk from a cow. In principle, the resulting product—clean milk—is indistinguishable from milk produced in the traditional way. In practice, this will not be true. Perfect Day aims to create milk that will lack the following: impurities frequently present in milk from a cow (such as blood serum proteins and hormones); lactose, which is typically⁶ present in cows' milk, though is not easily digestible by many humans; bacteria, limiting the need for refrigeration; and cholesterol, which is associated with certain health risks.

Pandya has stressed the differences between clean meat and clean milk when talking to journalists:

Many people initially go 'oh is this like lab or test-tube milk', but that's wrong. There are no test tubes in our fermentation [process; instead,] it's just like brewing craft beer. The meat folks are trying to invent technology that doesn't exist today, but our milk is made through techniques in use for more than 3 decades. (Pandya, quoted in Levitt 2016)

Thus, it is not clean milk itself that is bioengineered, it is the yeast that is used to create the proteins it contains. The genes, crucially, are created and added to the

⁵ I reached out to Perfect Day to seek clarifications, but did not receive a reply. I welcome any correction of misunderstandings or misrepresentations, though do not envisage any misrepresentations or misunderstandings changing the substance of my philosophical arguments or normative conclusions.

⁶ There exist cows who have been genetically modified to produce milk with less of, or alternatives to, particular proteins/sugars.

yeast using technological means,⁷ and are based on information about bovine DNA sourced from the United States Department of Agriculture. Thus, no animals are involved in the process.

Perfect Day's approach is likely not the only possible means to create clean milk. The Real Vegan Cheese project is exploring the gene-editing technology CRISPR/Cas9—a favourite of biohackers—to modify yeast DNA. As with Perfect Day's approach, the modified yeast can then be used to create plant-based proteins for clean dairy products, though the production of liquid milk is not the group's goal. Meanwhile, New Harvest supports the exploration of production methods not involving fermentation for the purposes of cellular agriculture, and both they and the Good Food Project express support for the development and growth of further groups seeking to develop clean-food innovations (see Datar et al. 2016; Bhumitra and Friedrich 2016). Thus, whatever the details of the methods used by Perfect Day and the Real Vegan Cheese project, it is possible that they will be developed and refined, and that alternative routes to the same end will come to the fore. Let us, then, leave these scientific questions to one side, and take the viability of the production of clean milk as a hypothetical reality, so that we might sincerely explore the normative issues at stake.

The differences in the processes used for clean milk and clean meat (among other issues) make a normative difference, and someone could consistently be in favour of clean milk while being opposed to clean meat (or vice versa). Pandya claims that clean milk is much easier to produce than clean meat (Pandya 2014), and Perfect Day's milk will, the company claims, be commercially available in the near future, perhaps sooner than any clean meat product. Despite this, there is a complete absence of philosophical literature on the topic—a problem that the remainder of the present paper will begin to remedy. To repeat, my focus is not so much on what would (not) be the case in an ideal state, but on how to respond to injustice in the world as we find it, and not so much the moral question of the consumption of clean milk, but the social question of whether animal activists should support the budding industry.

Seeking an Alternative to Dairy Products

As I and many other academics openly call for the end of the dairy *industry* as it currently exists, one might reasonably ask why we should direct attention to clean milk when we could instead simply call for the end of *dairy products* altogether. Exploration of this alternative, it might be said, muddies the waters, or compromises on principles, or tries to have it “both ways”.

There are, I think, three broad reasons that it is worth exploring the ethics of clean milk. First, and most obviously, there is reason to believe that this product will soon be here, and it is appropriate to ask how we as individuals should respond to it. More importantly, and speaking from a political perspective, the development of an

⁷ Reference is sometimes made to 3D printing, but I have been unable to locate any scientific literature confirming the existence of 3D printing of genes.

