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ARTICLES

Moral Steaks? Ethical Discourses of In Vitro Meat in Academia and Australia

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Abstract The profile and possibilities of in vitro meat are rapidly expanding, creating new ethical conundrums about how to approach this nascent biotechnology. The outcomes of these ethical debates will shape the future viability of this technology and its acceptability for potential consumers. In this paper we focus on how in vitro meat is being ethically constructed in academic literatures and contrast this with discourses evident in the mainstream print media. The academic literature is analysed to identify a typology of ethical discourses, ordered from the most common to least expressed. We then apply this typology to investigate the frames present in Australian print media reportage on the topic. In the academic literature, discourses relating to in vitro meat's promised environmental, animal welfare and food security benefits are most prominent. In contrast, ontological struggles over its 'nature' have emerged as the dominant feature in the Australian print media. Although these spaces of engagement evidence decidedly different discursive trends, ethical discourses critical of in vitro meat's wider socio-cultural ramifications are currently under-represented in both. This paper therefore calls for critical scholars to move beyond the narrow, presumptive framings of in vitro meat as a technological remedy for our consumptive ills, to more seriously engage with the ethical consequences of this new form of food.

Keywords In vitro meat · Cultured meat · Biotechnology · Bioethics · Discourse analysis · Australia

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Introduction

The idea that we might one day be able to harvest lab-grown meat and "escape the absurdity" (Churchill 1932) of raising and then slaughtering an animal has long been an imagined possibility in discussions of food and environmental ethics. This possibility took an important step away from the imagined towards the corporeal with the well publicized tasting of the world's first in vitro hamburger patty in August 2013 (Post 2013). At its most basic, in vitro meat (henceforth IVM), involves deriving meat products from muscle tissue grown in a lab rather than grown as the flesh of animals (Edelman et al. 2005; Datar and Betti 2010; Bhat and Bhat 2011b). A commercially viable IVM product is unlikely to appear anytime soon (Edwards 2010), however it is moving from the realm of the promised to the possible. As such there is an urgent need to expand debates regarding *how* to make in vitro meat to also question whether we *ought* to make IVM. After all IVM has the potential to revolutionise food, eating and agriculture. As the future of IVM may turn on whether potential consumers view IVM production and consumption as ethically sound, it matters how these ethical negotiations evolve and resolve. In this paper we seek to provide some clarity around the ethical dimensions of IVM, and to encourage further debate on the technology before it materializes on our supermarket shelves.

Understanding the ethical discourses surrounding IVM is important in allowing insight into how the technology might become established, fall by the wayside or evolve in the coming years. Ursin (2013) points out, that in the context of nascent biotechnologies, ethical discourses have an important generative capacity, that is, they can themselves motivate investment in and influence the form of the relevant technology. Examining such ethical debates is also significant in light of the way IVM acts as an important space for deliberation about the multiplicity of food futures being conceived and advocated. While meat consumption has traditionally been normalized in contemporary Western cultures, it is becoming an increasingly reflexive practice and a range of alternative culinary possibilities are being explored. These include flexitarian and plant-based diets, locavorism, slow food and organic eating, entomophagy and plethora of biotechnical responses. This menu pluralism is more than simple 'bourgeois piggery' (Johnston 2008); as Galusky (2014) notes, "[c]hoices about what to eat expand beyond taste and become expressions of value and demands for solutions." We have reached an important junction—a crossroads of sorts—where we must decide which food path we intend to pursue. The ethics of IVM play a key role in this decision with significant implications for future food trajectories.

As its profile grows, researchers are beginning to explore the ethical dimensions of IVM. While earlier work has been useful in eliciting some of the ethical concerns surrounding IVM (see Hopkins and Dacey 2008; Pluhar 2010; Miller 2012; van der Weele and Driessen 2012; Stephens 2013), there have been few studies subjecting IVM debates to more detailed discursive analysis examining how different ethical arguments are already actively shaping how we think about and understand the technology. Such research is especially necessary in light of recent developments seeking to further draw both academics and the public into IVM debates including

the IVM hamburger tasting, the successful release of an IVM cookbook through the crowd-funding platform Indiegogo last year, and the BiteLabs organization's satirical claim to be developing in vitro artisanal salami using celebrity tissue samples. Given the novelty of the technology the ethics of IVM are far from set, instead we are in an interesting phase where ideas from the realms of science, science fiction, environment, food and animal rights, are influencing how proponents, opponents and potential consumers come to construct and value the forms of meat being produced.

In light of this, the paper has two aims. First, we seek to develop a typology of ethical positions on IVM. We do this by conducting a discourse analysis of the academic literature relating to IVM where some of the most advanced and informed debates are taking place. Discourse typologies are a valuable means of mapping the diverse and sometimes divergent frames stakeholders adopt to construct issues. They are also powerful tools for dissecting power-knowledge structures embedded in discursive struggles, elucidating how certain discourses are more powerful than others because of their ability to appeal to already dominant narratives or fit within existing ontological or epistemological paradigms. Use of a discourse typology drawn from scholarship has previously been found to be a helpful lens through which to examine wider discursive practices, particularly those that engage the public on environmental ethics (e.g. McGregor 2004). The developed typology therefore offers insights into the contested ethical terrain of this budding biotechnology but also provides a useful discursive framework through which ethical debates in other contexts can be interpreted.

Our second aim is to contrast the ethics emerging in academia with those emerging in the more publically-accessible and influential print media. Given the prominent role of academics in both developing the technology and providing expert opinion in various public forums, we see the academic landscape as helping to provide contours for broader discussions about the ethics of IVM. It suggests and reflects a vernacular from which public engagement with the issue can proceed. As such we use the typology as a frame of reference for engaging in a qualitative case study analysis of Australian newsprint and magazine articles concerning IVM that have appeared since 2005, when the topic first gained media attention. Australia offers an especially interesting case study as meat eating is intimately connected with notions of national identity, yet the ethical issues associated with animal agriculture have pushed the production and consumption of meat onto Australians' moral and political agendas in recent years. Drawing on these two spheres of engagement the paper examines how academic and media discourses concerning IVM differ and identifies some of the influences within these different spheres. The ethics that come to dominate how we think about and approach IVM in academic and public life will have important ramifications for research, policy and consumption.

