

Under the Skin: Assessing the Ideological Underpinnings and Material Reality of Cultured Meat

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

The relationship between industrial animal agriculture, resource depletion, and environmental instability has become increasingly clear in recent years. In keeping with the longstanding focus on consumers, and consumption's role in mitigating climate issues, a number of potential "resolutions" for this subject area have been promoted, including "local" food and plant-based diets. Cultured meat – the act of growing meat in a laboratory setting – has seen increased attention as a theoretical silver bullet, able to appease both consumer demands and environmental concerns. Recent developments have also presented the general public with the possibility that cultured meat may be a reality in the near future.

This dissertation investigates the promises, imagination, and narratives surrounding cultured meat. This work demonstrates that there is a need for caution; multiple aspects of cultured meat require further investigation, debate, and reconciliation before the promises of this sector can be seen as viable. The current state of the cultured meat industry is fraught with conflicting claims, inconsistent and incoherent information, and projections which do not align with ongoing revelations. Academic literature and media discussion also needs to be treated with critical attention; overarching themes in the literature point to an early normalization of cultured meat without a strong evidential basis, and there is a need to acknowledge the under-developed nature of much of the discourse writ large.

Furthermore, cultured meat is not often discussed in reference to a systemic context – this dissertation addresses this issue by placing the subject matter in the context of anthroparchy and carnism, two theories related to the natural and animal condition. These theories are utilized to test claims that cultured meat is disruptive, as well as investigate whether cultured meat reinforces ongoing systemic practices, or even expands them in unexpected directions. Such an approach is important in ensuring that cultured meat is contextualized, understood in reference to larger frameworks of material and immaterial matters. This investigation finds that there is considerable reason to be wary of claims that cultured meat is truly "revolutionary."

The dissertation contrasts the current "state of the industry," as well as the themes seen in ongoing discourse, with long-standing and emerging discourses which have been important in legitimizing cultured meat as a theoretical – and investment-worthy – innovation. Long-standing narratives of cultured meat as a "disruptive" entity are called into question, both in terms of cultured meat's current developmental status, and in terms of various imagined futures stemming from these narratives. Such narratives are contrasted with claims that cultured meat is simultaneously familiar, a mere continuation of ongoing practices but in newer, more environmentally friendly form. Finally, the dissertation also identifies recent narratives and imagery which, though a small part of the overall discourse, hold massive implications for cultured meat, and larger societal concerns, in both material and immaterial manners.

These narratives require critical investigation in tandem with the systemic theories of anthroparchy and carnism. Despite the wide-ranging, theoretical impacts of cultured meat on animal(s), nature, and other elements, the narratives of these impacts often refer to animal and nature in a broad, general sense, if such reference is even made. This dissertation emphatically demonstrates the

limitations of current approaches, and makes a clear case that cultured meat should not be treated as an interesting novelty, nor a force of inherent good or liberation, but an entity which necessitates wide-ranging inquiry, regardless of how cultured meat comes to fruition.

This dissertation ultimately calls for a more robust discourse and research agenda surrounding cultured meat; a greater sense of caution regarding its prospects; and a stronger reference to the material and immaterial conditions of the animals who will be the subject of cultured meat production.

Acknowledgments

Though I prefer to avoid sentimentalism, there are moments when it is necessary. I want to thank my supervisor, Dr. Jennifer Clapp, who has provided me with insight and guidance for more than half-a-decade at this point. This project would not be what it is without her ability to rein in the excessive ambitions which occasionally threaten to plague my research efforts, and for that, I am immensely appreciative. I would also like to extend my thanks to the members of the dissertation committee – Dr. Andrea Collins, Dr. Katy Fulfer, and Dr. Bruce Muirhead – for their insight and clarity which strongly influenced the foundations of the project. Furthermore, I would like to thank Dr. Stephen Murphy, who was a key member of my comprehensive examination committee, and also played a fundamental role in influencing the direction of my academic career and intellectual pursuits. Finally, on the academic side of things, I would like to extend my appreciation to the administrators, faculty, and members of the School of Environment, Resources, and Sustainability, who have tolerated my lone-wolf approach in an accepting manner.

Outside of the academic context, I want to thank my parents, who read – and reread – the numerous iterations of this work, and never hesitated to tell me what needed to be changed. The two of you have been instrumental, both in inspiring my academic career, and providing a sounding board for me during these times; no language can ever match the gratitude that I feel.

I also want to thank Chris, whose sage wisdom and humorous levity have been an encouragement throughout the most trying aspects of this process. Whenever I have been in need of perspective, you have come through; my thanks are eternal.

Before diving into this dissertation, I want to offer two dedications. First, to Troy – if there is something which follows this mortal coil, I hope you have kept up with everything that has been going on, even if I also hope that it stings you a bit that you are not here to listen to my ramblings.

Finally, I dedicate this dissertation to every animal that I have known, loved, and cared for. Though this dissertation advocates for every animal and natural being who is impacted by the systems this work identifies, the time with all of you is what inspired this path in the first place – and regardless of the prospects of failure, I have no plans to give up the good fight.

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Chapter 1: An Introduction

Why is Cultured Meat Relevant?

Cultured meat is one of a few emerging alternative protein products which have received increased attention throughout the past decade, with the post-2017 media landscape serving as an especially notable realm of discussion and hype. Cultured meat, like plant-based foods and insect proteins, has been presented – throughout the overall literature and discourse – as a force of disruptive replacement, a threat to certain industries but a “fixing”¹ of harmful practices for others, without major disruption for consumers. With such promise permeating the imagination surrounding cultured meat, this dissertation evaluates not only the implications of current discourse, but what is not necessarily being addressed. However, it is important to provide some deeper contextualization for cultured meat’s emergence.

The Current State of Industrial Animal Agriculture

In recent years, concerns have arisen regarding the environmental, ecological, and social costs of meat production and consumption. The focus has taken aim, primarily, at industrial meat production. Meat consumption has been increasing at a steady rate on a global scale, consequently warranting attention despite opposition to such inquiry which has arisen in certain sectors. This shift in attention has brought awareness to the sheer scale and scope of modern industrial animal agriculture: in 2011, *Meat Atlas* estimated that 61,955,800,000 land animals were killed, with 58,000,000,000 of them being chickens (Potts, 2016, p. 3). That figure does not include fish, as fish tend to be measured in tonnage; however, some estimates have the figure in the range of 2.7 trillion individual fish, excluding aquaculture (Potts, 2016, p. 3). If one includes some estimates of aquaculture figures, an additional 51-167 billion fish could be added to this overall equation per year (FishCount, n.d.). The ambiguity of this data reveals a key conundrum when talking about the current state of industrial agriculture; given the rapidity of slaughter and the speed of processing, collecting pinpoint-accurate data will always be a difficulty. Nevertheless, the estimates are reason enough to raise the alarm from an environmental perspective, as eating this many animals is inevitably going to generate some sort of environmental impact.

Unfortunately, it is at this point where much of the discourse becomes fractured. The environmental aspect of this area of focus has always been contentious, with varying figures – often discussed with passion and vehemence – being bandied about. For example, the World Economic Forum (2019) notes that animal agriculture is responsible for 10-12% of global greenhouse gas emissions; the United Nations Environmental Program Global Environmental Alert Service (2012) claims that some estimates, when accounting for different perspectives on deforestation, have the emissions closer to 35% of agricultural emissions, which is in line with recent reporting by the IPCC (Crippa et al., 2021, p. 198); and Richard Twine (2016), observing that Worldwatch’s estimates would have animal agriculture contributing to 51% of agricultural emissions, argues that there is no consensus regarding animal

¹ Readers should be aware that quotation marks are used, throughout this dissertation, to call attention to ambiguous meanings and unstable terminology.

agriculture's contribution to global emission issues (p. 243). Similar discontinuity is present when it comes to the connections between animal agriculture and matters of water use, deforestation, and the impact on biodiversity.

Given the ongoing estimate that 1 billion people are currently involved in the animal agriculture industry, which contributes to 40% of agriculture's overall 3% of global GDP (World Economic Forum, 2019), it is difficult to tell whether the inconclusive nature of the discourse stems solely from a scientific inability to reach consensus, or if there is discomfort regarding the larger implications of taking potential action against meat's ecological and environmental impacts when one considers the potential economic implications of such actions. It is likely a combination of the two, and, furthermore, this tension can be seen as an unwitting acknowledgement of deeper discomfort once matters of health, sociocultural affiliation, and taste are brought into account. The World Economic Forum (2019) opens one of its information sheets by noting that "meat can be a touchy subject. Strict vegans and unrepentant carnivores rarely find any common ground."

This quote, however, does not quite capture the complete range of viewpoints. "Between" the strict vegans and unrepentant carnivores is an array of consumers who do not fit strictly into either category, and, increasingly, these consumers are demanding greater reforms to industrial animal agriculture. Animal welfare has become a considerable point of concern for consumers, representing a "compromise" approach to meat and other animal-derived products. While difficult to quantify, because of inconsistent surveys of public opinion as well as the complications related to how one frames animal welfare, there is evidence of increasing public support for some changes to the treatment of animals in society overall. Between 2008 and 2015, support for animal rights equivalent to human counterparts increased in the United States from 25% to 32%, with another 62% supporting "some protection" (Riffkin, 2015). However, the data from this Gallup poll must be qualified: animals in zoos and entertainment settings usually received more concern amongst those already concerned about animal welfare than animals in industrial animal agriculture (Riffkin, 2015). This revelation tends to contrast with data indicating that animal welfare concerns are relevant to consumers of meat; Cornish et al.'s (2016) study found evidence that 71% of participants in an Australian study, 68% of respondents in a Scottish study, and 86% of respondents in a Dutch study demonstrated concern for animal welfare. Once again, disparities between studies reveal that there are likely ongoing changes in perspective and attitude amongst the general public, which are difficult to quantify with complete accuracy. Nevertheless, they point to a shift in public concern and possibilities for change/reform.

Changing Trends

Literature on the environmental and sociocultural impacts of meat, until a few years ago, can be considered an exercise in defeatism. Authors would find themselves encouraging a wide-range of decreases in meat consumption, but without a complete shift in dietary identity, rendering conclusions that felt as if they contradicted the alarms that were raised in the authors' work – examples include Vaclav Smil's (2013) calls for a 90 megaton drop in yearly meat consumption, without reference to how such a figure could be maintained with increasing populations (p. 209), and Machovina et al.'s (2015) call for a 90% decrease in meat consumption, with no discussion of the political fallout of the remaining

10% (p. 426). Current literature, however, seems a bit different, with a greater sense of possibility arising from changes to the meat alternatives market in the latter part of this past decade. Once considered an unlikely alternative, because of the issue of taste, it is estimated that the current plant-based meat market is worth \$12.1 billion, with expectations that the value could more than double by 2025 (Markets and Markets, n.d.). Plant-based meat products – with Beyond Meat and Impossible at the helm – have seen a sudden increase in popularity since 2017. Of course, as with any sudden increase in popularity, it is unclear whether this increase will be a truly long-term shift; however, plant-based meat has made enough of a market impact that other possibilities for diversifying the meat alternatives market are being considered. Another possible contributor to this market is insect meat, which is being touted as a potential way of delivering protein in a new manner. However, its market value has not yet reached US \$1 billion (Global Newswire, 2020); unless there is a sudden explosion of interest, in a manner similar to plant-based, it seems unlikely to be of significant relevance in the near future.

An issue facing both of these products stems from awareness; there is concern that plant-based and insect meat will not be able to replicate, in a 1-to-1 manner, the taste and texture of traditional meat, consequently meaning that universal adoption will be impossible. Furthermore, the mere labels of “plant-based” and “insect” make the consumer aware of the change in tradition, creating more issues surrounding the notion of global adoption of meat alternatives. Because of these fears – whether reasonably justified or not – there is an ongoing dialogue on other potential ways to entice consumers with new alternatives, such as cultured meat.

Cultured Meat

Cultured meat involves performing biopsies on animals, harvesting their cells, and growing them in a lab-setting, through the use of complicated biotechnological processes, with the goal of eventually creating a finalized cultured meat product. Chapter 2 will greatly expand this explanation, but the basic idea is to make meat out of part of the animal, instead of the animal itself. The notion that the animal can sit there and watch the process of meat being made from its cells has existed in the literature and discourse since the beginnings of cultured meat research in the late 1990s, and has made for an enticing promise amongst those concerned with limiting meat’s impacts while not causing widespread sociocultural and economic disruption. Inevitably, cultured meat brings about a far more complicated realm of possibility and concern, which this dissertation will address; nevertheless, cultured meat has captured considerable attention and investment.

The dream of cultured meat promises an end to the environmental destruction of meat production, as well as a relief to the ethical conundrums associated with the killing of animals for food. That does not mean cultured meat would bring about complete resolution to questions stemming from hunting, husbandry, and various sociocultural relations to animal and meat; however, in theory, cultured meat does demonstrate a possibility of at least disrupting the primary focus of much of the ire currently aimed at “traditional” meat consumption. It is in this realm of possibility, however, that one needs to step back to remember the large context in which cultured meat “exists.” Typical accounts of both “traditional” and cultured meat tend to focus on current food production systems, with some focus on their relationship to capitalism. While such foci are important, they are not the whole story,

necessitating a larger theoretical framework. In order to highlight the need for this framework, however, the guiding research questions for this dissertation must be clarified.

Research Question

Taking into account what has been put forward in this chapter so far, three research questions ultimately guide this dissertation. The first asks: **can the developments in cultured meat, so far, be considered constitutive of an “industry?”** The second asks: **what themes can be identified throughout the cultured meat discourse and literature, and what role have these themes played in the legitimization of cultured meat as a prospective product?** The third asks: **what narratives have arisen surrounding cultured meat, and what are the implications of these narratives for various interpretations of the human-animal-natural condition?** These questions are expansive, but they must be addressed in approximate tandem with one another if cultured meat is to be understood beyond a biotechnological innovation, but as a simultaneously theoretical paradigm shift and reaffirmation of current practices.

Introducing the Theoretical Framework²

Anthroparchy

A multi-faceted approach will be required for answering the research questions, necessitating the employment of certain theoretical frameworks related to the human-animal-natural condition. Cudworth (2005) identifies anthroparchy as “a complex system of relations in which the non-human living environment (i.e. organic entities such as animals, plants, soils, seas and contexts for life such as rock and ice scapes) is dominated by human beings as a species (p. 8).” While anthroparchy covers aspects of the human/nature relationship which are also engaged with in other theories, such as deep ecology and speciesism, Cudworth’s effort focuses on specific modern formations of social relationships which order social control over the environment (Cudworth, 2005, p. 45). While Chapter 4 will review this theorization in greater detail, it is important to establish, at this juncture, the relevance of anthroparchy to this dissertation. Meat consumption and production are influenced, even guided, by ideas regarding the relegation of animal and nature. Furthermore, the relationship between human beings, nature, and animals is founded on a basis of control and reaction, with various influences across space and time on a global scale. For example, an ocean can cause tremendous damage following a hurricane; numerous sociocultural and political-economic elements are involved in the reaction to said hurricane. An area without access to resources, such as raw materials and capital, will not be able to formulate a major reaction. An area with access to said resources can both better prepare for a future

² It should be noted, at this juncture, that there are a few variations of the phrase “framework” which are used throughout the dissertation. When I refer to the “theoretical framework,” I am referring to the specific side-by-side comparison of anthroparchy and carnism employed throughout the dissertation. When I am referring to “theoretical frameworks,” I am referring to anthroparchy or carnism on their own accord. I use this phrase, in place of the singular “theory,” to denote that anthroparchy and carnism could be used in ways that emulate that of a framework, whether combined with an outside theory, or utilized in ways which mix and match internal elements. Occasionally, “frames” or “systemic theories” will be used to also denote anthroparchy and carnism on their own accord.

hurricane, and also could possibly take action against the natural world, such as establishing what is known as a “bubble curtain,” a theoretical way of stopping, or at least limiting, the impact of a hurricane by utilizing a series of pipes which use compressed air to change water flows in the ocean, potentially cutting off warm water supply (Perkins, 2020a). Anthroparchy attempts to account for the multiple relations at play in this scenario, not just in a global state-to-state sense, but in terms of the relationship between the states, their individuals, and nature. A state that can establish better protocols, or even control over natural processes, maintains a different relationship than a state that is impacted by the variations of nature without recourse.

Traditional and cultured meats are important to understand through the framework of anthroparchy, hence Cudworth’s (2008; 2014) increased focus on the relationship between traditional meat and anthroparchy throughout the past decade. While there are considerable points of concern, which will be addressed later in the dissertation, anthroparchy can provide a way of understanding the dynamics of relation between the “organic” and “inorganic” world, while also allowing one to question where cultured meat might fit in this binary. Is it organic, inorganic, both, or neither? How might that impact our relationship to, and understanding of, both animals and nature? Anthroparchy may not provide a definitive answer, but it is important to at least attempt establishing the contours of what is needed to come close to an answer. However, there are other systems at play, beyond anthroparchy, which must be accounted for.

Carnism

While Anthroparchy is important, underlying ideological concerns must also be addressed when answering the research questions. Joy (2016) defines carnism as “the ideology that conditions people to eat animals” (p. vi). Rooted in the field of Critical Animal Studies (CAS), Joy’s (2010; 2016) theory expands on work from Adams, Derrida, and others, setting out to comprehensively account for the larger, systemic ideology behind meat eating. Chapter 4 will establish carnism’s relationship to CAS, as well as the diverse range of “carnisms” that Joy has come to identify; at this juncture, however, it is merely important to posit the relevance of carnism to this dissertation.

Meat does not exist in a nebulous state of being; it is constituted – in various social, cultural, political, economic, and personal contexts – as an item of food and desire through ideological means and reasoning. Like all food, meat should be understood with reference not just to the systems which bring meat to the table, but also the systems which normalize what makes its way to the table. Despite meat being seen as an everyday facet of human life, it is rationalized for numerous reasons, such as religious, environmental, historical, nutritional, etc.; these rationalizations need to be extracted and understood ideologically. While Joy’s specific incarnation of carnism focuses on Western industrial animal agriculture, the theory holds significant relevance in understanding what has been a global practice for ages. Carnism contributes, substantially, to the standing of animals in legal, sociocultural, and ethical senses, so it is important to understand carnism not just for anthropocentric reasons, but for animals as well. If cultured meat ever sees introduction into the markets and diets of consumers, it is essential to get a sense of its relationship to the ideology of meat, as well as how it impacts traditional meat as a marker of said ideology.

Argument

With the theoretical framework and research questions in mind, I will be advancing three key arguments throughout this dissertation.

Argument One

Cultured meat's disruptive capacity is materially questionable, and even theoretically difficult to envision. Much has been said, in literature and general discourse, about the disruptive potential of cultured meat. Cultured meat rhetoric currently embodies a mentality of "having our cake and eating it too," maintaining the taste and familiarity of traditional meat, but without the environmental or ethical quandaries. However, such presentation does not reconcile well with growing revelations from current research, as well as longstanding theoretical concerns.

From a material perspective, there is little tangible proof that cultured meat is going to be produced at an effective cost. The notion that there is a "cultured meat industry" rests on difficult-to-justify grounds; while this issue is of greater focus in Chapter 2, at this juncture, it is important to put forward that the supposed "industry" of cultured meat is highly questionable, and worthy of greater investigation. This presentation of an "industry" has also made use of weak evidence stemming from the academic literature, consequently warranting the literature review in Chapter 3. Many of the long-held visions of cultured meat are beginning to come apart, requiring more focused, detailed attention than they have received so far.

However, the imagination surrounding cultured meat also does not test particularly well in relation to the idea of "disruptive capacity." Much of the discourse has failed to contextualize cultured meat through an account of a larger systems perspective; Chapters 4-5 will attempt to rectify this issue through an analysis which utilizes the theoretical framework. Nevertheless, at this point, it is worth noting that once cultured meat is theorized as having to rely on the resources, capital, and sociocultural perspectives which constitute the current industrial animal agriculture system, one can develop a sense of the issues with claiming that cultured meat is theoretically disruptive. Much of the focus of cultured meat literature has been about selling it is an idea worth investing in, before the theoretical elements have been fully investigated by the actors who promote this prospective product. The phrase "putting the cart before the horse" unfortunately rings true regarding cultured meat.

Argument Two

Cultured meat's capacity to reinforce the current human-animal-nature relationship, as understood by way of anthroparchy and carnism, is theoretically possible. This argument should not be seen as a reiteration of the theoretical aspect of part one; instead, this argument develops from a growing number of changes to recent cultured meat rhetoric. For example, in 2005, some proponents of cultured meat were discussing the possibility of harvesting cells from a number of animals in the single digits, which has been seen as a massive potential disruption to current practices (Knab, 2005); as of 2020, that estimate, amongst some, has grown to closer to 20,000 – a major change to certain industrial practices, but not to the whole of the human-animal-nature relationship (Melzener et al., 2021, pp. 9-

10). Such a shift represents a growing awareness that the “disruptive” capacity cannot be understood as it was originally presented by early proponents, but this dissertation, instead of maintaining the rhetoric of disruption, argues that such changes should instead be understood as reinforcing the current dynamics which guide and shape socio-natural life.

However, this argument also looks at symbolic elements, questioning whether cultured meat, if it is meant to serve as a “replacement,” ends up reinforcing certain symbolic notions related to a variety of human-animal relations, as well as intersectional concerns of gender, race, ability, and class. While there is not adequate space to pursue a full intersectional analysis in this work, some preliminary inquiry will be made into the subject matter. Traditional meat, as understood through the lenses of anthroparchy and carnism, brings with it numerous ideas about social hierarchies and orders. I argue, throughout the dissertation, that such traditions are not guaranteed to be disrupted solely through a “replacement” of one type of meat with another.

Argument Three

Cultured meat’s capacity to expand the human-animal-nature relationship, through anthroparchy and carnism, is simultaneously possible and impossible, depending on the lens of theory vs. materiality. All three parts of this argument come with the recognition that the current state of cultured meat’s alleged “industry” is subject to change at any point, which could render points moot within a day’s news cycle. Nevertheless, this dissertation identifies, through analysis of recent revelations in the literature, that cultured meat could expand the relationship between the human and natural world in new directions, consequently necessitating not only material analysis but also theoretical investigation. It is important to consider – regardless of cultured’s potential presence on store shelves – how the concept can impact anthropocentric understandings of animals as objects of food or inattention, especially if one wants to work towards an inherently systematic, multi-faceted understanding of the animal condition.

This argument pays attention to the prospects of a small handful of emerging companies, which are promising a revolution in just how many different types of meat can be on store shelves; a paper which puts forward the possibilities of combining cultured meat practices with insect meat; and companies promising new sources of protein from solar power and methane, as well as entities investigating the integration of plants into cultured meat production. All of these promises are based on both the theoretical and material prospects of cultured meat, and because of how they offer varying visions for changes to anthroparchy and carnism, they must be understood in a greater capacity than has been on offer so far.

Contributions of this Dissertation to the Literature

The three parts of the argument will ultimately lead to the conclusion that changes must be made to the general approach of researching and discussing cultured meat. Consequently, stemming from these arguments, the dissertation makes a number of contributions to the literature. First, the dissertation provides simultaneous theoretical and empirical engagement with cultured meat. The specific focus on attempting to rectify whether there is a “cultured meat industry,” through assessing

both theory and data, is an original contribution through the conclusions that this work offers; while arguments have been made regarding cultured meats being a “performative” industry (Mouat et al., 2019), this dissertation provides not only a different perspective, but one that is contextualized using recent data and observations on growing debates.

Second, this work applies the theoretical framework to cultured meat, which has yet to be done in a sustained and explicit form. Authors such as Poirier (2018a; 2018b) have engaged with notions of carnism and animal ethics, but an explicit application of carnism and anthroparchy is still needed in relation to cultured meat, given its status as an emerging biotechnology with potentially wide-ranging impacts. While there have been some critiques and concerns surrounding cultured meat (Alvaro, 2019; Ckriki and Hocquette, 2020), they have yet to be processed, in an explicit manner, through the theoretical framework of anthroparchy and carnism. At this point, any effort at placing cultured meat in a larger context would be welcome, but this dissertation works to ensure that anthroparchy and carnism are accounted for in an attempt to understand cultured meat’s material and theoretical prospects.

Third, this dissertation provides an original contribution by way of “disruption, reinforcement, and expansion,” which takes into account both the theory and actuality of cultured meat in ways current literature is failing to explore. The idea of cultured meat being disruptive has been present in literature for a long time (Stephens et al., 2019), but the notion has not necessarily been juxtaposed with the possibilities of reinforcement and expansion, and certainly not with the theoretical framework in mind. As such, merely through this approach, the dissertation makes an original contribution to the literature on cultured meat.

Beyond these three contributions, this document makes recommendations for improvements to cultured meat discourse and research, including greater engagement with theoretical possibilities/improbabilities, in order to gain a better understanding of cultured meat’s potential impact. Chriki and Hocquette (2020) have posited that cultured meat research has stagnated, now subject to a wide range of discussion without new insights and developments in the overall research canon (p. 1); this dissertation attempts to overcome this notion by presenting pathways for various interpretations and understandings of cultured meat, while also advocating for improvements to the general discourse in order to overcome many of its ongoing issues, a perspective which is not common in the literature.

Methodology

Of course, all of this argumentation can only go so far without a methodology behind it. This dissertation, in keeping with its multi-part approach to argumentation, will make use of a multi-component methodology to verify its arguments. The methodology can be understood in the following manner.

A Systematic Overview and Analysis of the “Industry”

This dissertation will provide an overview, and analysis, which will be important for answering the question of whether or not there is a cultured meat industry; once this question is addressed, the theoretical analysis can be undertaken in a manner that satisfactorily takes into account the current

material state of cultured meat. This systematic overview, however, has to be conducted in an atypical manner. Cultured meat is defined by what does not yet exist, even more than it is defined by what exists at this time; such a principle, unfortunately, applies to the data surrounding cultured meat. The secrecy of companies and concerns of proponents create a situation in which cultured meat is expected to be adopted without nearly the same proof of concept that other products might be expected to endure. While this secrecy is typical of venture capital, it does create tensions regarding the scale of projected socio-cultural changes and societal acceptance. Consequently, this dissertation will compile what data are available and what data are unavailable, in order to better answer the “industry” question.

Regarding what data are currently available, this component will compile data about the companies involved, their geographic locations, and the publicly known investors. This part will be an amalgamation of data made available by Cell Based Tech and The Good Food Institute. Cell Based Tech is an online service which claims to offer analytical research and scientific support to cultured meat producers; it also provides a database of companies to the general public (or, at least, those who provide the entity with an email address). In keeping with the usual practices of cultured meat, the service is secretive; its location, funders, and general structure are unknown. It also has, unfortunately, not updated since late 2020, a matter which will be discussed in detail in the next chapter. Nevertheless, it does provide verifiable information on the companies listed in its database. This information will be cross-referenced with data from The Good Food Institute (GFI). GFI is a non-profit 501(c)(3) organization, located in Washington D.C. Its recent reports on the state of the cultured meat industry will be cross-referenced with information from the Cell Based Tech database, with the ultimate goal of providing a detailed list of companies currently working on cultured meat. This data collection does not make particular use of academic research at this time, as academic research tends to have different matters of focus when compared to the work of these entities, an issue which will become apparent in subsequent sections of the methodology.

Because of the nature of cultured meat, this dissertation will also compile and analyse unavailable data. Consequently, matters related to production costs, production facilities, prototypes in current existence, value of investments, government deals/relations to private companies, and university research will be analysed in regards to the data that cannot be collected. While small bits of information are available in different pieces of media and academic publication, generally, there are not enough data to provide a substantial demonstration of ongoing trends in cultured meat production. Some may see this issue as a hindrance towards answering questions surrounding the “industry” of cultured meat; I, however, posit that data unavailability can still tell a certain story, one of grand expectations that are not empirically verifiable in any current form. This discussion of unknown data will also ensure that a stronger vision can be provided in regards to the necessary changes in cultured meat discourse.

Thematic Discourse Review

This dissertation provides a contextual, thematic discourse analysis of 209 academic papers, as well as six books, five reports, and three chapters, published between 2005 and 2021. Alongside this review is contextual consideration of over 1000 media articles, published between 2002-2022. The

review identifies five overarching themes, each containing a number of sub-themes which compose the thematic “whole.” The first identified theme is “the potential benefits of cultured meat,” which is reinforced by discussions and notions surrounding cultured meat’s alleged environmental benefits; positive animal welfare implications; and possibilities for market efficiency and expansion. The second identified theme is “the potential pitfalls of cultured meat,” a theme that is becoming more notable due to questions surrounding the potential environmental issues stemming from cultured meat; production costs and matters of scalability; various ethical quandaries and methods of framing; transparency and corporate monopolization concerns; and the notion that cultured meat may alienate one from nature. These first two themes are important to consider alongside one another, as they demonstrate the wide-ranging perspectives on cultured meat, as well as the idiosyncrasies of the discourse.

The remaining themes may not necessarily “speak” with one another in the same way as the first two, but they all maintain an important role in the overall discourse. The third theme is that of consumer acceptance, which has been – as will be demonstrated in Chapter 3 – a longstanding focus of cultured meat proponents and interested researchers. The fourth theme stems from the notion that cultured meat may create “ontological instability and ambiguity;” translated into different terms, cultured meat may destabilize specific and long-term understandings of human relations to meat, as well as the role of meat in cultural construction and functionality. The fifth theme is that of “remaining concerns,” a compilation of sub-themes which are notable, and do have ramifications for the other themes, but have yet to be developed to the degree of the first two themes. The sub-themes in question look at matters of nomenclature, regulation, and religious consideration.

This thematic approach has been adopted in order to make sense of the cultured meat discourse in a large-scale, but ultimately fluid, manner. Cultured meat literature, discourse, and media publications are disparate, and often depend on proponent rhetoric in trying to understand what is currently ongoing with cultured meat production. Because cultured meat remains in the laboratories and factories of private companies, much of the understanding surrounding cultured meat has arisen from a wide-ranging discourse, so it is important to identify what themes are present in this discourse; what implications arise from these themes; and whether the themes need to be understood in larger systemic context. This last point necessitates the theoretical framework and its interpretive analysis.

Theoretical and Interpretive Analysis

Following the systematic overview and the thematic discourse review, I will utilize the theoretical framework in order to make greater sense of the robust implications of cultured meat. The core of the framework rests on the concepts of anthroparchy and carnism; they will be introduced and explained fully, and some commentary will be offered on issues stemming from these systemic understandings. However, I must address what reasoning led to the decision to apply these frameworks, as well as the contexts from which these frameworks have arisen. Following this discussion, I will identify the types of analysis and reasoning which will be seen throughout the dissertation.

Critical Animal Studies

While this dissertation will be utilizing the theoretical framework(s) of anthroparchy and carnism to review cultured meat, it is important to understand the context in which both theories exist. Critical Animal Studies (CAS) is an emergent interdisciplinary field, but its origins are complex. A common and reasonably straightforward explanation stems from the reaction to Animal Studies, though two different aspects of reaction are identifiable. The first is the long-standing resistance to Descartes, the philosopher whose notion that “I think, therefore I am” would inspire much philosophical thinking; as Almond (2004) notes, such a line of thinking would render animals mere automata, unable to express their thinking through human terms, therefore being removed from philosophical and ethical consideration as a result (p. 167). While utilitarian Jeremy Bentham would ultimately posit that the question to be asked is not one of thinking or talking – their sentiency – but suffering (Almond, 2004, p. 167), CAS scholars have argued that Descartes’ thinking has had a larger impact beyond this framing. McCance (2013) specifically notes that the notion of Cartesian dualism – the organization of existence into modes of duality, with hierarchical understandings embedded in such dualities – can be understood as “faith” in certain and referential “factual” knowledge; the reduction of language to a way of communicating referential truth; preponderance of analytical methods which distinguish, fundamentally, body and mind; the demotion of the biological animal body alongside the association of the “essential” human with mental capacity; and the reinstatement of the self as alive by “virtue” of its rational capacity, ability to author ethics, and establish norms by which all other living beings are measured (p. 3).

While the first aspect of CAS reaction went against long-standing academic and philosophical thought, the second aspect reacted to scholars who had come to formulate the more recently established field of Animal Studies.³ CAS scholars and activists have specifically reacted to the theories, and Cartesian roots, of the utilitarian and rights-influenced theories of Singer and Regan, respectively. Specific examples of aspects which drew concern from CAS scholars include Singer’s belief that disabled infants can ethically be killed because they cannot adhere to the norms of Cartesian dualism, so long as the killing is painless (McCance, 2013, p. 25-26). Karen Davis (2016) also notes that Singer has advocated for the biotechnological innovation of brainless chickens; though presented as an ethical solution to animal consumption, because of the inability to feel pain, the identity and being of the birds is destroyed at both the material and symbolic level (p. 195). On the other hand, while Regan called for beings to be valued in themselves, the understanding of that valuation stems from human rights, which Ryan (2015) notes posed a risk for the animal other, as they would never be considered “completely human” (p. 125). The concept of rights being granted status as “subject-of-a-life,” in Regan’s framework, came into major question because of the idea that mental normality was required, raising questions for animals, the disabled, etc. (McCance, 2013, p. 35). As such, the great apes would theoretically receive greater moral protections than the disabled, under Regan’s assessment; furthermore, the liberal individualist

³ While Animal Studies, itself, has a complicated history, it is often seen as becoming prominent as an academic field following the release of Peter Singer’s *Animal Liberation* and Tom Regan’s *The Case for Animal Rights*, both of which became associated with Oxford and Cambridge style philosophical analysis, and are noted for bringing animal rights rhetoric “to the table.”

focus would grant those rights on an individual, instead of group, basis, raising questions as to when such rights could be violated (McCance, 2013, p. 38).

These threads combined into a coherent call-to-arms by Best (2009), who introduced the notion of CAS to respond to what he saw as an increasingly insulated and removed Animal Studies program. Specifically, Best (2009) argues that “the profound ethical, social, political, and environmental issues of animal exploitation are buried in dense theoretical webs; the lucidity and power of clear communication is oiled over with jargon and inscrutable language accessible only to experts; politically charged issues are depoliticized; and theory is divorced from practice, resistance, and struggle.... [A]ll this unfolds amidst a new extinction crisis” (p. 11). Best (2009) crystallizes this reaction to mainstream animal studies by arguing that CAS maintains an explicit commitment to animal well-being and freedom, alongside the opposition to all forms of discrimination, hierarchical organization, and oppression, whether through direct and disruptive action or coalition-building and the development of theory (p. 12-13). Such a presentation allows for a great deal of theory and practical action to be housed under the tent of CAS, but Best (2009) makes clear that the goal is to do more than rearrange “the furniture in the conceptual house of humanism,” which is the limit of what he claims postmodernism and poststructuralism have been able to do (p. 14).

This dissertation, as will be demonstrated, attempts to adhere to the overall guiding notion of CAS, which is to treat animals – and by extension, human liberation, however liberation may be defined – as a matter beyond the abstract, translated into topics of interest and academic capital (Best, 2009, p. 21). Put differently, CAS is concerned with both the *question* of the animal, as well as the *condition* of the animal (Taylor and Twine, 2014, p. 1);⁴ this notion guides the dissertation. With that being said, Best (2009, p. 24-26) proposed a set of 10 principles for CAS, not all of which will be relevant to this study:

- 1) Interdisciplinary collaboration and research
- 2) The rejection of “objective” academic analysis in favor of subjective, clearly defined normative values and political commitments.
- 3) The rejection of “theory for theory’s sake” with the goal of transforming analysis, theory, and academia to politics, practice, and community.
- 4) The advancement of holistic, intersectional understandings, with the goal of identifying the interconnections of all hierarchical oppressive systems.
- 5) The rejection of apolitical politics in favor of anti-capitalist and anti-hierarchical politics; often found in the support of anarchist politics.
- 6) The rejection of “reformist, single-issue, nation-based, legislative, strictly animal interest politics;” instead, CAS advocates for systemic transformation through alliances.
- 7) The acceptance of the inseparability of the relations between human, nonhuman, and natural freedom.
- 8) The rejection of social binaries and dual oppositions.
- 9) The support of radical politics and strategies, up to and including economic sabotage.

⁴ CAS scholars will often present the difference between CAS and AS as a difference of inquiry into the animal as a matter of a question, or of a condition.

10) The inclusion of a diverse range of actors.