alternative dairy industry offers a valuable opportunity for animal activists. In decades of animal ethicists and animal activists calling for veganism and the abolition of animal agriculture, veganism (and even vegetarianism) remain minority positions in the west, and, globally, the consumption of animal products is growing. Thus, it is worth exploring alternative possible futures, even if this is done through the lens of non-ideal theory (see Garner 2013). Second, it could be that milk itself has significant value. Philosophers critical of veg(etari)anism or otherwise supportive of the value of particular/diverse food practices have sometimes accused animal ethicists of underestimating or underappreciating the value of food itself (Brown 2007; Kazez 2017; Lomasky 2013; cf. Ciocchetti 2012; Regan 2004, 220–221). If milk has a value of this sort—a possibility I neither endorse nor deny—then critics of animal agriculture can offset/eliminate the negative consequences of the abolition of the dairy industry by offering a genuine alternative, thus preserving dairy’s value as food.⁸ Third, the identification of humane forms of milk production allows for the end of the dairy industry without having to call for unemployment; to utilise the terminology of Coulter (2016, 2017), exploration of alternative dairy industries allows for the creation of *humane jobs*, rather than simply the abolition of inhumane jobs.

Previous proposals for alternatives to the present milk industry involve either doing away with milk and replacing milk with some milk-like product (i.e., plant-based “milks”), or rethinking animal agriculture to make it more animal-friendly. Possible inadequacies with the first approach have already been indicated. The second route is the kind of approach being taken in many other contributions to this special issue, and it might seem that this is the natural non-ideal route for political conceptions of animal rights.⁹ Indeed, this is the route that has come to be associated with “protectionists” or “new welfarists” (see Francione and Garner 2010)—animal advocates who have goals approximating the abolition of animal agriculture in the long term, but work towards that end by promoting gradual improvement of presently existing institutions. Robert Garner is associated with this position. When Garner explicitly utilises non-ideal theory in discussing justice for animals, however, he suggests that we should adopt a non-ideal theory (the “sentience position”) in which all sentient animals have a right not to be made to suffer (2013).¹⁰ This is firmer than the simple protectionist perspective, as a *right* against suffering entails that inflictions of suffering¹¹ must be *eliminated*, rather than merely *lessened*. This leads Garner to endorse solutions more radical than are typically

⁸ We can exaggerate the extent to which plant-based “milks” truly serve as an alternative to dairy. These products have their own culinary history, purposes, and values beyond being an alternative to animal-derived dairy products. While they often can serve as a substitute for dairy products in recipes and diets, they offer an alternative in much the same way that apples might serve as an alternative to oranges, or vodka might serve as an alternative to gin. They are different products.

⁹ For a developed rejection of putatively humane farming with support for the development of clean or plant-based products, see Stănescu (2016).

¹⁰ Given that the sentience position offers no *other* rights to animals, it is more minimal than the alternative non-ideal approach I am inclined to endorse, which is closer to the framework developed by Cochrane (2012; cf. Milburn 2016c).

¹¹ Garner, though he could be more explicit about this, seems to be concerned with a negative right against infliction of suffering rather than a positive right to alleviation of suffering.

associated with protectionism, including genetically engineering non-sentient animals and developing clean meat (2013, 136).

Nonetheless, we could imagine a system of dairy farming—I refer to it as a form of *genuinely humane farming*, to distinguish it from existing putatively “high-welfare” forms of pastoral agriculture—in which the rights of animals, including at least rights not to be made to suffer or be killed, are respected (Cochrane 2012, 86–89; Donaldson and Kymlicka 2011, 139). At least, this is possible if we are not abolitionists, opposed in principle to any *use* of animals (Francione and Garner 2010; cf. Wayne 2013). A full development of this form of farming is not possible here, but I note that the idea of animals *as workers* could offer a fruitful lens to explore the issue (Clark 2014; Coulter 2016). Conceptions of animals as workers differ, but a notion particularly relevant to the current enquiry would be the way that animals could be given workers’ rights: rights to a safe working environment, a right to a retirement, a right to (a form of) remuneration, and so on (Cochrane 2016). Pushing for legal recognition of animals as workers even offers a chance for the development of animal rights in a courtroom setting, and thus offers a genuine transformative opportunity for animal advocates (Kymlicka 2017).¹²

I do not suggest, however, that this mode of agriculture would be a suitable one for animal advocates to encourage, even if it might be a practice (hypothetically) consistent with respect for animal rights. First, the practice would be exceedingly costly—economically and environmentally. This limits its potential to offer a genuine alternative to present means of producing milk. Second, there would always be the risk of advocacy messages being diluted; it is emphatically *not* my claim that there is nothing fundamentally wrong with the present institution of dairy farming, and that it is merely tweaking at the edges that is required. Any support for genuinely humane farming is support for dismantling and rebuilding present dairy farming, not for gradually modifying present farming practices until they come to approximate a given image of genuinely humane farming. The possible practice, however, does offer a point of comparison for my exploration of clean milk, to which I will now turn in earnest.