Moralised Meat and the IVM Solution

The production and consumption of meat is linked to a range of ethical conundrums that increasingly plague our palates. In addition to longstanding concerns regarding animal

welfare, meat is implicated in a multitude of environmental ills, including habitat degradation, land-use inefficiencies, biodiversity loss, air and water pollution, erosion and climate change (Steinfeld et al. 2006). It is also linked to a number of public health concerns, including the emergence of pandemics and the growing prevalence of diseases associated with overconsumption of animal-products (Weiss and McMichael 2004; Walker et al. 2005). Meat has thus become an increasingly moralized foodstuff—its normative content is becoming equally as important as any nutritional content. Numerous campaigns advocating meat-free or meat-reduced diets such as Meat Free Mondays, Meat Free Week and Veganuary are testament to the fact that people are increasingly confronting their moral ambivalence about meat eating. Yet this decline in meat's reputation is stymied by what Sage (2014) terms the 'meatification' of the human diet, whereby meat remains a deeply culturally embedded foodstuff in the West. Global demand for meat is rising rather than falling as the rapidly expanding middle classes of emerging economies increase their meat consumption, contributing to what Delgado (2003) refers to as a "livestock revolution".

It is in this context that IVM is being advocated as a technological means of addressing environmental, human health and animal welfare problems (Hopkins and Dacey 2008; Bhat and Bhat 2011a)—a way of removing the unpleasant ethical after-taste associated with conventional meat. Currently the most promising scaffolding techniques proliferate embryonic myoblasts or adult skeletal muscle attached to a carrier, such as collagen mesh, in suspension in a culture medium (Bhat and Bhat 2011a). Such methods are only capable of yielding small amounts of unstructured meat suitable for use in processed products such as hamburgers and sausages at present (Post 2012). A number of other production techniques are being explored, including self-organising cultures and 3D printing methods (Chiles 2013b). These methods offer the prospect of more complex meats. It has also been suggested that nanotechnologies and biophotonics may provide future production possibilities (Hopkins and Dacey 2008; Bhat and Bhat 2011b).

If the technology develops as is hoped IVM is expected to use less resources, such as water and grains; cause less land and water degradation; result in far less greenhouse gas emissions; cause less suffering for animals; and pose fewer risks in terms of the global pandemic threats associated with intensive agriculture. As we will discuss in further detail below, it is presented as a technical solution with win–win outcomes for people, planet and animals. Opponents, however, see it as promoting a growing appetite for flesh or 'carnivoracity' (see Miller 2012) that risks pushing the prospect of dealing with the problems of meat eating to some undefined future moment, backgrounding other possibilities and allowing us to elide responsibility for altering our consumptive practices now.

Research Methodology

This paper approaches discourses as the multiple sets of ideas, concepts and categorisations which shape and give meaning to material and social realities, embracing both text and the practices through which discourses are embodied (see Hajer 1995: 44; Sharp and Richardson 2001). Discourses provide the linguistic,

experiential, and metaphorical resources through which we construct and make sense of the world, with different discourses normalizing, shaping and interpreting physical and social phenomena in different ways. Our methodology explores the ethical discourses shaping written constructions of IVM in academia and the print media. For academic discourses an extensive search was made of the Scopus, Informit, ScienceDirect, SpringerLink and Google Scholar databases for papers dealing with IVM. The bibliographies of papers identified were then investigated for additional literature. The final cohort consisted of 55 papers. These covered the period from 2002 to 2013, and were drawn from a wide range of disciplines including tissue engineering, environmental philosophy, law, food, development studies, critical animal studies and other cognate fields. To develop a typology each article was analysed and sorted according to the key narratives being produced, their ethical underpinnings, authoritative sources and common words and terminologies.

Print media was selected for analysis of the Australian case study as it remains a widely available media source that plays an important role in framing contemporary issues for mainstream society. Media articles were collected using the ProQuest Australia & New Zealand Newstand database. Relevant Australian articles published between January 2005 and December 2013 were identified using the search terms 'cultured meat' and 'in vitro meat' as well as more pejorative appellations including 'artificial meat', 'shmeat', 'frankenmeat', 'lab meat' 'vatmeat' and 'test-tube meat'. Any articles not on topic or with only cursory engagement with IVM were not utilized. Duplicate articles and those <100 words in length, were also excluded. A total of 41 media articles were included in the final analysis. These came from a range of publications including major metropolitan newspapers, smaller local papers and rural publications. Our final source of material came from references to IVM in science fiction, a theme that features in a number of dystopian books, such as Margaret Attwood's *Oryx and Crake* and William Gibson's *Neuromancer*, as well as films such as *Soylent Green.* While not analysed in depth, we refer to science fiction themes where relevant, as these are likely to be some of the first exposures people have to IVM. Other parts of the media landscape including social media and the blogosphere, will also play a role in shaping ethical perceptions of IVM, and remain areas for future investigation.

Typology of Ethical Discourses Circulating in Academia

We identified seven main ethical discourses within academic writing on IVM. These don't capture all the nuances and complexities of different arguments, instead some smaller discourses have been subsumed into larger discursive categories into which they logically fall. We have ordered them from the most dominant to the most marginal. Pro-IVM discourses relating to environmental sustainability and animal welfare are the most common; more contested discourses relating to food equity or the naturalness of IVM appear less frequently; while discourses that oppose IVM for techno-skeptic, liberatory or Arcadian reasons are the most marginal. We discuss each below and summarise key elements of these discourses in Table 1, at the end of this section.

Environmental Sustainability

As noted above, conventional meat production and consumption is associated with a number of environmental issues. The environmental sustainability discourse emphasizes the environmental benefits of IVM—that it is less ecologically damaging than present production methods, including factory farming (Alexander 2011; Welin 2013). Datar and Betti (2010) argue that IVM may "alleviate the environmental burden exhibited by today's meat harvesting techniques." Pluhar (2010) notes that many researchers suggest it will minimally impact the planet as a whole. It draws particularly on a sustainability ethic, imposing a moral imperative to support IVM based on responsibility for what Robert Goodland calls 'eating greenfully' (2011: 41); the idea that we should produce and consume food in a way that is environmentally sensitive. Metcalf (2013) suggests this discourse might be characterized as one of environmental utilitarianism, with the most morally compelling course of action being that which offers the greatest sustainability advantage. Such sustainability vocabularies have gained particular currency in light of the increasing recognition of livestock contributions to climate change (Steinfeld et al. 2006).