Principles 3, 5, 6, and 7 are reasonably explicit throughout the dissertation: the application of theory in this work is meant to highlight the limitations of continually imagining cultured meat as some sort of liberationist project without any reference to what the animal is being liberated from; the dissertation maintains an anti-capitalist tone, though it also critiques the anthropocentric and oppressive issues which can arise in other political understandings; and the inseparability of the relations between human, nonhuman, and natural entities – and the need for systemic transformation therein – serves as the impetus for the theoretical frameworks which are utilized in this work. Principles 2, 4, and 8 are present in this work to a degree, but with certain limitations in mind: there is no “objective” research on cultured meat to reject at this time, given the theoretical scale of the subject, even if clear normative goals are present throughout the assessment; and the rejection of social binaries, alongside the acceptance of intersectional understandings, is a matter which must be developed – vis-à-vis cultured meat – in further detail outside of this dissertation. However, to exemplify why this development will have to be commenced, various sections in Chapters 4 and 6 posit that some of the very groups identified by CAS and ecofeminist⁵ thinkers as potential antitheses to patriarchal and heteronormative oppression have formulated their own reasons for continuing practices of violence towards animals, which stands in opposition to the notion that animal and human liberation will be one in the same. Consequently, this work does maintain a human/animal binary to the degree that the animal can still be identified as a subject of violence by a diverse array of actors, regardless of identity and economic context. This maintenance requires a continued identification of an “oppressed/oppressor” binary in order to keep the animal condition from melting into a singular pot of “holism” which may, in actuality, allow the perpetuation of violence and hierarchy in ways which function differently than inter-human or intra-human violence. Principles 1, 9, and 10 are not of particular relevance to this work, though principle 1 will be reiterated in the concluding chapters.

CAS also maintains a variety of methodological approaches (Stephens, 2014), and some scholars have advocated for a move beyond reflexivity; Gröling (2014) argues that validity should not be determined by either the supposed absence of a researcher, nor an “apologetic presence” of a researcher, but a committed presence, iterated and reiterated through consistent and developed attitudes surrounding, and towards, matters of injustice and oppression (p. 106). While her claims are in reference to ethnography, which this dissertation is not, they still maintain a purpose in this work; my concern with any purported “solution” for meat and animal agriculture is what impacts will be had on the animal in both material and immaterial senses, which offers a clear reason for my use of the theoretical frameworks, and one which I do not hide from, regardless of the implications for the companies and proponents of cultured meat (as well as other researchers).

There is no denying that CAS finds itself in a difficult position. Not only is the field attempting to advocate for those often not considered relevant to matters of activism and oppression, but it is attempting to do so at a time of tremendous instability. The death of environmentalism (Shellenberger

⁵ As will be discussed in later chapters, CAS and ecofeminism have a close, but fraught, relationship as academic and activist fields, which explains their association in this sentence.

and Nordhaus, 2009) comes increasingly into focus following the failure of events such as COP26 (Conca, 2021); modern leftism, especially in the West, can be said to be near nonexistent (Zeiher, 2016), instead a loose assemblage of various levels of commitment to certain philosophies within a complex network of opposing parties and ideologues (Gui, Yuang, and Ding, 2020), with wildly fluctuating levels of irony guiding and influencing years-long debates in new ways (MacDougland, 2021; Beijer, 2020); and the goals of intersectional thinkers are finding themselves facing stiff opposition from various branches of leftism with variable levels of commitment to orthodox socialism, Marxism, Leninism, Stalinism, and Maoism, as well as other leftist approaches (Foley, 2018; Fields and Fields, 2010; Reed Jr., 2013). The reaction to postmodernism has also grown increasingly vocal, which leaves CAS in a vulnerable position as its calls for various postmodern approaches which have coincided with such widespread claims of subjectivity that, now, certain scholars find their critiques of violence towards animals being presented as overly objective and reiterative of the very dualisms which CAS rebelled against, a point which will be discussed in further detail throughout Chapters 4, 6, and 7.

There is also internal incoherence and debate which threatens CAS; Best (2020) himself has declared CAS to have capitulated to every facet of mainstream animal studies which he once fought against, rendering it a self-parody and an easily adaptable paradigm for bourgeois academia and institutions alike (p. 31). While the CAS that I am familiar with still registers considerable discomfort amongst the academic class, Best's (2020) declaration of failure is important to register, a signal that CAS may be in need of a revised set of principles and commitments, especially during such politically distraught and confused times. While this dissertation does not claim to provide such a reformation, its commitments to animal struggle and life do find themselves in opposition to a wide-range of systems and claims of reform, utilizing various strains of materialist and immaterialist thinking to strive for a synthesis, of some sort, in relation to the issues which may arise from cultured meat. Further study and theory will be needed to rectify these many issues, but it is important that I acknowledge the difficulties facing the field and how they influence the approach taken in this dissertation.⁶

⁶ At this juncture, I will address the use of the word "animal" in this dissertation, as CAS scholars tend to avoid the singular use of "animal," and instead will use phrases such as "nonhuman animals, animals other than human, etc." In my own daily vernacular, I tend to use the phrase "beings" to denote my desire to refer to animal and human in a more united, holistic fashion. However, I use "animals" in this dissertation for the following reasons. First, because cultured meat – and meat writ large – demands the use of certain beings, who are referred to as "animals," for use in the production process, there is a difficulty which can emerge in attempting to refer to these beings using different terminology; to more forcefully guide the critique, especially for those who may be reading this dissertation without a CAS background, I do believe a certain capitulation is needed to keep the critique as focused as possible. However, there is a deeper reason I still use the term "animal," which has to do with language and intentionality. As this dissertation will make clear, I advocate for consideration of living beings as those who wake up and, as far as I can tell, want to live to see another day. Such consideration has led me to disregard the belief in human exceptionalism which supposedly grants us dominion over the lives of others. In the process, the word "animal," for me, tends to be merely a referential phrase to denote where there are certain material differences, such as the difference between having two and four legs. I do not believe the use of "animal" must automatically generate a belief of superiority, depending on the intention of the user. As well, human exceptionalism has a way of infecting all modes of reasoning regarding how to discuss "human and animal;" for example, even in efforts I have made to discuss, with others, the benefits of using "nonhuman animals" as a phrase, an exceptionalism can still emerge – "even if we are all animals, us human animals are the only ones who

Inductive Mode of Reasoning

This dissertation utilizes inductive reasoning in the analysis of its data and theoretical framework. Hawthorne (2018) notes that inductive reasoning can be seen as valid if the truth, which stems from the premises, provides a reasonable degree of support to establish the possibility of claiming the “truth of the conclusion;” essentially, inductive reasoning allows for a conclusion to be rendered from a reasonable degree of empirical data and analysis, but does not necessitate that every premise leads to a “total” conclusion. Hayes and Heit (2017) note that inductive reasoning is commonplace in many daily situations, serving as a use of existing knowledge to make predictions about new, unknown situations (p. 1). Despite its everyday use, inductive reasoning is often considered inferior to deductive reasoning, a form of reasoning which Hayes and Heit (2017) claim is “linked to making valid inferences that are 100% certain given a set of premises, and do not depend on, or ideally even use, other background knowledge” (p. 8). However, despite the seemingly obvious gulf between inductive and deductive reasoning, there is still connection between the two, even if further development is needed to map all of the links in question. A distinction between problem and process views reveals that problem views can be broken down by categorical strength: deductive problems can be seen as conclusions with 100% (or 99.9%) certainty; strong inductive problems can be rendered highly probable (75-99.9%); and weak inductive problems can fall somewhere under 75% probability (Hayes and Heit, 2017, p. 8). Process views, on the other hand, can be further categorized in two modes: the one-process theory posits that deduction and induction potentially rely on the same cognitive processes, rendering the difference as the imposition of different evidence thresholds; two-process theory posits that induction and deduction are both influenced by heuristic (similarity relations and casual background knowledge) and analytic (logical principle consistency) processes, but to various degrees and with various results (Hayes and Heit, 2017, p. 8).

Readers can likely sense, at this early juncture, that there will be difficulties in making definitive declarations about cultured meat. For one, the infancy of the product, combined with the complexities of scientific research, market fluctuations, and funding changes, means that a sudden change – understood as either a “known unknown” or an “unknown unknown” – could be introduced at any moment, consequently rendering definitive conclusions a fruitless task. There is too little information about the specifics of cultured meat, at this time, to render definite conclusions. Furthermore, the theoretical framework combines two broad theories of natural and sociocultural dynamics, requiring a form of reasoning that does not necessitate the absoluteness of deductive reasoning. Heracelous and Lan (2011), in their assessment of inductive reasoning and agency theory, argue that universal generalization, often a focus of deductive scientific research, is not appropriate for the social sciences; instead, inductive reasoning should be accepted, as is, for its ability to generate hypotheses in place of the imposition of preconceived assumptions regarding the relationship between variables (p. 235). Wittgensteinian philosophy bears some relevance here; general theories of meaning cannot necessarily stem from the specificity of verification, which cannot always work for matters such as meaning, an

have been to the moon.” As much as efforts to destabilize language are important, they are not the end-all-be-all, and therefore, I do stand by my use of the phrase “animal,” while recognizing the legitimate reasons there are for using different terminology.

entity that is not always logical. Sometimes, watching how theory functions in general, or is generally applied, explains more than attempting to break it into individual, sometimes conflicting, pieces (Robinson and Mayblin, 2004, p. 139-140). This dissertation does not offer some sort of general theory that can be universalized and applied to all meat alternatives, nor other universalisms in a similar vein; instead, it uses the theoretical frameworks to offer general observations about a subject matter in reference to theories of complex social relations and structures.

Inductive reasoning is important for this dissertation, and requires a brief return to the previous section. As I have stressed, this dissertation should be understood holistically. The specificity of the first two components of the methodology moves to a broader, more generalizable application of the theoretical framework; therefore, the work as a whole – not just on a piece-by-piece basis – functions on the basis of inductive reasoning. The conclusions of this dissertation are established on the basis of probabilities, at least in the sense that they can be applied to systemic social and natural theories. The potential for change in cultured meat itself, alongside the complicated and dynamic elements of the theoretical framework's components, renders inductive reasoning not just a logical choice but an inevitability; an attempt to make deductive, definitive declarations at this stage is tempting but inappropriate.

Interpretive Research & Reflexivity

The postmodern rupture – if one accepts the notion that it represents the instability of language, grand narrative, and objectivity (Robinson and Groves, 2004, p. 156) – has unleashed numerous implications for academic methodology and practice. CAS represents many of these implications in one field, serving as a simultaneous questioning of common narratives surrounding the animal, as well as a supposed rebellion against common academic practice and its institutionalized practices. The work which emerges from CAS is broad; elements of philosophy, language, art, various strains of feminism, and political economy all influence CAS assessment, leading to works which often borrow ideas from various fields. Meigs (2021) also highlights that postmodernism, itself, borrowed from the sciences, a point which Sokal set out to critique in his subversive parody of postmodern theory which would ultimately come to be known as the “Sokal hoax.” Woodhouse (2021), furthermore, demonstrates that many who use the ideas of the postmodernists in modern political struggles have come to utilize these ideas through the same practices that postmodern thinkers, such as Foucault, set out to critique, an emergence of a new discursive power.

This dissertation represents an effort to navigate this tense rupturing, but it is important to acknowledge the limitations of self-awareness in postmodern times. For example, Elliott and Timulak (2005), in reference to research question formulation, identify five types of research questions for qualitative research: definitional, descriptive, interpretive, critical/action, and deconstruction (p. 149). If the research question can be seen as setting the stage for the results of the work, then this dissertation uses all five approaches: it sets out to define the cultured meat discourse, describe it, interpret it, recommend critical action in regards to it, and deconstruct both the discourse and the research into it. Here, however, marks a key issue with identifying self-awareness; is this type of deconstruction meant in a Derridean sense, in which there is no tried-and-true methodology in order to keep it from becoming a

mechanistic approach? Or can deconstruction still occur even with a repetition in method as will be seen in Chapters 5-7? Furthermore, Gare (1995) proposed that postmodernism, in its breakdown of the grand narrative, represented the possibility for a new grand narrative to come from the emergent smaller narratives of the postmodern rupture; but what happens when a “little narrative” attempts to overcome others as a grand narrative? Is CAS a “little narrative,” or an effort to formulate a new grand narrative? Whether I can truly answer such a question, on behalf of an entire field, marks a limitation of reflexivity.

My work for this dissertation takes inspiration from a variety of fields, from political science to environmental studies to philosophy. There is no clear demarcation aside from the distinction between social science and science. While there are methods used in this dissertation, they are not necessarily ones I have developed with universal replication in mind, though others are welcome to adopt a similar approach. The mode of reasoning, in being inductive, allows for statements to be general and potentially collapsible, though the ideological assertions underlying this dissertation – that of the animal condition – remain a guiding force throughout. Gabriel (2015) posits that reflexivity is a “pretentious synonym for reflection,” one which can be reduced to a clerical exercise which offers no guarantee of sound academic work (p. 333). He also argues that “reflexivity has emerged as one of the qualitative researcher’s best responses when challenged to defend the reliability or validity of his/her claims, most especially those working within a discursive, critical, or poststructuralist paradigm;” the overall implication is that self-awareness is the key, which Gabriel (2015) finds concern with (p. 333). Instead, Gabriel (2015) recommends that an approach be taken in which data is treated as a terrain, where certain trends and interesting aspects are identified, in place of an overwhelming focus on “distinct fragments of information” constantly processed through a cavalcade of self-reflection (p. 334-335).

Taking into account this discussion of reflexivity and interpretive approaches, I offer the following summary for readers to consider throughout the remainder of this work. A diverse set of inspirations and approaches has been adopted for this dissertation, none of which is meant to make truly universal, definitive claims. Instead, this dissertation is a survey which embraces the potential critique that it might be “a mile wide but an inch deep;” as cultured meat continues to be developed, the limited and idiosyncratic discourse which has come to formulate current understandings of the subject requires an assessment which identifies as wide a range of considerations as possible, regardless of the actual probabilities of these considerations coming to fruition. The sustained commitment to the consideration of the animal condition, both in its implicit and explicit modes found throughout the dissertation, forms an underlying foundation on which the rest of this assessment plays out; the following section will provide a brief guide as to what lies ahead.

Chapter-by-Chapter Summary

Chapter two contains the systematic overview and analysis of the “cultured meat industry.” The chapter will first establish a brief history of cultured meat, as well as a brief explanation of how cultured meat is made. Following these matters, the first component of the methodology will be applied. It alone cannot answer the question of whether there is a cultured meat industry, so it is important to note that Chapter two is symbiotic with Chapter three. However, it will present the idea that there is not a “cultured meat industry” in a strict sense; this chapter will engage with Mouat et al.’s (2018; 2019)

notion that there is a “performative” industry, but I will ultimately put forward that there is no “cultured meat industry” at this juncture, which will help establish why the discourse must be understood in a more complex manner.

Chapter three contains the thematic discourse review. This review will identify five prominent themes, as well as important sub-themes, which are present in the discourse in both academic and media form. The implications of each theme will be important in establishing not only the performative and contradictory nature of the discourse – a point which further establishes the conclusions of the previous chapter – but in clarifying the lack of context which permeates much of the discourse. This chapter is essential for establishing the need for the remainder of the dissertation, in which the claims of these themes are processed and understood in reference to larger systemic theories which specifically consider both the natural and animal condition.

Chapter four introduces the theoretical framework, the third component of the methodology. The concepts of anthroparchy and carnism will be introduced one after the other. Each section will present the theories and general applications. Following these discussions, I will put forward some concerns regarding the theories, address them accordingly, and establish their relevancy for the remaining chapters. I will also, at the end of the chapter, briefly discuss whether future work needs to reconcile anthroparchy and carnism to a greater degree. While the theories are not combined in this work, their juxtaposition – in reference to cultured meat – has yet to occur. Furthermore, these theories provide the context in which the narratives of disruption, reinforcement, and expansion are tested.

Chapter five introduces the “disruption” component of the theoretical framework. In this chapter, the concept of “disruption” will be defined and explained. It will then be applied to cultured meat through the lens of anthroparchy and carnism. Overall conclusions, stemming from the application of each theory, will be discussed at the end of each chapter. Ultimately, the chapter will posit that anthroparchy and carnism are essential for understanding cultured meat’s role in environmental damage, perpetuating violence towards animals, and even controlling animals at the cellular level.

Chapter six introduces the “reinforcement” component of the theoretical framework. In this chapter, the concept of “reinforcement” will be defined, and then applied through anthroparchy and carnism, demonstrating that cultured meat holds the possibility of continually perpetuating control over animals in both a material and theoretical sense. Cultured meat, in acting as a “replacement” of traditional meat, could continue to perpetuate numerous stereotypes and images relevant to humanistic intersectional considerations. The natural world will also be discussed; the chapter will posit that cultured meat continues to perpetuate anthropocentrism through its inability to enact its supposed disruptive qualities. Chapters five and six form a symbiotic relationship – what cannot end up being disrupted ultimately ends up being reinforced.

Chapter seven introduces the “expansion” component of the theoretical framework. This chapter, once again, follows the structure of the previous two chapters. However, the chapter briefly introduces a few small case studies – the rhetoric of a small set of companies, an academic paper on cultured insect meat by Rubio et al., and recent claims by companies regarding solar energy and

methane as potential protein sources – in order to present examples of the potential for cultured meat to introduce new ways for anthroparchy and carnism to be expanded. Overall, the chapter argues that, even if cultured meat is considered materially unlikely to come into existence, the theoretical implications of the visions used to promote cultured meat must be examined in a critical and wary manner.

The final chapter of this dissertation will offer a synthetic summary of the answers to the research question which have emerged in the preceding chapters. Once this conclusion is established, recommendations will be made for overall improvements to the cultured meat discourse, as well as the research agenda of the literature. While not an outright dismissal of cultured meat, the overall conclusions of this dissertation serve as a stringent call for caution.

Chapter 2: The Process, History, and Hype of Cultured Meat

Issues surrounding the consumption of meat, as well as its production – or, at one time, its attainment – are not recent, despite certain claims. Porphyry of Tyre’s predictions of environmental and biodiversity issues related to meat envisioned a system closer to that of the Roman peasantry, circa 300 A.D., than of modern industrialism; nevertheless, his predictions remain prescient (Porphyry of Tyre, 2000, p. 37). In 970 BC, Abu al-Ala al-Ma’aari constructed a moralistic argument for veganism, much to the ire of modern critics such as the Islamic State (“Al-Ma’aari,” n.d). And though the following individual will be of greater focus later in the dissertation, it is important to mention a North African rabbi named Chayyim Ibn Atar, whose inquiry into meat stemming from his interpretation of Leviticus – the third book of the Torah and Christian Old Testament – has become an important point for cultured meat proponents who are concerned about Kosher adoption of the prospective product (Purdy, 2020, p. 187-188). It is doubtful that all of these individuals contributed to Winston Churchill’s 1931 declaration that “fifty years hence, we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing by growing these parts separately under a suitable medium” (New Harvest, 2019). All of these individuals call attention to the need for a larger-scale historical perspective. However, this dissertation focuses on a much more recent history; still, it is important to recall the context that cultured meat exists within – and could possibly influence. This chapter addresses research question #1: can the developments in cultured meat, so far, be considered constitutive of an “industry?”

Before addressing this question, however, an important matter must be engaged with. This chapter will often be referring to an “industry,” or lack thereof, surrounding cultured meat. The difficulty, however, is attempting to determine what an industry is, and how it is to be determined. If one were to use a basic definition of industry – “a group of establishments engaged on the same, or similar, kinds of production activity” (OECD, 2013) – then it would seem as if there should be no question as to whether there is a cultured meat industry, as establishments are engaging in similar production activities. However, OECD (2013) also notes that there is no “harmonized definition for the term ‘industry’ in business statistics,” and that industry is often used as “a synonym for activity.” Nightingale (1978) also notes that “industry” tends to be used synonymously with “market,” which implies sales and profit (p.31). These qualifications serve as the starting point for our understanding of how “industry” is to be defined in this chapter. Even atypical industries, such as cottage industries, tend to have reasonably established modes and prospects of production, such that producers will not have to question whether production is possible in a basic sense – therefore, the activities of such industries can be reasonably theorized, understood, and translated into plans for the establishment of an eventual market.

Towards the end of this chapter, I will be making the argument that there is not, at this point, a cultured meat industry – instead, it should be understood more as a large-scale, privatized, ongoing experiment. Readers who are familiar with the cultured meat literature may wonder why I do not just adopt the framework of Mouat, Prince, and Roche (2018) who, in an attempt to clarify the “industry” of cultured meat, put forward the idea that cultured meat can be classified as a “performative industry” (pp. 147-148). The authors argue that the animal-free food industry does not exist, and may never exist as it is imagined by advocates; it is too early to even get a sense of what assemblages can be attributed

to cultured meat. That being said, advocates, think-tanks, and companies are attempting to legitimize the claims of industry status by creating discourse that normalizes the currently fractured state of cultured meat production (Mouat, Prince, and Roche, 2018, pp. 138-148). Ideological debates and visions are important in creating the extra value added to the ontological-scientific processes, and they present cultured meat as being constituted by its future-ideological possibilities, regardless of the current reality of cultured meat production (Mouat and Prince, 2018, pp. 315-316). My contention is that the authors, by still utilizing the phrase “industry” in some form, grant more legitimizing power to cultured meat proponents and producers than they realize. In my personal conversations on cultured meat – with farmers, doctors, etc. – I have come across a general presumption of where the “industry” currently stands, and it does not match the revelations from this chapter. With the ambiguity and contradictions readers are about to engage with in this chapter, I posit that stronger wording than “performative industry” is needed – it is a phrase which presumes a degree of coherence and clarity which does not come across in the following evaluation.

What Is Cultured Meat?

Only a few years into the new millennium, Edelman et al. (2005) identified a theoretical process for producing cultured meat. I am maintaining their explanation verbatim in order to avoid the risk of significantly altering the meaning stemming from their specific wording:

In scaffold-based techniques, embryonic myoblasts or adult skeletal muscle satellite cells are proliferated, attached to a scaffold or carrier such as a collagen mesh-work or microcarrier beads, and then perfused with a culture medium in a stationary or rotating bioreactor. By introducing a variety of environmental cues, these cells fuse into myotubes, which can then differentiate into myofibers. The resulting myofibers may then be harvested, cooked, and consumed as meat.... [A] scaffold-based technique may be appropriate for producing processed (ground, boneless) meats, such as hamburger or sausage. But it is not suitable for producing highly structured meats.... To produce these, one would need a more ambitious approach, creating structured muscle tissues as self-organizing constructs or proliferating existing muscle tissue *in-vitro*.... Future efforts in culturing meat will have to address the limitations of current techniques through advances that make cultured cells, scaffolds, culture media, and growth factors edible and affordable (Edelman et al., 2005, pp. 659-660).

This explanation can be offered in other ways, but it is vital to stress that this envisioning has served as the basis for the majority of work surrounding cultured meat. The general process has remained adherent to Edelman et al.’s vision since 2005, though many refinements have been introduced and acted upon.

To explain the process of cultured meat production in different terms, the origin of the meat is the first important factor. Cultured meat is procured through biopsies performed on animals with the goal of obtaining cells. O’Neill et al. (2020) predict that the most important types of cells for cultured meat production, at industrial scale, will be muscle satellite cells, myoblasts, myocytes (often referred to

as myotubes or myofibers), adipose-derived stem cells, adipocytes, and fibroblasts (p. 687).⁷ While different cell types serve different purposes, this variety of cells is viewed as what will be generally necessary for cultured meat production; this claim is further reinforced by Post (2020, p. 2-7). These cells must be placed in a medium, which provides the nutrients for cells to grow and mature. Producers often indicate that they have a goal of using a plant-based medium – and a number have claimed that they are producing cultured meat using such mediums – but Fetal Bovine Serum (FBS) is still the most commonly used for reasons of accessibility and effectiveness for cultured meat production at small scales, despite the ethical paradox of relying on material from dead animals for a product meant to reduce the number of killed animals (Humbird, 2020, p. 44; O’Neill et al., 2020, p. 687). Throughout the process, scaffolding must be considered – unless a company wants to sell cell-based animal slurry, in which case, unstructured products can be created through extrusion texturization blending (Humbird, 2020, p. 1). However, for companies looking to sell structured products – which is likely the desire for the majority of cultured meat companies – the scaffold serves as the organizational tool on which cells grow. Currently, collagen and gelatin are seen as the most viable options for efficient, scalable cultured meat production, but the use of such materials is an issue, as the reliance on animal materials in the production process creates an ethical issue similar to that of Fetal Bovine Serum. Consequently, there is ongoing research into scaffold possibilities based on mushroom-based Chitosan, plant proteins, polysaccharides, decellularized plants, and synthetic polymers (Seah et al., 2022, pp. 316-319). Scaffolding, as a process, involves the procurement of adult muscle skeletal cells, or embryonic myoblasts, and attaching these elements to a scaffold, following the cell proliferation process. This scaffold is immersed in medium inside of a bioreactor. The scaffold and medium reveal key production issues for cultured meat producers. In regards to scaffolds, there is still a great deal of experimentation to determine what scaffolds work best for certain types of meat, as well as how to overcome certain issues with different scaffolds; for example, pore size is an issue that has been identified as needing further research to determine optimization, both in general and for specific products (Ben-Ayre & Levenberg, 2019, p. 8). The composition of various scaffolds and the relationship to different meats are also an issue; as an example, an algae-based scaffold may be beneficial for cultured seafood production, but may not combine effectively with cultured beef production, meaning a “one-size-fits-all” approach is not probable (Post, 2020, p. 7). Once past a certain point, the stem cells differentiate into myofibers, and are then harvested into structured products. It should be noted that the fibers must be “exercised” in order to attain similar taste to “traditional” meat; most of this exercise has been conducted electrically, but some inquiry is being made into the possibilities of mechanical exercise (Chriki and Hocquette, 2020, p. 2). As noted by Chen et al. (2022), “there are no commercial scaffolds with non-animal bio-materials for cultured meat production, and the current scientific research on such scaffolds is scarce” (p. 7), a dilemma which is likely to serve as another concern for critics of cultured meat in the foreseeable future. As well, scaffold materials are expensive; “currently, one kilogram of scaffolding material costs about €100,000” (Southey, 2021e). Various companies, such as Gelatex, are claiming to have alternative materials at less than €1,000 per kilogram, but whether their materials can be used in scaled production is unclear (Southey, 2021e). Plant-based scaffolds will also have to overcome the

⁷ Muscle satellite cells, myoblasts, and myocytes are different types of muscle cells; adipose-derived stem cells and fibroblasts are types of connective tissue; and adipose cells specialize in the storage of fat.

superior biological properties of animal-based scaffolds, and the reproducibility of synthetic scaffolds, in order to become viable for cultured meat production and the goals of proponents (Seah et al., 2022, p. 319).

Bioreactors are an essential component of cultured meat production, with visions often arising of cultured meat being produced in facilities resembling breweries (Humbird, 2020, p. 2). Van der Weele & Tramper (2014) proposed a 20 m³ sized bioreactor as a model for potential production to feed “a small village” (p. 296); while such a prospect is commonly referred to as a theoretical possibility, Humbird (2020) notes that such a bioreactor is “at or near world-record levels” (p. 22). To match even a small level of industrial meat production on a global scale, Humbird (2020) claims that 10,000 m³ of 20 m³ bioreactors would be needed, dwarfing the entire biopharmaceutical industry; attempting to reach 10⁵ kTA of production would outpace all of the bioproducts of the ethanol industry (p. 36). This point has been reiterated in a recent GFI report, which acknowledges that reaching 1% of the current tonnage of traditional meat production requires “220 to 440 million liters of capacity, eclipsing the estimated 10 to 20 million liters of pharmaceutical-grade cell-culture capacity currently built” (Cohen et al., 2022, p. 18). The matter of bioreactor size is considerable; Josh Tetrick, founder of JUST, acknowledges that his requests for 100,000 L reactors for animal cell-culture are currently impossible to fulfill (Fassler, 2021); that is despite a recent announcement that GOOD Meat plans to build “ten 250,000 litre bioreactors... the complex will have the capacity to produce up to 30 million pounds of meat” (Webb, 2022). Humbird (2020) posits that current industrial bioprocess designs are not meant for cultured meat production, and the disparities between microbial cells and animal cells will pose considerable issues across the entirety of the production process, especially in terms of bioreactor design (p. 4-9; 22-30). Future Meat Technologies is already quoted as having “closed the door” on the notion of large bioreactors, commonly considered one of the most important ways that cultured meat can be produced at comparable economies of scale to traditional meat (Fassler, 2021). As well, even if pharmaceutical bioengineering processes could be adapted by cultured meat production without technical issues, because of the difference in scale and scope, the smaller profit margins of the food industry may create prohibitive costs which prevent the adoption of such technologies (Bomkamp et al., 2022, p. 11), requiring innovations and productive processes which may take considerable time to develop and integrate, once again calling into question cultured meat’s ability to reach store shelves in a timely manner. Such a matter raises considerable concerns when taking into account a recent quote from SciFi Foods on the prospects of scaled bioreactors, the viable maximum size of which “no one really knows... it would be ideal to get 40,000 to 50,000 litre in terms of economies of scale and reductions in capex, but the bigger the bioreactor the more aggressively you have to mix the contents, which creates challenges,” especially in terms of bioreactor condition variations and cell protection, as animal cells do not have protective cell walls (Watson, 2022).

Furthermore, many companies have the goal of producing immortal cell lines, as current cell cultures can only tolerate a finite number of cell divisions before senescence renders the line unusable (Soice & Johnston, 2021, p. 2). Research into cancer cells, misexpression in somatic cells, and transformation with viral genes, have revealed that cell lines can be rendered immortal, sometimes

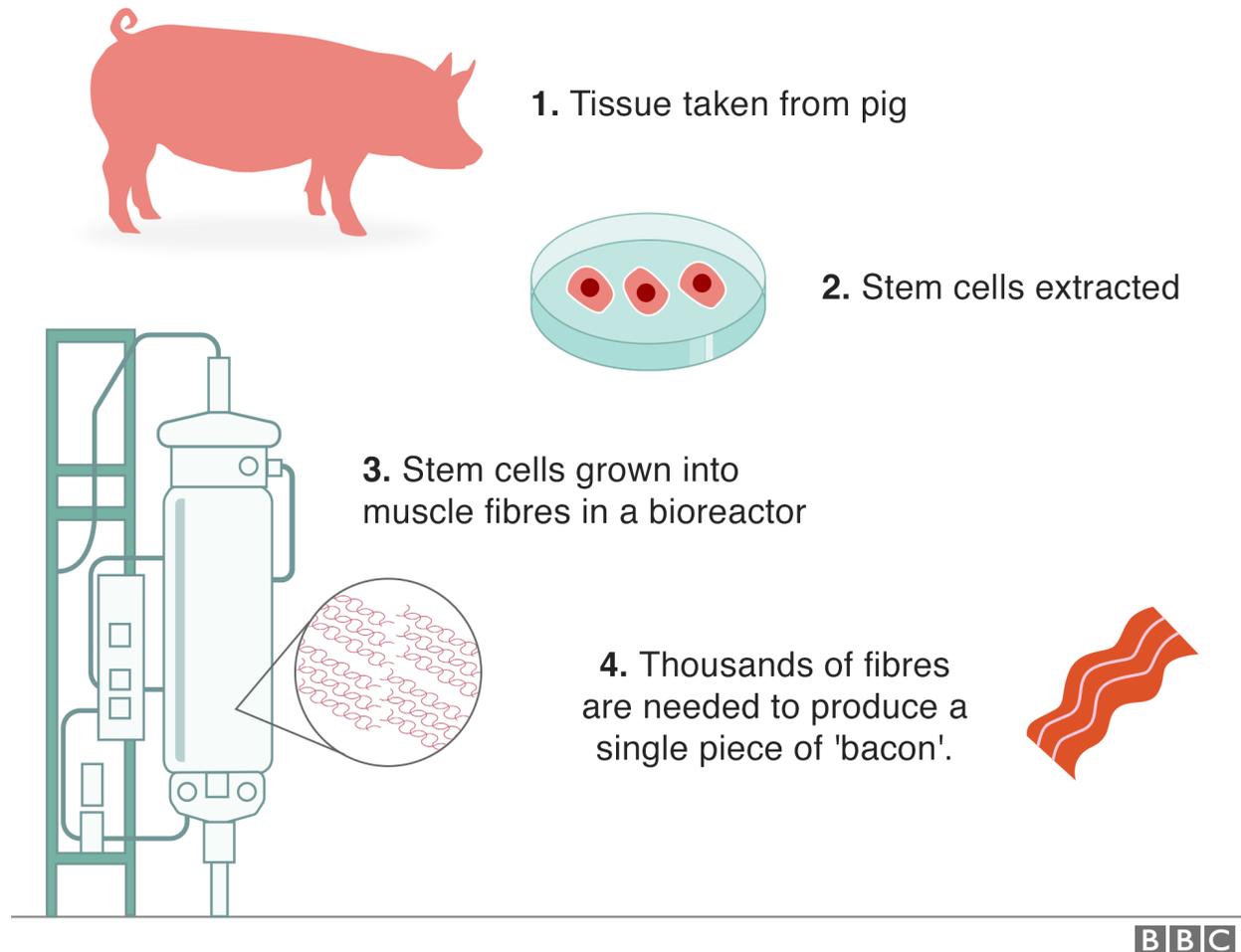
through genetic modification methods like CRISPR,⁸ and sometimes without such a need (Soice and Johnston, 2021, pp. 4-6). However, despite the ambitions of cultured meat companies, and the dreams of being able to utilize animals for biopsies only once, “there are no cultured-meat-appropriate cell lines available to researchers and developers... the closest existing cell lines are myoblasts from model species commonly used in research such as mice, rat, hamsters, and Japanese quail” (Soice & Johnston, 2021, p. 2). Efforts to establish appropriate cell lines have been slow; Kerafast has established one cell line in its bank (Soice & Johnston, 2021, p. 3). Some patents have been filed for various methods, but researchers and companies do not have access to immortal cell lines. Cell immortalization, at the necessary scale, may produce unexpected results due to unpredictable mutations, and there is a significant lack of knowledge regarding the cell lines of marine invertebrates (Soice & Johnston, 2021, p. 4). Even if research can overcome all of the scientific known-unknowns (and unknown-unknowns), and ensure immortalized cell line cultured meat can taste comparable to industrial meat, regulatory factors may be an issue. The European Union may reject cultured meat from immortal cell lines if the lines are modified using CRISPR, whereas spontaneously immortalized cell lines may be rejected by other countries who interpret them as being equivalent to cancerous cells, even without GMO concerns at play (Soice & Johnston, 2021, pp. 4;7). As well, because there are no available cell lines for agricultural purposes, maintenance costs have not been studied.

While there are numerous other issues to consider, especially because of the ambiguity surrounding necessary post-harvest processing requirements (Bomkamp et al., 2022, p. 7), I will highlight one more considerable point of order. Hormones and growth factors are essential for an animal being raised for eventual slaughter. Removing the cells from the animal does not remove the need to provide the cells with hormones and growth factors, leading to two major questions: first, can these elements be produced on an industrial scale, especially one which matches the potential scale of cultured meat? Second, what happens to cultured meat in places such as the European Union, which has banned hormonal growth factors? (Chriki and Hocquette, 2020, p. 2). Vergeer, Sinke, & Odegard (2021) argue that the cost to produce cultured meat can be greatly reduced with the reduction of growth factor costs (p. 33), but how to do so is a major question, especially since Humbird (2020) posits that the reduction in costs depends on the simultaneous scaling of cultured meat and growth factor industries (p. 11). Consequently, the move away from FBS comes across as quite difficult, and is one of many major unanswered questions at this juncture.

Before moving onto more complicated matters, I will include a few examples of visual explanations for cultured meat. These graphics, which come from a range of sources, are not as detailed as linguistic explanations, but can help to visualize the process. The visuals are obtained from the following sources, in chronological order: Briggs (2019); Bartholett (2011); Zhang et al., (2020); Jaraith et al. (2021). These images are but a small sample of the variety of visual aids used to explain the process of cultured meat production; more can often be found on company websites or in news reports. Nevertheless, this small sample should be adequate for those unfamiliar with the process.

⁸ CRISPR is an acronym for clustered regularly interspaced short palindromic repeats.

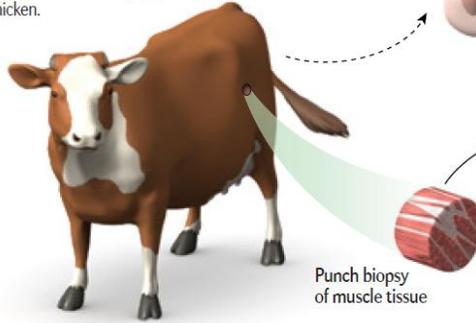
How to make artificial meat



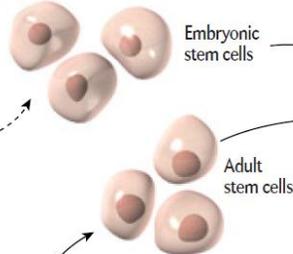
The Petri Dish Platter

Researchers are developing methods to grow stem cells from livestock into edible meat products. Here's how it would work.

1 Researchers isolate embryonic or adult stem cells from a healthy pig, cow or chicken.



2a Stem cells taken from an embryo are easy to make proliferate but hard to coax into muscle cells.