Outside Concerns

It is worth quickly acknowledging two kinds of concerns that may be raised about clean milk for reasons that have little to do with animal ethics. First, some food activists are opposed to the use of genetically modified organisms (GMOs) in food. As indicated, the production method proposed by Perfect Day would create clean milk free of GMOs, but this is unlikely to impress those critical of genetic modification. Second, biotechnological innovations—including clean meat (see, e.g., Miller 2012)—face critique from anti-capitalists who are concerned about their potential to consolidate control of, and wealth from, food production in the hands of

¹² The category of animal worker is not a useful one when it comes to the current dairy industry. As Gaard (2013, 597–8) observes, there is something perverse about framing the factory-farmed dairy cow as a “worker”, a view she attributes to Donna Haraway. Porcher and Schmitt (2012) defend the view of dairy cows as workers; Coulter (2016) is more ambivalent, while Kymlicka (2017) rightly challenges it.

a few. Of course, bioengineered food could be democratised. One vision of clean meat sees machines in every home that could produce food using cells “harvested” from companion animals (van der Weele and Driessen 2013). Datar presents a similar image, speaking of open-source cells ordered from a catalogue (Ceurstemont 2017).

An in-depth exploration of these issues is beyond the scope of this paper.¹³ However, in addition to the beginnings of responses outlined above, it is worth identifying two points. First, neither the use of GMOs nor the existence of capitalism will likely be thought inherently problematic on a liberal interest-based approach to animal rights. Second, neither concern seems particular to clean milk. As such, I put these aside, and focus on issues related to animals and to milk.

Clean Milk and Animals

In one sense, the issue of animal use and clean milk can be dealt with briefly, as neither the production nor the development of clean milk requires the use of animals. This is in contrast to clean meat, which uses living animals as the source of cells (Schaefer and Savulescu 2014, 194), and will even, according to one ideal-theoretic scenario, continue using animals indefinitely into the future (van der Weele and Driessen 2013). Clean meat could thus never be a solution for the strict abolitionist, unless the technology was developed further, but clean milk could be. There is also no reason for animal products to be used in the production of clean milk in less direct ways, while clean meat—minimally, in one research project—is grown in fetal bovine serum. This is something that scientists involved hope to phase out (Stephens 2013, 166–167), and it is something that would have to be removed if products were to minimally appeal to veg(etari)ans (a marketing issue) or be in accordance with animal rights (a normative issue).¹⁴

The only animal involvement in clean milk comes from the fact that, at some point, some cows were utilised for the sequencing of DNA. Even if this was highly unjust, it offers no reason to refuse to make use of the knowledge acquired.¹⁵ We may have duties to make amends for the past injustice, but refusing to make use of

¹³ These concerns are also set out in Milburn (2017).

¹⁴ I note that, while lacking in (some) projects developing clean meat (see Stephens 2013), an aspiration towards veganism is at the base of clean milk development. Perfect Day—despite its statement of support for “the countless dairy farmers across the globe who use sustainable farming practices and genuinely care for their animals”—is keen to stress that its milk is “100% vegan” (Perfect Day n.d.; see also Pandya 2014), while the name of the Real *Vegan* Cheese project is revealing.

¹⁵ One might say that this opens the door to meat and leather, as cows have been killed whether or not I buy a burger or belt. However, the historical use of cows (by a third party) in the clean milk case—however objectionable—has provided all bovine input necessary for clean milk, while the continued production of meat and leather requires the killing of more cattle into the future. To put this another way, there is a difference between an injustice opening the door to the production of x, and an injustice being involved in the production of x. Were we able to have meat and leather from here on without the need to use, kill, or hurt any cows, I accept that many (though perhaps not all) of the better arguments against leather and beef would lose their force. Clean meat and clean leather technologies could open doors to ethically acceptable beef and leather industries, though exploring such possibilities is beyond the scope of this paper.

this knowledge would result in all of us, *including those to whom we would make amends*, losing out. The history of science involves all kinds of abuses—to humans, animals, the environment. While we should certainly object to such abuses, we have no obligation to refuse to benefit from the scientific knowledge we now possess (Milburn 2016b, 255). Indeed, given the prevalence of historical abuse, seeking to do so might come close to seeking a return to a pre-science society.