While the moral imperative to eat in environmentally responsible ways is largely unchallenged in the literature, the empirical basis for alleging that IVM is not as environmentally damaging is less certain. While a preliminary life-cycle assessment has suggested that IVM may be the better environmental option, the authors acknowledge that this is underpinned by a number of unknowns and assumptions (Tuomisto and Teixeira de Mattos 2011). Tissue engineering, for example, still generates significant amounts of waste, even at the developmental stage (Catts and Zurr 2013). Given the uncertainty of actual environmental impacts of the still developing technology, particularly when taken to scale, it is important to note that the environmentalist discourse is rarely appealed to in isolation. Instead, just as sustainability advocates avoid calls for more intensive, condensed and integrated factory farming as a way of reducing environmental impacts, as this generates a "tension between reducing the environmental impact of conventional meat production and good animal ethics" (Welin 2013), so too IVM advocates simultaneously appeal to discourses concerning animal welfare.

Animal Welfare

Twine and Stephens (2013) suggest that expectations around improvements in animal welfare underlie the call for uptake of several proposed biotechnologies. It is particularly conspicuous in the academic literature on IVM, which promotes a vision of reduced animal suffering in an IVM future, with no need for factory farms and the (mis)treatment of animals that often accompanies them (Bhat and Fayaz 2011; Alexander 2011; Welin 2013). Its moral force is thus grounded in a utilitarian consequentialist philosophical approach advocated by academics like Peter Singer, in which equal moral consideration of animal interests in determinations of maximum utility, becomes a measure for ethical conduct (see Singer 1995).

Table 1 Typology of ethical discourses of IVM in academia

Discourse	Key narratives	Philosophical underpinnings	Key imagery/Terminology/ Sci-fi associations	Key persons	Key groups
Environmental	sustainability (Pro)	Improved sustainability of meat production/ decreased environmental impacts	Utilitarian environmentalism Sustainable development principles	Lifecycle assessment Sustainable meat consumption	Tuomisto & Teixeira de Mattos Datar & Betti Mark Post
New Harvest					
Animal Welfare (Pro)	Improved animal welfare/less animal suffering and death	Utilitarian consequentialist approach to animal welfare	Victimless meat/Happy meat No animal slaughter	Mark Post Hopkins & Dacey Evelyn Pluhar Peter Singer	New Harvest PETA
	Consequentialist Veg*ns				
Food Equity (Pro & Anti)	Narrative of improved food security…… Opposing narrative of food system stratification and corporatization	Sustainable development principles- Intra and inter-generational equity Food justice	Cheap protein for the masses/ solution to global hunger…… Industrialisation and food corporatization Oryx & Crake Brave New World	Edelman et a. (2005) Hanna Tuomisto …….. John Miller	New Harvest
Naturalness (Pro & Anti)	IVM as natural/unnatural	Teleology/Naturalistic fallacy	Optimization of natural processes/genuine meat Fake meat/synthetic meat/ zombie meat/shmeat/ Frankenfood Soylent Green Oryx and Crake	Neil Stephens	New Harvest (pro)

Table 1 continued

Discourse	Key narratives	Philosophical underpinnings	Key imagery/Terminology/ Sci-fi associations	Key persons	Key groups
Techno-skepticism (Anti)	Increasing reliance on technological solutions undermining normative and social change	Anti-technocentrist ethic	Designer ethics' Techno-(dys)topic imagery Genetic engineering/ Diminishment Frankenstein	Donna Haraway	
Animal Liberation (Anti)	Continued animal instrumentalisation/ Undermining of alternate food cultures	Anti-speciesism Ecofeminism Deontological veg*nism	Cartesian dualism-human-as-person/animal-as-machine Patriarchy/hegemony	John Miller	Deontological veg*ns Virtue ethicists
Socio-ecological harmony (Anti)	Ecological interconnection and interdependence Meat production/ consumption as a way of connecting with nature agriculturalists	The Land Ethic/eco-agrarian ethic Enlightened anthropocentrism/eco-centrism	Equilibrium Interconnection/ cycle Ecological/sustainable animal agriculture	Aldo Leopold Brian Ford	eco-

However, a number of authors have problematized the animal welfare narrative of victimless meat, pointing towards the unpleasant material reality of current tissue culturing practices, which retain a significant corporeal intimacy with living (or rather once living) animals (McHugh 2010; Miller 2012; Driessen and Korthals 2012; Catts and Zurr 2013). Catts and Zurr (2013) argue that existing culturing practices really only offer "the illusion of 'victimless' meat consumption" as animals are still sacrificed in the process. At present tissue culturing requires a large number of donor cells, and the most common growth medium used is foetal bovine serum, which necessitates the death of livestock generally sourced from the factory farming complex (Stephens 2013). The response of IVM advocates to this tension is twofold: firstly, that there is ongoing research into developing non-animal growth media, so that future practices might more closely resemble the narrative presently espoused (Stephens 2013). Secondly, in line with utilitarian consequentialist philosophy, some animal suffering can be justified if it leads to a reduction of total animal suffering. Proponents of IVM argue that even allowing for some animal death, many millions of animal lives may be spared and animal suffering lessened overall (Pluhar 2010; Welin 2013).

Food Equity

Food equity discourses centre around the ethics of IVM in relation to impacts on availability and distribution of food. In recent years food insecurity has resulted in unrest and violence in a number of countries (Barrett 2010). Meat consumption is a particular source of food inequality (Ursin 2013). Many cultured meat proponents champion a food security narrative, suggesting that IVM products may help address devastating food shortages by providing a cheap source of protein that can cater to a rapidly growing demand for meat (Edelman et al. 2005; Bhat and Fayaz 2011). However, as with the other promissory narratives embedded in the discourses discussed above, it has been problematized and contested.