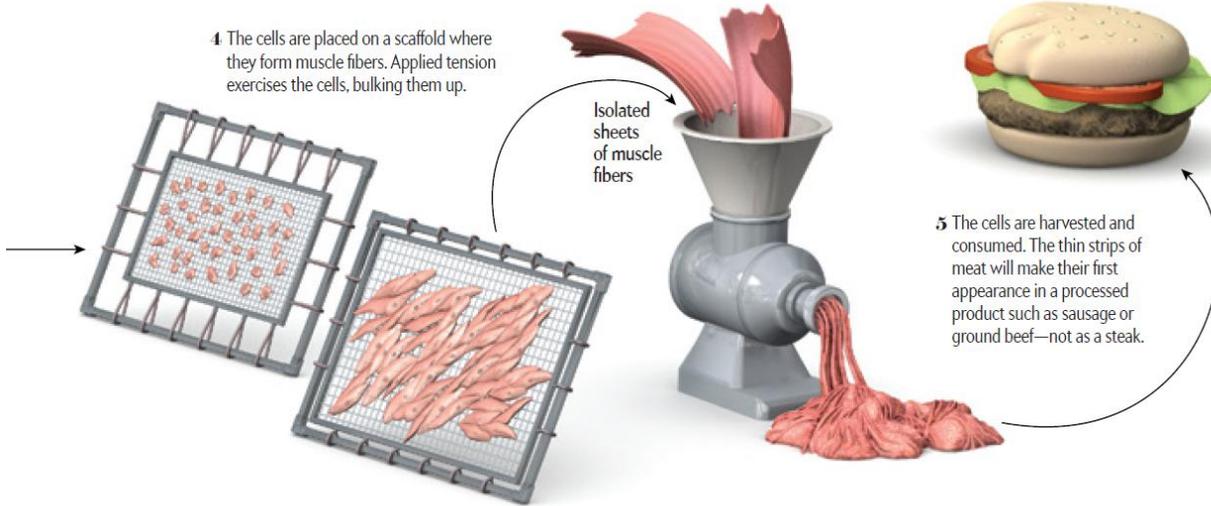


2b Conversely, adult stem cells taken from muscle tissue are difficult to grow but easy to convert into muscle form.



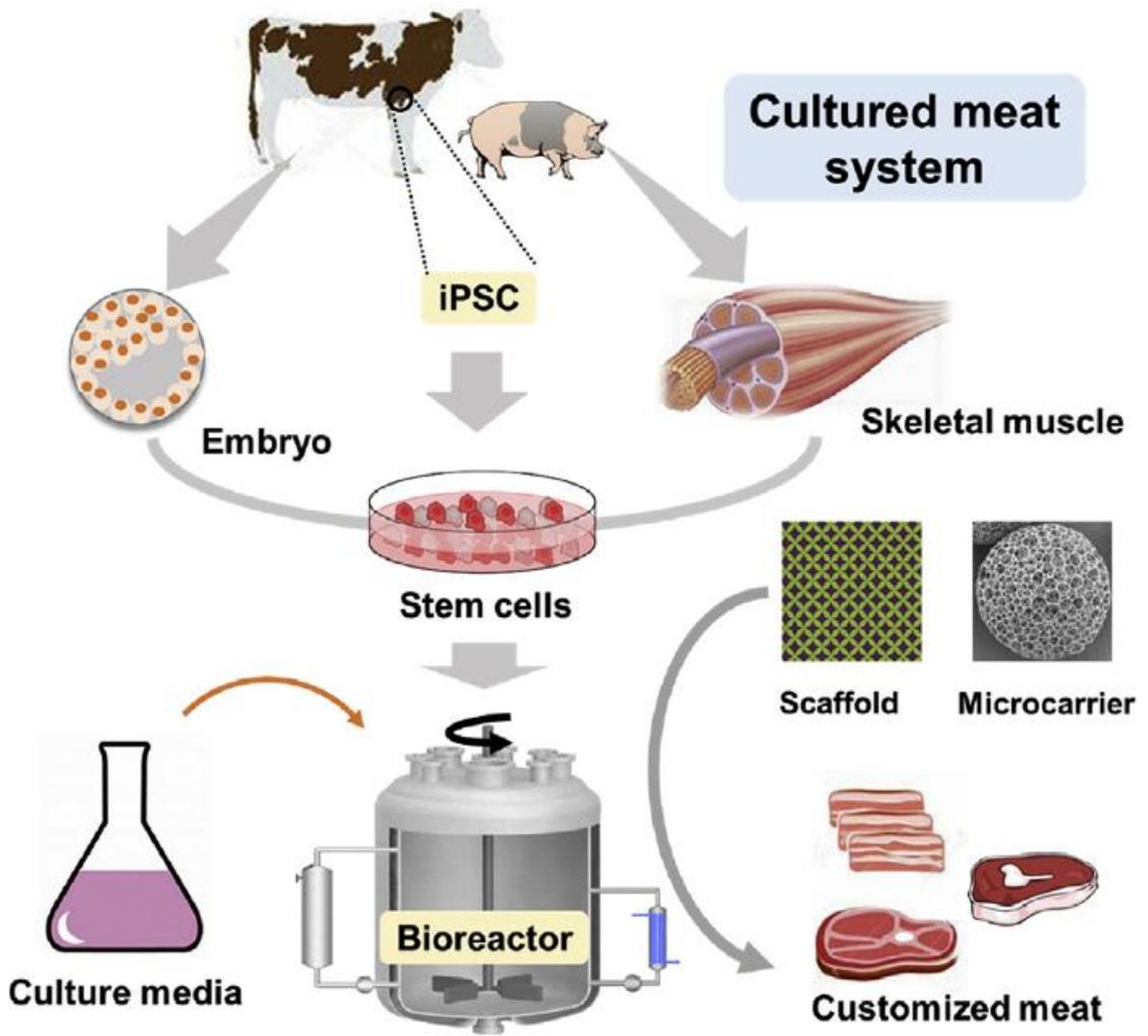
3 Scientists induce the stem cells to multiply many times over by culturing them in a bacterial-based growth serum. Embryonic cells are prodded to form muscle cells.

4 The cells are placed on a scaffold where they form muscle fibers. Applied tension exercises the cells, bulking them up.



5 The cells are harvested and consumed. The thin strips of meat will make their first appearance in a processed product such as sausage or ground beef—not as a steak.

Visual #3 (Zhang et al., 2020, p. 444):



Visual #4 (Jairath et al., 2021, p. 703):

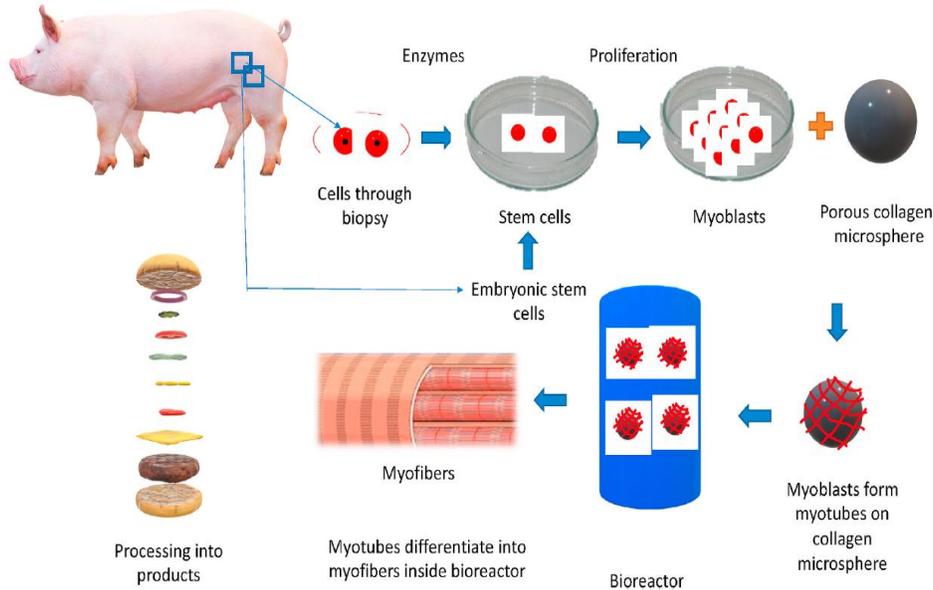


Fig. 2. Basic schematic view of scaffold-based technique (A continuous flow of oxygen as well as nutrients is required in bioreactor for the successful culturing and to avoid spoilage).

Further Complexities and Other Matters

When Edelman et al. (2005) identified the potential production process, they also predicted that there would be some considerable issues for researchers and producers down the line. These issues include procuring stem cells in culture for certain species; identifying how much electrical stimulation would be needed to simulate exercise that gives meat its “taste;” identifying an appropriate culture medium and set of growth factors; and designing the necessary bioreactors. The potential production process may be reasonably agreed upon, but numerous matters remain unclear. Furthermore, as noted by Newman (2020), much academic research has focused on cultured meat at the expense of acellular products, such as artificial flavors and rennet (p. 172). While this dissertation does maintain its focus on cultured meat, given the status it has attained as a sort of “holy grail,” Newman’s (2020) concerns should be recognized, especially when considering the competitiveness and necessity of cultured meat vis-à-vis other modes of production (p. 172).

Scaling-up is one of the primary concerns among the skeptics, as well as producers, of cultured meat. All production has been conducted in small, controlled laboratory settings. Numerous companies are preparing to begin construction of cultured meat production facilities, and a handful of companies – as will be discussed momentarily – have actually broken ground on such projects. Currently, these facilities are likely going to be able to produce samples for regulators, key industrial partners, and high-end restaurants for an estimated three years (Cohen et al., 2022, p. 16). The cost of these factories is only recently seeing discussion. A conservative estimate from Vergeer, Sinke, & Odegard (2021) claims that a model 10kton production facility would need \$450 million in investment capital (p. 21); 4000 of these facilities would cost \$1.8 trillion, which is estimated to match 10% of current meat production (Southey, 2021i). It has always been clear that cultured meat will be expensive, but recent projections

are alarming. The reduction of these costs is also a considerable point of contention. Between two CE Delft reports (Sinke & Odegard, 2021; Vergeer, Sinke, & Odegard, 2021), switching from current to sustainable electricity would substantially reduce both the environmental impacts of cultured meat as well as the costs of production; on-site electricity generation is even more desirable. However, global sustainable energy adoption has been inconsistent, indicating that CE Delft's report recommendation(s) may not be achievable. This example is just one of a number of controversies surrounding the costs of cultured meat production and scalability.

While bioreactor design was an issue identified by Edelman et al., they theorized that research-size rotating bioreactors could be scaled to industrial sizes without affecting the physics of the system; they based this conclusion on previous scale-ups from 250ml to 3L, as well as low-shear particle-based biofilm reactors which allow larger concentrations (Edelman et al., 2005, p. 661). However, this notion recently came under dispute from Zhang et al. (2021), whose research posits the theoretical possibility that it may be impossible to reproduce favored conditions in large-scale reactors; their specific concern stems from impeller-exerted shears, which they posit could cause cell detachment from microcarrier sources while simultaneously, through sparging,⁹ introduce great hydrodynamic stress (p. 2). The authors still conclude that freely suspended cells should be safe in their industrial scale-up model, but microcarrier production of cultured meat may be at risk of being impractical (Zhang et al., 2021, p. 8). It is here where a constant issue with cultured meat discourse becomes clear; neither proponents nor skeptics can claim definitive proof for their arguments. All are based on simulation and theoretical scale-up of current small-scale, laboratory settings – until a facility, with industrial bioreactors, is actually built and tested, and can be accessed by researchers, no absolute claim can be made. It is still important to get a sense of possible complications in the scaling process, but nothing definitive can be said about the effectiveness of the production process at this time.

The issue of culture medium has also been of considerable focus, though companies are claiming that the matter will soon be resolved (Chriki and Hocquette, 2020, p. 2). Fetal Bovine Serum ultimately defeats the purpose of a “slaughter-free harvest,” as a dead animal would still be required for the cell medium.¹⁰ This issue is not one of “vegan/vegetarian” adoption of cultured meat, but whether or not cultured meat can actually deliver on its ethical promises. Considerable research has been invested in moving away from FBS, but the alternatives raise new questions. Horse serum has been used in select cases, but points to the prospect of horses being integrated into the process of cultured meat production to satisfy theoretical demand (Lee et al., 2022, p. 13). A similar prospect is arising with Nanyang Technological University's research into chicken serum (Tan, 2022). SeaWith announced that it replaced 90% of its FBS use with marine microalgae, but that is only at the prototype level – questions of environmental impact and scalability have yet to be determined, and it is unclear if SeaWith's method can be replicated for cultured meat overall (Lee et al., 2022, p. 3). Mosa Meat has also produced a

⁹ Sparging is essentially a filtering process through which volatile compounds or pollutants are removed.

¹⁰ It is important not to overlook, however, that even if FBS is no longer used in cultured meat production, many companies still procure their cells from animals used – and killed – in the industrial animal agriculture system, which many advocates for animal rights/liberation would view as still being too close for comfort with the destructive systems in question to be truly “slaughter-free” and “ethical.”

serum-free media, but it did not achieve 3D cell differentiation, which will be essential for scaled production (Southey, 2022a). Furthermore, a recent LCA by Sinke and Odegard (2021) concludes that cultured meat has a higher environmental footprint than plant-based meats, including those which are wheat-based; while this disparity relates to industrial processes and energy-intensive production (p. 25), Humbird's (2020) assessment also notes that cultured meat – presuming that soy hydrolysate feed is used for the cells – requires “3-4 calories of raw plants” to “make one calorie of cell mass” (p. 68). These conclusions point in a concerning direction for cultured meat producers; even if cultured meat is environmentally superior to traditional meat, it may not be superior to plant-based meats, raising questions regarding the entire mission even if the use of FBS can be overcome. However, another concern is that, even if cultured meat can overcome a variety of environmental concerns and medium composition issues, cultured meat may not be introducible in a comprehensive manner. Chriki and Hocquette (2020) claim that the sheer variety of meats on offer today cannot be replicated by cultured meat producers. The variety of flavors between and within species is also dependent on farm conditions, as well as bodily conditions, that cannot yet be replicated in lab-grown settings. When this matter is considered alongside the issue of flavor replication – still a difficult matter, given the process of oxygen perfusion¹¹ – cultured meat development seems poised to, at this juncture, merely introduce a small variety of differentiated products (Chriki and Hocquette, 2020, p.2). This revelation makes some of cultured meat's history, and the hype stemming from it, interesting for reasons that proponents may not appreciate. However, at this point, what is most important to establish is that merely the general process is agreed upon; the fine details, as well as what will come of this process, remain ambiguous, if not considerably contested.

These concerns have not deterred proponents from advocating for cultured meat; when proof-of-concept was far more limited and not intended for commercial use, Edelman et al. (2005) predicted that cultured meat could be genetically altered to be more nutritious than traditional meat; foodborne disease could be significantly reduced; and resources could be used more effectively (p. 662). These matters are still prominent selling points for cultured meat, and they will be addressed in the literature review in Chapter 3. Ironically, Edelman et al. (2005) indicated that the economic validity of cultured meat was most questionable; while the economics are still highly concerning, this chapter will demonstrate that cultured meat is certainly being invested in, even as the supposed benefits come under scrutiny. The economics may not seem cost-competitive, but that is not stopping the economic dynamics of cultured meat from beginning to take shape. At this point, it is necessary to address one other foundational matter; the history of cultured meat requires some analysis, especially before moving on to the “state of the industry.”

The History of Cultured Meat

Though J.B.S. Haldane, in 1927, discussed the culturing of beef steaks (Jaraith, 2021, p. 701), cultured meat remained only a component of scientific fiction until the mid-90s. Even then, it still remained a fiction – but instead of a narrative, it was articulated in the form of a patent, filed in 1995 by Willem Van Eelen, achieved through \$750,000 in private investments (Purdy, 2020, p. 23). Though the

¹¹ The oxygen flow going through the tissues.

patent was for a theoretical product, it signaled the beginning of serious inquiry into the potential of cultured meat production. Following this patent, in the early 2000s, two events preceded Edelman et al.'s landmark publication. The first was Benjaminsson et al.'s efforts to cultivate goldfish explants, meant to produce edible entities that could sustain long-term space travel, which were declared "acceptable as food" by NASA. The second was Catts and Zurr's Tissue Culture and Art Project, a "discussion about the transgressive status of the tissue, as the frog muscle was consumed with the live frogs from which the cells were sourced also sitting at the dinner table" (Stephens, Sexton, and Driessen, 2019, p. 3). These two events, combined with Edelman et al.'s (2005) paper, signaled greater potential for cultured meat. However, it also became clear, around this point, that cultured meat proponents would have to pursue funding from atypical sources, an issue demonstrated best with Van Eelen's 2002 scientific consortium, which merged with Meester Stegman BV, a single division of food company Sara Lee (Purdy, 2020, pp. 23-24). Tissue engineering entities and food science groups, which one might think would be most likely to fund such projects, were unwilling to involve themselves in early cultured meat research. The reasons likely had much to do with the "science fiction" of cultured meat, though other factors – such as cultural commitment and economic anxiety – may also have played a role. Other entities, such as the Programme of Sustainable Food Systems – a Dutch government program – became important in funding Van Eelen's work. While Van Eelen would ultimately fade from the "cultured meat scene," his hiring of Mark Post marked another major contribution to cultured meat's promulgation.

As research continued into cultured meat, interest in the topic grew, though not substantially. However, a breakthrough occurred in 2013. In 2011, Mark Post was interviewed by *The New Yorker*. Now leading his own research team, Post lamented that a lack of funding was preventing his team from utilizing the technological research and advancements they had made in order to produce a prototype. Sergey Brin – a founder of Google – privately provided the necessary funding (Stephens, Sexton, and Driessen, 2019, p. 4), and in 2013, Post's team debuted its prototype cultured hamburger to a small group of reporters. The prototype is estimated to have cost over \$300,000US (O'Riordan, Fotopolou, and Stephens, 2017, p. 153), but for proponents, the cost was worthwhile when one accounted for the symbolic importance of demonstrating that cultured meat was, indeed, possible. Private venture capital turned its attention towards cultured meat – as will be demonstrated later in the chapter – ultimately setting into motion cultured meat's current status.

Since 2013, significant events have been infrequent, and their relevance has become more difficult to determine. For example, cultured meat saw a major increase in media coverage because of investments from Cargill and Tyson, two major meat producers, in 2017. However, despite an increase in coverage, the companies actually participated in only a few rounds of investment, and the number of companies they invested in was considerably small. That does not negate the symbolic significance – nor the significance to the companies that were invested in – but the actual implications of this event are not clear-cut or easily determinable, especially as the presence of venture capital creates ever-more secrecy. Another example occurred in 2020, when it was announced that Singapore, on the basis of safety standards, approved Eat JUST's cultured chicken nuggets (Terazono and Palma, 2020). This approval has been celebrated as potentially paving the way for a commercial launch, especially since

JUST is one of a number of companies to have announced plans regarding the building of the first facilities for cultured meat production (Phua, 2020). Nevertheless, plans do not mean reality; when one takes into account the issue that cultured meat has not yet been scaled-up for mass-production purposes, it is too early to tell if JUST has managed to “cross the finish line,” or if it could end up providing evidence for doubters of cultured meat’s viability. As more work is done on cultured meat, it seems as if the potential for its significant events becomes murkier.

In terms of the existence of cultured meat, its history is significant; a few small projects and papers would ultimately “get the ball rolling.” However, there is no denying that the lofty promises of cultured meat’s proponents – a meat that is ethical, environmental, and overall beneficial – do not arise merely from the history of this entity. Cultured meat’s history will constantly be redefined by the developments that are yet to be predicted or determined; the next few years, especially, will be critical in determining whether cultured meat might “make history” in the sense of consumer choice, or if it will be relegated to an interesting blip in the history of biotechnological engineering. However, in order to get a sense of what might come of this upcoming decade, it is best to get a sense of what cultured meat “looks like” at this specific juncture.

Is There a Cultured Meat Industry?

While much academic work has been done on cultured meat, there has been little on the “industry” of cultured meat, and what has been done tends to be theoretical and analytical, asking readers to accept certain ideas regarding cultured meat without necessarily providing a swath of data to justify the acceptance of said ideas. In order to build a stronger sense of whether there is a “cultured meat industry,” the following sections have been constructed around an analysis of two different sources of information – the website/database Cell-Based Tech (CBT), and reports from the 501(3)(c) non-profit Good Food Institute (GFI).¹² CBT and GFI have specifically focussed on compiling and amalgamating information about what companies are in operation; what funding they have received; and who has invested in these companies. While these entities are not the only proponents of cultured meat, in terms of think-tanks or other similar enterprises,¹³ they have made a considerable effort to provide necessary information. They are not the first entities either, but they are currently available and relevant. Before these entities began work on their information, the company Kieran Meats attempted to supply this information, but the data was deleted following the closure of the company. As such, it is important to recall that this information is only up-to-date to a certain degree. In the case of the GFI reports, I will be utilizing their 2019, 2020, and 2021 “State of the Industry” reports, which were respectively published in May of 2020, April of 2021, and April of 2022. Additional information, obtained from other sources, will be cited so that any disparities between GFI’s reports, and this dissertation, can be justified. CBT, unfortunately, demonstrates the difficulties in keeping up to date with cultured meat revelations. CBT has not updated its website since September of 2020; while that was not a particularly pressing issue when the first draft of this chapter was composed in March of 2021, at this current

¹² The bibliographic information for these reports can be found under the names “Byrne, B.,” “Crosser, N.,” and “Cohen, M.”

¹³ New Harvest is an important example of a prominent cultured meat think-tank, though it does not publish enough material to warrant being evaluated here.

juncture, it is clear that the CBT database is not keeping up with GFI's efforts. While there is still relevant information from CBT which will be considered, it should be recognized that the lack of updates may be a sign that the database might go the same way as that of Kieran Meats, despite calls for a more open-source (or less monopolized) approach to cultured meat information.

The data points in question are available in the appendices of this dissertation. Before assessing this data, there are some important points to highlight. Both entities have disparate and incomplete data, so the focus of this assessment will be on amalgamating and aligning their information. Appendix A will present the name of each company; its area of focus; its geographic location; the year it was founded; where this information came from;¹⁴ and the total that has been invested in the companies so far. Where information is unavailable, "N/A" is used to note missing information, or where information will not be relevant for the remaining assessments.¹⁵ Appendix B will look more in-depth at the matter of investments, analyzing: what entities have invested in cultured meat; the type of investor; their location; their portfolio (as it is relevant to cultured meat); the number of investment rounds; and the source of said information. Appendix C will look specifically at companies producing cultured meat, and analyse: whether the companies have made note of a prototype for their products; the cost of the prototypes; whether the available information on these prototypes is detailed; and when these companies claim their products will be introduced to the market. More detailed explanations of the criteria will be offered in each section.

The assumptions made by CBT and GFI will have an impact on the first section of this assessment. Neither entity does particularly well in identifying its criteria for company selection and highlighting, which leads to some guesswork. CBT attempts to present a larger picture of the overall cell-based technology industry, which leads to their including a variety of microbial engineering firms, companies focussed on inputs, and tissue engineering start-ups. This approach is understandable; CBT seems to be attempting to identify a larger industry that can share resources and information, and ultimately make a stronger case for an overall "industry." However, that does not mean that all information provided by CBT is relevant; its classification of cannabinoid companies has been removed from this data, as the relationship between cultured meat producers and cannabinoid companies cannot be reasonably demonstrated through CBT's work. Companies producing inputs and processes that might be relevant for cultured meat companies will be assessed in Appendix A, but will be removed from Appendix C. GFI's focus does include some related companies and industries, but is stricter about focussing on cultured meat. However, that does not mean it covers every company; CBT and GFI include certain companies with minimum information, and the reasons for such disparities are unclear. Consequently, the process of amalgamation does not necessarily have to account for each disparity; with all information brought into one place, a stronger idea of what the industry could, in theory, shape up to be can be attained, while also simultaneously questioned.

¹⁴ So, whether the information came specifically from CBT, GFI, or both.

¹⁵ For example, some companies focused on inputs or microbial engineering will not be relevant for appendix C; therefore, the "N/A" in table appendix A will be used to denote where such information is not of particular relevance for the following sections.

The Cultured Meat Industry: Companies and the General Industry Shape

To begin this analysis, Appendix A will present the amalgamation of the relevant data from both CBT and GFI. This appendix includes a wide variety of companies that could, in theory, constitute a “cultured meat industry;” however, subsequent assessment will focus more on specific companies, which will greatly alter the data – and, consequently, the presentation of a supposed “industry.” This approach is purposeful, as it allows for a demonstration of the various issues and benefits which can be seen in different approaches to identifying an “industry.” The information in Appendix A is sorted by the “area of focus” column; in brackets, the specific area of focus of each company is identified when possible.

Appendix A identifies 140 companies, highlighted by either CBT or GFI, or other sources, that may or may not be relevant when considering the possibilities of a “cultured meat industry.” Three companies – Singcell, Bruno Cell, and Luyef Biotech – cannot fit the classificatory scheme utilized in the appendix, as they are focussed on periphery elements of the industry (contract development, and research/licensing). Otherwise, thirty four companies are focussing on inputs, defined as entities necessary for the procurement of cultured meat, such as the medium, as well as bioreactors and even biobanks, but these companies can also ensure their products are used by a wider variety of industries and studies. Nineteen companies are defined as microbial engineering; these companies are focussing on related technologies, such as yeast, oils, leathers, protein pathway engineering, etc., which use culturing biotechnology but are not specifically “cultured meat.” Eighty seven companies have been identified as working on tissue engineering. A number of these companies are working on what can be understood as cultured meat, involving actual animal tissue produced in some cultured form setting; furthermore, many of these companies are also working on other products or productive inputs, which I have identified as much as possible in the classificatory system. Regarding geographic location of these companies: 50 are in the United States; 12 are in Israel; 11 are in the United Kingdom; 8 in Canada and Singapore; The Netherlands, and Germany each have 7; China has 5; 4 are in Japan; Russia, South Korea, and Australia each have 3; India, Brazil, Argentina, and South Africa each have 2; and Chile, Austria, Croatia, Denmark, Italy, Spain, Switzerland, Turkey, Mexico, France, and the Czech Republic each have 1 company. When it comes to tissue engineering specifically: 26 companies are in the United States; 10 in Israel; 8 in Canada; 7 in the United Kingdom; 6 in Singapore; 5 in Germany; 4 in the Netherlands and China; 3 in Japan; 2 each in South Korea, Brazil, Australia, Argentina, and Russia; and 1, each, in South Africa, Denmark, Croatia, India, France, Switzerland, and Spain. These patterns reflect general trends throughout the cell-based technology industry.

Appendix A emulates the direction of CBT’s approach – if one is to understand the cultured meat industry as part of a larger industry of cell-based technology, then it is important to consider how microbial engineering firms, as well as companies focused on inputs, are performing. There is adequate reason for considering the potential dynamics between inputs and microbial/tissue engineering. However, there also is a significant risk in going down this path; it may present more than there actually is, as there are no guarantees that inputs/microbial companies will function alongside cultured meat companies in a manner that actually sustains an “industry.” Furthermore, there is the issue of potentially overstating the presence of this industry. Take, for example, how the total investments

change between the full data and the specific tissue engineering set. Seventy-two companies have unidentifiable funding; 6 companies have known funding, but in the form of undisclosed seeds. In CBT's classificatory scheme, a further three companies are identified through their stock market indicators, as they are publicly traded companies;¹⁶ I will remove them from the following calculations because of the incompatibility with the rest of the investments. Consequently, the remaining 71 companies – if we were to add the investments identified by both CBT and GFI – have obtained \$3,825,373,000 in investment capital, mostly obtained through seed and series A-E funding, as of 2021.¹⁷ That is a substantial valuation, but much of it depends on CBT's inclusion of microbial engineering and input companies. If one focuses only on tissue engineering, the picture changes. Of the 84 identified tissue engineering companies, 48 do not have identifiable funding,¹⁸ and the total value of the known investments ranges from \$1,831,103,000 to \$2,557, 972, 000, taking into account discrepancies and conflicting information noted in appendix A.¹⁹ This figure is slightly larger than GFI's 2021 report (Cohen et al., 2022, p. 9), which likely stems from some of the discrepancies in investment reporting visible in the citations of appendix A, as well as some new funding which occurred around the time of the report's publication. These figures demonstrate the issues with utilizing CBT's approach; the inclusion of microbial and input companies presents a larger picture of invested capital – even with CBT's lack of data after September 2020 – so researchers should carefully consider what companies are or are not included in their assessments.

The rapid evolution of the cultured meat sector renders definitive conclusions ineffective; even in the time between different drafts of this chapter, a tremendous increase in funding occurred, and as subsequent sections will make clear, new developments arose. However, while these growing figures are impressive, it is still important to contextualize these developments. For example, Byrne (2021) notes that cultured meat accounts for only 14% of the overall alternative protein sector (p. 5), a sector which includes products which are actively being sold in grocery stores, fast food chains, and restaurants. Furthermore, these figures are still dependent on a smaller handful of companies for their impressiveness; JUST and UPSIDE play an essential role in the snapshot of cultured meat's investment landscape. Especially if cultured meat proponents plan on going against industrial meat production, the two billion plus dollars in investment capital noted in this dissertation will not be enough; more will have to be invested – with far more profit to be made – for such a notion to hold validity.

Investors

Between GFI and CBT, a total of 153 investors have been identified. This section – based on the data available in Appendix B – identifies these entities; the type of investor each entity is; their

¹⁶ Brooks Automation, Codexis, and Nissin Food Groups are the companies in question.

¹⁷ Seed funding is defined as the first stage of equity funding, or the first official round of investments in a company. Series A-E funding represents increasingly successful business stages; Series A assists in the implementation of business strategies, Series B assists with scaling, Series C with new product development, etc.

¹⁸ A further two companies have been removed due to their listing being constantly fluctuating stock market figures.

¹⁹ It should be noted that certain companies have multiple investment values linked to different sources; this approach has been taken to demonstrate the disparity of information and the timeframe for additional information.

geographic location; their portfolio, as is relevant to cultured meat; the number of investments rounds; and the sources of information. Unfortunately, CBT does not discuss the number of investments rounds, so data specifically from CBT will include “N/A” in appendix B. Furthermore, GFI made the decision, following its 2019 report, to no longer identify investors who participate in only one investment round, which came into effect with their 2020 report. The rationale is not given full justification, so it is unclear why this decision was made. Reasonable speculation may look at the increased investment in cultured meat seen throughout 2020, and posit that GFI may not have been able to keep track of all one-round investors. It is also possible that the increased investment came from a smaller group of investment firms, but such a conclusion does not align with the data surrounding new companies. Furthermore, GFI’s 2021 changed its analysis from “investment rounds” to “deal counts;” without the necessary clarity regarding the change in approach, the data in Appendix B is only relevant to 2020 to prevent potential issues in translation. Whatever the reasons for such changes may be, it does mean that this section is up-to-date only for investors who participated in two or more rounds of investment to 2020; the data for one-time investors is relevant only up to 2019. Appendix B is organized, in order of maximum to minimum, by the number of investment rounds.

Only 22 of these investors – at least, where data is available – have performed more than two rounds of investment.²⁰ Of the remaining 131, 26 have participated in two investment rounds; 74 have participated in one round of investment; and 31 do not have this information made available through CBT. Thirteen of these investors are identified as “accelerator/incubators,” which take on more specialized investment roles;²¹ 10 are what are known as “angels,” which is essentially investor terminology for individuals who substantially invest; two are identified as an “angel group,” a conglomeration of angel investors; three are considered “corporate venture capital,” functioning as the specific venture capital arm of a company; 17 are corporations; two are family offices; four are governments; one is a hedge fund; four are “impact investors,” identified as entities focussed on investment in disruptive, impactful enterprises; eight are various;²² two are “PE/buyout,” a form of private equity related to underperformance and debt-load; and the remaining 87 are venture capital firms without corporate affiliation. This data confirms the long-held notion that cultured meat is primarily being funded by venture capital. It can also be confirmed that most of this capital is flowing from the United States: 78 of the investors are located in the United States; ten are in Israel; eight are in Japan, and another eight are in the United Kingdom; seven are in Switzerland; six are in Germany; five are in Singapore; Hong Kong, China, the Netherlands, Australia, and Belgium each have three; Spain, France, Italy, and the United Arab Emirates each have two; and Argentina, Austria, Canada, India, Ireland, Norway, British Virgin Islands, and the Philippines all have one investor.

Unfortunately, because of the secretive nature of cultured meat production, this dissertation is unable to present a more specific analysis of the power dynamics at play with each investment round.

²⁰ Investment rounds refer to the number of times an investor makes investments into a company in relation to the “seed/series” funding dichotomy. For example, a seed round can be considered round 1, series A round 2, etc.

²¹ These investors are often involved with companies which have already had considerable investment success.

²² They can be identified in the “type” section with the following classifications: Investment Fund; Other; Private Conglomerate; Private Equity Firm; Private Investment Firm; Public-Private Fund; and University. Each has one investor each, except for “other,” which includes three.

For example, CPT Capital has participated in five funding rounds, and has contributed to a significant number of companies. However, what is unclear is how much it has invested, and how that investment is distributed; therefore, it is unknown whether it invested substantially in all of the companies in its portfolio, or if a certain number of companies received substantial funding, whilst the rest received only minimal investment. Guesses could be made, but in situations where a company has a considerable number of investors, the guesswork would be ineffective and inappropriate. What would emerge from this data is unclear, but it is worth noting that a complete picture of the investor/company relationship is not possible to obtain at this current juncture. Furthermore, the lack of information on 2020 one-time investors is unfortunate, and should be considered an area of future research that is needed.

However, at this stage, the number of investors – even when removing the companies specifically identified by CBT, and taking into consideration the limitations of the post-2019 lack of data – demonstrates that cultured meat will still require far more investment in order to be considered “competitive” with its competitors. The plant-based meat industry was valued at \$12.1 billion in 2020, with expectations that it will double by 2025 (Markets and Markets, 2020). Even plant-based is having difficulty being seen as truly “competitive” with “traditional” meat, so the likelihood of cultured meat coming close to being seen in such a light is slim, at least for the considerable future. Taking the following section into account solidifies this point further.

Prototypes, Production Facilities, Costs, and Hype

Cultured meat is being promoted on the promise of its capacity to potentially bring about revolutionary change. However, much of this promise hinges on secrecy; companies are closely guarding their production processes and developments, leaving the public to engage in guesswork as to whether promises of market introduction have any validity or not. This section attempts to provide a broad assessment of the claims surrounding “market introduction.” I want to stress, immediately, that this section is speculative, and cannot be accepted as “empirically verifiable.” This section works with limited information, and ends up presenting a complicated picture. Such an issue is inevitable when engaging with cultured meat, but it is important to stress this matter emphatically.

Appendix C identifies 84 tissue engineering companies from appendix A, and attempts to identify the following relevant matters: prototype status; the cost of each prototype, if cost is even discussed; the level of detailed explanation potentially available for the public; claims for market introduction; and additional information, which points to certain sources beyond GFI/CBT, and also notes whether companies are discussing production facilities. The prototype status section will identify what prototypes companies have created, or, at least, are alleging have been made. In the case that companies have spoken only in general detail, in which one can infer or assume that prototypes have been made – but discussion is not direct or explicit – a “(P)” will signify that a prototype can be presumed to exist, in some form, but no (or few) further details are available. The “detailed explanation” section uses the following classificatory scheme: RD (reasonably detailed), MD (moderately detailed), PD (poorly detailed), and N/A (not applicable). The criteria for this scheme are as follows: if a company can indicate a prototype’s existence, give a somewhat detailed account of its cost, and provide a reasonably detailed roadmap for market introduction, and does not contain considerable

contradictions in its public presentation, it can be viewed as RD. MD means that one of these criteria is unclear; often, that means a broad idea has been given for market introduction, but with major matters unaddressed. PD means that only broad explanations have been offered; information, in this instance, takes the form of promise and expectation, and is given precedence over what has actually come to fruition. PD will also be used to identify cases where unclear information can lead to issues of envisioning their product. N/A indicates that a company has provided too little to even make a claim regarding the quality of their information.

It is here where I need to be clear about the purpose of this classificatory scheme; I am looking at what information the consuming public could attain, in relation to these companies and their prospective products. Investors may have access to more information, and therefore, might classify much differently. However, investors are not the only factor at play when it comes to cultured meat; an ill-informed public may not take to cultured meat, or may expect too much too soon. It is important to see if the image being presented by proponents actually can match publicly available information. Furthermore, this section looks at prototypes – and not merely the promise of potential products – to provide a stronger sense of the difference which may, or may not, exist between perceived possibility and current actuality. When CEOs and companies are quoted as indicating that they may not be able to achieve the promises of cultured meat production (Fassler, 2021), it is important to gain some sense of where the companies are actually at with their production, and what implications these prototypes may have on an alleged “market introduction.”

Out of 84 companies, 29 have not commented on prototype status, making it unclear if their prototypes, behind closed doors, have been reasonably successful or not – three companies have indicated that they are currently developing their prototypes, and one has outright admitted to not having a prototype at this point. Furthermore, 36 companies are listed as having presumed prototypes; the companies have highlighted what general ambitions they have, and what they are working on, but information is not detailed enough to identify much about what they have actually produced. Presumably, investors have seen prototypes, but there is not enough information to back up such claims. A few of these companies have prototypes, or have announced their intentions to create prototypes, but it is unclear what these prototypes actually are, or if they are intended to be the area of focus for each company. The remaining 13 companies have provided reasonably clear statements about their prototypes. For the general public – if one assumes they are obtaining their information through company websites and news reports – the overall understanding they can obtain of the status of cultured meat’s production is inconsistent, based on considerable vagueness. There does seem to be some frustration amongst cultured meat proponents regarding prototype status; Stephens was recently quoted as saying “since Mark Post has made the first burger, no one has made the second” (Tatum, 2022b).