Interestingly, clean milk is also likely to face objections because it does *not* use animals. Cor van der Weele and Clemens Driessen present a clean-meat-eating society as potentially preferable to the “abolitionist world in which urban vegans are completely separated from nature and from animals”, which is in turn presented as a dystopic vision by apologists of animal agriculture (van der Weele and Driessen 2013, 656). One can imagine the same criticism being made of a society in which the ubiquity of clean milk eliminates the “need” for dairy cattle. Such a critique, however, is not compelling. People who value human/cow relationships could seek them out in sanctuary-like environments, or by developing genuinely humane farms. If there is any value in the relationship between farmer and cattle, the removal of cows’ death and suffering would surely not diminish that value. Advocates of animal rights can affirm the place of animals in our societies going forward, and there is reason to endorse a political vision of a mixed-species society over an abolitionist separation of humans and animals (Kymlicka and Donaldson 2016). While large-scale adoption of clean milk would indeed lead to a reduction in the number of cows kept by humans, this could be a good thing—both in terms of a reduction of harms to cows and in terms of a reduction of the negative environmental effects of cows.

Those few cows who did continue to live in a mixed-species society—perhaps on highly humane farms, on sanctuaries, or similar—could be treated with the respect they deserve, and would likely be much more visible to humans than today’s cows. Thus, the opportunity for humans to have meaningful relationships with cows could be greater in a clean-milk-consuming society. It is true that large-scale adoption of clean milk may mean that certain *modes* of relating to cows—specifically, certain careers—would no longer be open to people, but this is the standard consequence of moral, social and technological advancement. Indeed, it is not normally presented as a cause for concern. It is hard to imagine that many people lacking financial interests worry about the loss of jobs in the tobacco industry as smoking becomes less socially acceptable. Similarly, people are no longer employed as pin-setters, ice-cutters, or telegram operators due to technological advancement, while work as a cockfighter, resurrectionist, or hangman is hard to find due to changing ethical/legal norms. In the future, the professions of dairy farmer and slaughterhouse worker may face a similar fate; due to technological, social, legal, and moral developments, these careers will be eliminated or changed beyond recognition. At the same time, new—more humane—jobs should be created, including those tied to a new dairy industry, and those grounded in new (or expanded) modes of peaceful human/animal coexistence (cf. Coulter 2017).

A separate worry, and one that Schaefer and Savulescu (2014, 194–197) raise in their defence of clean meat, comes from the fact that a world in which clean meat is consumed would contain fewer “happy” animals, which is a concern for certain

consequentialists (e.g., total utilitarians). Similarly, a world in which a clean milk industry replaced the current dairy industry would contain fewer cows. On the type of liberal approach that I favor, this is simply the wrong kind of question to be asking. While it may or may not be better to have $x + 1$ happy animals than x happy animals in existence, this *good* cannot take priority over the *right*; we cannot pursue a *merely* better (“more good”) world at the expense of justice. If animals have rights, we may not trample over these rights in the pursuit of some outcome, even if that outcome is good.