Challenges to the food security narrative draw on concerns that IVM technology may amount to a privileging of the ethical discomfort of the wealthy over the needs of the impoverished. Mattick and Allenby (2012) suggest that, "the introduction of cheap (perhaps subsidized) factory-produced meat to feed the poor could actually have the opposite of its intended effect." Welin (2013), for example, questions what will happen if the markets predicated on developing countries exporting meat to developed countries, or on producing feed crops for animal agriculture, break down in light of IVM. Some authors suggest that IVM will emerge as costly niche product catering to specific ethical desires of the rich rather than a cheap protein source for the world's poor (Metcalf 2013; Cole and Morgan 2013). Miller (2012) points to the possibility that the introduction of IVM could mean that conventional meat eventually becomes the preserve of the wealthy who can, "afford to pay for the inflated produce of a 'downsized' industry", further eroding the food choices of the poor.

This is the techno-dystopic vision articulated in Margaret Atwoood's *Oryx and Crake,* where 'real' meat is only available to the socially elite, with the poor having no option but to eat "ChickieNobs", the engineered, non-sentient cultured meat entities unappetizingly described as "meat tubers" (2003: 202–203). While this may seem to venture into speculative terrain, the cost of traditional meat is already

expected to rise due to increasing competition for resources (Post 2012). A similar situation is presently playing out in relation to organic food and there are already discussions concerning the right of consumers to be able to differentiate between conventional meat and IVM through labeling (Schneider 2013).

There is also concern that IVM will reinforce food production hegemonies inherent in the corporate agri-food industrial complex. Miller (2012) argues for example that, "the technical sophistication in vitro meat requires may also stand to militate against autonomy and self-sufficiency in food production within communities, increasing the already considerable influence of global food corporations." This can be paralleled with Vandana Shiva's eco-feminist criticism of the "food dictatorship" created by the corporate control of transgenic seed technologies (2000: 117–120). Notably, some methods of in vitro engineering have already been subject to patenting (Edelman et al. 2005) and the literature is starting to grapple with issues of legal regulation and control (MacDonald Glenn and D'Agostino 2012). Such concerns draw on the narrative of industrialization, with its emphasis of efficiency over choice. The conception of IVM as the "Brave New Meat" (Pluhar 2010), conjuring the Fordist imagery embedded in Huxley's imagined dystopia is particularly evocative.

Naturalness

A number of academics point to the ontological ambiguity of cultured meat (Stephens 2010; McHugh 2010; Metcalf 2013; Chiles 2013b; Stephens 2013; Cole and Morgan 2013). The IVM nomenclature that has emerged from the literature serves to highlight the uncertainty that is colouring discussions of tissue culturing for food, with monikers ranging from 'genuine meat' (Hopkins and Dacey 2008) to 'vatbeef' (Fox 2009), 'synmeat' (Edwards 2010), 'shmeat' (Metcalf 2013), 'frankenfood' (Miller 2012) and 'zombie meat' (Stephan Herbrechter quoted in Stephens 2010). A significant part of the ontological struggle is centered around notions of naturalness, artifice and authenticity. McHugh (2010) uses the term 'real artificial' to emphasize the inherent ambiguity, while Catts and Zurr, bioartistists and researchers who have been examining the ontological fuzziness of IVM, characterize it as a 'natural-ish' entity (2007). The centrality of this discourse in the typology attests to the fact that both supporters and detractors of IVM mobilize concepts of naturalness and authenticity in formulating their ethical arguments. Notions of 'naturalness' have significant normative power, referring to the ways things ought to be (see Castree 2005).

Some constructions circulated in the academic literature assert that IVM is as natural as wine or hydroponic tomatoes and simply represents the optimization of naturally occurring processes (Chiles 2013a; Welin 2013). Other constructions suggest that IVM is unnatural (see Hopkins and Dacey 2008; Ford 2010) or make associations between IVM and practices generally conceived of as 'unnatural' such as cannibalism (Schneider 2013). Schneider (2013) notes concerns that IVM will become a real life Soylent Green, the protein source famously made from human remains in the 1973 dystopic film of the same name. While there are some exceptions (see for example Hopkins and Dacey 2008), these contestations are

largely predicated on a well-entrenched ontological hierarchy embedded in the naturalistic fallacy-that 'naturalness' is superior and is automatically equated with the moral good.

Techno-skepticism

The techno-skeptic discourse challenges the ethicality of using technology to address the contemporary moral quandaries associated with conventional meat. This approach has been termed 'designer ethics'-where a convenient techno-solution is engineered which means there is no need to engage in a more difficult normative struggle to alter social practices (Franklin 2004; Haraway 2008). As Hopkins and Dacey (2008) point out, for some, IVM fortifies a 'technology will save us' response equated with moral cowardice or laziness.

The discourse also engenders concern about how a lackadaisical technological approach might impact discursive struggles in food production and environmentalism more generally. The fear is that a trend towards techno-fixes like the genetically engineered enviropig™ and the diminishment process of removing pain receptors from factory farmed animals might be normalized, further entrenching the hubristic perception of human mastery over our environment (Miller 2012). Metcalf (2013) suggests that cultured meat might in fact be seen as "the ultimate extension of disenhancement"; instead of investing effort in changing 'how' we eat, we can simply engineer a different 'who', or indeed engineer away the 'who' altogether. As such the technocentrist optic reinforced by IVM may cause further estrangement from nature (Welin 2013).

The techno-skeptic discourse is embedded in a wider uneasiness that many people feel about mixing technology and food (Catts and Zurr 2013), as evident in debates over genetic engineering. It draws on the imagery of techno-(dis)topian futures, often associated with Frankenstein imagery (Stephens 2010; Pluhar 2010; Bhat and Fayaz 2011; Miller 2012); Shelley's creation being the archetypal tale of technological manipulation leading us morally astray. It is evident in a range of literatures including those exploring the ethics of biotechnology more generally.

Animal Liberation

While animal welfare and animal liberation are often conflated, in the context of IVM the distinction between the two is clear. The liberatory agenda extends beyond animal suffering to protest against animal instrumentalization more broadly (Cole and Morgan 2013). The liberatory discourse is based on the idea that ethical consumptive practices should seek to resituate the relationship between humans and non-human animals in a non-speciest, non-hierarchical mould. It has found particular resonance in critical animal studies literature.