Most companies have not commented on prototype cost, regardless of whether they have identified what they are working on or not. Alife Foods has provided a cost without indicating whether it has produced a prototype of the cultured schnitzel that they imagine will cost €19.50 at some unidentified point. ANJY Foods has declared that its cultured Lion Burger will sell for \$900 each, despite the company currently searching for seed funding (“For Investors,” n.d.; “Lion Burger,” n.d.). In regards

to the companies that have identified costs for producing their prototypes, the figures range wildly, to the point where no definite conclusions can be made about the current cost of producing cultured meat. Eat JUST has indicated that its chicken-bite dishes are priced “at an unprofitable \$17” (“Lab-Grown Meat Start-Up, Eat Just...,” 2022). Smaller prototypes tend to be presented as having smaller costs, such as Aleph Farms’ 1-2 oz. steak costing \$50USD (CBT, n.d.); New Age Meats’ \$5 Sausage links (which, by the pound, cost \$23US) (Brodwin, 2018); Supermeat’s \$35 burger (“New IDTechEx Report...”, 2021); and Future Meat Technologies claiming it can produce a \$10US/lb cultured steak (the costs drop \$6US should the cultured meat be combined with plant-based) (Shieber, 2019), as well as \$4 per 100g of cultured chicken (“Nestlé Eyes Control...,” 2021) – the company is currently focusing on driving the costs of cultured meat, overall, below \$7.70US/lb, which sharply contrasts the \$36 per kg it claims was the cost earlier in 2021 (Shoup, 2021). The company has recently claimed it is now producing below \$16US/lb (“Charoen Pokphand Foods...,” 2022). JUST and UPSIDE Foods also provide examples at smaller costs; however, UPSIDE Foods, while claiming \$50 for a small piece of its cultured meatball in 2018 (Carrington, 2018), also claimed that its costs had slipped just under \$2400 per pound in 2018 (CB Insights, 2021), rendering a discrepancy in how its costs are discussed. Other companies provide disparate costs for their products. Besides Mosa Meats, whose prototype is so costly because it was the initial prototype, Wild Type claims a spicy salmon roll, of unclear size, costs \$200US (Lamb, 2019). HigherSteaks claims that its Pork Belly prototype, of unclear size, costs “thousands of pounds per kilogram” (Ho, 2020a). Ochakov Food Ingredients claims that its 40 gram meatloaf costs 900,000 rubles, or \$14,000US (Banis, 2019). Gourmey has noted that it is now producing cultured foie gras at “<\$1,180 per kilogram” (Gross, 2021). Shiok Meats claims that one kilogram of its cultured shrimp costs \$5000, but the company also hoped to reduce its cost to \$50 by the end of 2020 – there has been no update on this ambition (Reuters Staff, 2020). Meatable’s product – whatever exactly it may be – is currently running at \$10,000 a pound (“Bill Gates Asks...,” 2021). The criteria and rationale for these costs are presented through small quotes to media sources (or journalist claims), not through rigorous explanation or detailed studies, so it is unknown how many externalities are being accounted for in these claims. What is clear, however, is that costs are disparate at this juncture, and proponent claims – such as Aleph Farms’ notion that cultured meat will reach price parity with traditional meat before plant-based meat (Morrison, 2021b) – should be treated with substantial caution.

It is these costs that lead to an important point regarding this data. Only four companies – JUST, Meatech, UPSIDE Foods, and Mosa Meats – have attained an “MD” ranking in the criteria for detailed explanations. The remaining companies all rank as providing poor detail, or are listed under N/A. This ranking affects the ability to render definitive conclusions regarding the costs previously discussed. For example, Ochakov Food Ingredients made its announcement out of nowhere, with minimal detail regarding what actually composed the expenses. Similarly, Shiok Meats provides a smaller cost, but it is unclear what size its prototype is, and it is also unclear how the costs have been calculated. BlueNalu claims to have a Yellowtail Amberjack prototype, but provides no idea of the cost. BlueNalu also claims to get its biopsies from anesthetized fish (Kruse, 2021), but simultaneously claims to focus on the production of fish that cannot be farmed (Leeuwen, 2021), raising major questions about how the company actually plans to obtain its cell samples, especially in scale-up scenarios. JUST achieved its ranking because it provides an idea of the actual sellable product; furthermore, the company has been

of focus since Singapore announced its approval of their product, so there is greater scrutiny of the company available for the public. The company's market introduction claims also seem to correlate, in theory, to the prototype status, though the recent disparity in bioreactor prospects, stemming from Tetrick's quotes in comparison to recent deals struck by Eat JUST, indicate potential contradictions in JUST's future rhetoric. Mosa Meats, having been responsible for the initial prototype, has also been the subject of greater scrutiny, which has tended to reveal a bit more information than other companies. UPSIDE and Meatech, given their continued prevalence in investment and news-cycle stories, have also seen some more assessment from various sources, even if there are still many unanswered questions regarding what goes on behind the doors of their companies. For the most part, though, companies routinely fail to provide adequate information surrounding their products. As such, the public – should it wade into this field – will find claims of reduced production costs and innovation, but without much information to provide a solid sense of the shape and direction of the supposed “industry.”

Consequently, it is interesting that a number of the companies have provided claims for market introduction. Bluenalu's goals of second-half market introduction in 2021 (Saigol & Kewon, 2020) did not end up coming to fruition, nor did Cubiq Foods' ambition to launch a product by the end of 2021 (Poinski, 2021). Shiok Meats (n.d.), Aleph Farms (n.d.), Meatech (Green, 2021), and Future Meat Technologies (Shieber, 2019) claim market introduction will be possible by 2022, despite the PD ranking obtained in this scheme. Peace of Meat (Cleene, 2019), Ochakov Food Ingredients (Starostinetskaya, 2019), Gourmey (Gross, 2021), Avant (Vegconomist, 2019), and ArtMeat (n.d.) all claim that market introduction for their products could begin by 2023. Biotech Foods is indicating a 2024 launch window for the European market, which is often considered a difficult market for cultured meat at this time (Keteling, Kremers, & Boer, 2021; Lähteenmäki-Uutela et al., 2021). Meatable has claimed possible introduction by 2025 (Fernández, 2019). The claims of market introduction are difficult to reconcile with the debates surrounding scalability and the lack of global regulatory approval. Furthermore, missed deadlines of proposed product introduction are commonplace (Fassler, 2021); the data from appendix C does not point towards a sudden onslaught of product introductions. While Neo (2022b) has claimed that various cultured meat companies in China have introduced products, it is unclear if they are for sale, what the products are, and what companies have produced said products; at this time, it is fair to claim that market introduction continues to be an area of contradiction and ambiguity. The lack of a concretely identifiable product launch is lending considerable credence to the claims of dismissive critics. For example, Blythman (2021) posits that UPSIDE's failure to fulfill its promise of financial viability by 2021 may explain Bill Gates and Richard Branson “quitting” their investments; while there is no evidence of a direct link between these factors, the continual promises of market introduction are prone to becoming a liability for cultured meat advocates, especially at a time when UPSIDE claims it is no longer using an animal-based media serum, which is considered a major “biological breakthrough” (Watson, 2021a).

Furthermore, returning to the issue of production facilities, much debate remains about their possibilities; however, some companies have begun the process of facility development. Bluenalu is currently building a 3,700 square foot facility in San Diego (Ali, 2021c); Esco Aster, in collaboration with JUST, opened what they claim is the first cultured meat production facility in July of 2021, located in

Singapore (Tan, 2021c & 2021d) – this facility is planned to house a 6,000 litre bioreactor sometime between 2022 and 2023 (Lei, 2022); JUST also received funding for plans to develop a facility in Qatar, which contributed significantly to the overall presence of investment capital for cultured meat (Ali, 2021e); UPSIDE Foods has opened a 53,000 square foot plant in California (Roose, 2021); and Future Meat Technologies opened what they claim is the first cultured meat facility in June of 2021, supposedly capable of producing 500 kilos – or 5000 hamburgers – a day (Watson, 2021v). It should be noted that the facility is “a space no larger than a living room” (Degani, 2022). Aleph Farms (Morrison, 2020d), Avant Meats (Albrecht, 2021a), Cubiq Foods (Poinski, 2020), Finless Foods (Watson, 2021k), Integriculture (Watson, 2020f), Meatable (Watson, 2021i), Meatech (“MeaTech 3D Ltd. Meatech Announces...,” 2021), Mirai Foods AG (StartUp Ticker, 2021), Mission Barns (2021), Mosa Meats (Southey, 2020e), New Age Meats (Coyné, 2020a), Shiok Meats (Ferrer, 2020), and Wild Type (Peters, 2019), have all claimed that their next goal is to produce pilot prototype facilities for scaled-up production.²³ The disparities in how facilities are being discussed are best embodied by Connecticut governor Ned Lamont who, following an economic mission to Israel, claimed the facilities he saw are “fascinating... these production facilities are not manufacturing – this is lab-space” (MIL-OSI USA, 2022). JUST, Mosa Meats, and UPSIDE Foods have been involved in cultured meat production for a long time, and are the most important players in the current landscape of companies; the status of their production facilities is of little surprise. However, it is unclear how the others will hit their market introduction goals, not just because their funding is considerably less in comparison to JUST and UPSIDE Foods – an issue which takes on considerable weight when accounting for recent debates surrounding costs – but because many of these facilities are being developed in countries which have yet to give any regulatory approval to cultured meat, which may prove to be an issue for cultured meat’s market future, though the crossing of a sudden regulatory threshold could alter the situation. This discrepancy does not mean that companies are just building recklessly, as Singapore gave production facility approval after it approved the sale of JUST’s cultured chicken, but there is still a surprising level of risk being taken in the production of these facilities. For example, Eat Just’s announcement of plans to build ten 250,000 litre bioreactors, in collaboration with ABEC (Watson, 2022), raises major questions. For one, Fassler’s (2021) article has the company’s CEO claiming that 100,000 litre bioreactors are a no-go; what changed in between that time period is unclear. Furthermore, Tetrick is quoted as saying that, in order for the bioreactors to be online and producing between 2025-2026, “vessel size needs to be north of 200,000 liters, cell density needs to go up, and media costs need to be in the cents, not dollars;” the quote comes across as a risky gamble, which Tetrick admits by saying that “does that mean that I or my CTO or ABEC are 100% certain that this will work in a way that we want on a large scale? No, it definitely does not. But it means we think there is a high probability of success” (Watson, 2022). Given that GOOD Meat is yet to be producing with even a 6,000 liter bioreactor, such plans come across as excessively hopeful, especially in light of Humbird’s (2020) claims about bioreactor size. Also, it should be noted that this analysis does not account for facilities such as the Cultured Food Innovation Hub – founded by Givaudan, Bühler, and Migros – which are hybrid research and commercial institutions (“Givaudan, Bühler, and Migros Establish...,” 2021). Given their early-stage functionalities and unclear commercial

²³ It should be noted that Mosa Meats is currently expanding its facility; the functionality of its current facility, however, remains secretive.

structure and potential, these types of facilities deserve critical attention, but their contribution to the overall “picture” of cultured meat is unclear at this time.

Prototype statuses, as well as costs, do not lend particular validity to market introduction claims, and they especially do not lend themselves to the idea that cultured meat will be cost-competitive sooner, rather than later. More companies and proponents do seem to be accepting that price parity will take a considerably long time, but the degree of acceptance varies greatly. What needs to be addressed by proponents and advocates, if the public is to take the claims of a “coming cultured meat revolution” seriously, is reconciliation between company promises and what is actually occurring behind the scenes. As of now, there are too few known prototypes in existence to claim that the supposed “cultured meat industry” can even produce a wide-enough variety of products to sustain an industry in the current global food system, especially an industry that is not aiming to be completely specialized. The prototypes that are known are not discussed in enough detail to give the public an actual sense of what is forthcoming; furthermore, the costs of production vary so wildly that the public will not be able to trust claims about price parity and cost-competitiveness. The state of the industry comes across stronger when one looks at increases in rates of investment and the number of investors/companies in circulation, but when one probes deeper into the actual work of these companies, there is too little for one to make sound, informed claims about cultured meat – at least, beyond the notion that the cultured meat “industry” currently comes across as chaotic and confused. Cohen et al. (2022) have recently asserted that the “industry” is currently poised to transition from the “pilot scale” to the “demonstration scale,” which moves the industry from producing hundreds to thousands of metric tons – but not only are the market samples of the demonstration scale few and far between, the authors also use a single question mark to denote the transition to industrial production, which is a stark change in the usual optimism seen in GFI reports (p. 8). It is also interesting to note that the report theorizes that cultured meat companies could “launch skincare ingredients and other products en route to achieving food-appropriate scale and cost,” another potential indicator that the expectations of market introduction are not going to come to fruition as expected (Cohen et al., 2022, p. 26).

At this juncture, I posit that there is not a “cultured meat industry.” The activities of cultured meat producers are, at this time, not standardized, nor subject to standardized regulation. Recent public comments, reviewed by the USDA, lament that cultured meat is so nascent, and poorly understood, that regulation for mere labeling is premature (Watson, 2021m). The Animal Defense Legal Fund has argued that the USDA’s Food Safety Inspection Service “should wait until it gets a better understanding of the products and technology” before offering any insight on its potential nomenclature (Watson, 2021m). The current lack of any governmental regime for cultured meat regulation points to an issue with understanding cultured meat production as an “industry,” as the production activity itself is still hazy, with too many unanswered questions at play – there is a stark difference between factories the size of a living room and the size of a football field, pointing to prospects of a continued lack of standardized approaches or understandings. On the matter of a cultured meat market, at this time, no cultured meat products are being sold directly to consumers, with distribution based on samples offered at private establishments, and no profits are being made from these exchanges. So while a basic definition of establishment activity can be used to proclaim a “cultured meat industry,” slight qualifications can

immediately call into question this notion, adding more impetus to be cautious in using this terminology to understand cultured meat production at this stage. Different terminology will be introduced at the end of this chapter.

Missing Information and Data

Beyond the information that has been presented so far, it is important to note some information/data that cannot be addressed at all because of its mostly nonexistent nature. Most notably, information on government and university involvement with cultured meat production and research is, at best, inconsistent. Pajčin et al. (2022) have recently commented on the difficulties in obtaining information regarding cultured meat, noting that “a large portion of CM research is being conducted in privately funded companies, making any discovery a proprietary intellectual property, not available for re-use and improvement in the general scientific community” (p. 2). While this section focuses specifically on questions surrounding university research and government involvement, the impact of intellectual property on public/private sector relationships in the cultured meat context will be a necessary point of investigation over time.

In regards to university work, there has always been involvement from such institutions; Mark Post’s work in relation to Mosa Meat could not have occurred without the support of Maastricht University. However, it is currently difficult to quantify – or even qualify – the role of such institutions. Stephens et al. (2019) argue that there are numerous projects at the university level, both in relation to established companies and without such connections (p. 6). The authors also indicate that New Harvest and GFI are funding a set number of projects; while New Harvest has not provided its figures, GFI indicates that it has put forward over USD \$7 Million in grants through 38 grants, spread across thirteen countries (GFI, “Research Grants,” n.d.). A database is available, and does match GFI’s claims (GFI, “Research Funding Database,” n.d.). However, there is no notable, concerted effort to conglomerate information about the university level’s involvement in cultured meat research. Given the range of GFI’s grants – everything from cell-line maintenance to food-system transformation – this area of inquiry is in need of more detailed, robust research. How much is actually going into cultured meat research, what may come of this research, and what the relationship is between university research and companies, is in need of greater clarity. This dissertation is not the place to attempt an inquiry into this area, but at this time, it can be reasonably asserted that university work on cultured meat is an underdeveloped matter for those interested in cultured meat.

The relationship between government and cultured meat is also an issue; it is unclear how much government involvement there is in regards to cultured meat. Information is usually obtained through spotty references in, or to, news reports. For example, Stephens et al. refer to a \$300 million trade agreement among the Chinese government, Aleph Farms, SuperMeat, and Future Meat Technologies (Stephens et al., 2019, p. 6). However, it is unclear if this deal aligns with what is known about Temasek Holdings or not. Despite appendix B listing a mere four government investors, that does not mean that there is not more involvement ongoing; however, identifying this involvement is currently difficult. Some recent news stories are indicating a growing government interest in cultured meat, including Spain recently giving nearly 4 million euros to eight cultured meat companies (“The Meat Business

Driven...,” 2022); the Israel Innovation Authority rewarding \$18 Million USD investment in four innovative consortia, including one focused on cultured meat (Ben-David, 2022d); Biotech Foods receiving 2.7 million euros in “European aid” (“Brazilian Giant JBS...,” 2021); and a group of Tufts professors receiving \$10 million USD from the USDA (“USDA Grants...,” 2021). However, the identification of government activity surrounding cultured meat remains a difficult task.

As well, regulation of cultured meat is a facet in need of further work, but that is primarily because there is so little to discuss. Beyond the recent safety ruling by the Singapore government, the most well-known policy matter is the USDA/FDA joint agreement on cultured meat regulation. Put simply, the FDA will oversee cell collection, cell banks, and cell growth/differentiation. The USDA – specifically, its Food Safety and Inspection Services division – will oversee the production of products, meant for human consumption, derived from livestock and poultry (USDA, 2019). Food products not under USDA jurisdiction – such as game and food for animals – will be regulated by the FDA (FDA, 2020). However, the agreement does not “create binding, enforceable obligations against either Agency,” and the agreement also stipulates that there is a mutual agreement to – at some time – develop an actual standard operating procedure, as well as create joint principles for product labeling (FDA, 2019). As such, this governance is merely a basic stipulation of what will likely regulate what; it seems as if the FDA and USDA are awaiting more revelations on cultured meat before establishing what regulation the prospective product might face, especially beyond the usual standards that the FDA and USDA apply to all entities under their regulation. Japan has recently assembled a team, through its Health, Labour and Welfare Ministry, to investigate the health of cultured meat; so far, cultured meat is not considered meat under Japan’s Food Sanitation Laws, and it remains to be seen whether the team’s investigation will lead to any change in this perspective (“Health Ministry to Check Safety...,” 2022). The Netherlands has also taken a recent step towards cultured meat’s regulatory approval by legalizing cultured meat samples, though the move still does not assist in envisioning who will be the first to approve sales directly to consumers (Buxton, 2022c). However, such steps may still not translate into governmental support for cultured meat; for example, recent activity from the United Kingdom’s Committee on Climate Change, and their National Food Strategy, indicates that the government sees alternative proteins as a “complement” to industrial agriculture, instead of its opponent, calling into question whether government action would support cultured meat as a replacement of traditional meat, instead of as merely an aside (Woroniecka, 2022).

One other notable moment of government involvement with cultured meat came in 2018. The NEMO Science Museum, located in Amsterdam, was accused of making “an illegal purchase of illegal goods” after it purchased cell-cultured meat from JUST, with the aim of displaying it at an exhibit (Purdy, 2020, p. 58). However, here, the issue came down to the handling of biological materials and how they fit into concerns about novel foods; despite the concerns from proponents about this action, it is not inherently a ruling against cultured meat. And while cultured meat may also be greatly impacted by numerous proposed legislations surrounding how meat is labeled, plant-based and insect meats could also be affected.

Consequently, the specific governance of cultured meat is unclear, and, as such, I cannot definitively render a conclusion about the relationship between cultured meat and governance. The

general notion that cultured meat governance will be slow and arduous is a reasonable assertion, but not only is it too early in cultured meat's history to tell, there is just too little attention from governments to render this claim as more than theory. Governance is an ongoing issue for cultured meat research, but it is also too early to identify solid pathways for how to overcome this research gap. It does, however, make claims of "industry" difficult to verify, when most governments seem to be ignoring cultured meat at this stage.

Concluding Remarks

There is validity to the idea of cultured meat being a "performative industry." Headlines of looming product launches have been a mainstay in media discourse for years; farm associations have grown quite concerned at the prospects of cultured meat; and, generally, cultured meat seems to be more on the public mind than ever before. When one looks at company websites, and even the information obtained from CBT and GFI for this chapter, Mouat et al.'s claims are certainly valid. There is no denying that the prospects of cultured meat, going from 2002-2022, have changed significantly; it is too early to completely discredit the work of companies and proponents. That earliness, however, also necessitates being more careful in regards to the claims about the current status of cultured meat.

Consequently, I argue that the data presented in this section goes slightly farther than Mouat et al.'s theory; ultimately, I posit that there is not a cultured meat industry, at this juncture, performative or otherwise. Advocates and companies are certainly performing, but it is too early to determine whether these performative efforts have been effective, beyond the investor level at least. The disparity between CBT and GFI marks a potential rift in the "performativity" of cultured meat's proponents; the efforts of the two entities actually reveal more about the limited state of cultured meat production at this time. CBT's inclusion of input and microbial companies makes for an impressive presentation, but that performativity comes undone once individuals begin to inquire about the relevancy of the connections between these enterprises. GFI may argue that 2019, 2020, and 2021 were "fruitful years" for cultured meat production – which, relatively speaking, they were – but the figures from its own data reveal that far more investment is needed to make cultured meat competitive (Crosser, 2020, p. 5; Byrne, 2021; Cohen et al., 2022). Companies are making claims about their market introduction, but a simple assessment of their prototypes and costs renders these claims contentious immediately. Furthermore, when placed against the backdrop of questions surrounding the costs and scalability of the industry – which will be assessed in greater detail in the next chapter – the validity of these claims comes under further scrutiny.

Mouat et al. do not necessarily identify to whom this performativity is directed, which is an essential point. As much as companies and proponents may be performing, that performativity does not necessarily do much for those who are wary of claims surrounding cultured meat. If the claims of advocates are accepted by academic and media figures alike, as well as the general public, then the performativity has been effective; if the claims are not accepted, then the performativity should be considered questionable. At this juncture, the performativity of the industry cannot be readily identified through quantitative methods, which the literature and media review will reiterate. While the

framework provided by Mouat et al. is important, the assemblage of actors and material is still too disparate and unknown to provide evidence of a truly effective performative industry.

As well, in stating that “there is no animal-free industry” at this time, Mouat, Prince, and Roche (2018) point to a concerning matter (p. 147-148). There is still so little known about cultured meat production, and so many contradictory notions of its future, that I find the terminology of “performative industry” to still not put to words the ambiguities of cultured meat as effectively as necessary. This notion was recently reiterated by Stephens – a prominent researcher in the field – who posits that “it would look almost embarrassing if all countries in the world went out and legalized cultured meat... because people aren’t ready to sell it” (Kleeman, 2022). Wurgaft, who has written prominent popular literature on cultured meat, recently claimed that “newspaper articles... may give you the impression that there is already a lab-grown chicken industry... but this is slightly misleading” (“A Writer and Historian’s...,” 2022). Consequently, I argue that there is no cultured meat industry, but instead, an ongoing cultured meat experiment. Companies of various stripes and foundation are still figuring out the ins-and-outs of small-scale production, with ambitions of large-scale production that are shrouded in darkness stemming from the completely unprecedented scale and scope of their activities. The market of cultured meat is more unclear than ever, a compilation of non-profitable taste-testings, unclear prospects as to the success of its most important product-standard (structured meat), and the volleying around of high-end restaurants as a starting point, a far-cry from the promises of imminent grocery store introduction and sales. Until a day is reached that cultured meat producers can say, with assuredness, what types of products will actually be sold – and to whom they will be sold – I argue that a more productive and fruitful terminology is needed to limit the confusion surrounding where cultured meat currently stands. Experiment is a reasonable term; it allows for the recognition of producers attempting to create a profitable production model, but makes clear that there are considerable barriers to cross before producers can safely declare success for their “industry.”

This argument may prove completely fruitless in the near future; depending on upcoming revelations from companies and investors, it is possible that more prototypes are introduced, more information is provided, and the claims of potential market introduction end up validated. Based on the limited information available, such a transformation seems unlikely, but certainly not impossible. However, this argument requires more in order to capture all elements; consequently, the literature and media review will play a key role in expanding this argument.

Chapter 3: Cultured Meat, in Literature and Media

Introduction

In the previous chapter of this dissertation, the notion of “the cultured meat industry” was challenged; while definitive statements about cultured meat are difficult to make at this time, data on the companies, investments, investors, prototypes, and costs of production indicate that the notion of an “industry,” as traditionally understood, is not strongly identifiable at this current juncture. However, the “story” of cultured meat goes beyond the composition of its material and economic foundation; the narrative of cultured meat arose before many companies were founded, consequently requiring a review of the discourse surrounding cultured meat. This chapter will put forward a thematic review of the academic literature and media discourse in order to situate the current study in the broader literature. This chapter responds to research question #2: what themes can be identified throughout the cultured meat discourse and literature, and what role have these themes played in the legitimization of cultured meat as a prospective product?

This review reveals three overarching matters which need to be considered in the context of cultured meat discourse. First, the literature currently comes across as idiosyncratic, likely due to the emergent nature of cultured meat and surrounding research, which does not allow – at least, to a degree – connections to larger literatures and debates. Much of the literature, so far, takes on a descriptive nature, instead of an analytical one, reinforcing the need for a review which attempts to provide a clear idea of what literature not only guides this dissertation, but has been especially relevant to cultured meat discourse so far. Second, the secretive nature of cultured meat production, combined with the overall speculative possibilities, renders analysis prone to over-speculation with under-developed empirical and quantitative reinforcement. Such an issue can lead to notions of questionable validity, which will require evaluation. Third, despite the way that the literature and media discourse have unfolded so far, some key areas of focus are identifiable; however, whether these areas are enough to validate the promises of cultured meat proponents is a matter which must be considered carefully. This review will argue that, not only are there foundational promises which are not validated by the literature, there are also numerous aspects both about, and related to, cultured meat – matters which are important in establishing the theoretical validity of cultured meat – that have yet to be addressed, let alone fully investigated. Given the promises of supposed market introduction in the near future, especially as some companies begin constructing factories for scaling purposes, this current historical juncture is an essential time for such a review, allowing for a critical reflection on material and immaterial matters.

For the purposes of this review, I have read and reviewed 209 academic articles, six books, five reports, and three chapters, all published between 2002-2022. In terms of media publications, over 1000 articles, published between 2005-2022, were consulted for the purposes of this review.²⁴ This

²⁴ The media publications were primarily obtained from the Dow Jones Factiva Database, using “cultured meat” as the search term, as well as through the searches utilized in Chapter 2. Cultured meat was used as the search term as it has been the primary label for this product for most of its history; though early discussion did use “lab-grown” and “in-vitro,” by the time of the first prototype unveiling, cultured meat was a term used by proponents and academics which, by extension, was reflected in media publications. Though proponents have pushed other terms,

review cannot be considered absolutely definitive, as only a few purely scientific papers were assessed; however, the number of sources has allowed me to establish general trends in the discourse writ large. In order to assess these sources, I am approaching this review using a thematic lens. The purpose of this review will be achieved by reviewing prominent themes in the literature, as well as the identification of underlying, or missing, themes of relevance. The use of themes will allow for general insight into the ideas which guide current discourse. Under each general theme, when relevant, “sub-themes” will be identified; while all of these themes are relevant to the discourse, some themes can fit under an umbrella theme, and will be identified as such.

These themes have been identified through a qualitative reading in place of a more quantitative coding system. The qualitative reading involved note-taking and observation to determine common, recurring ideas which compose various themes. When it comes to understanding the decision to pursue a qualitative reading, publications can sometimes convey numerous themes in ways which are not always easy to determine without qualitative assessment. For example, a 2021 article, “Comedic Trio on Rough World Trip,” is too difficult to quantifiably identify as a piece which engages with both the themes identified in this chapter, and the narrative of reinforcement identified in Chapter 6. Phrases such as “I don’t want to go vegan or stop flying”, on their own, are more difficult to connect to the themes without a qualitative judgment which juxtaposes this quote with a follow-up explanation from the author that one of the trio was able to “stuff his face” with cultured meat. Cultured meat is mentioned in surprising places and ways, which is why I elected for a more straightforward approach of reading, then determining the identifiable themes, rather than attempting a system of coding, keyword recognition, etc., that may not have captured certain nuances.

The (Potential) Benefits of Cultured Meat

Edelmann et al.’s (2005) publication – discussed in detail in the previous chapter – has left a lasting impact on cultured meat discourse. The paper established the theoretical possibilities of a number of benefits, specifically: the reduction of zoonotic diseases; the possibility of creating more nutritious meat; and the reduction of resource use. Each potential benefit has been subject to various degrees of attention throughout the literature, as well as media discourse, so far. For example, there has yet to be a concentrated effort to establish the possibilities of nutritional improvement, so the matter is commonly mentioned, only in passing, as a “possibility.” The reduction of zoonotic disease spread has seen more attention, but often in the form of a presumed likelihood, the logic being that meat produced in a sterilized lab, under complete human control and guidance, would inevitably reduce zoonotic

such as “clean meat” and “cultivated meat,” these are much more recent terms that are not as commonly used in international, and speciality, media sources; for example, farm journals have adopted the use of cultured meat, whereas cultivated meat is not commonly used by these sources. As well, following the emergence of “cultivated meat” as a more popular term in certain sources, I did compare media publications for “cultured” and “cultivated” from January – June 2022; there was no significant difference in the themes which will be of focus in this assessment. A few articles were also acquired through preliminary searches using Proquest; these searches occurred at the beginning of 2018. The articles, books, and chapters were found using the University of Waterloo PRIMO search system, as well as inquiries through Google.

disease spread to a considerable degree. This matter has been reinforced in the literature, but actual studies on such possibilities are not found with reasonable ease.

Environmental Benefits

The possibilities for reduced resource use are constantly emphasized throughout the entirety of the discourse, and have more clearly identifiable points of origin than other alleged benefits of cultured meat stressed in the literature. While Edelman et al. established such a possibility in 2005, it was Tuomisto and de Mattos who began the process of assessing such a possibility in 2011. The authors used a Life-Cycle Analysis (LCA), based on the principles of ISO 14000, to investigate theoretical large-scale production systems for cultured meat in Thailand, California, and Spain (Tuomisto & de Mattos, 2011, p. 6117). Because the paper is a LCA, the theoretical aspects must be stressed; the 2013 prototype had not yet been unveiled, so the process of cultured meat production was still completely behind laboratory doors, with the ambition of scaled production considered, at the time, a distant ambition instead of a distinct possibility. Any paper like this one would inevitably have to engage with cultured meat on a purely theoretical, speculative level. For example, the authors assumed that stem-cell production could be excluded from the assessment (Tuomisto and Mattos, 2011, p. 6117-6119), a decision which goes unjustified. Furthermore, the LCA included both renewable and non-renewable energy sources; while this approach is still seen in Sinke and Odegard's (2021) LCA, it has been challenged for its validity by Humbird (2020) and Mattick et al. (2015). As well, the LCA assumed that 80% of the water at a cultured meat production facility could be recycled without treatment, an assumption based on a certain theoretical model that cannot be confirmed to reflect the "realities" of producing cultured meat; Humbird (2020) notes that only a small amount of water ends up in cultured meat, with the rest being wastewater that producers and researchers are still unsure how to address in a sustainable manner (p. 68-69). Most importantly, the paper assumed that a cyanobacteria (blue-green algae) medium would be used, which has not yet proven true (Tuomisto and Mattos, 2011, p. 6117-6119). Despite the theoretical nature of the subject, the approach, and the results, the authors concluded:

In comparison to conventionally produced European meat, cultured meat involves approximately 7-45% lower energy use (only poultry has lower energy use), 78-96% lower GHG emissions, 99% lower land use, and 82-96% lower water use depending on the product compared. Despite high uncertainty, it is concluded that the overall environmental impacts of cultured meat production are substantially lower than those of conventionally produced meat (Tuomisto and Mattos, 2011, p. 6117).

I have included their conclusion, verbatim, because it has been oft-quoted throughout the cultured meat discourse. The notion that cultured meat will be "sustainable" can be traced to this paper, and it must be stressed that such a notion has had a domino effect. For example, Schaefer and Savulescu (2014) link environmental and ethical assessments together by citing Tuomisto and Mattos's conclusions – without reference to the theoretical element of their work (p. 190) – which contributes to the notion that cultured meat is not only ethically permissible, but worth promoting, "especially" for ethical vegetarians (p. 188). While the literature which counters the supposed benefits will be identified in subsequent sections, the relationship between Tuomisto/Mattos's and Schaefer/Savulescu's work is but

one example of how the LCA's conclusions have permeated the general discourse, providing a theme for many works, as well as considerable media discussion. It should also be noted that their conclusions have also been long-standing, only recently reiterated in Sinke and Odegard's (2021) assessment, which repeats the need for sustainable energy in order to ensure that cultured meat has a lower environmental impact than traditional meat products (p. 3).

Ethical Relief and Animal Welfare

Another prominent, but supposed, benefit of cultured meat is the potential to provide relief in the face of the myriad of ethical issues stemming from meat consumption, especially of the industrial variety. This matter, which is also a key promotional selling point for many companies, can be identified as having emerged from Hopkins and Dacey's 2008 work. Prior to both the 2013 prototype revealing, and Tuomisto/Mattos's 2011 publication, Hopkins and Dacey (2008) argue that cultured meat is not just an "intriguing development," but that there is a potential "moral obligation" to develop cultured meat further (p. 579). Surveying a wide range of potential concerns – such as authenticity, naturalness, "realness," moral change and cowardice, various forms of existence animals embody, and the impacts of objectification – the authors ultimately conclude that "all" cultured meat impacts is the "need" to kill animals for food. All considerations beyond the killing of an animal for food, such as intrinsic value and animal experience/existence, could be dealt with in various contexts outside of the considerations of food. The authors went as far as to say that the "only" objection to cultured meat, morally, would be from individuals/groups who believe that human beings have a moral obligation to kill animals for food – such groups, the authors claim, do not exist outside of a few interpretations of religious views (Hopkins and Dacey, 2008, p. 591).

Despite the range of matters the paper covers, there is a narrow focus – moral matters are considered only in relation to the killing of the animal for food, with other matters discarded if they are not part of this narrow focus. However, this notion has permeated the discourse writ-large, and in various forms. One form is the acceptance of Hopkins and Dacey's assumptions – Schlottman and Sebo's (2019) book reiterates many of the points made by Hopkins and Dacey, while also accepting the general notion that the main consideration is that of the animal being killed for food. Another form is the continuation of the "moral obligation" to produce cultured meat, prominently seen in Galusky's (2014) paper, which argues that cultured meat is a technologically necessary way to exercise responsibility towards humans and nature (p. 939-944).

Furthermore, the process of producing cultured meat tends to lead to the ethical benefits being accepted *prima facie* throughout the media and literature. Many descriptive²⁵ papers reiterate the idea of cultured meat being ethically sound, even without reference to the papers discussed in this section. However, while there is literature which stands in contradiction to the idea of "ethical benefits," there is still a noticeable theme of positivity surrounding the ethical possibilities of cultured meat; Jairath et al.

²⁵ I will note that "descriptive" here refers to a substantial subset of papers which focus on summarizing cultured meat's prospects and issues. These papers defy the thematic analysis, as they are overviews of cultured meat, covering considerable ground without a specific methodological approach or disciplinary background being required for their functionality.

(2021), Ruzgys and Pickering (2020), and Bryant (2020) are a few examples of this positive interpretation in practice, often declaring cultured meat to be ethical from the outset, as well as in the conclusions, of their work. Furthermore, this belief in the ethical possibility is not just a discursive point of interest; it is often used as a promotional claim by many companies.

Market Efficiency and Expansion

Another aspect of the “benefits” theme relates to markets, efficiency, and expansion. Though there has yet to be a distinct study on cultured meat’s potential impact in relation to these fields, a number of descriptive works claim that cultured meat might be not only more economically efficient than traditional meat, because of the nature of its production and the required resources, but also might allow for the expansion of the meat market through the introduction of meats currently not produced by the industrial system. Such possibilities could, in theory, expand investment opportunities. The notions of market expansion and efficiency improvements became more prominent throughout 2020, as VOW Foods, during the promotion of its kangaroo meat prototypes, also announced another project, in which it would create a “Noah’s Ark” of cells from as wide a variety of animals as possible. VOW has stressed that “less than 1%” of natural animal life has been domesticated, meaning that its project – if successful – could introduce meat from the remaining 99.6% of undomesticated animals to the food system (Fortune, 2019).

Whether or not any of these impacts are actually possible is yet to be addressed in any academic literature; the possibilities are often mentioned as a potential benefit, but with no real efforts to actually model such impacts, the notion should be considered as part of the “hype” of cultured meat, instead of an actual reality. Yet this theme is becoming prominent in the discourse, especially in media publications which have covered VOW (Harvey, 2019c; Cherney, 2019). Academic literature on cultured meat is also perpetuating this idea, and often separates it from the idea of “more nutritional” meat; market expansion opportunities are not framed through the perspective of contributions to health and sustainability, but as investment opportunities. This framing allows for simultaneous images to emerge; either completely new meat from animals yet to be tasted (on a large-scale), or meat that has been improved nutritionally and sustainably (Penn, 2018, p. 113-115; Bhat, Kumar, and Fayaz, 2015, p. 242-243; Schneider, 2013, p. 1005). This aspect of the “benefits” theme may play more of a role as the discourse on cultured meat continues to grow, but at this stage, it should be noted as an emergent benefit which is linked more directly to economic performance, especially in comparison to matters of resource use and ethical relief.