This argument might nonetheless be deployed as a reason to prefer genuinely humane farming (or, minimally, “high welfare” farming) over clean milk production. Such a deployment would not be convincing, even on a total utilitarian approach. This is because of the cost of genuinely humane farming compared to clean milk. First, supporting many happy cows in a genuinely humane farming system would be incredibly expensive—to consumers and/or the state—and this money could be better spent elsewhere. Most obviously, it could go to supporting the happiness of existing humans or animals, but, if maximising the number of happy individuals is a goal, it could be better spent creating large numbers of (say) happy hamsters; animals requiring fewer resources than cows to be happy. Second, the environmental impact of large-scale genuinely humane farming would presumably be greater than even the current impact of intensive farming—not least because animals on genuinely humane farms would live far beyond their optimally productive lifespan, and thus require more resources and produce more emissions per pint of milk. This would, in time, lead to considerable unhappiness/disutility. Clean milk, on the other hand, has compelling environmental credentials. For instance, in an analysis funded by Perfect Day, the conservation biologist Mark Steer found that, compared “to conventionally produced milk, [Perfect Day’s clean milk] involves approximately 24–84% lower energy use, 98% lower water use, 77–91% lower land use, and 35–65% lower [greenhouse-gas] emissions” (2015, 1). Thus, a “happy animals” argument, even in the context of a total utilitarian framework, could not support either conventional, “high welfare,” or genuinely humane farming over clean milk production.

Consuming (Clean) Milk

Let us turn to what is, I think, the most pressing challenge to clean milk production. It could be that the consumption of animal products *is itself* unethical, no matter how they are acquired. We see this thought in debates about the eating of flesh/meat/“meat” that is sourced in ways that do not clearly set back the interests of sentient beings (“scavenged” flesh, clean meat, plant-based “meats,” etc.). These arguments can be individualistic/moral or societal/political. Individualistic approaches are offered by Bob Fischer and Burakay Ozturk, who press the thought of a detective seeking out replicas of human-skin products he saw in the house of a serial killer to conclude that there is something immoral about producing, consuming or desiring “facsimiles of flesh” (2017), and Susan M. Turner, who proposes that animals

might possess a right “not to be represented as a mere resource” (2005, 4–5).¹⁶ People who press the argument at a societal level claim that we should not support such foods because they reinforce harmful ideas about the place of flesh/meat or animals in society (e.g., Cole and Morgan 2013; Miller 2012; Sinclair 2016).¹⁷

It is true that we have reasons to challenge the idea of meat-as-food, and this is difficult (though possible) while we continue to consume/promote alternative meats/“meats” (Milburn 2016b, 252–254). We might also have good moral, social, or political reasons to stick firmly to a vegan diet to be a part of a movement (see, e.g., Gruen and Jones 2016), even if the moral or justice-based reasons that originally motivated us towards veganism do not speak against the consumption of animal products in every case. These kinds of challenges could feasibly be deployed against clean milk.

There are two ways to respond, and both have merit. The first is to point to the methodological distinctions I drew in the introduction to this paper. One can consistently hold that there are moral reasons that speak against drinking milk even when it would not be unjust to do. Similarly, one can consistently hold that it is appropriate to support the creation of a clean milk industry in our non-ideal world, even if an ideal state would be vegan.¹⁸

The second response I can offer, however, is that there is a mistake in opposing milk-as-food, *even if* there is not in opposing meat-as-food.¹⁹ Popular vegan discussions about milk can be, to their detriment, unnuanced in this area. This can be illustrated by considering five ways that vegans can and do oppose framing milk as food: metaphysical, ethical, disgust-based, health-based, and racial.

First, take metaphysics. I contend that there is something confused about trying to redefine milk, *a priori*, as something other than food, whatever account of the metaphysics of food we endorse. Milk exists solely as food; in this sense, it is different from flesh/meat, which exists first as the body of an animal. To deny that milk is food seems to suggest that infants, human and nonhuman, who drink their mothers’ milk are consuming something that is not food. This seems to be straightforwardly incorrect.

Second, activists will endorse slogans to the effect that cows are “not your mother”, meaning that what they produce is “not your milk”. This points to a moral claim about the wrongness of consuming milk (that is not from your mother). Alternatively, activists will frame milk as food only for baby animals (human or otherwise); thus, milk drinkers are behaving unethically because they are stealing food from babies. The sentiment behind these slogans is admirable, but, as arguments for ethical principles, they go wrong. Gaard (2013), in her call for a

¹⁶ I elsewhere challenge Turner’s arguments (Milburn 2016b, fn. 12).

¹⁷ In a paper on clean meat (2016b), I grouped individual and societal arguments together under the “flesh-as-food” objection.

¹⁸ Note the *if*, here. There are a range of reasons that the ideal state might not be fully vegan (Milburn 2016a).