Miller (2012) argues that because IVM continues to operate within the dominant framework of 'carniculture'[1] in which animal bodies are still food, it reinforces

[1] Term coined by Hopkins and Dacey (2008) to refer to the production of meat in parallel to the production of plant food through 'agriculture'.

anthropocentric instrumental values rather than biocentric intrinsic ones. By this logic individual animals will continue to be subjugated and instrumentalized through the in vitro process (Cole and Morgan 2013), even if overall suffering is reduced. Drawing on Miller's work, Stanescu and Twine (2012) have written that what is being witnessed as IVM biotechnology, "is merely an intensification of the original Cartesian dualism inherent in the factory farm system between human-as-person and animals-as-machine." IVM may simply render anthropocentrism less visible but more firmly embedded in contemporary agribusiness, making the 'animal machine' (Harrison 1964), or 'machinimal' (Galusky 2010), both a psychological and material reality.

The liberatory discourse also emphasizes the fact that "[IVM] is competing on ethical terrain carved out by veganism" (Cole and Morgan 2013). There is concern that the cultured meat enterprise may undermine a move towards more plant-based food cultures and detract focus from other areas of animal subjugation such as dairy and egg production. Miller (2012) argues that it makes plant-based diets seem a less appealing path by facilitating nostalgia for meat. As evidence Miller points out that some advocates for IVM suggest that vegetarianism is not really a 'live option' for consumptive change in contemporary society (e.g. Hopkins and Dacey 2008). Cole and Morgan (2013) note that this assumed unpalatability of plant-based diets by IVM supporters can be seen as reinforcing a symbolic order based not just on the subordination of non-human animals, but on the privileging of a patriarchal worldview in which lesser 'plant' foods have traditionally been associated with women. The liberatory discourse is thus critical of the way IVM is implicated in maintaining power hierarchies more generally, drawing on ecofeminist philosophy that sees non-human animals and women as being linked by "fused oppression" under a patriachical world order (see Adams 2010: 102).

The liberatory discourse is developing through arguments within vegan and vegetarian communities. Something of a rift is emerging between those that take a deontological view seeing all animal instrumentalisation as wrong and those that have a more consequentialist perspective and see IVM as a step towards reducing animal suffering. Val Plumwood, for example, suggests that deontological veganism's indiscriminate proscription of all animal instrumentalisation as having the "same moral status" is unhelpful, failing "to provide philosophical guidance for animal activism that would prioritise action on factory farming over less abusive forms…" (2012:78). In contrast the deontological camp has been critical of the vegan animal rights group PETA's 2008 pledge to award one million dollars to the first laboratory to create a commercially viable IVM product using chicken cells (see Stephens 2013: 175).

Socio-ecological Harmony

The final, and most marginal, discourse parallels notions of Arcadia, whereby pastoral communities are portrayed as being in harmony with natural systems. Core to this discourse is the articulation of sustainability embedded in Aldo Leopold's (1949) land ethic. Leopold extends moral consideration to non-human members of the biotic community embedded in the concept of 'the land'. Proponents of socio-

ecological harmony are concerned that IVM production is antithetical to notions of interspecies dependence and connection to 'the land' that are consistent with this particular understanding of sustainability. Meat production is viewed as an important element in maintaining environmental equilibrium in certain rural ecologies (Ford 2011). It forms part of an ecological cycle dependent on biological processes such as soil fertilization and vegetation management. As Metcalf (2013) notes, although factory farming can also be seen to have undermined these interconnections, transitioning to IVM would fail to "restore the ecologically sound loop between animals and plants".

For many, livestock are seen as having a non-substitutive culturally and ecologically constitutive role in food production systems. Ecological agriculture, particularly that consistent with a permaculture approach, is positioned as an ethical alternative to factory farming within this discursive framework. The socio-ecological discourse can thus be seen to valorize traditional agrarian values, positioning them as morally sound. It can be linked with a new nostalgia for meat in which producing and eating a certain kind of meat is construed as a way of connecting with our rural roots and with nature, constructing "an idyllic, rural, preindustrial hinterland, in which humans lived closely and honestly with the animals they exploited, interconnected with, and attuned to, the natural life-rhythms of the countryside" (Parry 2009).

The resultant 'post-modern carnivoracity' may in fact be seen to idealize a particular construction of nature as 'red in tooth and claw', valorizing slaughter as a part of the ecological process (Miller 2012). A number of authors have pointed to the 'looking dinner in the eye' trend, a fetishization of do-it-yourself slaughter as part of certain vision of ethical and sustainable agriculture (Parry 2009; Alexander 2011; Miller 2012; Chiles 2013a). Yet while this emergent 'meet the meat' mentality is reminiscent of the famous fictional encounter with a meaty animal of the bovine type that wants to be slaughtered in Douglas Adam's *Restaurant at the End of the Universe*, the tension remains that the animals in question don't obviously exhibit such inclinations. Parry (2009) has argued that such a romanticized notion of agriculture may simply work to obscure the extent of the violence embedded in much contemporary livestock practice.

Typology Summary

In Table 1 we summarise our findings and develop a framework that can be used to analyse IVM debates in a range of different media and contexts. Each discourse is positioned according to the frequency in which it occurs, so the more dominant and influential discourses appear first, while increasingly marginal and uncommon discourses appear further down the list. We have then identified the core narratives, philosophical underpinnings, imageries/terminologies and links to science fiction, and finally the key people or groups associated with that discourse. The environmentalist, animal welfare and food security narratives are particularly established and prevalent in academic writing on the topic. As scholarly engagement with the issue grows, more discourses critical of the technology are emerging, yet remain marginal to most debates.