The (Potential) Pitfalls of Cultured Meat

Environmental Issues

For the most part, the potential environmental benefits of cultured meat have been accepted at face-value throughout the discourse, creating a general theme that anyone new to the field would likely identify quickly. However, the 2011 LCA is not the only work on cultured meat’s environmental possibilities. Mattick, along with colleagues, in response to the 2011 LCA, authored three papers which present cultured meat’s environmental impacts in a negative light. The most notable paper utilized a

Life-Cycle Inventory Analysis (LCIA) to assess cultured meat (Mattick et al., 2015, pp. 11941-11949). While a LCIA is different from a LCA, both papers rest on entirely theoretical scenarios and mostly theoretical assumptions. However, under the LCIA, cultured meat would use three times the energy of the 2011 LCA – because of basal media and cleaning processes – and would use 20 times as much land due to feedstock and additional inputs (Mattick et al., 2015, p. 11945). The discrepancy between these results became more prominent in subsequent years, when Lynch and Pierrehumbert (2019) put forward their own theoretical model; the authors posited that the environmental benefits are felt only initially, but in the long-term, because of carbon emissions from production and inputs, the environmental impact of cultured meat overtakes industrial meat production because of the timeframe of methane emissions (p. 1-11). The authors even posit that, in comparison to smaller systems, cultured meat still emits more in certain scenarios, providing a much narrower window for cultured meat to make an environmental impact that could be considered “positive” (Lynch and Pierrehumbert, 2019, p. 1-19). The claims being made by Mattick and Lynch/Pierrehumbert are in keeping with recent revelations that Tuomisto has chosen not to publish a paper which would show the electricity use being four times higher than the 2011 LCA (Purdy, 2020, p. 46).

Once again, the speculative nature of cultured meat must be taken into account; no author can claim “true” accuracy so long as production facilities remain unbuilt, and prototypes remain subject to change. Nevertheless, despite much of the discourse presenting the alleged positive environmental impacts as not only possible, but even as a given, it is clear that such conclusions are not universally held. Especially since Lynch and Pierrehumbert’s paper, more media and academic sources are making reference to a “debate” about the potential negative impacts cultured meat may, or may not, have on the environment (Reuters, 2019; Chowdhury, 2019; Ganesan, 2019); however, this theme is still not present to the same degree as its positive counterpart. What is clear, though, is that the environmental benefits can be questioned to a significant degree, raising concerns as to whether cultured meat can legitimately be considered “sustainable” or not. Yet, because of the current environmental impacts of industrial meat production, an underlying message can be detected throughout the discourse, in which it is accepted that cultured meat may be harmful, but could not be as harmful as current practices – whether such an assumption will hold under increased scrutiny is something that will be revealed only with time and increased research.

These concerns have recently been reflected by Escobar et al. (2021), who compare the available LCAs and LCIAs to conclude that “the lack of real data related to cultured meat decreased [*sic*] the level of accuracy of each study. The missing environmental profile of the process itself, including the proliferation and differentiation phases in bioreactors, along with key ingredients such as growth factors and other recombinant proteins, increase the difficulty of achieving reliable conclusions” (p. 1). The authors demonstrate that important details were not considered in these assessments, including the impacts of cell collection (p. 6), the replacement of multifunctionality in moving from traditional to cultured systems of production (p. 12), the impacts of various concentrations of growth factors (p. 17), and the potential impacts of antibiotic presence in cultured meat production (p. 17). While the authors make clear that existing studies have had to rely on assumptions and literature, due to the lack of access to empirical data, it is clear that environmental claims cannot be made with certainty (Escobar et al.,

2021, p. 20). The presence of antibiotics is also a considerable point of concern, due to the difficulties in growing large numbers of cells without antibiotics (Lee et al., 2022, p. 9).

Production Costs and Scalability

Edelmann et al. (2005) identified production costs as the biggest issue facing cultured meat (p. 661), and while there is certainly a growing proliferation of funding for the prospective product, the matter of costs has always been presented as an issue in the discourse writ large (Humbird, 2020; O’Neill, 2020; Balasubramanian et al., 2021; Datar and Betti, 2010).²⁶ A variety of academic and media sources have reiterated the concerns about how much cultured meat will cost – both to produce and consume – and whether current modes of production can be scaled to not only match the current industrial system of production, but possibly even overcome such a system. Post (2012) posed the question “what after in vitro meat can be grown successfully,”²⁷ and answered by identifying scaling-up, quality control, sterility, contamination prevention, and breeding control as the key issues which could “likely” be solved (p. 300). As the subsequent section will demonstrate, these matters cannot yet be considered “solved.”

Prior to 2020, there was no identifiable effort to model what a scaled-up system of cultured production might become, despite the considerable attention the subject received in the discourse overall. Recent publications have sought to reverse this trend. For example, Risner et al. (2021) attempt to establish what a cultured meat factory might look like, and whether such a model could be scaled. The study relies on a wide variety of assumptions, likely with many that could be challenged. Nevertheless, its conclusions should be considered. In their model of 67 variables, which are presented as common components of conventional cellular biology and chemical engineering processes, the authors estimate that a single, 20m³ bioreactor runs at a capital cost of USD \$778,000 (Risner et al., 2021, p. 7). After analysing four scenarios with various degrees of resolution to overbearing technical challenges, the authors conclude – I quote verbatim to maintain their technical terminology – “the results of our calculations indicate that ACBM production will only approach economic viability as a commodity when the significant technical challenges are overcome... The cost of the bioreactor was the main driver of capital costs in the model. To displace the demand for beef in the US by 1%, the scenarios ranged from requiring the deployment of 5205-50 bioreactors (20m³) at a total capital cost of USD 4 billion to USD 37 million” (Risner et al., 2021, p. 9). Media costs would have to be reduced, in the model, from 376.80 USD/L to 0.24 USD/L, and cell maturation time would need to drastically decrease as well (Risner et al., 2021, p.9). The authors also posit that an alternative type of bioreactor could cut these costs significantly, but such a bioreactor has yet to be created (Risner et al., 2021, p. 10). The study is wide-ranging, but cannot cover every variable which likely springs to mind.

Outside of the Risner et al. (2021) piece, an article by Fassler (2021) received considerable attention for its summation of two disparate reports on cultured meat scalability. Both have already

²⁶ It should be noted that these citations are a small sampling of papers which call the matter of cost to attention – the matter has been of such wide consideration that readers are likely to come across discussion of economic feasibility in a wide variety of media and academic publications.

²⁷ Post’s quote here refers to proof-of-concept.

been cited in the previous chapter – Humbird (2020; 2021) and Vergeer, Sinke, and Odegard (2021) – but a succinct summation of the disparities between the two papers is necessary. Humbird’s (2020) conclusions do not align with the idea of cultured meat being “scalable;” using a techno-economic analysis (TEA), the assessment concludes that “the overall cost of production for a perfusion-based cell cultured process is \$51/kg” (p. 61). This conclusion is problematized because of a limited range of possibilities for cost reduction, especially because capital costs contribute to almost 50% of the total production costs (Humbird, 2020, p. 61). While a fed-batch process using hydrolysate could be brought under \$25/kg, Humbird (2020) asserts that the perfusion process cannot be brought to this price point (p. 66). Furthermore, cultured meat demands productive processes which have yet to be seen at any global scale; Humbird (2020) goes so far as to claim that “it is difficult to reconcile even basic concepts of industrial bioprocess design with known characteristics of animal cell culture today” (p. 4). Growth rates, bioreactor size, cell density, catabolite inhibition, high-quality media availability, aseptic operation capital costs, metabolic engineering and value propositions, and inconsistent projections are all presented as major potential barriers to cultured meat production being a scalable process (Humbird, 2020, p. 4-11).

In contrast to the dire picture painted by Humbird, CE Delft published its own TEA, compiled by Vergeer, Sinke, and Odegard (2021), with more positive prospects. “Substantial cost reductions that bring [cultured meat] production costs close to the benchmark are feasible” (Vergeer, Sinke, and Odegard, 2021, p. 3). However, such wording should not be taken out of context; current costs are, in terms of order of magnitude, 100 to 10,000 times higher than current traditional meat benchmarks, and future reductions will be determined through major decreased costs of production, medium ingredients, and perfusion reactors, as well as lower requirements for investment returns than common in “commercially motivated investments” (Vergeer, Sinke, and Odegard, 2021, p. 3). Improved production processes and varied choices in cell types are also cited as being important for reducing costs and scaling up (Vergeer, Sinke, and Odegard, 2021, p. 3). Reduced growth factor costs make a considerable impact, rendering cultured meat at \$15/kg, which is noted as still being far from the \$2/kg of comparable meat products (Vergeer, Sinke, and Odegard, 2021, p. 16). The adoption of “social investment criteria,” instead of “commercial investment criteria,” pushes cultured meat below the \$10/kg threshold (Vergeer, Sinke, and Odegard, 2021, p. 17). Maximizing cell density and creating more efficient production processes bring cultured meat closer to \$5.50/kg, which Vergeer, Sinke, and Odegard (2021) claims is “the same order of magnitude” as traditional benchmark values, but notes that “there are no clear candidates for further substantial cost reduction” (p. 28).

As Fassler (2021) argues, even favorable reports on cultured meat production present the process as economically unfeasible. It is difficult to reconcile the scale of difference between Humbird (2020) and Vergeer, Sinke, and Odegard (2021); two different TEA’s have essentially presented cultured meat as either possible from a productive standpoint, or as a gamble with biotechnology on a never-before-seen scale. Both, however, present cultured meat as being incapable of reaching economic competitiveness with traditional meat; while Fassler (2021) quotes Isha Datar as saying that it is unfair to compare such price points at this juncture, Fassler also quotes Josh Tetrack as acknowledging that cultured meat production may not be possible at the desired scales, even if JUST’s investors want

results. Fassler (2021) further notes issues with CE Delft's approach; there is no explanation for how to alter the investment criteria from commercial to social, and certain medium costs are based on e-commerce prices not suitable for cultured meat production. I argue that there is a further issue with CE Delft's (2021) approach; not only do they not engage with Humbird's previously published report at all, but their LCA (Sinke and Odegard, 2021) also explicitly removes engagement with Lynch and Pierrehumbert's (2019) environmental claims (p. 36), demonstrating a perceivable unwillingness to engage with more extreme assessments. While the authors claim that the lack of inclusion stems from methodological differences, some form of commentary would have been helpful in overcoming such perceptions of potential bias. In fairness to CE Delft, they do contrast their analysis with Humbird's and note that their information has been provided by companies, whereas Humbird's relies on publicly available data; however, concerns about the transparency of the industry are not eliminated because of this revelation, and it is unclear what measures CE Delft took to ensure the data they received was accurate (Tatum, 2022b).

To date, it is difficult to get a sense of just how costly cultured meat will be for consumers, as well as producers, and the issue is further compounded by the unknown variable of scalability. The recent revelations of Risner et al. (2021), Humbird (2020; 2021), and CE Delft's two reports (Vergeer, Sinke, and Odegard, 2021; Sinke and Odegard, 2021) demonstrate the urgent need for greater dialogue on cultured meat scalability, as well as the need for further studies. Scalability is a foundational issue, but the lack of varied work on the topic renders speculation as the only mode available to engage with what will, likely, be the make-or-break issue for cultured meat's potential market introduction.

Ethical Quandaries and Framing

Like the environmental aspects, the ethical elements of cultured meat have often been accepted, in the descriptive literature, at face value; however, there is literature which presents the ethical matters in a different light. Dilworth and McGregor (2015) published an overview of common narratives in media coverage and academic literature, which doubled as a meditation on how ethical matters are framed; the authors concluded that techno-skepticism, animal liberation, and socio-ecological harmony did not maintain the same presence in the ethical discourse as environmental sustainability and animal welfare (p. 102). As a result, the authors identify a simultaneous acceptance of cultured meat as a solution to sustainability and welfare challenges, as well as an anthropocentric rejection – or, at least, anxiousness – surrounding matters of “unnaturalness” and “undesirability” (Dilworth and McGregor, 2015, p. 102). While certain changes are ongoing, in the general discourse, their conclusions are still prominent (Schlottman and Sebo, 2019; Schaefer and Savulescu, 2014; Weele and Driessen, 2019; Galsuky, 2014); however, through Dilworth and McGregor's (2015) identification of potential discourses surrounding the diversity of ethical issues related to cultured meat, Hopkins and Dacey's (2008) notion that the range of ethical considerations is “limited” comes under scrutiny.

For example, Dilworth and McGregor's notions were reinforced by Leroy and Praet (2017), who argue that postdomestic meat consumption raises a “new moral polemic” (p. 67), which creates the impetus for new “meat narratives” to calm what will be a market disrupted by a range of moral considerations (p. 82-83). Though cultured meat is only part of their assessment, the authors posit that

it might reinforce – if not expand – anthropocentric instrumental valuation at a symbolic level; furthermore, it is possible that cultured meat could even perpetuate “carnivoracity” in a postmodern manner (Leroy and Praet, 2017, p. 81). These matters indicate that Hopkins and Dacey’s (2008) claim – in which the “only” objection would come from those who believe in a “moral obligation” to kill animals – is not particularly well-developed, as even the market level may be affected by moral narratives. Another interpretation of the ethical debates came from Alvaro (2019), who argues that cultured meat narratives depend on consequentialist and deontological frameworks to maintain legitimacy. Alvaro (2019) distinguishes between the two as a difference of “doing the right thing for the right reason,” arguing that consequentialists support cultured meat if it leads to the promotion of maximum utility, whereas deontologists support cultured meat’s promotion of maximum utility “for the right reasons” (p. 131). In raising concerns with such approaches, Alvaro (2019) evaluates cultured meat from a virtue-oriented ethical framework, arguing that cultured meat is arising from self-indulgence, which is not viewed – in the framework applied in the paper – as a characteristic of virtue (p. 138). Whether one agrees with Alvaro’s approach, or finds it effective, is not of particular importance. What is important to note is the different results stemming from different applied frameworks; it is difficult to envision Hopkins and Dacey’s (2008) claim always holding under each possible differentiated framework.

The most vocal author on cultured meat and ethical issues is Poirier, a CAS scholar who has led three papers on the topic. In the first of these papers (Poirier, 2018a), he argues that proponent claims of cultured meat being more “effective” than dietary change are likely based on socio-cultural norms and value judgments, rather than pragmatic assessment (p. 3). In another paper, Poirier posits that cultured meat’s ability to actually change the status of nonhuman animals is questionable, especially because cultured meat comes across more as a “replacement” than a “critique” of current anthropocentric narratives and practices (Poirier, 2018b, p. 15). In a third paper, Poirier and Russell (2019) conclude that cultured meat reaffirms current human perspectives on animals and the practices of violence towards them, which is a far cry from the supposed “challenge” that cultured meat is theorized to offer; the sentiment is succinctly summarized in their claim that cultured meat does not fit under a variety of animal liberation frameworks (p. 209). Poirier’s work directly challenges the positive framing of cultured meat’s contributions to ethical relief, and instead presents cultured meat as a continuation of “business-as-usual” practices; such a presentation does not fit with the rhetoric which comes from proponents, nor the discourse highlighted under theme one.

Consequently, there is emerging literature which indicates that the ethical matters cannot be considered settled; while general discourse has accepted many of the prima facie arguments for cultured meat’s ethical superiority over conventional consumption and widespread dietary change (“The Cultured Meat Solution...,” 2021; CRB, 2021; “Amazon Reaps...,” 2021), there is literature which contradicts such a notion (Poirier, 2018a & 2018b; Poirier and Russell, 2019; Alvaro, 2019; Leroy and Praet, 2017). And while some claim that these challenges, themselves, are illegitimate – such as Chauvet (2018), who claims that cultured meat offers no possibility for creating an “us/them” dichotomy if consuming in the name of animal rights (p. 408) – it can be safely argued that there are distinct interpretations of cultured meat’s ethical possibilities. The literature, under this sub-theme, will be expanded upon in the theoretical framework of this dissertation, as Leroy/Praet (2017), Alvaro (2019),

and Poirier (2018a; 2018b) all engage – implicitly and explicitly – with the concept of carnism, a larger systemic theory which is often not engaged with by authors who perpetuate the idea of cultured meat offering “ethical relief.” At this juncture, though, what is important is to discount the idea that the moral opposition to cultured meat is limited to those who believe in a “moral obligation” to kill animals; if anything, Hopkins and Dacey’s (2008) claim cannot be proven because those who pose such opposition believe that there is not a “moral obligation” to kill animals. There are many ethical issues which will come to light throughout this dissertation, so it is important to account for literature which provides alternative assessments of cultured meat’s alleged ethical contributions.

Transparency and Corporate Monopolization

In comparison to the ethical-opposition rhetoric, which is not particularly widespread throughout the entirety of the discourse, there is a noticeable concern about transparency and corporate monopolization. Given the limited theorization on cultured meat’s scalability, it is unclear what a “cultured meat industry” might look like. This issue is compounded by the growing awareness that cultured meat producers are not transparent, especially in comparison to producers who were active before the involvement of venture capital. Stephens et al. (2019) present pre-2013 producers as being more diverse in their visions of what cultured meat could be; the authors also present pre-2013 producers as visionaries who were not as focused on market pathways and PR work (p. 4) The change to venture capital marked a significant shift in relations between public, academic, media, and private ventures. Wurgaft (2019) is especially vocal about this matter, arguing that cultured meat companies were once typified by inviting journalists into office settings, as well as providing more frequent updates on research and innovation progress; he argues that such access has changed, with updates harder to come across, and a greater sense of ambiguity about progress having emerged (p. 18). While some authors, such as Purdy (2020), have still had success in being invited to offices, and even being offered taste tests, the concerns of Stephens et al. (2019) and Wurgaft (2019) have not necessarily come undone. Both Stephens et al. (2019, p. 12), and Stevens and Ruperti (2021), express concern about the role monopolization might play in a theoretical ascendance of cultured meat production; such monopolization, characterized by Kleeman (2020b), leads to considerable concerns about industry opaqueness. Cohen et al. (2022) present a more positive view of the prospect by assessing liquidity events – the acquisition of one company by another – which are “indicative of healthy industry development. Acquisitions reduce the number of duplicative early-stage companies and inefficient business structures across the industry... Consolidation also facilitates faster R&D and scaling by acquirers through inorganic growth” (p. 37). However, whether those concerned about monopolization will feel the same way is a point of concern, and does not necessarily engage with the industry’s opaqueness.

While the protection of intellectual property is often offered as an “understandable” reason for such quiet, when one factors corporate monopolization into play, such quiet can turn into rising concern. For example, Bryant (2020) – in a mostly descriptive academic article – does, briefly, engage with how employment in the meat sector might be affected by cultured meat. He posits that many jobs will likely be lost, on the basis of how cultured meat will be produced, and the education level likely needed to work on such production would have to increase greatly (Bryant, 2020, p. 4). Instead of engaging with what might need to be done to ensure that such workers can be filtered into other

industries, Bryant merely claims it is “self-evident” that sectoral changes will always shed jobs (Bryant, 2020, p. 4). To those employed in such an industry – or Marxists who are primarily concerned with the working class – such dismissiveness may be seen as cavalier. Such dismissal also does not play well when one considers Kleeman’s (2020b) work, which argues that cultured meat – alongside changes in sex robots, artificial wombs, and death machines – could alienate ourselves from ourselves, each other, and nature (p. 333). Within this framework is also Kleeman’s concern that cultured meat could lead to multinational companies having total control of the meat industry (p. 334). While Kleeman presents such a vision as a “future,” there is more than enough reason to assume that such a vision is already part of the “present,” especially when one considers the composition of the industrial meat industry as it currently stands; monopolization concerns have been present for a considerable period of time. However, the lack of transparency about an emerging biotechnology, when combined with the theme of scalability and costs, is likely to generate concerns that a small number of companies will monopolize production – because of the costs – and, consequently, humans may become even more far removed from control of their circumstances and nature (Kleeman, 2020b, pp. 333-334). Rynnänen and Toivanen (2022) have recently demonstrated that online comments on Finnish news articles about cultured meat are indicating a general concern about monopolization and corporate control (pp. 21-22); similar sentiment can be seen in a recent assessment of German policymakers (Moritz, Tuomisto, and Rynnänen, 2022).

Of course, whether such concerns are within the true realm of possibility remains speculative at this time – as do all observations about cultured meat – but this theme is becoming more noticeable (Purdy, 2020, p. 47 & p. 201; Kleeman, 2020b, p. 332-335; Stevens and Ruperti, 2021). So long as cultured meat production remains opaque, it is more likely that concerns will be raised about the lack of transparency and the implications, writ large, both for proponents and those concerned about cultured meat in general. The relationship between transparency and monopolization rhetoric(s) should be carefully considered, especially as companies begin to announce prototype facilities. With production costs still unclear, as well, it is likely that this sub-theme will see continued attention. This point has become especially pertinent following recent efforts by Tatum (2022a; 2022b), who has reported on some of the fall-out of Fassler’s (2021) reporting. Tatum (2022b) notes that claims of reduced medium costs are shrouded in trade-secrets, meaning that there is little scrutiny regarding what ingredients are going into non-FBS mediums, and what their ramifications may be. More concerning, however, Tatum (2022a) also claims that a former employee of a prominent cultured meat company – who is anonymous in the report – paints a picture in which cultured meat companies are malfunctioning behind the scenes. Various claims include an allegation that companies are hiring inexperienced workers, and a claim that more than 50% of the company’s production attempts resulted in contamination of the sample. Beyond the anonymous source, however, Tatum (2022a) has also procured quotes with various researchers. A researcher from a food tech investment funds argues that it is not just the public which is being negatively impacted by industry opaqueness, but investors. “‘I’m seeing a lot of people investing in these companies without proper technological due diligence.’” Tatum (2022a) also quotes Anthony Chow, a founder of investment firm Agronomics: “I think there are companies that have received funding when they shouldn’t have or at the wrong valuation which they didn’t deserve... in some of the demonstrations they’re showcasing a product that has less than 1% of animal cells in it.” Agronomics is

an important investor in the field, meaning that Chow's quote is revelatory, and provides further impetus to not only be careful of the claims of a coherent "industry," but the implications of proponent opaqueness overall. These comments also align with those of Leonard Lerer, CEO of Back of the Yards Algae Science; while the company initially started pursuing cultured meat production, the project has been abandoned, with Lerer arguing that "once we were doing it, we realized there was no way. This thing is impossible. Anybody who says we're gonna have lab-grown meat in Whole Foods in a year or two doesn't know what the hell they're talking about. It's a lie" (Sula, 2022).

Alienation from Nature

While already mentioned, the notion that cultured meat may "alienate" one from nature should be discussed as a theme in the discourse. The notion that cultured meat might be an "alienating" force is engaged with in a variety of ways, but with little consensus on what such "alienation" might actually entail. I have already engaged with Kleeman's (2020b) notion, in this regard, but it is worth noting that Kleeman's (2020b) claims of "alienation" (p. 332-335) are not developed, in her work, relative to another point in history. Questions of what our "nature" actually is are not a part of this discourse; instead, there is a general, but idiosyncratic, set of visions about what impact cultured meat might have on a nebulous nature which may – or may not – exist (Welin, 2013, pp. 29-33; Jönsson, 2017; Marcu et al., 2015). Many of these matters are dealt with, to a degree, under the "ontological instability" theme, which will be engaged with later in this chapter. The "consumer acceptance" theme also offers some limited insight into the notion of "alienation from nature," as authors are attempting to determine whether perceived unnaturalness will affect cultured meat sales, and also whether such perceptions can be overcome (Wilks, Hornsey, and Bloom, 2021; Hansen et al., 2021; Bryant et al., 2019a). However, for the most part, this theme arises as a looming concern, but is not engaged with in specific theoretical ways beyond the individual as a consumer. The impact of this theme, in relation to perceptions of cultured meat and the surrounding discourse, can be difficult to qualify, given the wide range of considerations, combined with the idiosyncratic foci and lack of theoretical depth.

Part of this dissertation's theoretical framework will attempt to circumnavigate this issue by processing cultured meat through a theory of nature and natural relations – anthroparchy – in order to address the shortcoming in the discourse. Nevertheless, numerous interpretations of nature, and relations to/within it, are likely going to be needed, overall, in order to better expand on the notion of how cultured meat may or may not alienate one from nature. Also notable is the lack of engagement in the literature with how "natural" or "unnatural" our current practices of meat consumption and production might be; it seems, often, to be assumed that there are certain "natural" practices, and "unnatural" practices also, but they are often referred to in a second-hand, unclear manner. One example stems from early in cultured meat's history; Catts and Zurr's (2002) Cultured Tissue and Art Project presented cells as "semi-living," creating a "high-tech version of the natural environment" to satisfy "our" biophilic need for "natural things and processes" (p. 369). The issue, here, is that Catts and Zurr (2002) do not define what is meant by "natural;" this approach, and its repercussions in cultured meat discourse, will be highlighted later in the dissertation, but references to "natural environments stemming from natural processes," without the definitional thoroughness needed to understand what is meant by "natural," leave a considerable mark, signifying a vast entity without clarity of what marks the

borders of said entity. The continued impact of this approach is still best seen in Kleeman's (2020b) notion that cultured meat may help perpetuate an unnatural future; the question of what, exactly, makes our current historical juncture "more natural" than the perceived future, under the assessment, is not clarified. Such a matter does, however, require clarification, especially when one takes into account the remaining themes of this review.

Consumer Acceptance

Throughout the academic literature, as well as in media discourse, substantial attention has been given to the matter of whether consumers will accept cultured meat; not in a sense of whether they will try it, though that is a common concern, but whether consumers would be willing to buy the product consistently. These concerns often have their own acronym – willingness to try (WTT) vs. willingness to buy (WTB). Despite no product being available for purchase, and no clear pathway to market introduction at this time, this line of inquiry has permeated much of the discourse. In descriptive literature, the matter is often given space and attention to a strong degree (Bhat et al., 2019; Bhat, Kumar, and Bhat, 2017; Bhat, Kumar, and Fayaz, 2015; Zhang et al., 2020; Sharma, Thind, and Kaur, 2015). However, there is also an identifiable sector of authors who are producing work, in the form of quantitative studies, to address this matter (Bryant and Dillard, 2019; Bryant et al., 2019a and 2019b; Wilks et al., 2019; Verbeke et al., 2015; Ruzgys and Pickering, 2020; Siegrist and Hartmann, 2020; Kantor and Kantor, 2021).²⁸

Bryant and Barnett's Systematic Reviews (2018; 2020) are an ideal starting point for those interested in this field, as these papers conglomerate the results of numerous studies in one place. In their 2020 review of 26 studies, the authors reiterated their 2018 findings that a majority of surveyed consumers would "at least try" cultured meat, and "substantial portions" would consume it regularly (Bryant and Barnett, 2020, p. 9). Consumers often find issues with cultured meat on a personal-risk level, but also view it as having larger societal benefits (Bryant and Barnett, 2020, p. 10). Recent changes in research practice have led to a greater variety of studies on a country basis, leading the authors to put forward that preliminary evidence indicates cultured meat will find more acceptance in China and India than the US; South American markets may be less interested in cultured meat than European markets; and more progressive countries will likely be more accepting of cultured meat – amongst its 65+ population – than less progressive countries, within the European context (Bryant and Barnett, 2020, p. 11). The authors also assess general research results, and indicate the following: younger people are more likely to be accepting of cultured meat than older people; men tend to be more accepting of cultured meat than women, with the exception of women in China; cultured meat seems to be more appealing to meat-eaters than vegetarians, especially more committed carnivores; liberal/left-wing political orientation is a stronger indicator of support for cultured meat than conservative/right-wing political orientation; educated consumers find cultured meat more appealing; and those unfamiliar with

²⁸ It should be noted that these citations refer to papers which take a general focus; numerous other studies have focused on a wide variety of regions. In the interest of coherence and space, the subsequent citations of Bryant and Barnett's systematic reviews will be used in place of the wider variety of studies; however, all studies that Bryant and Barnett have cited – in relation to cultured meat itself – were reviewed for this dissertation, and bibliographic information will be available in the bibliography.

cultured meat were less accepting of it (Bryant and Barnett, 2020, p. 12). The authors also note the impact of socioeconomic status on cultured meat acceptance is unclear at this point (Bryant and Barnett, 2020, p. 12). However, despite the signs that cultured meat acceptance may be more successful than not, the authors do argue that consumers still see cultured meat as part of a growing variety of alternatives, which is different than seeing cultured meat as a replacement of traditional meat.

Comprehensive review of the papers Bryant and Barnett have cited – specific examples include Weele and Driessen (2019); Zhang, Li, and Bai (2020); Mancini and Antonoli (2019); as well as subsequent publications (Bryant and Sacntorum, 2021; Bryant, Nek, and Rolland, 2021; Kantor and Kantor, 2021; Francković et al., 2021; Szedja, Bryant, and Urbanovich, 2021; Escribano et al., 2021) – indicates a general willingness to try cultured meat, and smaller – but reasonably sized – groups are willing to consider purchasing it regularly, barring sensory/taste issues and certain individual concerns. Now, with that being said, surprises are still possible. For example, a recent study claimed that 72% of “Gen-Z” respondents were unwilling to accept cultured meat (Bogueva and Marinova, 2020, p.1). Such results are not in keeping with the typical results of such studies. However, Bogueva and Marinova’s study is based on 227 Australian online survey participants, which may not be seen as representative or generalizable. A similar issue was noted in Bryant and Barnett’s (2018) study; the authors compared results from Hocquette et al. (2015) to Wilks and Philips (2017) and Slade (2018), and noted that, while the 5-11% respondent willingness in the Hocquette et al. (2015) study aligned with the results of Slade (2018), instead of Wilks/Philips (2017), the sample size was not representative, “thus limiting generalizability” (Bryant and Barnett, 2018, p. 9). Consequently, whether Bogueva and Marinova’s (2020) study can be considered “representative” is questionable; despite this questionability, the results were widely disseminated throughout media discourse following the publication, with headlines such as “Gen Z Won’t Swallow It” (Goodwin, 2020), “Gen Z Not Ready to Eat Lab-Grown Meat: a Study” (Morrison, 2020), and “Fake Meat a Gen Z Turn Off” (Dowler, 2020). As such, despite the general results of many of these papers, there will likely be disruptions to such results as more research is conducted regarding consumer acceptance.

Larger sample sizes, however, should also be treated with caution. A new study by Hocquette et al. (2022) has a large sample size – 5418 citizens of France (p. 1) – and produces some interesting results. Only 18-26% of those surveyed believe that cultured meat can address the ethical and environmental issues of conventional meat production (p. 1); confusion between cultured meat and plant-based alternatives may be prominent in the results of previous consumer acceptance literature (p. 2); consumers who are concerned with environmental and ethical issues do not seem to believe that cultured meat will disrupt rural life and conventional farming (p. 9); and prior knowledge of cultured meat is greatly increasing when compared to previous studies of unfamiliar individuals, which may affect results from here out (p. 12). However, even these larger results need to be approached with caution; despite the survey’s spread across multiple social media platforms to about 25,000 potential participants (p. 3), 40.7% of the surveyed subjects work in the meat sector, despite only 2.5% of France’s population working in the field (p.12). Notwithstanding France’s noted conservatism towards cultured meat, the over-representation of the meat sector in the study demonstrates that large survey samples need to be treated critically and carefully.

Another important element to this theme is the role of framing. As Bryant and Barnett (2018) initially noted, the descriptions of cultured meat provided in these studies can vary greatly, which leads to questions surrounding how results are impacted by these framings (p. 9). Bryant, outside of these systematic reviews, has led numerous studies on the impacts of framing. In one study, of 480 US adults, the framing of cultured meat as “high-tech” – similar to that of early media coverage – generated negative perceptions amongst the participants of the study (Bryant and Dillard, 2019, p. 1). In another study, which surveyed 1185 US adults, Bryant et al. (2019) found that taking a different approach, and arguing that conventional meat is what is unnatural, managed to significantly increase cultured meat acceptance, at least in certain factors; meanwhile, claiming that cultured meat is natural did not produce such results (p. 37). If one were to accept these results at face-value, it would seem as if framing surrounding naturalness has a considerable impact on cultured meat acceptance. However, Wilks et al. (2019), in a survey of 1327 respondents of comparable demography to the previously mentioned studies, claimed that naturalness was the least significant factor at even the bivariate level, with no controls for other factors (p. 143). As such, it is still difficult for proponents to identify an exact framing that will work, in terms of promoting cultured meat acceptance, and certainly at a level that can be considered “homogenous” or “definitive.”

The disparity between the Bryant and Wilks studies demonstrates not only the issue of framing, but also the theme of “naturalness.” If industrial meat can be argued to be unnatural, in a convincing way, yet consumers cannot be convinced to see cultured meat as “natural” – if such a factor is even relevant to the consumer – such a finding may indicate that consumers are still affected by larger ideological factors and influences, which play a role in their relation to cultured meat. However, the drivers of consumer acceptance, in terms of sociocultural norms, have not been of substantial focus in the consumer acceptance literature, which Onwezen et al. (2021) argue must be addressed “urgently” (p. 11). Yet it should also be stressed that the consumer acceptance literature views its subjects as consumers, and not as individuals; to the best of my research capability, I have been unable to find work which attempts to determine the impact of framing subjects as consumers, or as individuals, in relation to cultured meat perception.

This framing of “consumers” does lead to a final consideration. The consumer acceptance theme, as important to the literature as it is, can fairly stand accused of an overwhelming market focus; comparing the number of papers cited in this section to the number cited on environment and scale-up issues reveals a perceptible “cart before the horse” approach, in which research focuses on the consumer acceptance of a product which may not be scalable. Without the ability to actually try cultured meat, nor with any real idea of what a cultured meat “industry” might morph into, it is difficult to tell how long such findings will maintain relevance, or whether there is a risk that they will be up-ended, unable to provide guidance to researchers and proponents, should radical changes occur. Consequently, there is a need for theorization on the perception of cultured meat which goes beyond the “consumer,” and looks instead at the larger ideological systems which may influence such perception. However, while this dissertation will take a distinctive approach to such a study, it is important to note other work which makes such attempts.

Ontological Instability

Given the role that meat plays, in not only individual life but in a sociocultural context, it is of little surprise that some would assess how narratives surrounding meat emerge, and what they mean for perception of self, meaning, community, and being – essential ingredients of ontology, which is understood, in this dissertation, as an inquiry into, and understanding of, being. Being, in this instance, does not necessarily have to engage with questions of what exists in a literal/material sense; one can consider questions of being without necessarily referring to the tangible. Readers should also be careful not to confuse ontology with epistemology – theorization and understanding of knowledge – nor metaphysics – which engages with similar matters, but also issues of reality, existence, etc., of which ontology is only a component. Generally – based on the literature within this literature – ontology should be understood as the constitution of meaning and being at various levels.

Interestingly, the ontological instability theme can be considered as having emerged even before the rest of the themes in this analysis, stemming from Catts and Zurr's (2002) research project. The project allowed those involved to eat cultured frog meat while the frogs were sitting at the table with them, which Catts and Zurr (2002) claimed allowed for subjects to engage with the limitations of current cultural understandings, especially in relation to emerging technologies with implications regarding the control of nature (p. 365-370). Consequently, ontology – in relation to potential control of, or alienation from, nature – has been a point of concern before a potential way of mass-producing cultured meat was even identifiable.

The ontological instability theme is engaged with in a multitude of settings and discourses, and does not always take the form of explicit discussion. For example, even if the phrase "ontology" is not in use, the alienation from nature theme still presents questions of human perceptions of self, especially in relation to, or in alienation from, nature. However, there is still a notable portion of the literature which engages with these ideas more explicitly, though there is a wide-ranging variety (Weele and Driessen, 2019a and 2019b; Jonsson, 2016 and 2017; Chiles, 2013a and 2013b; Marcu et al., 2015; Stephens and Ruivenkamp, 2016). To provide a more explicit example of this variety, Mouat et al.'s (2019) economically engaged theory can be seen as still engaging with ontological instability, given the role of narrative and moral aspirations in the creation of market narratives. Opposite to Mouat's work would be a chapter by Wolpa (2016), who engages with cultured meat and art, investigating whether cultured meat can be used in "artistic" ways to disrupt current anthropocentric understandings.