¹⁹ I am not the first to acknowledge this. Rebekah Sinclair notes explicitly that her challenge to “meatless meats” does not necessarily extend to products seeking to mimic meat and eggs, as the “original ... referents”—i.e., milk and eggs produced by the bodies of animals—“do not imply a necessary animal death” (2016, 231–2).

feminist postcolonial milk studies, explores examples of milk sharing beyond mothers sharing milk with their own infants. For example, in Latin America and Africa, women share nursing requirements to help each other and children, while in the west, mothers have created social-media-based spaces to arrange the sharing of milk with the children of others (p. 601). Sharing need not be limited to human-mother-to-human-infant; Gaard points to the human suckling of “pigs, dogs, monkeys, and bear cubs in precolonial Polynesia, the forests of South America, and the hunter-gatherer societies of Southeast Asia, Australia, and Tasmania” (p. 599), and breastmilk is sometimes sold as food for adults (as milk, cheese, icecream, etc.) although, as Gaard reports, it fares poorly (p. 602).

The autonomous sharing of breastmilk holds a place in human culture and history. In classical mythology, Romulus and Remus were suckled by a wolf, while in Catholic hagiography, St. Bernard of Clairvaux was breastfed by the Virgin Mary in a vision. John Steinbeck’s *Grapes of Wrath* closes with Rose of Sharon offering her breast to a starving man. Traditional and alternative medicines have made, and still make, use of human breastmilk. Stories about the “sharing” of one’s own flesh are harder to take seriously outside of life-and-death emergencies, extreme (sexual or otherwise) fetishes, or highly idiosyncratic religio-spiritual rituals (Wisniewski 2014). Thus, an ethical rejection of milk-as-food seems, unlike a rejection of meat-as-food, to impact upon a wide range of autonomously undertaken, intuitively innocuous practices. For this reason, I consider it suspect.

Third, vegans will sometimes present milk, along with other animal products, as disgusting. It makes sense to say that there is something disgusting about anything produced through the means utilised by the dairy industry, just as there is something disgusting about products created through practices exploitative of humans. If one is disgusted by milk *itself*, however, there seem to be unacceptable consequences for one’s view of a mother—human or otherwise—offering her own milk to her child. This is emphatically not something that should be considered disgusting, but it is hard to see how we could reconcile this claim with the idea that milk is disgusting. Additionally, one must ask about the extent to which disgust directed at milk can be separated from an implicit misogynistic aversion to women’s bodies.

Fourth, vegans will identify claims about the healthfulness of milk consumption for individuals as reasons to reject the idea that milk is food. It is beyond the scope of the present enquiry to determine the healthfulness of milk in human diets. I do, however, want to note three responses to this worry. First, it would be an uphill battle to claim that milk is *so* unhealthy that it is better thought of as something other than food, in the way we might think, for example, that poisonous mushrooms (even if consumable and providing some nutritional benefit) are not food because of the deleterious health effects they have.²⁰ Second, proposing that milk consumption is unethical or should be banned because it is damaging to the health of individuals seems to be the worst kind of paternalism. Indeed, opponents of milk consumption

²⁰ I allow that someone may want to conceptualise food as closely related to healthfulness in such a way that a great many of the items we colloquially refer to as foods would be excluded. This conceptual claim, in tandem with claims about the unhealthfulness of milk, would allow them to reasonably declare milk as something other than food. Though I lack the space to defend this, I suggest that such a conceptualisation of food should be rejected—unhealthy food is still food.

on health grounds should welcome clean milk, as it reduces some of the health risks associated with conventional production of dairy (including those relating to zoonoses and pollution). Third, clean milk offers the potential for biohacking, producing dairy- or dairy-like products that can minimise particular health risks. Perfect Day claims to be “working on hypoallergenic innovations” to produce clean milk that can be consumed by those with dairy allergies (Perfect Day n.d.), and there is no reason that they or another group could not produce milk that is more healthful.