Ethical Discourses Concerning IVM in the Australian Print Media

In this section we use the typology to review the framing of IVM in the Australian print media, where in theory, a broader array of stakeholders are granted access. While academics play an influential role as authoritative experts in framing new issues in the print media, non-academic actors, such as representatives from government, industry and NGOs, as well as celebrities, are also influential. The print media can be seen as a public arena where different actors vie for influence, leading to particular constructions of social and environmental issues. How IVM becomes framed in this arena will influence, but not determine, the ethical acceptability of IVM in broader society. Importantly, the popular media is positioned as a space where those involved in the development of IVM might proactively frame ethical discourses. In Goodwin and Shoulders' (2013) analysis of cultured meat media coverage in Europe and America, for example, the authors have the express intention of providing insights into how IVM scientists might strategize to better communicate their preferred framing of the issue.

The Australian Context: 'Carno-nationalism' and Meat in the Media

Australians are some of the biggest meat eaters in the world (Norat et al. 2001) and meat-eating is intimately tied to certain constructions of national identity such as the 'aussie meat pie'. In 2010 the National Australia Day Council commissioned a poster series to encourage Australians to celebrate the National holiday. One, in the style of a WWII propaganda poster, reads, 'Your country needs you-BBQ like you've never BBQ'd before this Australia Day' and shows three Australians proudly clasping meat trays in front of a flag draped barbeque (see Fig. 1). Meat and Livestock Australia has a similar annual campaign encouraging Australians to eat lamb on Australia day, claiming those that do not are 'unAustralian'. This theme reappeared when the animal welfare charity 'Voiceless' recently helped fund a 'Meat Free Week' campaign. The Queensland MP George Christensen, along with the Cattle Council of Australia and the Sheepmeat Council of Australia responded with a counter-campaign, 'Free Meat Week', through which Mr Christensen claimed that, "When Aussie farmers and graziers are doing it so tough, a drive to convert people to vegetarianism is just un-Australian" (Bettles 2014). In Australia, meat eating and 'banal nationalism' (see Billig 1995) are inextricably linked, creating what might be termed 'carno-nationalism' (see Chen 2014).

In recent years meat consumption has become popular media topic in Australia (see Panahi 2013). In terms of IVM, the popular media, particularly newsprint and television, is for most people, the first point of exposure to the topic. In what follows we discuss the ethical framing of IVM in the Australian print media. We found no mentions of IVM prior to 2005, however reportage has increased in light of a number of well-publicized events, including PETA's competition announcement (2008) and the tasting of the world's first IVM hamburger (2013).

Discursive Framing of IVM in the Australian Print Media

The naturalness discourse is the dominant discourse framing the ethics of IVM in the Australian print media. It was evident in more than half of the articles analyzed. While the academic literature constructs IVM as both natural and unnatural, the print media predominantly constructs IVM as 'unnatural'. This is apparent in the choice of terms used to describe IVM, including, phony meat (Gannon 2013), bogus meat (Blythman 2013) and pseudo snag (Collier 2011). Science-fiction associations reinforce the notion of unnaturalness of IVM, with one writer suggesting it will be viewed by some as reminiscent of Soylent Green (Anonymous 2012b, Feb 22 *Canberra Times*). Another likened the technology to Star Trek's replicator machine, which synthesized meals from molecules (Mathiesen 2013).

The 'unnaturalness' of IVM was associated with 'yuck' reactions from writers, encouraging negative framings, and even revulsion, in readers. Macintyre (2007) suggests that the idea is 'stomach-turning', while Crabb (2013) notes that readers "with breakfast left to lose" might prefer not to think about scientists' recent progress with the technology. IVM is often portrayed in less than appetizing terms, with descriptors such as "snotty solution" (Konkes 2009), "meat-sheet" (Macintyre 2007) and "cake of bovine muscle cells" (Anonymous 2013a, Aug 22 *The Land*). 'Yuck' reactions to IVM may already be embedded in the public mindset in light of popular dystopic literary interrogations of 'fake' meat such as Pohl and Kornbluth's *The Space Merchants* (1953), Harry Harrison's *Make Room! Make Room!* (1966) (on which the film Soylent Green was based) and Margaret Atwood's *Oryx and Crake* (2003). McHugh (2010) points out that, "novelists have long used the disgust elicited by fake meat as a flash point for eco-minded critique." These literary treatments provide a range of terms and metaphors that are easily recognizable and employable in reinforcing disgust as an intuitive response. The naturalness discourses that elicit 'yuck' reactions are centrally implicated in ethical considerations, drawing on what Leon Kass (1997) termed the 'wisdom of repugnance'; whereby the disgust response is something more than mere neophobia, instead involving ethical concerns. As one writer suggests, "messing around with the natural order", its 'unnaturalness', makes IVM both "literally unpalatable and philosophically unpalatable" (Anonymous 2013a, Aug 8 *The Land*).

In the academic literature on IVM, much of which has been written by scientists or agro-food scholars, safety is largely viewed as a technical, rather than an ethical issue. In the Australian print media however, safety emerges as an important theme linked to the naturalness discourse and questions of ethicality. In particular, discussions of safety leverage existing concerns about GM food, regularly linking IVM to genetic engineering and drawing analogies with the technology. Cheng (2010) writes for example that, "[a]s with genetically modified foods…it might take some time to prove the new technology doesn't harm humans". Gadd (2011) suggests that, "cultured meat will lend itself for genetic engineering". A number of articles characterize IVM as 'Frankenfood', with the first in vitro burger revealed last year frequently dubbed the 'frankenburger' (e.g. Blythman 2013; Mathiesen 2013; Anonymous 2013b, Aug 8 *The Land*). Alkon (2013) notes that 'Frankenfood' is one of the most compelling framings of GM food, regularly used by campaigners