Ontological instability literature also engages with the multitude of impacts on different entities, their classifications, and the relationship to notions of "being." Jonsson has led numerous works on this topic, most notably arguing that cultured meat represents the possibility of creating "multiple realities" by disrupting typical understandings of animality and meat, (re)making the world in ways that question categorization while also calling the power of definition into question (Jonsson, Linne, and Mc-Crow Young, 2018, p. 23). The use of "(re)making" is important, as Jonsson has also argued that cultured meat proponents often present it as a logical next step for industrial animal agriculture, which destabilizes traditional faith in industrial production while also continuing to necessitate current consumption practices (Jonsson, 2016, p. 733-734). The presentation of a certain future may actually mask the

continuation of past and present practices, calling into question cultured meat's true possibilities, as well as the intentions and goals of those involved. The role of imagination is also important to take into account; narratives of hype, used to promote cultured meat and attract funding, combine fiction and nonfiction, "reality" and imagination, and even impossible practices, to create the narrative of cultured meat (Jonsson, 2017, p. 855). Essentially, the (re)creation of reality may be constituted by everything from current practices to imaginary visions of impossible futures, all of which may impact the perception of reality, self, and being, amongst many.

However, in the ideological creation of marketplaces, investment pushes, and consumer acceptance, Chiles (2013b) notes the importance of ambiguity;²⁹ he argues that meat is an enigma, and therefore cultured meat might be an ambiguous solution to an ambiguous problem (p. 479). The strongest example of this "enigma" in action comes from what Chiles (2013b) identifies as the "Green Luddite" ideology, in which animals are still dominated and commodified at even the small-scale level, which stands in opposition to what can be seen as "harmony with nature" (p. 477). The possibilities of scaling-up such a system are ambiguous, and so, even if cultured meat is rejected by these groups as a solution – it being yet more scaled-up industrialism – the problems of meat consumption, and who is to be viewed as key to overcoming its impacts, remain ambiguous (Chiles, 2013b, p. 477). If one compares the implications of both Jonsson and Chiles's work, cultured meat may represent the (re)making of an ambiguous reality. Consequently, while Driessen and Korthals (2012) have argued that such proposals actually render radical critiques mainstream, because of the shocking nature of such proposals (p. 812), the ontological instability theme points to the possibility that the mainstream narratives are already ambiguous, with a variety of possibilities for creating, recreating, or reinforcing a potential myriad of realities.

One strong example of ontological ambiguity, in practice, can be seen as emanating from the scale-up theme. Despite little work having been done on this matter, there have been a variety of images for what cultured meat may "allow." For example, early in cultured meat's discursive presence, some journalists and authors engaged with the image of a "meatmaker in the kitchen," with Cain (n.d.) going so far as to claim that kitchen counters may one day house meatmakers next to bakers. Such an image stands in contradiction to what is "known" about current practices, in which the costs of production and specialization will likely require companies to sell final products, instead of the cell lines needed for individuals to create meat in their own homes – this prospect serves as a contribution to the concerns of corporate monopolization, though it is still in keeping with current consumption and production practices. However, the original "meatmaker" image is still mentioned on rare occasion (Charlebois, 2021d), and invites subjects to consider the possibilities of high-tech solutions in the home, to not only environmental and ethical problems, but even logistical matters such as going to the grocery store, storing meat, etc. Elements of this imagery have been maintained in another form of imagination, "the pig in the backyard," which first emerged in a paper by Weele and Driessen (2013, p. 656). This imagery takes the "local, sustainable" food movement imagery and applies it to cultured meat, in which

²⁹ It should be noted that ambiguity is different from instability; "ambiguity" presumes paradoxical elements from the "beginning" of the entity in question, whereas "instability" denotes the destabilization of categories previously perceived as stable. There is overlap between the two terms, but they are not synonymous with each other.

a pig stays in either a backyard or a village square, and supposedly maintains a dynamic which eliminates industrial meat, yet does not create a separatist, abolitionist “urban vegan” world in which human and nature are completely separated (Weele and Driessen, 2013, p. 656). Wurgaft (2019) expands on this imagery in his book, and posits that the pig in the backyard can help the human project of “becoming” move forward (p. 189-194). This imagery faces a similar problem to the “meatmaker” imagination, in that it does not seem to align with current practices of production and investment, and furthermore, the image also suffers from the matter of ambiguity which was raised by Chiles (2013). These images do not necessarily engage with all of the potential issues with meat consumption and production, or the logistics of these systems, but they do demonstrate how ontological ambiguity can be used to harness not only imagination, but excitement, for the general cultured meat project. As such, despite the difficult range of subject matter, ontological ambiguity is an important theme in the literature, and should always be accounted for, despite the ways it manifests.

Remaining Concerns³⁰

Nomenclature

Regardless of exactly how many matters remain to be addressed in cultured meat literature, there are some matters which are repeatedly mentioned, even if there is still a need to dedicate specific research to such topics. The first such matter is that of nomenclature. In 2018, during the FDA and USDA hearings on cultured meat, lobbyists for the animal agriculture industry encouraged the organizations to define meat in specific ways so as to remove plant and cultured meat from definitional consideration; a petition was also filed by the US Cattlemen’s Association, encouraging lawmakers to define meat as coming exclusively from animal flesh, though such a definition still does not remove cultured meat (Radke, 2018). Concerns surrounding nomenclature, and how state definitions of “meat” may impact cultured meat sales (as well as sales of any analogue), have been a mainstay of the discourse for a considerable period of time, but much of the discussion surrounding this theme has come from small reports or descriptive commentary. For example, Purdy’s (2020) contribution to this matter notes that a GFI focus-group session could not come to a consensus on what cultured meat should even be called amongst proponents (pp. 160-161), as terms such as clean meat, IVM, and others, have their share of supporters, even if cultured meat is often the common terminology at this current juncture amongst a variety of sources, though “cultivated meat” has surged in popularity since 2021.

Ong et al. (2020) have made an academic attempt at navigating through the nomenclature issue, but it is clear that these matters will likely not be considered “settled” for a considerable time. From a lack of standardized terminology, there will likely be inconsistent definitions of “meat,” and consequently, inconsistent labels at both organizational and country levels. For example, the United States Cattlemen’s Association defines meat as “any edible portion of livestock or poultry carcass or part thereof,” meaning that cultured meat would have to be produced from any already dead animal before meeting the definition; however, Israel’s Ministry of Health defines meat as “chicken or animal skeletal

³⁰ It should be noted that the following sections are shorter than the previous sections due to metrics; while many of these points are discussed in media publications, there are not as many academic articles on these matters, limiting the number of articles this review can be based upon.

muscle, with or without bones,” which is not only a far cry from the Cattlemen’s definition, but also indicates why cultured meat seems to be making headway in Israel itself (Ong et al., 2020, p. 225). The authors argue that effective labelling by “trusted” authorities will be key for ensuring informed consumer choice, but as the disparities in definition indicate, differences in nomenclature, as well as definition, are likely to lead to global differences which will have varying impacts on cultured meat.

While nomenclature can be considered an ontological ambiguity issue, it is often presented as its own issue in current discourse, and consequently can be fairly considered its own theme. As well, nomenclature is often raised in relation to potential regulation or consumer acceptance, instead of the difficulties in determining reality (Ong et al., 2020; Watson, 2021m; Foster, 2021; Chriki and Hocquette, 2020); this focus helps demonstrate the typical concern of much of the discourse at this time.

Regulation

Because of the ambiguity and subjectivity of cultured meat, and especially its scale-up possibilities, regulatory matters are a theme that is, once again, dealt with in a mostly descriptive manner. Böhm, Ferrari, and Woll (2018) conducted semi-structured interviews with a range of stakeholders, asking questions about matters related to politics and civil society; however, the majority of the responses merely reiterated the themes covered in theme one and two of this section, even if certain concerns emerged about deeper issues (p. 222). Newton and Blaustein-Rejo (2021) interviewed rural producers in the United States, and found that producers are concerned about loss of livelihood, as well as barriers and exclusion from a new cultured meat industry, which will be political matters (p. 1). Moritz, Tuomisto, and Rynänen (2022) conducted semi-structured interviews with 13 German policymakers between January 28, 2020 and March 18, 2020, and found that policymakers, while aware of the challenges in food system sustainability, are hesitant about cultured meat’s ability to address these challenges (pp. 54-56; 62). However, to date, there is no identifiable paper which applies a specific political theory to cultured meat; for example, there are no easily identifiable Marxist or Anarchist critiques of cultured meat’s potential. There is still a great deal of ambiguity surrounding what is being considered the “current bottleneck” for cultured meat companies (Cohen et al., 2022, p. 13).

At most, regulation is treated as a descriptive matter, with reflection on the USDA/FDA hearings, or European regulations, as already discussed in Chapter 2. There is also speculation regarding when political leaders will begin to pay specific attention to cultured meat; as it stands, policymaker comments have been of a personal nature, as institutions typically do not have official stances on cultured meat at this time (Moritz, Tuomisto, and Rynänen, 2022, p. 57). However, regulation remains an undeveloped aspect of the literature, so despite being a noticeable theme, it is treated in a repetitive and undetailed manner. It should also be stressed that policymaker opinions cannot always be considered authoritative; for example, Moritz, Tuomisto, and Rynänen (2022) cite politicians who are concerned that a food system without animal production will leave grazing lands open to humus³¹

³¹ Humus is a set of molecules believed to be extremely resistant to decomposition, consequently becoming an important principle of carbon sequestration through soil management. The concept was called into question/disproven due to increasingly intense microscopes which revealed that molecular decomposition occurred more frequently, and at smaller scales, than previously understood.

problems (p. 58) – however, soil scientists have recognized that the concept of humus is no longer valid, despite being used to justify numerous carbon capture claims, an issue which makes this concern more difficult to accept without issue (Popkin, 2021). Moritz, Tuomisto, and Ryyänen (2022) also cite politicians concerned that cultured meat will lead to specific monopolistic and oligopolistic power (p. 59), despite the trend also being present in traditional meat production, best seen with two-thirds of German processed pork production being controlled by five companies (Sharma, 2021). While more papers are emerging on the topic of EU approval for cultured meat (Keteling, Kremers, & Boer, 2021; Lähteenmäki-Uutela et al., 2021), the difficulties in identifying the exact production process make conclusions difficult to argue with assurance at this juncture.

Religious Considerations

Cultured meat, in relation to Judaism and Islam, has been given some attention in the last few years. Islamic dynamics have often received only a mention, but Hamdan et al.'s (2018; 2021) papers are a noticeable first step towards developing a sense of how Islam may take to cultured meat. The results are not particularly reassuring for those looking at cultured meat as a process meant to free animals from slaughter, as the authors argue that, not only must the cells come from a Halal slaughtered animal, but the serum must be proven to not contaminate the cells which contact the serum – the authors even argue that serum should be abandoned, which does not seem to be in keeping with how cultured meat can be produced (Hamdan et al., 2018, p. 2202-2203).

However, as current discussions surrounding Judaism and cultured meat demonstrate, there may be more debates which arise, challenging the status of cultured meat in religious sectors. For example, Purdy (2020) has given special attention to North African rabbi Chayyim Ibn Atar, who was active in the early 1700s; Atar, in his interpretation of Leviticus, claimed that God will alter pig physiology so that it can consume its own cud in such a way as to be ethically safe for the Jewish people (p. 187-188). If Atar's ideas are interpreted by religious authorities to be applicable to cultured meat, then it could be considered Kosher, overcoming years of prohibition regarding pork. However, while proponents are paying attention to Atar's notions, other work indicates that cultured meat could not be found Kosher. Kenisberg and Zivotofsky (2020) present a variety of debates surrounding cultured meat's alleged "kosherness;" the authors find that, in many interpretations, the source cells would have to come from a slaughtered kosher species, as slaughter dictates the "kosherness" of the animal (p. 1). That being said, if the process of culturing is viewed as being radically different from traditional practices, kosherness may still be possible if the end product is considered entirely "new," and not a result of its origins (Kenisberg and Zivotofsky, 2020, p. 1). Yet, because of the nature of the subject matter, such a process may be interpreted as similar to that of the "miracle meat" story from the Talmud, in which meat fell from heaven, therefore not being subject to ordinary regulation and considerations; the authors posit that cultured meat cannot be considered a "miracle" because it is a scientific process, therefore disputing interpretations which cite the Talmud's "miracle meat" story (Kenisberg and Zivotofsky, 2020, p. 3).

As of now, there are no clear-cut answers as to whether cultured meat can be considered Halal or Kosher; preliminary work indicates that cultured meat cannot be considered as such without the

animal being slaughtered which, to some, renders the cultured meat project ineffective. Such subject matter will likely be given greater attention as time goes on, but for now, it remains a niche – but notable – focus. However, it is the issue of slaughter where I will offer concluding remarks.

Concluding Remarks

One of the frustrations of engaging with cultured meat literature stems from the summative nature of most of the discourse. While academic literature and media articles can be helpful, in terms of delivering information to those unfamiliar with the topic, there has been a saturation of summative material, to such a point where one can even identify numerous structural similarities across a number of articles. Consequently, there is a risk that readers may feel that much of the literature “bleeds together,” which could potentially lead to oversights; while much of the literature is summative, occasionally, ideas of importance are tested within these articles.

An essential example can be seen in Melzener et al’s (2021) paper. Though slightly more “scientific,” the paper is primarily a summative piece; it reviews the current industrial animal agriculture situation, reflects on the potential regulatory situation facing producers, and provides an overview of production techniques. However, amongst these matters, the authors also engage with what a “scaling up” might look like. The authors posit that a single biopsy of a cow could generate enough meat to replace 13 million cattle, meaning a herd of 20,000 cattle could replace the estimated 1 billion cows who were slaughtered in 2019 (Melzener et al., 2021, p. 10). Early literature would often refer to this idea without providing much in the way of numbers, so some changes in the practices of even the summative literature are becoming clear. However, the issues that the authors put forward, to counter-balance their proposal, are a reminder of just how speculative such assessments are. For one, Melzener et al. (2021) stress that such a shift would also depend on cultured milk, as cows are used for more than just beef (p. 10). More alarming, though, is what happens to the cows who are no longer effective for the purposes of biopsies, at least in the vision of the authors. I will quote the authors verbatim, for tonal purposes:

An ethical position may be that the animals can continue their lives until they die from natural causes. However, from an environmental and efficiency perspective, it would be more logical to slaughter the animals and either harvest all of their remaining satellite cells (producing huge quantities of cultured meat), or produce traditional meat from the carcass.... If, for instance, the conventional market will continue to have a share as small as 10%, the number of cows needed to produce that volume will still far exceed the number needed to produce the other 90% through cultured meat. In such a scenario, it may be reasonable to slaughter the animals at an age where they are no longer considered productive as donor animals (Melzener et al., 2021, p. 10).

The “ethical imperative” to produce cultured meat, at this juncture, no longer comes across in the same way that it did in earlier literature. Even with a reduction in global herd size, for slaughter to be proposed as the final destination for donor animals adopts the logic of the industrial animal agriculture system that cultured meat was once poised to disrupt. Such an idea is not only a far cry from the “five or six” cows once imagined, by some, but also seems to mark the beginning of the end of some of the utopian imagery which early cultured meat discourse relied on for legitimacy.

Before discussing the implications of this literature review for the rest of the dissertation, it is important to revisit this review in relation to Chapter 2. The foundations of cultured meat's legitimacy – as an environmentally friendly, ethically sound biotechnological innovation – can be comfortably challenged. The themes of the discourse are idiosyncratic and contradictory, as well as mostly summative, raising serious questions as to just how achievable the “vision” of cultured meat can be. Many ideas were quickly adopted, in place of thorough research – admittedly, because of the secretive nature of cultured meat production – during cultured meat's formative years, but may now come at the expense of the cultured meat project as a whole. As cultured meat producers begin to promise prototype facilities, it is doubly important for researchers and interested parties to reflect on whether cultured meat's promises are not just achievable, but founded on reasonably well developed grounds. The thematic literature review demonstrates that such development is difficult to perceive in a completely positive light.

A major point the literature review puts forward is the need to contextualize cultured meat, especially in ways which can shed light on the systemic context from which cultured meat has emerged. In the “ethical quandaries” theme, I noted that three authors – Leroy/Praet (2017), Alvaro (2019), and Poirier (2018a; 2018b; 2019) – have implicitly, to various degrees, engaged with the tenets of “carnism,” a theory on the ideology of meat consumption; however, these papers engage with the idea in a smaller space, and sometimes in manners implicit to the author's approach, instead of as an explicit focus. I have also noted that the theme of “alienation from nature” is not necessarily contextualized through a systemic lens. Consequently, the remainder of this dissertation will be an effort to understand cultured meat through the lenses of these two theories. In order to not only better engage with the ontological ambiguity theme, but to call into question the assumptions and conclusions stemming from many of these themes, it will be important to put the theories forward, assess them for their validity and issues, and then apply them to cultured meat.

The thematic review will prepare readers for the chapters following the theoretical framework, as the notions of “disruption, reinforcement, and expansion” will be engaged with further. Throughout the literature and its many themes, authors often engage with questions of whether cultured meat disrupts the current logics on industrial animal agriculture, or remains a direct continuation. However, following in the footsteps of Chiles (2013a, 2013b), I argue that cultured meat needs to be understood beyond the “industrial” context. Avoiding conclusions which relegate cultured meat to a solely industrial, as well as animal welfare, issue, will be of utmost importance, especially following the revelations of this review. Such an approach will allow for greater insight into the presence of certain themes as well; for example, without systemic theorization, the “market expansion” theme runs the risk of being normalized in cultured meat discourse. There is a need to inquire into the potential issues stemming from market expansion, and whether such a process may actually expand the systemic foci of cultured meat.

Consequently, the theoretical framework is meant to critically evaluate, and essentially problematize, the ideological and theoretical origins of cultured meat as an idea and ambition. This approach will be justified, but is already legitimized, to a degree, as a result of the review. Cultured meat may, indeed, be an exciting possibility; it could also be a poorly developed enterprise that is unable to

deliver on the possibilities some believe it might have. Even if cultured meat does not “play out” in the ways that some envision, that does not mean that the cultured meat project would not have impacts outside of the market setting; as such, all lines of inquiry into cultured meat should be encouraged. Though there are likely other ways to interpret cultured meat, from a systemic lens, carnism and anthroparchy are essential theoretical frames for engaging with cultured meat beyond the limitations of the anthropocentric approach throughout much of the discourse. Despite claims that cultured meat may be “helpful” for animals, the primary bias of the themes, such as consumer acceptance, inevitably guide the focus to anthropocentric interests; to get a better sense of the full set of possible implications of cultured meat, overcoming such a focus will be required, creating more impetus for the theoretical framework, as well as the overall function of this dissertation.

Chapter 4: Theoretical Framework

Introduction

In the previous chapter, I postulated – through a review of literature and media surrounding cultured meat – that the idiosyncratic, contradictory, and mostly summative discourse discourages those attempting to get a solid grasp of the current state of cultured meat’s possibilities. Attaining a straightforward understanding of this complicated subject matter should not be the only goal of interested parties and researchers; there is a need to make systemic sense of this discourse, understood in reference to larger contexts outside of the discourse itself. To date, most of the discourse surrounding cultured meat maintains an ad-hoc quality; even the ideological critiques of cultured meat, which arise from various actors, do not necessarily stem from systemic, theorized roots. Critiques of cultured meat’s unnaturalness, ethical qualities, etc., do not necessarily stem from a systemic perspective; while large-scale considerations are implicit, they are not necessarily called to the fore, leaving those who contribute to the discourse – or those who attempt to understand the discourse – to navigate systemic questions without the language or understanding of systemic theory. While exceptions exist, they often take on smaller conceptualizations, such as virtue theory – applications of specific approaches and fields which are not necessarily constructed, or practiced, in ways which call attention to the systemic factors which may create the contexts in which smaller theories might be applied. Consequently, the need for an expanded theory on cultured meat is important given the current, ambiguous juncture through which proponents and critics find themselves navigating .

However, there is an important aspect to this conundrum which should not be ignored. Because there is so little truly “known” about cultured meat, determining which systemic theorizations should serve as theoretical lenses for the subject is a difficult task. For example, while cultured meat would likely impact labor forces to some degree, if it were to have a large-scale (and comprehensive) launch, a Marxist theorist may find it too early to apply rigorous Marxist theorization to cultured meat; in the face of ongoing and pressing issues, such a topic may be viewed as unimportant at the current historical juncture. An Anarchist theorist, on the other hand, may find certain possibilities in the visions of cultured meat production, but with so little known about the potential to both scale-up, and horizontally disperse, cultured meat production, such a theorist would likely want more information before commencing theorization and rendering judgments about the possibilities and impacts of cultured meat from such a perspective.

The choice of systemic theory,³² then, is important; it must be able to account for the material possibilities of cultured meat, while also providing enough ideological and symbolic analysis to allow for the engagement with cultured meat as an item of imagination. Such theories also require the consideration of a wide range of actors, beyond a sole focus on anthropocentric matters, which can be of questionable achievability under certain theories. While more theories will need to be engaged with in relation to the subject over time, this dissertation will examine cultured meat through two theoretical lenses – anthroparchy and carnism – to the matter of cultured meat. As Chapter 1 put forward, both

³² The understanding of the relational aspects and relationships of individual components under a conceptual framework

theories have emerged, and have found varied use, in the field of Critical Animal Studies. Both of these frameworks have been selected in order to maintain CAS's overall goal of considering the animal condition.³³ While other theories and approaches do consider the animal condition, these two theories are structured in ways which allow for reasonably clear identification of principles, mechanics, and implications, all of which can still be used to contribute to the overall CAS mission. This chapter will unfold in the following manner: each theory will be discussed individually, with the background, core tenets, and underlying issues reviewed. Following the introduction of each theory, the conclusion will review the relevancy of the theoretical framework for what has been argued, in this work, so far. Finally, the relevance of the framework for the dissertation's analysis of cultured meat and its discourses will be established. This chapter lays the groundwork for answering research question #3, summarizing and clarifying the context in which the identified narratives of cultured meat will be understood.

Before explaining the theories in question, however, two important points should be noted. First, the approach that is being used in this chapter is atypical. Theoretical frameworks tend not to be placed in a side-by-side analysis as one theoretical framework; they tend to be integrated, synthesized into a new theoretical framework. Consequently, readers may wonder why this approach was not taken in the first place. However, as this, and future chapters, demonstrate, the application of these theories to the topic of cultured meat creates numerous complications which, I argue, must be engaged with on the basis of each theory. To use an analogy of an old RCA cord for an older television, if there is a problem with one of the inputs, the output – the overall sound and picture – may be incomplete and confusing. I believe the analogy is applicable to the application of theory. Previous drafts of this dissertation did attempt to combine anthroparchy and carnism into one theory, which I called “anthrocarnism.” However, I was dissatisfied – not with the idea itself, but the prospect of producing an effective, important synthesized framework in a space that was inadequate.

It is here where I must make another important point. Spatial limitations do leave their mark on this chapter, as well as the dissertation overall. In order to effectively answer the three research questions, I found the attempts to synthesize the theoretical framework to be counter-productive, risking a reduced analysis of industry and the literature for a synthesized framework which I did not feel a single dissertation could adequately develop. I have also, as a result of spatial limitations, generally refrained from commenting on why I chose anthroparchy and carnism over a wide-range of other approaches, such as deep ecology, anthropocentrism, speciesism, Marxism, anarchism, etc. At this juncture, however, I will offer a simple explanation for why I chose these two theories for a side-by-side framework. Anthroparchy and carnism, as theories, offer reasonably straightforward explanations of their systemic functionality, such that they can be distilled, and applied narratively, in a more limited space. They also, I find, are solid frameworks for centering the animal as a subject of analysis, a point I grew especially concerned about when considering other frameworks to use. That is not to say that there are not valid reasons to use other frameworks, and I do plan on going down such pathways following the dissertation – reconciling anthroparchy and speciesism is a task which I would like to engage with post-dissertation. However, for the sake of readability, clarity, and focus, I argue that this

³³ Like the human condition, the animal condition should be seen as a broad topic which attempts to consider the entirety of (non)existence and experience, ranging from psychological to social life and mortality.

chapter will demonstrate that I am justified in my reasoning for choosing these theories, and my side-by-side approach.

Anthroparchy

Basic Definition

Erika Cudworth (2005) claims that anthroparchy “refer[s] to a complex system of relations in which the non-human living environment (i.e. organic entities such as animals, plants, soils, seas and contexts for life such as rock and ice scapes) is dominated by human beings as a species” (p.8). This definition is not the only one that has been provided, but it is a baseline for understanding anthroparchy. Further clarifications offer stricter parameters for what anthroparchy is; one example presents this system as “a particular modern formation of social relationships in which non-human nature is cast as a series of resources for human ends, and in which human interests organized the systemic ordering of social control over the environment” (Cudworth, 2005, p. 45). The dynamics of social institutions, as well as processes, create a relational matrix with specific spatial and historical formations, ultimately creating the grounds for anthroparchy as a system of human relational power over other species, which can be considered socially formed (Cudworth, 2014, p. 28). Anthroparchy can also be viewed as a conceptualization, or “capturing,” of the social ordering of humans and environment; this social ordering is viewed as complex yet stable in its ability to privilege human beings through such relational dynamics (Cudworth, 2008, p. 33-34). While anthroparchy has undergone definitional refinement over time, the core idea of assessing the social relations between human and nature, in which the human comes to be privileged in such dynamics, has remained stable.

Background

Before going further into the details of anthroparchy, some background matters need to be addressed. Anthroparchy was introduced and popularized by Cudworth, specifically in the 2005 book, *Developing Ecofeminist Theory*. The book’s subtitle, “the Complexity of Difference,” alludes not only to the general ethos of the book, but the underlying academic fields which permeate her work. Cudworth is listed as a professor with research interests in critical animal studies, complexity theory, feminism, and posthumanism (University of East London, n.d.), all of which are entities that influence anthroparchy, as will be demonstrated in subsequent sections of this dissertation.

Cudworth’s diverse research interests are of relevance to the choice of this theory for the framework. Underlying tensions and conflicts, especially regarding anthropocentricity and interpretations of “nature,” have brought critical animal studies and ecofeminism into certain tension in recent years, best seen through the conflicts between Greta Gaard (2017) and Annie Potts (2017) regarding ecofeminism’s place in critical animal studies theory (and vice versa), as well as the debate between Rebekah Sinclair (2016) and Carol J. Adams (2016) in Donaldson and Carter’s (2016) edited volume. Cudworth, herself, maintains clear influences of Anarchist thought, posthumanism, sociology, and complexity theory (Cudworth and Hobden, 2018; Cudworth, 2015, pp. 93-107) in her work; such work has even contributed to a project with Hobden set to develop a field of study referred to as “posthuman international relations” (University of East London, n.d.) Consequently, attempting to place

Cudworth's work in one specific field or another is a fruitless task; the influences and approaches of anthroparchy maintain a distinctly interdisciplinary/transdisciplinary approach. These matters point to the need for a theory which can navigate certain underlying tensions without the outright dismissal of one field for another. Anthroparchy is well suited for such a choice; it maintains a focus on nature and environment, while also – as will be demonstrated – allowing for the application of anthroparchal theorization to animal lives, best seen in Cudworth's 2008 paper. Given cultured meat's potential impact on all lives in question, anthroparchy is a comprehensive theory, and consequently requires further explanation.

The Functionality of Anthroparchy

Cudworth (2005) posits that current efforts to theorize the "posthuman" condition must be cognizant of difference and its multiplicities, especially in the face of domination; however, with this principle, it is also necessary for posthuman sociology to recall that social life is characterized by embedded and embodied characteristics (p. 8). Such embodiment, in this work, can be viewed as emphasizing the body as a complex, interrelated systemic network of "becoming and emergence," which is presented as allowing for the overcoming of the "nature-culture divide" which is the current embedded ecological condition (Cudworth, 2005, p. 130). In order to understand how anthroparchy reinforces the current embedded condition, the matter of how such reinforcement functions must be reviewed.

Yet, there is one other matter to note. Cudworth tends to present anthroparchy as a sort of antithesis to what can be seen as the failings of deep ecology and other theorizations. Specifically, anthroparchy is compared to anthropocentricity, and Cudworth (2008) argues that anthropocentricity – the humano-centrism identified by the likes of Naess and Devall – is too weak of a political term to effectively describe the violence faced by the nonhuman, necessitating a term which automatically implies a form of domination (p. 34). Cudworth (2008) also compares anthroparchy and speciesism, arguing that speciesism implies a behavior (or practice) of discrimination (p. 34). The comparison reveals the difference between the two terms; anthroparchy is not "just" societal discrimination against nonhumans but is, instead, a hierarchy around which the relations with nonhumans are organized on a wide-ranging basis (Cudworth, 2008, p. 34). Cudworth (2005) does not necessarily discount anthropocentricity nor speciesism; the very definition of anthroparchy retains a repackaging of Spinoza's view of nature as part of the cosmos by way of holism (p. 18). However, Cudworth (2005) specifically works to reject what is viewed as the denial of difference within humanity, which is presented as a perpetuated failing of deep ecology scholars (p. 19). To quote Cudworth's (2005) specific claims, "the deployment of theories of anthropocentrism in a way which juxtaposes human-centered and biocentric analytics and ethics cannot account for the complexity of domination in a world fractured by difference, just as a theory of patriarchy or of capitalism or, indeed, of a postmodern 'condition,' cannot by itself provide us with an inclusive theoretical framework" (p. 21). Whether or not Cudworth's conceptualization of anthroparchy actually fills this gap, or replaces the need for theories of anthropocentricity and speciesism, is a question that cannot be addressed in this dissertation. What is clear, though, is that the conceptualization of anthroparchy attempts to reconcile complex difference and the need for a more inclusive theoretical framework.

The Formation of Practice(s) of Power

Cudworth's conceptualization of anthroparchy relies on two factors: the formation and practice(s) of power, and the structure-networks which form the anthroparchal social system. The formation and practice(s) of power are oppression, exploitation, and marginalization. When necessary, I will refer to this conceptualization as the "OEM" element of anthroparchy. OEM embodies Cudworth's (2005) concern with capturing the various degrees of complex difference, as it identifies various degrees of social domination, as well as how such domination formulates, implicating different elements in a variety of ways (p. 64). OEM is based on a "sliding scale" of sentiency; animals "closer" to human beings, in ways of both biology and sentience, experience *oppression* under anthroparchy (Cudworth, 2005, p. 64). The presence of sociality, and the presentation of such sociality, is viewed as a way to measure how different forms of oppression apply to different species (Cudworth, 2005, p. 64). Oppression might be seen, then, in cases of exploitation of apes, gorillas, and monkeys in the production of food, as an example. For those further away from "sentiency," *exploitation* under anthroparchy may be experienced. Exploitation refers to the use of spaces, beings, etc., as resources for human ends – here, plant life, soils, and "certain" domesticated animals in agricultural use would fit under this category (Cudworth, 2005, p. 64). Finally, entities which are "rendered merely insignificant" can be seen as experiencing *marginalization* under anthroparchy (Cudworth, 2005, p. 64). Marginalization is presented as the "most" of what anthropocentrism is capable of capturing, reiterating the differences between the two concepts (Cudworth, 2005, p. 64).

Different organizations can perpetuate the entirety of the OEM concept simultaneously. For example, animal agriculture's political economy can be seen as marginalizing animals by defining certain species and animals as resources, or in animal agriculture's disregard for certain animals and natural entities (Cudworth, 2014, p. 29). The exploitation occurs through the use, modification, and intensification of an animal's reproductive capacity (Cudworth, 2014, p. 29). The oppression of animals arises through the denial of specific species behavior, physical harm, and ultimately the murdering of the animal (Cudworth, 2014, p. 29). Interestingly, Cudworth (2014) does posit that intensive animal agriculture can be conceptualized as an "extreme" or "strongly oppressive" institutional site of anthroparchal violence (p. 29), which raises questions regarding what might be seen as "less extreme" or "less oppressive," especially in relation to the impacts on the beings in question. This question will be addressed in a subsequent section of the chapter.

It is important to note that OEM is also affected by the spatial and temporal dynamics of anthroparchal relations. Cudworth (2005) notes that weather patterns and tidal flows may prevent human beings from exerting control over the environment in exactly replicable ways when compared to those in more temperate regions, reiterating the importance of accounting for human diversity in socioecological theorization (p. 64-65). Spatial and temporal dynamics impact the relationship(s) between human and nonhuman entities, which must be accounted for in the assessment of anthroparchal functionality. As well as the impact of the spatial and temporal, the "cross-cutting" of other systemic dynamics must be accounted for; patriarchy, capitalism, colonialism, and orientalism are all cited as systems which coalesce and intertwine with anthroparchy, changing the ways that anthroparchy functions in different contexts and settings (Cudworth, 2014, p. 28). It should be noted

that such considerations do not necessarily mean one group may be “more oppressed” or “more socially excluded,” but “situated differently” than others within the anthroparchal context (Cudworth, 2008, p. 33).

Structure-Networks

The OEM framework cannot be constituted without the practices stemming from the structure-networks of anthroparchy. Each will be assessed in detail.

Anthroparchal Relations in Production

Cudworth (2005) conceptualizes anthroparchal relations in production as the use of “nature,” through its classifications as resources for human ends to be satisfied (p. 65). The production of goods, and consequently the rendering of natural elements as “goods,” has long served as the link between humanity and environment; with the rise of globalized, postmodern capitalism, European modernity and industrialization change the spatial and temporal impacts of productive relations, with multiple specified and general impacts which continue to call attention to the disparity between the logic/needs of capital and the goals of social cohesion alongside diverse cultural values (Cudworth, 2005, p. 65-66).

It should be noted that, under anthroparchy, “environment” is defined as both the animate, non-human world, and the contexts of such a world, which covers an immensely wide ground (Cudworth, 2008, p. 34). This grouping is simultaneously critiqued and used by Cudworth in the conceptualization of anthroparchy; the critique notes the wide range and need to better conceptualize “nature” and “environment,” but this definitional standard utilizes a biological-referent-grouping in which what is defined as “environment” is considered using criteria of metabolism, growth, reproduction, and stimuli response (Cudworth, 2008, p. 34). Therefore, to Cudworth (2008), “‘nature,’ as applied to non-human animals, is a socially constituted category with the physical referent of species difference” (p. 34). This conceptualization of “environment,” which does not reject the anthroparchal definition outright, but utilizes it with critique, does lead to some difficult questions regarding the conceptualization of anthroparchal relations in production. For example, how might one overcome the social criteria of the physical referent of species difference, and would such an overcoming allow for the imagination of new – or destroyed – relations in production? Such a question may arise from the assessment of such relations in production, but will not be answered solely through such a concept. Anthroparchal relations in production, as a constitutive category, highlight the modern formation of relations in production which, between human-animal and human-nature, is a highly industrialized and modernized relational matrix.

Anthroparchal Reproduction and Domestication

Because anthroparchy undergoes temporal changes and shifts, at a systemic level, numerous structures can produce sudden and rapid changes over a set historical period. A primary change that Cudworth focuses on is the application of technology to “nature” and “natural processes.” Reproduction and domestication have long-served as the sites of technological and biological intervention; hybrid breeding of plants and animals has been a long-standing practice for what is identified as “millennia”

(Cudworth, 2005, p. 67). However, what is problematized, under Cudworth's (2005) assessment, is the intensification of such (bio)technological practices since the onset of industrialized modernism, which often renders nature, through determinism, as a "passive collection of genes subject to environmental forces and constraints" (p. 67). Private interests and corporatized global governance, through entities such as the World Trade Organization, have pursued the privatization and intensification of biotechnological modification for the purposes of obtaining capital; simultaneously, as innovations become defined more by artificial technology and efficiency standards, the logic of capital so maximizes these interventions that concerns of "unnaturalness" unravel quickly, as the presence of industrial and biotechnological innovations threatens the presence of nature in material and immaterial senses (Cudworth, 2005, p. 67-68). Such logics of intensification can also affect "natural" processes indirectly, seen in ongoing patterns in natural fish reproduction stemming from intensified industrial fishing (Cudworth, 2005, p. 67).

Cudworth (2008) best demonstrates the impact of this dynamic on farm animals when looking at pigs who are slaughtered within the animal agriculture system: specific examples include the use of female animals as profit maximizers, who are subjected to major biotechnological interventions with their natural reproduction processes; and the symbolic presentation of animals in ways resembling human gender binaries, through imagery – utilized in advertisements designed by professionals within the animal agriculture industry – which presents female animals as "good mothers" and male animals as "promiscuous" (p. 38). Cudworth (2008) does note that all animals are subjected to metaphorical feminization through gendered terms of abuse used by agricultural workers and slaughterhouse staff, but stresses that the most heavily feminized animals are the ones who suffer most (p. 40). Anthroparchal reproduction and domestication also reflect the gendered division of the social structures of other systems; patriarchal standards and behaviors are often seen in the butchering industry through the symbolic/metaphorical functionality of its workers, as well as the actual labor pool (Cudworth, 2008, p. 40-42). Consequently, anthroparchal reproduction and domestication cannot be viewed as a solely "human-animal" or "human-nature" issue, as the standards in "human-human" relations also perpetuate anthroparchal norms and standards in a symbiotic manner.

Anthroparchal Politics

Anthroparchal politics are the least developed aspect of Cudworth's (2005) conceptualization of anthroparchy. Essentially, by definition and by "nature," the institutions and practices of governments, governing bodies, and governance, reflect anthropocentric interests. These practices can occur through policy, such as subsidies for intensive farming or support for infrastructure/development projects with no regards for natural settings (Cudworth, 2005, p. 68). Indirect practices, such as inaction, can also reinforce anthroparchal politics, and the production/domestication network-structures therein. However, states can also alter anthroparchal relations, through laws or activism, such as animal welfare laws or natural resource protection practices (Cudworth, 2005, p. 68).