Fifth, vegans may observe that the foregrounding of milk is a peculiarly racialized phenomenon. As Gaard explains,

Populations that have a historical practice of milking domestic animals ... have retained the enzyme (lactase) that digests lactose sugar in milk, far beyond childhood; however, the majority of the world’s populations lose the lactase enzyme by the age of four, and thus lactose intolerance is common among Vietnamese, Thai, Japanese, Arabs, Israeli Jews, and African Americans, Native Americans, Asian Americans, and Hispanic Americans. (Gaard 2013, 608)

Consequently, the foregrounding of milk in the dietary advice of western, predominantly white, nations has been framed as displaying a problematic ethnocentrism (see Wiley 2011). In 2017, this was apparently taken a step further, when white racists used statistics relating to lactose-intolerance as “evidence” of white supremacy, and references to milk were used as a coded message about their beliefs, with references to veganism replacing overt mentions of racist conspiracy theories. At least, this has been reported (Nagesh 2017; Smith 2017); it can be hard to know how seriously to take these stories. “Poe’s law” tells us that it is impossible to distinguish online parodies of extremist positions from sincerely held beliefs, while internet “trolls” take pleasure in sowing discord—and both antiracists and vegans are popular targets of their attention. Whatever the precise extent of the links between white supremacy and dairy (if any), all of this speaks to a need to be more racially aware in nutrition advice and animal activism, rather than a need to declare dairy consumption inherently immoral. This is especially true in the case of clean milk; the form being developed by Perfect Day is free from lactose, so may be more universally accessible.

For the reasons above, I am sceptical about framing the consumption of milk as inherently problematic, even while I endorse the claim that, in this world, we *may* have good moral reasons to avoid consuming any animal product, no matter how justly acquired, and while I endorse the *possibility* that there would be no need for an industry producing animal milk for human consumption in the ideal world. As such, while we have very good reason to take steps to ensure that any support for clean milk does not serve to legitimise the current milk industry (cf. Milburn 2016b, 252–254), we make a mistake if we refuse to support clean milk on the grounds that milk is not food, is inherently immoral, is disgusting, is unhealthy, or is tied to problematic beliefs about race.

Human Milk

A final challenge to support for clean milk might come from animal advocates who criticise said support as tacit endorsement of human superiority over cows. Supporting clean milk, it might be said, frames humans and cows as fundamentally different, normatively speaking; cows' DNA can be used to produce milk, while humans' DNA cannot. This is parallel to what I have called the false hierarchy objection to clean meat. I have suggested, echoing Friedrich Nietzsche (2000a[1886], §257; 2000b[1887], §I:2), that creating cow-but-not-human flesh would “affirm a kind of *pathos of distance* between ‘us’ and ‘them’; a kind of ranked hierarchy with humans above and [animals] below” (Milburn 2016b, 256).

This challenge should not undermine our support for clean milk. I am not convinced that using a being's DNA to create milk puts members of that being's species in a “lower” category than individuals who do not belong to a species that has been used to create milk. Milk is food, and we do not inherently disrespect or devalue animals by recognising them as a source of this food, just as we do not inherently disrespect or devalue humans by recognising them as a source of this food. If we did, we would presumably be committed to the idea that (some) human mothers were disrespected or devalued, simply because they produce milk consumed by someone else. We do not disrespect or devalue humans by using human hair to produce wigs, or human organs for the purposes of transplant. Arguably, we *lionise* humans precisely by considering their hair or organs suitable for these purposes. Thus, I cannot see why using cattle DNA to produce clean milk would affirm any kind of pathos of distance between cattle and humans.

Indeed, there would be very good reason to support, eventually, creating human breastmilk.²¹ If, instead of being (near-)vegans dissatisfied with vegan alternatives to dairy, the people behind Perfect Day and the Real Vegan Cheese project had been (say) single fathers, then it is conceivable that they would have pursued the development of *human* milk, rather than cows' milk. Many mothers, including those who cannot produce enough milk to feed infants, those concerned about breastfeeding interfering with their careers, or those who cannot safely breastfeed because of drink or drugs, could also benefit from access to human breastmilk. Various systems—from the formal to the informal—are already in place in some contexts for mothers to access breastmilk from others, but these can be unreliable or costly. For example, for handling *donated* breast milk, hospitals will pay “\$50 per liter in Norway, \$96–160 a quart in the United States” (Gaard 2013, 600). If hospitals had a reliable, cheap and completely safe source of human milk, infant medical care could be revolutionised. Thus, a very large number of humans (and cows!) could benefit from the bioengineering of human milk before we have even entered the sometimes-bizarre world of gastronomical experimentation. For this reason, I predict and hope that we will see the bioengineering of human milk