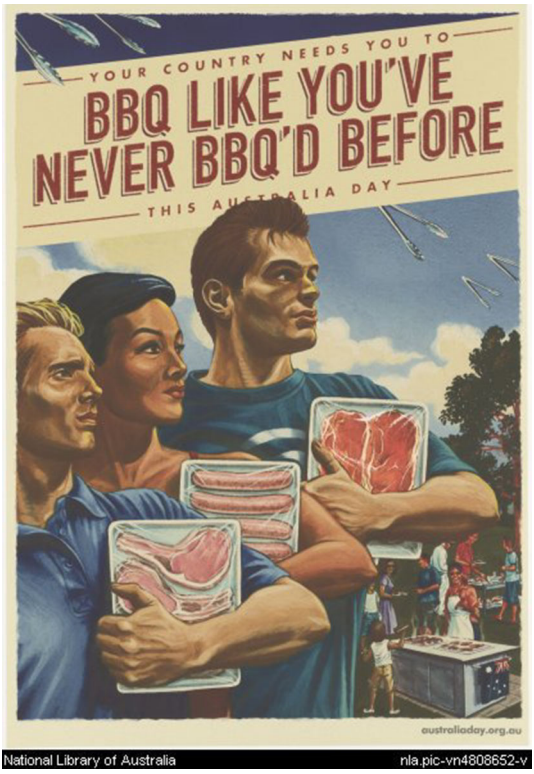

Fig. 1 Poster commissioned by National Australia Day Council in 2010. Australia Day Poster. Thomas, M (Artist) (2010). For the National Australia Day Council. *Your country needs you BBQ like you've never BBQ'd before this Australia Day*. Melbourne: George Patterson Y & R. National Library of Australia Collection, nla.pic-vn4808652. Reproduced with the consent of the National Australia Day Council

against the technology. This association serves to reinforce both naturalness and safety concerns. Importantly, Australians remain quite skeptical about GM food technologies (Meyer et al. 2013). Linkages with GM thus appear to have particular resonance in the Australian context.

While such ontological struggles may challenge support for the technology, the other common ethical discourses currently evident in the Australian print media are generally mobilized in favour of IVM. The narratives of improved sustainability, animal welfare and food security are largely normalized and not actively contested to the same degree that they are in the academic literature. The assertion, for example, that IVM production is more environmentally sustainable than conventional large-scale meat production was never questioned. Although the tension regarding the material reality of animal use in current culturing practices was raised on occasion, it was generally assumed that this could be overcome through development of new non-animal growth mediums or justified in utilitarian terms. The environmental sustainability and animal welfare discourses often emerged in the context of direct quotes from prominent scientists working on the technology, such as physiologist Mark Post, or from high profile advocates, including Thomas Matheny, founder of the New Harvest Organization. This highlights the important role that such stakeholders may play in promoting IVM in public arenas.

The food security narrative was raised in favour of IVM in about a quarter of the articles. The articles generally referred to the narrative in terms of IVM presenting a solution to 'global hunger' (Cheng 2010) or addressing significant food shortages. Dibden et al. (2013) point out that for consumers living in largely food secure developed countries, persuasiveness of food security arguments in biotechnology debates relies largely on such 'guilt-provoking' references. While likely price differentiations between conventional meat and IVM were acknowledged, with one article suggesting that "steaks from animals would likely cost hundreds of dollars per kilogram in the decades to come and would be viewed as luxury items" (Strachan 2012), issues of equity and access raised in the academic literature were not present. Price differences were not problematized as a possible source of stratification of food systems or reduced food choice for the impoverished.

The ethical discourses most critical of IVM in the academic sphere were marginal to print media reporting. The socio-ecological harmony discourse was evident in only two articles, both written by British journalists and generally reflecting a UK perspective. The articles argued that, "the land needs the presence of feeding animals and their droppings for the cycle to be complete, so that soils and grassland areas stay productive" (Blythman 2013) and that, "taking animals out of the equation could damage the ecosystem" (Cheng 2010). Such arguments don't necessarily translate well to an Australian context. In Australia, stock herds have different impacts on soil structure, vegetation and ecology than in places like Britain, where ungulates are native or long established. The Australian farming stakeholders generally represented were those involved in intensive livestock rearing or large industry bodies rather than smaller scale, organic and permaculture operators with which this discourse is generally associated. Both the unique Australian ecological context and the absence of such stakeholders may account for the fact that these ethics were so infrequent.

The techno-skepticism discourse also only emerged in a small number of articles, and usually in a muted form. While Cornish (2010) viewed IVM as a part of a general trend of responding to modern dilemmas via technology, this was not seen as morally problematic. Only one article directly questioned the ethicality of such responses stating that IVM is a "reflection that humans believe technology is the answer to all their problems" (Anonymous 2012a, Aug 30 *North Queensland Register).* While techno-skepticism in the academic literature drew out negative associations between IVM and other proposed technocentric solutions such as alteration of livestock via genetic manipulation, these specific associations were not made in the media articles.

Not unsurprisingly considering its more radical nature, the liberatory discourse was almost entirely absent from the media coverage. The only exceptions were a letter to the editor expressing concern that IVM promotes the myth that we need to keep consuming meat (Anonymous 2011, Sep 6 *Herald Sun*), and one article noting that for some IVM perpetuates a "meat addiction-rather than focusing on promoting non-meat alternatives"(Anonymous 2012b, Feb 22 *Canberra Times*). Instead throughout the media reporting carnivoracity was not challenged. It was presumed that Australians will not give up meat eating and the subject position of the reader was generally assumed to be that of a meat-eater. In the absence of the deontological

vegan and eco-feminist ethics evident in the critical animal studies literature, IVM's wider ethical implications in relation to specieism and patriachical power structures were not explored at all.

While the media profile of IVM in Australia is growing, analysis of treatment of IVM in the Australian print media shows that those discourses critical of IVM's wider socio-cultural implications have received little attention to date. However, despite the prevalence of narratives supportive of IVM in the articles, ontological struggles over its 'nature' have emerged as the dominant feature of ethical debate in this sphere. IVM's future as a marketable commodity may therefore depend in large part on whether public aversion to its perceived 'unnaturalness' can be overcome. This is evident in Fig. 2 and Table 2 which represents the relative importance of the discourses and the way they are mobilized. In Fig. 2 the size of the dots gives an indication of the relative strength of each discourse based on the number of articles reflecting a particular ethic as a percentage of total number of sources analysed in academia and the print media.