This broad definition does raise some important questions. While institutions of governance are an understandable focus, other entities are left unaddressed. For example, can environmental activist groups be viewed as actors in anthroparchal politics? Or are they too weak to be seen as an institution

which impacts anthroparchal politics? What about the general populace? In the production and contestation of relations in anthroparchal domination, one is left to wonder what role other groups, especially at non-systemic levels, might have in anthroparchal dynamics. A state may move in one direction in anthroparchal politics, but whether the citizens of said state will move in the same direction – or could move in another direction entirely – renders a state-based conceptualization of anthroparchal politics somewhat weak. Furthermore, would a restructuring of anthroparchal politics necessitate a restructuring of the entire human-animal-natural relationship – something akin to the implications of Cochrane & Cooke’s (2016) or Matsuoka & Sorenson’s (2013) arguments – or are there matters which can be separated from anthroparchal politics? These matters demonstrate that the structure-network is certainly a valid point of order, but may require some further adjustment or definition in its application.³⁴

Violence

In regards to violence, a direct quote is needed to convey both the exactness and ambiguity of Cudworth’s (2005) conceptualization; “violence is conceptually contestable. I take a broad sweep and include symbolic forms of violence, which may recall or suggest physical harm, as well as the most usual material definition of physical coercion. The definition of violence depends on both culturally specific and ‘real’ notions of subjectivity, and normative presumptions [which] shift over time, place and space” (p. 68). Cudworth (2005) specifically cites Britain, where domestic violence has been rendered illegal, but fierce debates rage in regards to whether the use of hunting dogs to violently tear foxes apart should be considered amusing or violent (p. 69). Sentiency continues to be a defining factor for Cudworth (2005) in understanding violence; as animal species closer to humans, in terms of sentiency, are seen as experiencing violence in a more intense manner, the debates between different ecologies play a role in how violence can be understood (p. 69). In this conceptualization, physical damage is an important factor in defining and identifying violence, which allows for nature to be accounted for under this structure-network conceptualization (p. 69). However, that makes the “symbolic forms of violence” a more difficult category to navigate, as Cudworth implies that such symbolism may need to be modelled around physical harm in order to be defined as “violence,” opening the possibility for inquiry as to just how much subjectivity can be unraveled in these debates, especially in ways which could lead to bad-faith distraction. Similar to anthroparchal politics, violence is a structure-network that is identified, but could use further refinement in future work.

Cultures of Exclusive Humanism

Cudworth (2014) provides a guide for identifying cultures of exclusive humanism, but it is difficult to arrive at a “definition” of this system-network; anthroparchal culture, as made clear by this point, is human-oriented and anthropocentric, with binaries which present the nonhuman in ways that

³⁴ As well, “politics” is a difficult concept to define on its own accord, let alone in reference to a specific type of politics. Cudworth’s assessment focuses less on the process of decision making, and more on the acquisition, holding, and use, of power in various material and immaterial forms. Given the broadness of the concepts of both anthroparchy and politics, Cudworth leaves room for interpretation and further clarification of the concept of anthroparchal politics, something which can be pursued outside of the purviews of this work.

reinforce human interests and “the norms of human domination” (p. 29). Culture, in and of itself,³⁵ is defined by speciesism and ethnocentrism, which also holds intrahuman implications, especially when considering the rendering of power relations and who controls which groups are defined as “human” or not (Cudworth, 2005, p. 69). It is here where Cudworth (2005) reiterates the importance of complexity theory in understanding anthroparchy; systems interact with other systems, contextualize themselves against or in tandem with other systems, and must be understood in complex ways (p. 69). These complexities of exclusively humanist cultures are cited by Cudworth (2008) as the foundation for the encouragement of animal consumption in the anthroparchal system (p. 35). It is important to note that the lack of a true “definition” of cultures of exclusive humanism could lead to theoretical conundrums, as some may contest that this network is merely the repackaging of the notion of anthropocentricity, albeit through the frame of complexity theory. Yet the contestation through Cudworth’s work – that certain ecological theories have failed to offer adequate commentary on intrahuman relation dynamics – likely explains the conceptualization of cultures of exclusive humanism, even if its actual definitional functionality does appear quite similar to anthropocentricity.

The Importance of Anthroparchy

In terms of assessing the relations between “human” and “nature,” anthroparchy provides a systemic theorization which has a keen eye for the ongoing limitations of certain approaches. Deep ecology is given special attention in Cudworth’s analysis; while there is likely disagreement with Cudworth’s claims about deep ecology and its weak nuance, it is difficult to deny that current approaches sometimes find themselves locked into symbolic flourishing which may overlook more detailed specificities. Anthroparchy is, ultimately, a theory defined by the era of complexity but is also an effort to define the role of complexity in conceptualizing and visualizing the social matrices which define human, animal, and inanimate life.

Anthroparchy provides a range of opportunities for assessment, from material considerations – such as workforce composition, productive forces, and changes to efficiency approaches – to symbolic and metaphysical matters, such as the language and definitions which render “environment” as a wide-ranging, homogenous category. This range is essential for navigating issues related to animal agriculture, climate change, and resource use. The notion of human domination can manifest at a variety of interrelated levels, necessitating an approach which can cover ground that, in many cases, is often considered separately. Whether or not the range of potential analysis is exercised to the fullest extent throughout Cudworth’s work is another matter; the issues in understanding the violence system-network, mentioned previously, do demonstrate a need to further experiment with the assessment of anthroparchy. However, the foundations for comprehensive analysis can be found in this theory.

³⁵ Of course, culture is an immensely difficult concept to define; its ambiguities alone have taken volumes of work to identify. Typical definitions of culture maintain some notion that the components of culture are shared; beliefs, social organization, customs, material existence, traits, values, goals, etc. are all believed to be *shared* amongst a group (or set of groups). While Cudworth is, in this instance, focussing on how cultures are exclusively humanist – consequently, not requiring a strictly held definition of what “culture” is – readers unfamiliar with the conceptual difficulties can use this footnote as a reference point.

In relation to cultured meat, at this juncture of the dissertation, the contours of the remaining assessment can be identified. Cultured meat raises major questions regarding how it might restructure the relations of production under anthroparchy. Domestication and reproduction concerns will remain whether cultured meat disrupts, entrenches, or expands current anthroparchal relational dynamics. Despite the limited political assessment in the current discourse, cultured meat can be theorized as a point of anthroparchal political order, especially in regards to whether cultured meat may still depend on violence towards animals or not as its production (potentially) progresses. In terms of cultures of humanist exclusivity, cultured meat will need to be assessed for its ability to alter the ontological foundations of current understandings of human and animal, as well as nature; anthroparchy provides a way of moving forward with such an assessment, even if the concept of human exclusivity, culturally, is currently left in a state of ambiguous definition. In terms of anthroparchy, each subsequent chapter of this dissertation will look at whether cultured meat might disrupt, reinforce, or expand the structure-networks of anthroparchy, using a variety of scenarios – which either exist in the discourse, or can be identified through various notions present in the overall discourse – to test such possibilities. Anthroparchy provides a systemic framework through which the concepts of disruption, reinforcement, and expansion, can be tested and engaged, and will prove important for better understanding the potentialities of cultured meat.

The Limitations of Anthroparchy

No theorization is “perfect,” in the sense that there are always underdeveloped points. However, anthroparchy has some notable matters which do need to be addressed, all of which relate back to the issue of sentience. The OEM framework demonstrates this matter best. Cudworth (2005) cites Iris Marion Young’s theory that oppression of certain groups comes into being through the “five faces” of power: exploitation of labor; marginalization through social exclusion; powerlessness embodied by a lack of political authority; cultural imperialism; and violence (p. 74). Young claims that a group facing any of these five faces can experience oppression. A driving question arises from Cudworth’s citation of Young: why did Cudworth not merely apply Young’s framing to the theory of anthroparchy, instead of coming up with the similar-yet-different OEM framework?

The answer seems to rest in sentience, as nature and animals are subject to exploited labor, social exclusion, powerlessness, and violence. Cultural imperialism is, admittedly, a different matter, though work outside of this dissertation could investigate this point further. Cudworth utilizes sentience to indicate that, despite these considerations, “nature” can only experience the oppression so long as it is closer to humans in terms of sentience. It is fascinating that sentience is used in this approach when Cudworth’s work has become so closely associated with critical animal studies, which Chapter 1 demonstrates is a fundamental point of rebellion for the field. The sliding scale of sentience, which is used to define the OEM framework, implies that how the animal or natural being in question understands itself is what determines the oppressiveness or exploitive elements of the relation, not the action in and of itself. There is a worrying possibility that anthroparchy moves the consideration of the animal from a condition to a question, and consequently, certain actions could be justified on the basis of questionable assumptions regarding awareness of self, especially for an animal other long ignored in philosophical and sociological senses.

Cudworth's association with CAS is difficult to reconcile when the idea of sentience is such a point of contention for this field. Ryan (2015) notes that Singer's framework³⁶ may advocate for equality, but that equality is one of equal consideration, not equal treatment; as a result, considerations of life and suffering come across as moral ideas instead of asserted fact (p. 121). As a result, Cudworth's (2014) own notion that animals "may" experience pain and fear during slaughter allows for the discussion to move to one of ideas rather than fact – or, subjectivity of no conviction in place of subjectivity with conviction (p. 29). An important factor remains unaddressed: can Cudworth actually guarantee the experience of animals in such a way that the OEM conceptualization is adequate?

There is no real commentary throughout Cudworth's work on animal experience and life in and of itself. The OEM concept may be relevant to scholars debating the inner-workings of systemic theorization, but its relevance to animal existence is highly questionable. The questionability is founded on three concerns. First, sentience is not only a contestable idea, but our understandings of sentience are subject to wide-ranging debate. For example, is access to the senses essential for experiencing sentience? If so, individuals without these senses – as well as animals without – can be seen as non-sentient, and subsequently, discarded from anthroparchal consideration, even if Cudworth takes issue with numerous systems of oppression. Second, what criteria are needed to determine, accurately, how "sentient" nature is? Though Cudworth gives some ideas – growth and stimuli response, for example – the actual nature of determining what "sentient" stimuli response entails, and what it does not entail, is left undetermined, generating numerous points of concern. This matter reiterates the ecofeminism vs. critical animal studies debates cited in the background section of this chapter. While broad determinations can be made through anthroparchy – for example, a carrot is likely only to be marginalized, in comparison to a cow killed for food – more detailed determinations are more difficult to obtain. Should sentience be defined by general category? Are disabled animals less sentient than non-disabled? These questions cannot be adequately addressed under anthroparchal theorization, which leads to a final concern. Cudworth does not necessarily conceptualize animal life as its own entity, nor as an anthroparchal actor in and of itself. As such, there is a limited imagination in this framework, which likely needs to be overcome for a more robust consideration of life under anthroparchy. One may not be able to verify, in typical terms, the "sentience" of the animal; at the same time, one cannot necessarily disestablish the "sentience" of the animal. Is it possible that an animal may feel oppressed, even if it would not be defined as oppressed under the OEM framework? What tools of verification may or may not exist to aid in such a determination? And, finally, is such a debate relevant to the condition of the animal, both materially and symbolically, under anthroparchy?

The closest Cudworth (2014) comes to addressing these matters is a comparison between farm animals, working animals, and pets (p. 30). Cudworth (2014) begins this comparison by claiming that domination is likely not experienced by all animals in the same way, but these categories remain evidence that all of these groupings of animals can experience domination and abuse in a variety of ways (p. 30). However, while this distinction is reasonably fair, Cudworth does not address how such a distinction can also be abused; pets may experience domination differently, and therefore individuals may argue that these experiences are not a concern when compared to the treatment of animals in

³⁶ Discussed in the "Critical Animal Studies" section of Chapter 1.

other contexts.³⁷ As well, there is no commentary on how certain identities may be interlinked to one another, and what the repercussions might be should such categories be challenged. The use of claims about what does and does not matter holds the potential to derail discussion about the overall anthroparchal condition. Such a matter warrants serious consideration, but also reiterates concerns about how relevant the distinctions are to the animals in question.

Cudworth's theorization is a helpful tool, but it may not necessarily address everything relevant when considering the conditions of animal and nature faced under anthroparchy. Such matters need to be dealt with, however, especially in the context of cultured meat. Even if animals would not suffer in certain situational contexts – which is not a determined point at this time – that does not guarantee that there would not still be concerns surrounding the animal condition under anthroparchy. Such points will be addressed throughout the remainder of the dissertation, but can also be counter-balanced by the presence of another systemic theory.

Carnism

Basic Definition

Melanie Joy (2016) defines carnism as “the ideology which conditions people to eat animals” (p. vi). Though carnism is ultimately more complicated than a singular ideology – as will be discussed in subsequent sections – this baseline definition serves as an ideal starting point. The notion that meat eating is different from vegetarianism or veganism calls attention to the idea that meat eating is normalized to a point where alternative approaches are viewed as ideological (Joy, 2010, p. 29). Work on carnism has often attempted to demonstrate that meat eating is an ideological approach to food consumption, regardless of normalized notions; efforts to defend meat consumption depend on ideological viewpoints and decisions, which postulate the need to identify an ideology behind meat eating in and of itself. Mainstream ideology does not necessarily reflect truth – take, for example, the reactions to Copernicus's and Galileo's claims that the Earth revolved around the sun – but, instead, the widespread and entrenched beliefs of the populace, which are so reinforced that they are automatically accepted by many as common sense (Joy, 2010, p. 31). It is this effort to determine what is “truth,” and what is merely “normalized,” which guides much of the current work on carnism.

Background

Carnism was first introduced in Joy's (2001) contribution to *Satya* magazine, which engaged with the importance of linguistic restructuring for the animal liberation movement (n.p.). However, the concept was popularized following Joy's (2010) publication, *Why We Love Dogs, Eat Pigs, and Wear Cows*. Joy's background relates to the psychology of violence and nonviolence, specifically in terms of what can be seen as “nonrelational” behaviors which are harmful (Joy, n.d.) While much of Joy's work relates to psychological communication and relationships, her ideas on carnism have been expanded

³⁷ For example, one may claim that the oppression of pets is not as relevant as the oppression of the farmed animal.

since 2010. Specifically, Joy (2016) has extended the theory of carnism to include what are referred to as “neocarnisms,” which will be engaged with in later sections.

Associated Fields and Foundational Works

The concept of carnism is a common point of assessment throughout the field of critical animal studies, and in a symbiotic relationship, Joy’s concepts ultimately expand on ideas introduced by other critical animal studies authors. Most importantly, Adams’s notion of the absent referent serves as an important foundational point of order for carnism. The language used to describe meat products – such as burgers, bacon, etc. – does not accurately describe the food in question; more accurate terminology would identify burgers as slabs of dead animals (cows, chickens, etc.) on a bun. As such, absent referents are free-floating images, rendering absent the actual process of food creation and violence towards animals. That said, there is still some level of knowledge of what processes are needed to create such food, but the absent referent calls attention to a falsified image of reality, allowing for cognitive dissonance (Adams, 2010, p. 13; 66-91). Adams posits that absent referents affect animals, women, and racialized groups in a variety of interlinked but also separate ways.³⁸

The absent referent concept ultimately serves an important purpose in providing a foundation for Joy’s work, because the engagement with the absent referent often occurs at the individual level. While Adams (2010) demonstrates many systemic elements which contribute to the creation and functionality of absent referents, it is still often discussed in terms of the engagement (or lack thereof) with the metaphor at an individual level. While readers of Adams’s work can point to systemic factors which likely contribute to the perpetuation of the absent referent, as well as the adherence to its metaphorical tenets, Joy’s work applies principles of absent referents at larger sociocultural and political levels. However, Joy’s work also goes beyond building upon the absent referent, so it is important to convey what else the theory of carnism postulates.

The Functionality of Carnism

(In)visible Violence

Producing meat – whether for mass global consumption or for a local context – inevitably involves violence. This violence is known, in a certain sense, because there is no other way for meat to be produced (or, at least, what many consider “meat;” those who do accept plant and cultured meat may define meat differently). However, most people will never engage with that violence in any direct form, and the indirect engagement often comes through consumption. Joy (2010) posits that avoidance and denial are important components in rendering carnism invisible to the public eye, as the invisibility of the system – through its ideological acceptance and its material manifestations – allows for the avoidance and denial of the system itself (p. 21; 32-33). Carnism is ideologically hidden, because it presents choices as not being choices, utilizing the absent referent to not only normalize violent practices, but to render them both present and invisible simultaneously (Joy, 2010, p. 30). Carnism is also literally hidden; the current historical juncture of carnism has moved animal production from town

³⁸ This matter is addressed in more detail on pages 122-123 of this dissertation.

squares and public rurality to facilities hidden from public view, subject to numerous whistleblower laws (Joy, 2010, p. 33).

This (in)visible violence ultimately exists because carnism is a violent ideology, organized around violence at numerous levels, most notably the physical. Joy (2010) posits that carnism would cease to exist if the violence was removed from the system (p. 33). Whether such a claim is accurate or not could possibly be put to the test by cultured meat, but at this point, Joy's claim is fair; widespread, systemic, organized violence towards animals is the foundation for carnism, and the removal of such violence would, at least, surely disrupt the system in a substantial way. Joy (2010) stresses that common human reactions to violence are usually to express discomfort with the idea of killing, going so far as to claim that there is a "natural aversion" to killing which systems such as carnism overcome through desensitization and normalization (p. 34-35). Consequently, I have modified the notion of "invisible violence" to "(in)visible violence" to accentuate Joy's simultaneous balancing of the awareness of violence with the cognitive dissonance and desensitization needed to perpetuate such violence.

Because of the nature of (in)visible violence, in which all are simultaneously aware of the violence necessary to perpetuate such a system yet participate in the creation and use of absent referents, Joy (2010) puts forward the idea that there is an "implicit contract" between consumers and producers; consumers accept producer practices, regardless of quandary, and producers push forward, comfortably, assuming that their practices will continue to be accepted (p. 71). In order to continue with current practices, consumers are obligated into accepting the narratives of producers, and producers are obligated to continue providing rationalizations for consumer demand. Joy (2010) engages with some comparison between Nazism and carnism as systems of (in)visible violence; Hitler's belief in simple, repeated lies being effective for mobilizing a large populace is used as a comparative device (p. 37), though whether such systems are "exactly" comparable would require analysis beyond this dissertation. However, the inherent logic can certainly be seen; despite awareness of violence, and the questionable origins/reasons for said violence, social controls and incentives create a symbiotic dynamic between individual and institutions, both working under implicit contract to, as Joy (2010) puts it, "hear no evil, see no evil, speak no evil" (p. 71). Joy's use of Nazism is part of a controversial tradition in animal rights and liberation ideology and practices, a tradition that, often, is met with disdain and general criticism, based particularly on concerns about the undermining of historical experiences amongst those who were (and continue to be) the targets of Nazi ideology. Seemingly predicting this eventual fault-line within animal rights thinking (and amongst those outside of it), Derrida (2008) argues that, in making such comparisons (or general comparisons of genocide(s) and violence towards animals,) "one should neither abuse the figure of genocide nor too quickly consider it explained away" (p. 26). It is generally this stance I take in regards to Joy's (2010) approach; my summarization of her approach does not automatically equal an endorsement nor a condemnation. There is too complicated a history to unpack in this specific context; however, readers should be aware of the scale at which Joy believes (in)visible violence is constituted, which does require making reference to her comparative devices.

Because Joy's work often focusses on the widespread industrial animal agriculture system that currently provides meat on a global scale, some questions about whether these patterns can be seen at a micro-level do not come across in Joy's texts, which is an issue. For example, Stanescu (2016) has

highlighted that major advocates for “local meat” – Michael Pollan, Katherine Friend, and Joel Salatin – have all encouraged consumers to visit local farms if they have questions about how their meat is raised (p. 145). However, it is never made clear what incentives small farms would have to be honest with consumers, beyond a belief that farmers – if they are not “industrial” – are honest. Consumers, under this imagery, would have to visit each farm relevant to their purchasing, and confront farmers in what are often non-confrontational settings, likely lowering the chances of “true” accountability arising through local meat. Whether or not local, small-scale meat production, by its “nature,” can overcome the issues of (in)visible violence is a matter that could use further addressing, as preliminary evidence points at a much different set of conclusions. Another question arises in relation to those who advocate for the “kill what you eat” approach; would these individuals render (in)visible violence visible because of the nature of what they are advocating, or would the violence still be (in)visible, even if more open to the public, because of the symbolic and metaphorical rationalizations which reinforce (in)visible violence? While Joy’s answers can likely be inferred, the prominent focus on industrial production does create the possibility for overlooking issues with meat consumption in non-industrial systems.

Mythmakers and Institutional Support for Carnism

Joy (2010) cites a speech by Timothy Cummings, a poultry veterinarian and clinical professor, as an example of the linguistic struggle to maintain the (in)visible violence of carnism. Cummings advocates for industry insiders to “control the debate” by changing terminology, related to violence towards chickens, in ways that deflect the violent nature of the practice. He recommends that “debeaking” be changed to “beak conditioning,” “backup killer” to “knife operator,” and “bled to death” to “insanguinated,” in order to make animal rights activism a more difficult linguistic task (Joy, 2010, p. 47-48). Cummings’s recommended changes do not fully remove the violence towards animals, as “knife operator” and “beak conditioning” still imply some level of violence, but the proposed phrases would, indeed, likely contribute to a further cognitive dissonance amongst consumers of meat.

Such recommendations are emblematic of the power of what Joy (2010) refers to as the “mythmakers” of carnism. Mythmakers range from the institutions of power – which perpetuate laws, develop policy, and support potentially harmful practices – to those who reiterate ideas of carnism without what can be seen as “necessary” critical reflection (p. 87-104). The largest identifiable institutions are the meat industry and democratic governments, who Joy (2010) argues form an undemocratic, violent bureaucracy which institutionalizes violent ideologies in ways hidden from public view (p. 87-91). Power within the meat industry is concentrated in a near monopolistic fashion, and with lobbying laws as they are – at least, in the United States – Joy (2010) goes so far as to claim we are living in a “meatocracy,” one so comprehensively powerful that even bourgeois celebrities, such as Oprah, can be sued for not following “food libel laws” (p. 91).

These actors would likely be considered “aware,” cognizant of what they are perpetuating. As Joy (2010) stresses, not everyone who encourages the myths of carnism is aware that they are doing so. Professional classes, and even personal figures – such as family members – can be classified as “mythmakers” of carnism, individuals who reiterate the narratives of carnism without necessarily critically questioning such narratives. Cognitive dissonance becomes easier to spread and reinforce if

individuals in positions of some authority reiterate the myths of carnism; veterinarians who eat meat and advocate for gestation crates, despite their daily engagement with the subjects of the systemic violence of carnism, are one example (Joy, 2010, p. 98). Joy (2010) does stress that there are key differences between those consciously and unconsciously perpetuating carnist narratives, but all parties can be seen as contributing to the continued reinforcement of carnism and its (in)visible violence.

Cognitive Dissonance and Rationalized Visibility

Because of the simultaneous nature of (in)visible violence under carnism, there is always a risk that individuals, who reiterate common narratives, may someday realize underlying contradictions about what they are claiming. Therefore, carnism cannot always remain invisible, and when it fails to “stay in the shadows,” so to speak, there are rationalizations available.

The Three N’s

The first of the rationalizations identified by Joy (2010) is the “normality” of eating meat (p. 105). Because the tenets of ideology, if said ideology is accepted at a large scale, can morph into social norms, the notion that meat eating is “normal” is considered not just a descriptive statement, but a prescriptive statement – essentially, not only is the consumption of meat normal, but it should remain the norm, guiding behavior in the process (Joy, 2010, p. 105-107). A key tenet of Joy’s (2010) concern, here, is that norms are socially constructed, even if these norms are so normalized that they are seen, to some, as innate (p. 105). Social rewards and punishment are inherently interlinked to the normalization of meat consumption, as vegetarians and vegans still face practical and social stigma (at least, in many circumstances related to meal availability and accusations of social/psychological abnormality – some changes can be seen since the original 2010 publication). Because of the role of normalization, the questioning of practices can be quite difficult; a common example is the questioning of Thanksgiving turkey, a practice so normalized that the holiday, were it not to involve the turkey, would likely be seen as abnormal (Joy, 2010, p. 107).

The second of the rationalizations is that meat eating is natural (Joy, 2010, p. 107-109). Joy frames the “natural” rationalization as a matter related to time and normalized social practice; humans have been consuming meat for a considerably long time, well before the advent of industrial capitalism, and therefore it must be natural to consume meat (Joy, 2010, p. 107). However, as Joy notes, infanticide, murder, rape, and cannibalism also have an ancient, historical presence; yet history is (often) not used as the justification for such acts (Joy, 2010, p. 107). Moving from “the way things are” to “the way things are meant to be,” the natural rationalization conflates natural with justifiable reasoning, which Joy (2010) warns against (p. 107). Notions of “natural” and “unnatural” have been used to subjugate races, genders, and other groupings, throughout history; to overcome such notions requires separating what has been natural with what has been justifiable (Joy, 2010, p. 108-109). Joy (2010) also puts forward that three disciplines – history, religion, and science – have all perpetuated the “natural” rationalization, as history has utilized the definition of “facts” to present ideas and notions of how things are as if they have always been a certain way, and will remain a certain way (p. 108). Religion and science are grouped together, as both utilize spirituality and intelligence – sometimes in unison,

sometimes not – to justify anthropocentric beliefs in natural superiority (Joy, 2010, p. 108-109). While underlying questions about how nature is defined, and related to by a variety of groups, would likely be helpful in fully clarifying the discipline-based arguments, the natural rationalization can still be identified to a fair degree.

The third of the rationalizations is that meat consumption is necessary (Joy, 2010, p. 109-110). Related, quite closely, to the previous rationalizations, the notion of “necessary” meat eating identifies a greater good – that of human and humanity’s survival – that must be fulfilled by the slaughtering of one group by another, creating a myth of inevitability that is difficult to shake (Joy, 2010, p. 109). Joy (2010) identifies three key myths which perpetuate this rationalization: “the protein myth;” the myth that the world will be overrun with animals to a potentially unstable degree, justifying the killing that has already been done with more theoretical killing; and the myth of an economic imperative to continue eating meat (p. 110-112). While other myths can likely be identified, even if they often take on a plethora of hybrid forms, Joy does well in establishing common ways of perpetuating the myth of necessity. However, these are merely common social reasons for meat consumption; internal dialogues and beliefs also require some attention.

Internalized Carnism

Joy (2010) argues that carnism distorts the perception of reality; animals under carnism are seen as things, abstractions, and naturally contingent in relation to the concept of meat (p. 116). Joy (2010) counterbalances these notions by identifying animals as beings, individuals, and “meat” only due to social classification (p. 116). However, a key concept for the maintenance of carnism is the internalized mechanisms which perpetuate and reiterate such ideas. Joy (2010) identifies a “cognitive trio” which maintains internalized carnism: objectification (viewing animals as things); deindividuation (viewing animals as abstractions); and dichotomization (viewing animals in categories) (p. 117-123). Each concept warrants discussion.

Objectification is considered the viewing of a living being as an inanimate object or thing (Joy, 2010, p. 117). Both language and institutions objectify the living being that is animal. Carnist language reduces the animal to a thing, with individualized components discussed in ways similar to inanimate objects; carnist institutions, such as the law, classify animals as property (Joy, 2010, p. 118). While the absent referent is still employed, objectification presents animals in such limiting terms that it is difficult to think, and even speak, about animals in other ways – those ways often are so disruptive that they can risk alienating one from the carnist system.

Deindividuation, while having some similarities to the notion of objectification, is defined as the viewing of individuals in terms of their group identity, and as a result, believing individuals share all characteristics of the perceived group (Joy, 2010, p. 119). Deindividuation fails to recognize the individuality of specific members of the group, homogenizing identity into a whole (Joy, 2010, p. 119). Recognizing this individuality can often lead to a disruption of the deindividuation process, as some report feeling uncomfortable with consuming whole groups of animal foods following their awareness with an individual animal (though, certainly, this realization is not a universal case) (Joy, 2010, p. 120).

Deindividualization also serves as a reminder of the socially constructive process of carnism; an example includes cultures which treat chickens in much the same way that dogs and cats are treated in Western contexts, a reminder that the carnist process is not built on inherent, inert truth, but processes of social definition and perception (Joy, 2010, p. 120).

Dichotomization “is the process of putting others into two, often opposing, categories based on our beliefs about them.... [D]ichotomies... are not just classifications; they are dualistic, and as such, they create a black and white picture of reality” (Joy, 2010, p. 122). When considered alongside deindividualization, animals are often placed into categories of “edible or inedible,” at scales beyond human comprehension, and often with numerous other dichotomies within these categories; the difference between the consumption of “cute” and “ugly” animals is one such sub-categorization (Joy, 2010, p. 122). Dichotomizations are not necessarily based on “objective,” or even well-reasoned, categories, which can result in disruptions in the dichotomization processes; for example, pushing individuals to think about why aesthetic looks serve as justification for killing living beings can often lead to realizations about the weakness of certain categorizations (Joy, 2010, p. 123).

Joy (2010) also posits that the cognitive trio must be considered in tandem with matters of scale (p. 121); technology (p. 124); and the distortion of moral feelings (p. 125) as contributing factors to the persistence of the carnist cognitive trio. As a result, empathetic processes become distorted, disgust can become rationalized, and cognitive dissonance becomes widely practiced; essentially, Joy (2010) claims that carnism is not just a social system, but also a psychological system, both of which come together to perpetuate a carnistic schema (p. 131).

Neocarnisms

Over time, Joy (2016) has identified further forms of carnistic rationalization beyond the cognitive trio and three N’s. They are grouped under the classificatory scheme of neocarnism, which incorporates specific ethical considerations that recommend for a change in form, regarding the consumption of animals, instead of an outright stoppage (Joy, 2016, p. x). As well, neocarnism seeks not to validate itself – like carnism – but to invalidate veganism and vegetarianism, a considerably different approach (Joy, 2016, p. x).

The first type of neocarnism is compassionate carnism, which continues to normalize the consumption of animals by arguing that the issue is merely how animals are being consumed (Joy, 2016, p. x). The concern moves from animal life to animal welfare, with the idea that animals can be raised humanely, consequently exonerating consumers from the ethical considerations of animal existence (Joy, 2016, p. x-xi). However, not only are definitions of “humane” inconsistent (Joy, 2016, p. xi), but other authors, such as Stanescu (2013; 2016) and Cole (2011) have identified a number of issues with the notion of “humane” meat. Regardless, compassionate carnism is merely a shifting of goalposts; it does nothing to address the question of animal life in and of itself.

The second type of neocarnism is ecocarnism, which perpetuates the idea that eating animals is “natural” by claiming that current consumption methods are unnatural because they are industrial (Joy, 2016, p. xi). Ecocarnism solutions include switching to “local” meat and “sustainable meat,” often

without any clear definition of what “local” and “sustainable” entail. As well, ecocarnist claims often assert that veganism is unnatural and unsustainable by focusing on highly-processed vegan foods, which do not account for all vegan food (Joy, 2016, p. xi). Ecocarnism also attacks veganism as a “modern aberration,” a continued softening of the human condition stemming from a “disconnection” with nature (Joy, 2016, p. xi). Both claims are weak: the first rests on specific notions of “sustainability” which do not capture much of the modern environmental movement; the second ignores the history of animal liberation discourse and discussion, which can be dated back all the way to Al’mari (Humanistic Texts, n.d.) and Porphyry of Tyre (2000).

The third type of neocarnism is biocarnism, which reiterates the idea that eating animals is necessary through the selective use of human health data and studies; an underlying notion is that what is necessary for human health is exempt from ethical consideration (Joy, 2016, p. xi-xii). Biocarnism relies on the constant back-and-forth of nutritionist studies to relay findings that often end up under scrutiny, as well as the ignoring of human history which includes groups that historically have not consumed meat in the same way as others (Joy, 2016, p. xii). Joy (2016) also notes that institutional advice and revelations are discarded under biocarnist rationalization (p. xii).

The neocarnist schema was only recently introduced, and will likely benefit from continued development; some efforts will be made to expand certain ideas in the remaining chapters. However, the concept demonstrates that carnism evolves, changes, and undergoes shifts, even if long-held ideas continue to maintain stability and general acceptance.

The Relevance of Carnism

Given the scale of global meat consumption, the passionate responses that meat evokes, and the instabilities of this current historical juncture, a theory which investigates meat as an ideological matter is essential. Carnism attempts to account for the ideology of meat consumption – at a broad level – across both sociocultural and psychological levels, which prevents meat from becoming an abstraction by deflecting meat from one realm to another (for example, claims that meat is not a psychological concern, but a sociocultural one, can prevent inquiry instead of offering the opportunity for more expansive analysis). This point offers considerable freedom when compared to anthroparchy, which does not necessarily account for ideological drivers. Now, explaining issues solely through ideology brings about certain limitations, so the ideological focus is not meant to discredit anthroparchy, but, instead, provide additional layers of analysis for what is an immensely complicated realm of assessment.

As well, carnism – like anthroparchy – attempts to balance both material and immaterial assessment. Once again, the drivers and symbols of carnism do not just exist in an immaterial realm of academic discussion and imagination; carnism can be demonstrated in ways that are both quantitative and qualitative. Quantitative examples include the continued expansion of animal agriculture, the proliferation of ag-gag laws, and assessments of discourse consistency, to name but a few ways to approach research on carnism. The balance between material and immaterial assessment can be reasonably difficult to maintain, with the possibility of sliding into one mode or another a tempting idea.

Nevertheless, throughout Joy's work, there is a clear effort to provide examples of carnist ideology in action, even if much of the explanation remains symbolic and linguistic. The concluding chapter of Joy's (2010) book provides an example of when this balance is not achieved; while specific material examples of carnism, such as industrial practices, are given throughout the book, the final chapter focuses on individual perception and empathetic awareness as solutions to these issues, casting aside considerations of what can be done at a systemic level (pp. 134-150). Such an approach does clash with the combined approach seen throughout the rest of the work.

Despite the aforementioned issue of balance, carnism will be of great importance for better understanding cultured meat. Given the competing narratives surrounding cultured meat's possibilities, a systemic theory of meat, overall, can grant researchers greater power to determine how cultured meat "fits" in relation to other forms of meat, food, and sociocultural practice. Carnism poses the possibility of removing violence – in certain scenarios – but whether that renders the animal truly "visible" is another matter entirely. Cultured meat could, in theory, disrupt the institutions and mythmakers of carnism, but the current structure of investment, as well as the narratives being pushed by producers, points to the opposite, creating the possibility for these institutions to be reinforced. And, most importantly, given that cultured meat is envisioned as a "replacement," it will be essential to ask whether such replacement is comprehensive or limited – will cultured meat actually disrupt the cognitive dissonance of the three N's, internalized carnism, or neocarnism(s)? These questions obviously cannot be answered definitively, but inquiry must be made into the possibilities. Overall, what will be most important is to determine, *prima facie*, whether cultured meat perpetuates carnism or not.

The Limitations of Carnism

While there is not a pressing issue with carnism comparable to anthroparchy and sentience, carnism is not without issue. Much of the focus of Joy's work has been diagnostic – identify the system, its relational breakdowns, etc. However, the efforts of Joy (2010) to provide solutions reveal that current conceptions of carnism remain too anthropocentric and are in need of systemic imagination, which stems beyond "meat." In the concluding chapters of her 2010 work, Joy provides many possible resolutions for breaking the cycle of carnistic violence. One example includes the power of "witnessing," in which emotional connection is established to close the "empathy gap" at both the individual and social level (Joy, 2010, p. 138). Joy's (2010) reasoning for such witnessing as a tool of disruption, however, is weak: "virtually every atrocity in the history of humankind was enabled by a populace that turned away from a reality that seemed too painful to face, while virtually every revolution for peace and justice has been made possible by a group of people who chose to bear witness and demanded that others bear witness as well" (p. 139). This quote comes across as a piece of hyper-optimism. Not only is the accuracy of this sentiment questionable, as history has seen populaces not only witness, but actively participate in, violence, but our current historical juncture is becoming defined by the mass witnessing of violence, disaster, and exploitation. Whether this sentiment was true more than a decade ago is one matter, but whether it is true right now is another entirely. Witnessing may be an important step, but it is likely not the end-all-be-all (Joy, 2010, pp. 134-150).