²¹ I have no intention of using the term “clean human milk,” as “traditional” human milk is in no way *unclean*.

alongside clean cows' milk, and thus see no reason to entertain "false hierarchy" worries.²²

Support for Clean Milk

Based on the above considerations, I conclude that the animal movement—including grassroots activists, animal-advocacy organisations, and academics concerned with justice for animals—should promote and support the large-scale adoption of clean milk. This promotion and support could take many forms, ranging from education and awareness-raising to charitable giving and (most obviously) purchase. I envisage that, in the early days of clean milk's availability, one form of promotion that will be key will be the petitioning of (private and public) food providers. These providers should be encouraged to switch from "traditional" to clean milk; minimal progress will see clean milk available alongside "traditional" milk, but preferable would be a complete switch-over. Though such change is unlikely to be easy, efforts to encourage a switch have the potential to make an enormous change for animals. This promotion of clean milk is something that it makes sense to do alongside promotion of veganism, not least because clean milk, without the need for any conceptual gymnastics, can be called vegan.

Importantly, this conclusion holds whether or not individuals have compelling moral commitments to abstain from *all* animal- and pseudo-animal products. Support for the development of clean milk and endorsement of the claim that clean milk is a just possibility does not commit one to drinking clean milk, just as one's support for (say) an independent Scotland does not commit one to living in an independent Scotland. The conclusion also holds regardless of whether an ideal political theory of a mixed human/nonhuman society would have room for clean milk; as a non-ideal proposal, clean milk offers the opportunity to remedy the grossest of injustices faced by dairy cows.

That said, and while arguing for these conclusions is not the purpose of this paper, I see no compelling reason to believe that we have non-justice-based moral reasons not to consume clean milk, and nor can I see why—given liberal/libertarian commitments to people's right to freely pursue their own good—an ideal theory of human/animal relations could not find space for clean milk. As such, assuming that there are no aesthetic, economic or health reasons speaking against a particular individual consuming clean milk, I suggest that individuals even have good reason to favour clean milk over plant-based "milks." Not only would this offer economic support for an industry that has genuine potential to severely limit the harms of the present dairy industry, but it is entirely plausible that—due to incidental deaths of animals in the harvesting process—clean milk involves harm to fewer animals than plant-based milks.

The state can also play an important role in the development of clean milk. The very least the state can do is ensure that any business interests or neophobic public

²² This also offers a response to any committed speciesists who oppose clean milk on the grounds that it opens the door to (or sets us on a "slippery slope" towards) the creation of bioengineered human milk.

perceptions are not allowed to hinder the impartial legislative assessment of clean milk products. Financial support of the development of clean milk would, of course, be a positive step, but perhaps more important would be changes in policy so that the cost of “traditional” dairy is truly represented in its price to consumers. It has been suggested that, in time, clean milk could become cheaper to produce than “traditional” dairy (Levitt 2016). Here, though, clean milk is at a distinct disadvantage, as subsidies and incentives support the existing dairy industry at every step of the way. Indeed, states and governmental bodies will buy dairy products simply to dispose of them, thus keeping the industry afloat. The dairy industry also receives a benefit in that it is not required to cover the costs of the negative externalities it imposes, not least its greenhouse-gas emissions and reliance on antibiotics. Requiring the dairy industry to pay for such environmental and medical externalities is something that states have reason to do *regardless* of any support for clean milk or animal rights.

Concluding Remarks

I have argued that there is little reason for animal advocates to be opposed to clean milk, and that there are many reasons for them to support it. I thus conclude that it is a technological possibility behind which they should put their political, economic, and social weight. The possibility of clean dairy, as being developed by Perfect Day and the Real Vegan Cheese project, is a game-changer, a development with great transformative potential. It is something to which all of us—states, societies and individuals; advocates for animals, public health and the environment; liberals, feminists and libertarians—have reason to offer our wholehearted support.

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