Conclusions

In this paper we have developed a typology of ethical discourses that are being used to contest and legitimize IVM based on the advanced debates taking place in academia. We have then used this framework to analyse the contrasting ethical positions on IVM being adopted in the Australian print media. A range of ethical discourses, both approving and critical of IVM, is present in the academic scholarship, however ethical concerns over environmental sustainability and animal welfare dominate the debate. In the print media, concerns that IVM is 'unnatural', and therefore undesirable (and unpalatable), have emerged as the dominant framing. However, accompanying such concerns about naturalness is a general acceptance of dominant academic themes that position IVM as a solution to ethical challenges regarding environmental sustainability, animal welfare and food security. The discursive contest that appears to be forming in Australia then is between the increasingly institutionalized narratives relating to the promised benefits of IVM dominant in academia and the moralized 'yuck' reaction that 'fake' meat seems to elicit, at least amongst journalists. We stress that this is only one study of a 'meatified' Western culture and research in other countries and forums, such as the blogosphere or social media, may result in quite different findings.

Given the novelty of the technology there are a variety of stakeholders who are yet to engage IVM debates. Marginal, or wholly absent, in the sources we reviewed were eco-agriculturalists, sustainable restaurateurs and religious stakeholders. Similarly governments have yet to develop formal policies on IVM. While these and other stakeholders are likely to become increasingly involved as the technology evolves it will be difficult to shift the discursive field that is forming as dominant narratives become more developed. As it stands the *ought* question is being slowly positioned in the affirmative through recourse to the environmental and animal welfare arguments, despite the hesitation expressed by some regarding the nature of IVM. This hesitation, most evident in the print media, may be addressed somewhat

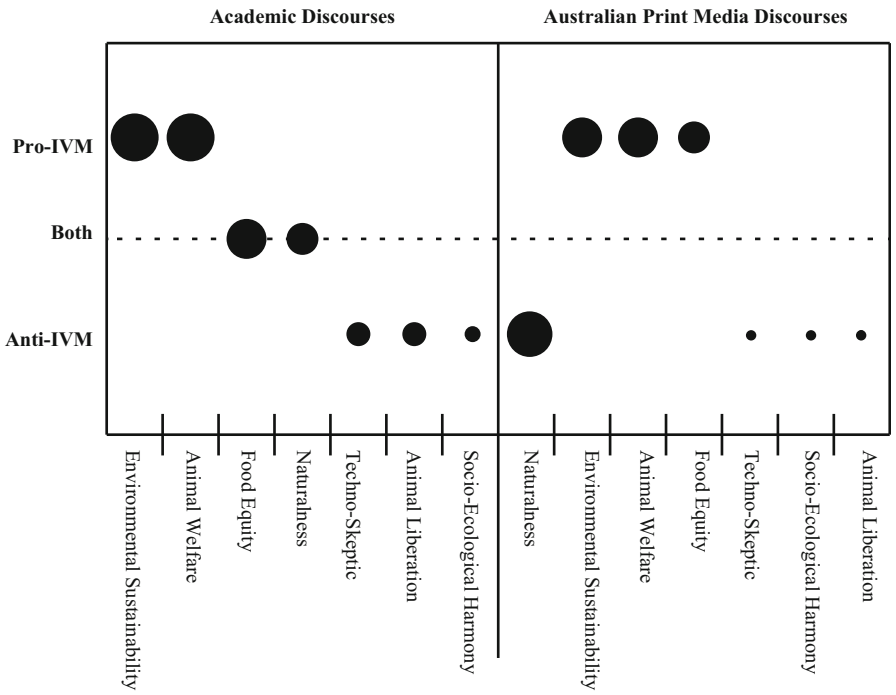

Fig. 2 Representation of discursive configurations in each space

Table 2 Number of papers/articles in which each discourse is evident

	Env. Sus.	Animal Welf.	Food Eq.	Nat.	Tech.	Lib.	Socio-Eco
Academic (55)	36	31	19	17	6	6	4
Media (41)	19	18	9	25	2	2	2

by the debates occurring in academia where the unnaturalness of IVM can be compared to the unnaturalness of industrialised agriculture, a view certain to be promoted by advocates as the technology moves to market. This is not to suggest that IVM will eventually be accepted by mainstream publics; embodied responses based on deeply entrenched ideas of food and nature are not easily overcome, and there are a wide array of powerful stakeholders, particularly farming lobbies, who will oppose it. However current ethical framings of IVM may yet coalesce in a powerful meta-narrative that asks people to get over their initial personal revulsion at 'artificial' food, for the broader good of animals, the environment and other people.

Hidden amongst this emerging consensus are alternative ethical discourses and strategies. They are less visible or developed and require time and resources if they are to play a role in ethically framing IVM. The environmentalist, animal welfare and food security narratives lend themselves to relatively straightforward cost-

benefit analysis, however those critical discourses concerning food justice, animal liberation, techno-skepticism and socio-ecological harmony require careful consideration before we ethically embrace IVM. Perhaps critical discourses will receive more attention and increase in resonance as IVM becomes less something of the 'adjacent possible' and more of a tangible reality, yet this may be too late to influence development. As Jacob Metcalf (2013) has written in relation to biotechnical developments, "it is far too easy to adopt a grammar of inevitability and neglect critical reasoning about which presents are articulated by the technologies." A future of cultured meat is developing on a vision of the present in which meat consumption retains a privileged position in our culinary appetites. However, a range of alternate dietary pathways challenging this already exist and are vying for attention alongside IVM. Adopting the consumptive path down which IVM lies is still a choice we must make, not a foregone conclusion.

While critical scholars can sometimes be hesitant to examine the ethics of technologies considered speculative, lab-grown meat, even in its most embryonic form, has very real impacts on our present in terms of where efforts, resources and focus are directed. Science-fiction metaphors and analogies can act as valuable ethical sense-making tools, however they can also serve to problematically position IVM as something for a far off future, disguising the fact that debates about IVM matter now. Without ever actually materializing on our plates, IVM still acts as an important site for scrutinizing existing socio-cultural narratives about carnivoracity, human-animal relations and agri-biotechnology applications. Serious engagement with the ethics of IVM is thus all the more necessary. This paper has developed a framework to help us understand how the ethics of IVM are evolving in public and academic debates. We encourage further engagement by critical scholars to challenge the emerging consensus around IVM as a remedy for our consumptive ills. We need to interrogate the visions of the present implicit in an IVM future and the reasons we might choose a different path. While the 'why' is being adequately considered, it is equally important to simultaneously ask 'why not'?

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