Joy (2010) posits that witnessing, on a mass-scale, could eventually disrupt the human identity as it stands, given the fundamental importance of meat-eating to the identity of many individuals and cultures (p. 143). However, it is unclear how much Joy (2010) is referring to meat eating overall, or meat eating in a solely industrial sense. If the latter, then the question becomes one of scaling other forms of carnism, rendering the human identity mostly untouched. If the former, then there is a great difficulty in Joy's (2010) solutions for getting started into activism. While the elimination of meat consumption would disrupt the role of meat in human identity, this practice – alongside joining an advocacy group and educating oneself and others about carnism (Joy, 2010, p. 147) – does not address the political, sociocultural, or “natural” status of animals “post-carnism.” The closest Joy (2010) comes to addressing “post-carnism” is by arguing that standing against carnism allows for more comprehensive stands to be taken against other systems of oppression (p. 148). This argument is not inherently an issue; however, by focusing so much on what human beings can do in the now, there is a gap in regards to the void that is what a post-carnist world looks like. Bearing witness to carnism now does not mean that individuals could overcome the inability to bear witness to a potential post-carnist world, which could provide rationale for bearing witness, and continually supporting, the carnist system as it stands. Essentially, the act of bearing witness cannot stand on its own, but should be combined with the practice of imagining – bearing witness now, and imagining what follows the actions which are taken post-witnessing. A potential first-step to rectifying this issue would be to consider the idea of the “including, but beyond” suffering approach to animal activism, which attempts to provide conceptualizations and understandings of animals as more than just the suffering they endure at the hands of exploitative systems (Corman, 2017, p. 252). General examples of this approach will be seen throughout the remainder of the dissertation.

Referring back to the Melzener et al. (2021) postulation that cultured meat may still necessitate the slaughtering of animals (p. 10), current carnist theorizations seem unprepared for the potentialities of cultured meat, despite the importance of understanding cultured meat in the carnist context. Bearing witness may not be enough to offset arguments that animal welfare would improve with cultured meat, because the animal is still constantly being defined as “meat.” Both anthroparchy and carnism fail to move the animal out of its “meat” or “resource” context; it will not be enough to merely describe the animal condition, going forward. Efforts must be made to understand the animal condition outside of the current status of “animal,” so that a “post”-anthroparchy and “post”-carnism world can begin to take some shape as an identity, as a possibility which offers comparative reason for current systemic disruption. This concern in no way invalidates Joy's recommendations, but by its very nature, the matter of what “postcarnism” might look like inevitably arises as an issue, and an important one in the face of cultured meat.

I will also, briefly, address some concerns which have been leveled at carnism as a form of “single-issue activism,” a concern – popularized by Francione (2010) – which proclaims that activism which focuses on single issues, at the expense of a totalized whole, can be ineffective. Carnism has been viewed through such a lens, especially relative to speciesism. However, I do believe that such interpretations of carnism fail to see the potential to expand carnism out of this single-issue approach, but also negate the specificities of ideology to which carnism demands attention. Justifications for meat-

eating take on a variety of forms, including the outright existential and hypocritical – sometimes, these justifications are not provided in the contexts of other forms of animal exploitation. Carnism maintains a specific concentration and focus on meat and the ideology of its consumption, but that does not mean carnist assessments cannot be later expanded to consider other forms of animal exploitation. For example, a rectification of carnism and the animal-industrial-complex theory, in future work, would be helpful in expanding the material assessment of carnism while also accounting for the symbolic, and ideological, which might not be considered through a stricter material assessment. It is here where I also posit that an initial assessment of carnism can eventually give way to a larger assessment of speciesism's relationship to cultured meat; however, assessments of speciesism can sometimes lose focus on the oddities and ambiguities of specific issues, so it is fair to begin with a "single-issue" assessment, and then push to a larger assessment, rather than begin at a broad-scale that then must be worked back from. Francione (2010) calls on activists and scholars, who use single-issue approaches, to make clear that specific manifestations are symptomatic of general exploitation of animal life; the remainder of this dissertation does not proclaim that meat is "morally distinguishable" from animal exploitation writ large, but that there are specific aspects which require examination.

Concluding Remarks

Considering Anthroparchy and Carnism Together

The range of interconnected issues under both anthroparchy and carnism – from human conceptions of "self" in relation to nature and animal, to the role of institutions and societal structure in maintaining and perpetuating notions of considerable violence and destruction – obligates some effort to bring anthroparchy and carnism together under one evaluative umbrella. While various critical animal studies works have considered both anthroparchy and carnism, such consideration often places the two theories under one roof, but still separates them from one another. Cudworth (2017) has considered carnism on its own in an evaluation of multi-species households (p. 222-242), but anthroparchy does not particularly factor into the chapter, at least in an explicit sense.

The remainder of this dissertation will demonstrate that cultured meat requires consideration of both anthroparchy and carnism in a way that, while keeping them separate for the purpose of methodological clarity, points towards interconnected points of order between the two systemic theories. The understanding of physical and symbolic violence, the interrelated and separated dynamics of material and immaterial consideration, and the prospects cultured meat holds for all natural entities, all point towards interrelations which will be explained in greater detail in subsequent chapters. This approach allows for gaps to be filled that could not be filled otherwise. For example, explaining animal agriculture using anthroparchy's "cultures of exclusive humanism" can establish the context of the animal being rendered as "meat" in a sociocultural sense, but the driving ideology for such rendering is not guaranteed identifiable under anthroparchy. Because anthroparchy often takes on a diagnostic role, identifying drivers beyond structure and organization can be quite difficult. Carnism allows for an attempt to identify the underlying drivers of animal consumption, or at least the dissonance which prevents the identification of the internal inconsistencies and issues with such cultures of exclusive humanism.

Considering anthroparchy and carnism together is especially important because animal agriculture's impacts are sweeping. Any woodlot leveled in order to be turned into feedgrain, or body of water put to use for the purpose of animal agriculture, will have impacts on "nature" – or, more appropriately defined, the wide swath of living entities whose functionality and organization depends on stable access and relationships that can be widely and deeply disrupted by animal agriculture and other related practices. Any effort to overcome – or collaborate with – animal agriculture, on the part of cultured meat proponents, creates a plethora of possibilities, potential feedback loops, and unforeseen consequences which should be engaged with, even in theoretical form; the interlinked considerations of anthroparchy and carnism, even if they are only engaged with towards the end of each chapter following the separate analysis of each framework, are important starting points for such efforts of understanding.

Towards a Theory of Anthrocarnism?

Anthroparchy and carnism, in tandem, can present a large-scale systemic picture of a world with wildly fraught social systems and organization, all of which are often imagined in ways that erase the animal and nature that are affected by such systems. However, given that both frameworks are systems, and both postulate that they interact with other systems, it is worth, briefly, considering whether the systems merely interact with one another, or could be formulated into their own system.

This line of inquiry, unfortunately, is beyond the scale and scope of this dissertation, for the most part. Yet the concluding chapter of this dissertation will revisit this matter, following the remainder of the analysis, in order to determine what may need to be "done," next, in terms of cultured meat evaluation and research. At this juncture, the overlap of anthroparchy and carnism does give reason to consider the systems in tandem, and given the impacts that cultured meat may have which ripple across both systems, some consideration will be given to whether both theories require more unification going forward, at least in face of cultured meat.

Before reaching the concluding chapter, however, much remains to be assessed. The following three chapters will utilize the theories of anthroparchy and carnism to test the potential validity of certain cultured meat narratives, which will work towards answering the third research question. These narratives will be introduced at the beginning of each chapter; following these introductions, the theory of anthroparchy, followed by the theory of carnism, will be applied. Commentary will then be offered, at the end of each chapter, on the similarities and differences between the application of each theory, as well as a summary of the overall "picture" painted by the arguments of each chapter. While other systemic theories will be referenced, anthroparchy and carnism remain the primary theories for the framework which guides the remainder of this dissertation.

Chapter 5: The Narrative of Disruption

Introduction

Throughout cultured meat's relatively short history, there has been a longstanding notion that it will be "disruptive," a nebulous reference to a wide-range of changes at various levels of market and society. While numerous innovations are often presented in terms of "disruption," proponents have relied on this notion as a selling point for cultured meat for a considerable time. This potential disruptive capacity is often brought up in terms of the industrial meat industry, with claims that cultured meat can disrupt the environmental and ethical impacts of industrial meat which, inevitably, come with economic disruption. However, the actual foundations for such claims are in need of greater investigation, especially taking into consideration the arguments and revelations stemming from the industry analysis and discourse review provided in earlier chapters. What such "disruption" looks like is often presented in broad, vague terms; before contextualizing these claims in a larger systemic context, a brief review is necessary.

A common narrative³⁹ is that cultured meat will "disrupt" industrial meat production, but how it will do so is an ambiguous matter. Industrial meat production has always been an economic powerhouse; one estimate puts it at being worth \$838.3 billion USD in 2020, with projections that such valuation will increase to \$1157.6 billion USD by 2025 (Shahbandeh, 2021). Though there are many varying estimates, accounting for a wide variety of matters, most assessments agree that industrial animal agriculture is an economically significant industry, and its expansiveness makes the notion of disruption difficult to envision. Taking into account the current valuation of the cultured meat proto-industry, discussed in Chapter 2, which has only recently reached the \$1 billion mark,⁴⁰ it is difficult to envision cultured meat as being an economically disruptive force. Certainly, in the near future, such visions come across as outright disingenuous, but advocates would likely retort that it is unfair to expect such disruption in the near future.

Even in the farther future, however, such notions of disruption are difficult to accept outright. For example, consulting firm A.T. Kearney circulated a projection claiming that cultured meat will make up 35% of overall meat consumption by 2040 (Best, 2020c). This figure, however, is a "calming" of the early claims from cultured meat advocates, who Stephens et al. (2020) demonstrate as having embraced the "disruptive" imagery, pre-2013, with ideas of changing the world running prominently throughout promotional materials and wider discourse (p. 12). Such imagery played with the idea of becoming a replacement for industrial meat, which is a substantially different claim than the 35% figure from A.T. Kearney. Such notions also do not align with the current state of cultured meat production; small

³⁹ I will note, here, that by "narrative," I refer to imagery/ideology/ideation which can emerge from the themes identified in Chapter 3, or which sometimes can drive said themes. For example, an early proponent of cultured meat may have used the narrative of potential disruption to theorize potential benefits of cultured meat, whereas currently, someone reading about the potential benefits of cultured meat may come to believe that it is "disruptive."

⁴⁰ Amongst companies dealing specifically with cultured meat, that is; companies who produce inputs and focus on microbial engineering do increase the valuation, though not to a degree comparable to industrial animal agriculture.

product launches may, or may not, arise in the near future. Unexpected disruptions, especially from economic instability and legislative surprises, could throw these launches off course. As schedules continue to change, and production facilities remain in the preliminary stages of construction and testing, the notion of “disruption,” in an economic sense, does not seem feasible.

Another way that cultured meat is presented as being “disruptive” stems from the imagery of how it could be consumed. Even if one removes consideration of the economic factors related to disruption, there is still the idea that, whenever cultured meat is introduced to the public, it could disrupt how the public consumes meat. However, over time, these ideas have unfolded in inconsistent ways. For example, early cultured meat discourse engaged with the possibility that households could buy cells and use “house meatmakers in the kitchen next to breadmakers” (Knab, n.d.). Such visions are, essentially, gone from the literature, only occasionally engaged with in very specific case studies of research by small companies. Other imagery surrounding cultured meat relates to the previously discussed “pig in the backyard,” recently popularized by Wurgaft (2019, p. 189-194). However, the viability of such a project stands in opposition to what is “known” about cultured meat production, in which it remains in the laboratories and factories of private companies who have enough capital to afford such production. Consequently, the imagery of cultured meat’s consumption, in popular discourse, is often not engaged with, and when there is engagement, such images do not align with the current composition of cultured meat production.

Throughout this “disruptive” imagery, there is a constant tension between material and immaterial matters. For example, the ontological ambiguity literature engages with cultured meat as a “disruptive” entity, regardless of what it is actually capable of in a material sense. Whether or not cultured meat ever sees market introduction, it has disrupted typical understandings of what meat might be – at least, amongst those familiar with it. As I have already discussed, such notions are not necessarily well verified from an empirical perspective, and do not cover the full gamut of immaterial considerations. However, immaterial considerations also give way to further claims of disruptive possibilities; by the very logic of cultured meat, traditional meat becomes suspect, alien, or at least, loses its sociocultural chokehold to varying degrees.

Such claims, obviously, are all speculative, but it is the wide-ranging speculative nature of such claims which necessitates the testing of such narratives through a theoretical framework. The economic, visionary, and immaterial considerations throughout the discourse demonstrate the difficulty of “disruption” going continually undefined. Disruption could mean anything from taking 1% of a trillion dollar industry, to the overall replacement of said industry, to potentially making people slightly more uncomfortable about their meat consumption.

Consequently, the remainder of this chapter asks whether or not cultured meat can “disrupt” both anthroparchy and carnism. As of now, I will identify the notion of “disruption” as the ability to potentially impact the principles of anthroparchy and carnism in ways that could change the status of animal and nature, or the human relationship to animal and nature, within these systemic theories. Given the difficulties in reconciling the material and immaterial considerations of cultured meat, this definition will allow for consideration of both material and immaterial matters. This approach provides

two systemic theories which can contextualize cultured meat, allowing one to move away from asking “what will cultured meat disrupt” to asking “what will cultured meat disrupt *within certain limitations and contexts*.” I argue that such contextualization will ultimately call into question cultured meat’s “disruptive” capacity. Of course, the notion of “impacts,” in my definition, does point to a large degree of ambiguity; I argue that this issue is unavoidable, given the scale of the subject matter. However, I understand “impact,” within this definition, as the ability to theorize a reasonably clear pathway towards “disruption,” and furthermore, one which also accounts for the status of animals within such impacts. Consequently, this definition does not require an exact “one-to-one” idea of how cultured meat can be disruptive, but does require that claims of disruption provide a reasonable degree of detail and imagination as to how cultured meat can be “disruptive.” This chapter begins the process of responding to research question #3: what narratives have arisen surrounding cultured meat, and what are the implications of these narratives for various interpretations of the human-animal-natural condition?

The Alleged Disruption of Anthroparchy

The OEM Framework

Before questioning cultured meat’s potential disruptive capacity, it is important to clarify that the status of animals designated as “meat” finds some ambiguity under the OEM framework. Animals designated as “meat” are not merely marginalized under industrial animal agriculture; because of the sliding scale of sentience, Cudworth’s (2005) proposition – that plant life and soils are exploited – can be seen as nullifying the category of marginalization, given the extent of what is impacted and affected by industrial animal agriculture in an anthroparchal setting (p. 64). That being said, it is important to consider that entities which are not often considered in tandem with animal agriculture, such as different insects and microbotic life, could be classified as “marginalized.” However, in determining which entities are exploited or oppressed, I argue that it is better to move away from the sentience aspect, and instead evaluate the use of animals. Cudworth (2014) has argued that intensive use and modification of animal and natural life can be seen as exploitative, and the control of species behavior – as well as the violence towards species, and most importantly, the taking of animal life – can be seen as oppressive (p. 29). I will use Cudworth’s later considerations to reiterate the issues with “sentience,” and posit that what must be considered is not how aware the animal is of his or her awareness, but the ability to exist as the animal would (or might) exist without OEM status. Therefore, animals and mammals who are subjected to the industrial system – pigs, chickens, cows, ducks, turkeys, geese, fowl, goats, sheep, and marine life – can be considered oppressed under anthroparchy. The natural world which is required for the maintenance of this system – air, water, soil, forests, biotic life – can be considered exploited under the OEM framework.

Could cultured meat disrupt the status of these nonhuman entities under anthroparchy? Cultured meat is presented as having the theoretical possibility of reducing the number of animals killed for food, but taking into account the projections of Melzener et al. (2021), who posit that the number of killed cows could be reduced to somewhere near 20,000 (p. 9-10), what becomes clear is that the status of those 20,000 animals is not disrupted. Because of the difficulties in defining “disruption,” one could

argue that the reduction of how many animals are killed yearly is a disruption of how said animals are impacted by industrial animal agriculture; however, such a claim ignores the status of the animal, who is still designated as “meat.” As well, it is important to question what impact cultured meat would have on the animals who do not become part of the cultured meat system of production; if only 20,000 cattle were to be selected for cultured meat production processes, what might happen to the remaining cows, who number in the hundreds of millions? The question is unanswerable in current cultured meat discourse, but if the animal’s status as “meat” is not disrupted by the presence of cultured meat, then it is likely that the animal would remain oppressed under anthroparchy.

Immaterially, it is difficult to see how cultured meat could disrupt the idea of “animal” as “meat.” Buscemi (2013), Driessen and Korthals (2012), and Jonsson (2016), all posit that cultured meat detaches the animal from meat – however, these authors are not in agreement over whether such detachment is liberating, a discrepancy which aligns with the conclusions of Poirier and Russell (2019). Buscemi posits that the process of producing meat can be separated from the living animal (2013, p. 961), which does not reflect the current practice of producing cultured meat from dead animals using Fetal Bovine Serum, nor does it engage with the possibility of animals being slaughtered after they are no longer “culture-able,” as put forward by Melzener et al. (2021). The animal is not necessarily “living,” nor is the ability for the animal to live without human intervention on its life and death status inherently guaranteed. Driessen and Korthals (2012) posit that animals are being biotechnologically manipulated into becoming so efficient that they go beyond their natural being; as such, industrial animal agriculture erases the animal as a natural entity, but that does not necessarily mean that the animal ceases to exist – instead, its existence becomes so warped that it is no longer an animal, but a machine of constant meat production, in keeping with the idea of cultured meat (p. 802). Meat is still constituted as a necessity by producers, consumers, and by the production system itself, and through that constitution, Jonsson (2016) posits, the animal cannot escape its designation as “meat” (pp. 733-734). Consequently, any claim that the oppression of animals can be disrupted by cultured meat cannot be viewed as satisfactory unless one also analyses whether the idea of “meat” is disrupted, because the animals oppressed under anthroparchy may not have any status unless they are, ultimately, “meat.”

The exploitation of nature is also difficult to imagine as being truly disrupted under anthroparchy, though the environmental claims of Tuomisto and Mattos (2011) and Sinke and Odegard (2021) may present otherwise. If cultured meat were to have the “beneficial” environmental impacts that some claim, water use, electricity generation, and land use would greatly decrease. However, not only are these claims being treated with greater suspicion, it is important to recall the matter of immaterial status. Even if, in a material sense, cultured meat did not depend on the exploitation of such environmental elements, there is no guarantee that its immaterial status would change. At the very least, the natural resources required for the continued maintenance of oppressed animals could still be seen as exploited for the purpose of maintaining animal oppression under anthroparchy. It is possible that the natural resources no longer used for animals, were a cultured meat system to proliferate, could be changed to the status of “marginalized,” as they would be “merely insignificant” for cultured meat producers. However, here, the interrelations of different practices of OEM must be identified; that which might be “freed” from cultured meat production could be utilized by industrial animal agriculture,

or other potentially exploitative practices, meaning that the status of “marginalized” can be considered unstable. As well, the status of animals as “meat” remains an issue for the natural resources which are utilized to maintain animal agriculture in various forms, as such status continues to link foodgrains and oilseeds to animal agriculture, perpetuating what Weis (2013) identifies as the “grain-oilseed-livestock complex.”

Structure-Networks

Anthroparchal Relations in Production

The current modern formation of productive relations, under anthroparchy, is highly industrialized, a continued classification of nature as resources for human ends (Cudworth, 2005, p. 65). Can cultured meat disrupt this ongoing formation? It is difficult to envision such disruption. Cultured meat, by design, is industrialized. The current composition of cultured meat production indicates that sterile, technologically driven factories will be the primary sites for cultured meat production. As a result, ideas such as the “pig in the backyard” come across as an attempt to rectify cultured meat’s highly industrialized modes of production with calls to localize and “historically naturalize” food production. However, not only is such an idea victim to the lack of political imagination surrounding cultured meat – as questions regarding community funding and management are not being addressed – it also represents the difficulty of using cultured meat as an “alternative” to industrial meat production. While cultured meat can call into question the legitimacy of various modes of production, and the relations therein, its own relations in production will likely remain industrial, barring any surprise innovations. Corporate control, and the embedded power relationships therein, may simultaneously mirror current structures of industrial meat production, while also creating their own structures which continually perpetuate industrialized control of the animal.

It is also important to look at how these relations in production impact animal and nature. Current relations in production require that the animal remain subject to anthropocentric control through various systemic methods. It is unlikely that cultured meat would inherently disrupt such relations. Even in a theoretical scenario in which all animals could be released from human control and sought out only for the creation of immortal cell lines, it is unlikely that private companies – or, even, state-run producers – would seek such a relationship instead of maintaining current relations in production, unless the theoretical scenario could be proven to be less costly, and less time-consuming, than the current efficiency of industrial production. Furthermore, if Melzener et al.’s (2021) notion of animal slaughter is accurate (pp. 9-10), cultured meat would not even change much in the production process; the animal may be kept alive longer for the purposes of obtaining cells, and it may not be in such cramped conditions, but the animal is still the subject of a heavily commodified relationship, and, therefore, a matter of productivity and efficiency.

Natural resources may find some differences in productive relations; cultured meat, if it actually uses less water and land, could alter the productivity that is currently expected of natural resources under anthroparchy. However, there is – if my prior definition of disruption is considered valid – a difference between alteration and disruption. If water and land are not utilized for cultured meat

producers, there is little reason to believe that these natural entities can be liberated from the productive relations to which they have been subjected, especially when one considers the urbanization of farmland and rural areas. Anthroparchy depends on the use of natural resources to maintain certain formations of productive relations; even if one aspect is altered, the systemic use of natural resources – and the designation of nature as a natural resource – does not necessarily come undone.

The environmental context remains an important aspect when it comes to anthroparchal relations in production, and of that context, cultured meat is likely to play only a part. Even if cultured meat were to “replace” industrial animal agriculture, it is unlikely that the animals within anthroparchy would see a substantial change to their status under such productive relations. They would still be designated as resources for human ends, and it remains possible for animals to be turned into goods not only overall, through the finality of their slaughter, but in their day-to-day lives, through their status as subjects of constant biopsy. Nature could see some shifts in how productive it is expected to be – presuming cultured meat could achieve its environmental promises – but, again, cultured meat does not introduce much in the way of changes to the status of nature overall.

Anthroparchal Domestication and Reproduction

The constitution of animal as “meat” often renders the consideration of other aspects of animal life invisible; the domestic daily life of animals, and the control of their reproductive cycles and functionality serve as examples of the invisibility. Cultured meat discourse does not often engage with animal life outside of its status as “meat,” with the occasional product-related imagination serving as an exception. When considering the status of animals under anthroparchy, and through cultured meat, it seems unlikely that animal domestication could be substantially disrupted by cultured meat. In order to maintain animals for the express purpose of culturing their cells, animals would likely remain subject to human domestication practices and desires, especially if animals are subject to similar relations in production as they currently are. While a reduction in the number of animals used for meat could lead to different settings for domestication, there is no guarantee of a change in the processes of domestication itself.

Furthermore, the application of (bio)technology to natural processes means that cultured meat, by design, renders nature and animal as passive collections of genes, subject to environmental forces and constraints (Cudworth, 2005, p. 67). Catts and Zurr would presumably disagree with such a notion, claiming that cultured meat should lead to new understandings of cells, not the reiteration of the category of animal (McHugh, 2010, p. 188). However, Jonsson (2016) might respond to such a notion by arguing that cultured meat is rendered viable through the metaphor of cells as the “foundation of life,” a modernist conception of human control which masks that cells, removed from their environment, depend on human maintenance to survive (p. 854). Anthroparchal domestication maintains validity at the cellular level, assuming a degree of power and control over cells, separating animal cells from the animal in the process, leading the animal to the same status it is currently subject to – a passive collection of genes.

The processes of reproduction also remain anthroparchal; cultured meat does not change the female, nor male, animal status from a machine of breeding efficiency to anything else. While a reduced number of slaughtered animals may mean that female and male animals are not expected to be “as efficient,” such a theoretical scenario still does not address the status of the animal and the expectations placed upon it by anthroparchal standards of domestication and reproduction. The domestication of plant life is also unlikely to be altered, but instead merely reduced; plant life will still be subject to domestication in order to be controlled for the purposes of maintaining animal domestication practices, whether current or in a new form. Consequently, the disruption of these practices through cultured meat does not seem possible.

Anthroparchal Politics

Cultured meat, as a product, is unlikely to disrupt the underlying logics of capitalism, and given the relationship between anthroparchy and capitalism, the possibilities for disrupting anthroparchal politics by way of cultured meat do not seem abundant. Current anthroparchal political structures support the institutionalization of meat consumption and production, as well as the subjugation of natural entities to the status of “resources.” Private companies reinforce such anthroparchal politics, but also guide said politics; the privatization of genetic material, reproductive capacity, and biotechnological processes demonstrates the symbiotic relationship between anthroparchal political institutions and the interests of private companies. Because of the role of capitalism, the pursuit of capital remains a guiding focus for political actors, though it is fair to question whether a non-capitalist state, or even an anarchist collective, may still possess an anthroparchal politics by nature of the pursuit of anthropocentric interests.

For animals, the continued definition of animal as “meat” will likely maintain the status of anthroparchal politics as an anthropocentric venture. Cultured meat does not separate the animal from the idea of “meat;” it offers a theoretical way of preventing the animal from having to die to provide said meat, though even this prospect remains questionable. Anthroparchal political structures and institutions, which currently support and reiterate the idea of animal as meat, have no identifiable reason to respond to cultured meat in a way which would disrupt such a status. Here, the lack of material consideration for animal life leaves a clear mark; there is little incentive for governments to change their political focus, on behalf of or in regard to animals, not just because of the anthropocentric nature of governance, but also because cultured meat fails to disrupt the animal status. Removing the “animal” from “meat” would place governments, activists, etc., in an awkward position; if farmed animals are not meat – or, even more radically, not property – what are they? What political rights should they have, or not have, or should rights even be a consideration? These theoretical revisions to anthroparchal politics require massive changes in ideological and governmental perspective, but the impetus for such changes rests beyond the limited possibilities of cultured meat, which may offer a different form of a currently available product.

In terms of “nature,” how cultured meat could disrupt the governance of natural life is unclear. Current governance continues to dictate that nature is a set of resources for human ends and desires. Cultured meat will depend on these resources in order to function; culture mediums, especially if they

are not to be based on animals, will require the use of entities such as algae, so it is not necessarily the incentive of cultured meat companies to have nature defined as anything beyond sets of resources. Furthermore, even if a cultured meat company were to aim to “disrupt our understanding of nature,” that does not necessarily guarantee a disruption of the politics which control nature. Governments and state actors may still practice inaction, or incentivize poor environmental practice, regardless of the goals of cultured meat producers, or even a theorized ideological shift. Immaterially, even if cultured meat companies were to see a major show of support, it seems unlikely that the perception of nature as a subject of anthropocentric control is changed by virtue of cultured meat’s supposed radical innovation. Consequently, anthroparchal politics demonstrates the need to look towards violence and cultures of exclusive humanism as the last possible sites for cultured meat to disrupt anthroparchy, seeing that these structure-networks involve various actors at all levels who can perpetuate – or question – the function and role of such structure-networks, even in the face of political inaction (Cudworth, 2005, p. 68).

Violence

The idea of cultured meat as a form of nonviolent production has given it considerable legitimacy. Because the process involves the act of culturing an animal’s cells, instead of killing it outright, cultured meat has been viewed as an alternative to violence towards animals (at least, those who are killed in the industrial system for meat). Cultured meat means little for the animals outside of this consideration at this current historical juncture, and as it becomes clear that cultured meat may not be able to encompass all forms of animal meat in a variety of settings at this time, it does not seem as if cultured meat will be able to disrupt industrial violence towards animals for a considerable period of time.

However, the notion that cultured meat itself is not violent requires some additional investigation. Cudworth’s (2005) conceptualization of violence is broad, so the idea of “physical damage” means that violence must be considered beyond just the factor of death. Take, for example, the following theoretical scenario; a community establishes a “pig in the town square,” and instead of anesthetizing the animal, community members merely hold the animal down and conduct a live biopsy. Can this scenario be considered “nonviolent?” It is difficult to consider this claim as valid. Even if the animal is not killed, the application of physical force to the animal, as well as the risk of physical damage, means that violence and coercion are core tenets for maintaining anthroparchal control of the animal. Because the production process is often not discussed in detail, anesthetization has not been a point of discussion despite its importance, and while Bluenalu may claim it will anesthetize its fish (Kruse, 2021), that does not guarantee that physical and mental coercion would not be used on the animal in order to obtain the cells necessary for production. Bluenalu’s goal of “protecting fish stocks for generations to come” (Southey, 2021i) may be noble, but does not necessarily unveil, or detail, the productive process behind this supposed protection. Primeval (n.d.) implies that it is interested in producing elephant meat at some point in time; the company has not indicated how it will conduct the process of anesthetizing and monitoring an elephant in ways that do not require physical coercion. Though there are claims that biopsies will be the size of a “sesame seed” (Kleeman, 2022), or a “tablet” (“In the Laboratory it Will be

Possible...,” 2022), the process of conducting a biopsy still requires post-biopsy health monitoring and the possibility of infection, necessitating control of the animal in numerous forms.

It is this matter which brings me back to the concerns about sentience. Animals “closer” to humans allegedly experience violence “more intensely,” but what is the difference between intense and non-intense physical coercion to the animal? Animals and mammals, regardless of “awareness of self,” tend to react to human interference in ways which indicate that the animals would prefer not to be subject to such efforts, regardless of the intentions of the human beings involved. Because of the difficulty in understanding, from a human perspective, the exact functionality of the animal mind, it cannot be said, for certain, that a fish experiences physical pain differently from a pig, or even a human – the inaccessibility of mental processes in relation to pain means that a sliding scale of “intensity” does not address the underlying universality of violence.

Furthermore, regardless of whether the physical feelings are markedly different, symbolic violence can still impact all animals and natural entities. Even if the animal is not killed in the process of producing cultured meat, the act of putting the animal “under the knife,” so to speak, recalls the physical process of slaughter, and the physical coercion required for the slaughtering of the animal. All acts against the animal, under anthroparchy, are reminders of the status of the animal as a resource and a subject of human control. While cultural contexts can render subjective judgments about how objectified animal and natural life may truly be, these contexts do not guarantee that the symbolic and physical realms remain separate. As well, cultural rationalizations can serve as veils, ways to justify physical violence through symbolic terminology and imagery.

Therefore, the claim that cultured meat could disrupt the violence of animal agriculture – in this instance, under anthroparchy – is dubious at best, and misleading at worst. The act of taking animal life may be altered through cultured meat, but that does not negate all considerations of violence towards animal and natural life. Finally, recalling Melzener et al.’s (2021) considerations and calculations (pp. 9-10), if cultured meat producers – under anthroparchy – slaughter animals who are no longer considered “valid” for cell culturing, cultured meat cannot even meet the limited expectations it has been legitimized through. Instead, cultured meat would merely delay the taking of animal life, and though not as many lives may be taken, there would still be a considerable animal population marked for eventual death.

Cultures of Exclusive Humanism

Without a clear definition, identifying “cultures of exclusive humanism” becomes a task of multitudes (Cudworth, 2005, p. 69; 2014, p. 29). Numerous definitions can likely be offered. However, what can be reasonably established is that, across a variety of definitions, the assumption of human control would be maintained. As demonstrated in the rest of the system-networks under consideration, cultured meat seems to lack the power to disrupt such exclusivist cultures. The animal remains subject to human control, domestication, and practices of violence. Female animals are likely to remain viewed as breeding machines.

Furthermore, the lack of political consideration throughout the cultured meat discourse demonstrates the limited functionality of cultured meat as a disruptive tool. If private companies control cultured meat production, under both anthroparchy and capitalism, the logics of capital remain tantamount; the idea of slaughtering animals after they have fulfilled their productive use is merely a reiteration of typical anthroparchal practices, regardless of the biotechnological possibilities in altering how such practices manifest. Even in more imaginative scenarios, the disruptive capacity remains limited. If, in a theoretical scenario, the “meatmaker in the kitchen” allowed a farmer to go out and give his or her animals biopsies in order to obtain meat, that does not mean the underlying power dynamics are disrupted in a substantial matter. The animal remains domesticated, objectified, and subject to human desires and assumed control.

A response to these concerns would likely raise the prospect of immortal cell lines; if they are possible to establish for a wide swath of creatures, then animals would not be subjected to more than a “one-” or “two-”time intervention. However, even here, the conception of animal as meat raises concern. Cultured meat requires the animal to be seen as meat in order to legitimize its reason for existing; after the establishment of immortal cell lines, though, one is left wondering what to do with the animals. If they are not destined for meat, what are they destined for? There is no reason to assume that cultured meat can disrupt this conceptualization, meaning that the animal – and by extension, nature – cannot depend on cultured meat for its liberation from anthroparchy. Even if an animal is materially liberated from a slaughterhouse, the options of either becoming a subject of cultured meat, or essentially no longer existing in a manner that can be conceptualized, demonstrate that the disruptions of cultured meat cannot go as far as necessary. Even if such changes are contestable, moving merely from oppressed or exploited to marginalized is of little benefit to the animals and natural entities in question, especially in times of severe instability and climate change. Such a shift still maintains the anthroparchal structures, definitions, and images, which maintain its legitimacy. Consequently, the possibilities of disrupting anthroparchy through cultured meat seem nonexistent.

The Alleged Disruption of Carnism

(In)visible Violence

If the production of cultured meat can be seen as violent, as the section on anthroparchy has posited, it is fair to ask whether such production would render violence towards animals more or less visible than current practices, which Joy (2010) posits are widespread, simultaneously visible and invisible (Joy, 2010, p. 30-33). Such violence is predicated on the powerholders who can control animal life and functionality. Cultured meat, in and of itself, cannot guarantee that violence towards animals becomes more visible, or even less visible. Company policies regarding how animals are to be handled in the sight of the public will guide the ability to render violence (in)visible. Of course, what can be seen may not be the “true” reality; the ability for companies to “manage, carefully, the presentation of animal life to a human public means that even “invisible” violence may be “visible.” Linné and Pedersen (2016) have demonstrated that industrial meat companies in Sweden routinely coordinate “pasture releases,” relying on imagery of “local food” to mask that animals spend most of their time in the industrial

system; the animals are made visible to the public eye for the purposes of rendering their daily lives invisible (pp. 116-125).

It is important to consider who holds power, and also, for what purposes power is being wielded. One could fairly argue that the “pig in the backyard” would not render such violence (in)visible, because it is being conducted by communities instead of private corporations. But communities who subscribe to the carnist ideology have similar reasons to maintain the legitimization of carnism, and by extension practices of (in)visible violence. The “implicit contract” of violence is not necessarily dependent solely on capitalist structuring, but on a variety of systems, including state and local power (Joy, 2010, pp. 87-104). It is theoretically possible that a community maintains invisible animal violence by cutting off access to the “town square or backyard” which houses the pig; it is also possible that communities would manage careful tours and cultural events to mask the day-to-day of animal life. A personal model of “the pig in the backyard” stands to render violence even more (in)visible, as the privacy of the individual household makes possible the prospect of further hiding such potential violence.

Consequently, the ability for cultured meat to disrupt the (in)visible violence of carnism stands in contradiction to notions that have arisen from ongoing discourse. As well, cultured meat’s potential inability to disrupt the market share of industrial meat – substantially, at least – means that cultured meat may not only be a form of (in)visible violence in itself, but also a failed tool for disrupting the widespread (in)visible violence which serves as a foundation of carnism.

In applying the theoretical framework of carnism, one can arrive at the conclusion that cultured meat’s (theoretical) spread could trigger a reaction from those more invested in traditional carnism, which could render (in)visible violence more visible. Philosophies such as “eat what you kill” may be seen as more legitimate in the face of increasingly opaque production practices from cultured meat companies; if such a theoretical scenario occurred, then cultured meat could disrupt (in)visible violence, but in an unexpected way. However, given that the “eat what you kill” approach often involves heavy symbolic and metaphorical rationalization, invoking anthropocentric notions of human purpose and “natural” coherence, said violence could still be, at least, symbolically (in)visible. Such a disruption does not seem to be the purpose of cultured meat proponents’ efforts, but it is worth considering that a “disruption” could go in an unexpected direction. However, in terms of the disruptions that are constantly touted – the ability to end the mass killings of animals for food and to produce meat in a nonviolent manner – these matters do not align with what is “known” about cultured meat. As well, due to the revelations from the considerations of anthroparchal violence, one must also be careful to define (in)visible violence beyond just life and death, but also the symbolic and daily harm and control that is exercised upon and towards animals.

Finally, while cultured meat may not be able to disrupt (in)visible violence, it is important to consider whether cultured meat could disrupt the idea of “meat.” While I have already demonstrated cultured meat’s inability to separate animal from meat, there is a notion that cultured meat can destabilize how traditional meat is understood. Weele and Driessen (2019) use a focus-group setting to drive this claim home, arguing that ambivalence about cultured meat being “unnatural” led focus group

members to question the naturalness of “normal” meat (p. 9). However, some focus group members rationalized such feelings by arguing that only certified butchers, “who know what it is they are selling,” should handle meat instead of grocery stores (Weele and Driessen, 2019, p. 9). The authors may be correct that ambivalence is not necessarily moral laziness (Weele and Driessen, 2019, p. 8), but they also demonstrate that, even if cultured meat and normal meat are rendered abnormal, that does not guarantee a break away from the consumption of meat, and consequently, animal life remains subject to the whims of human ambivalence. A butcher might render animal violence more visible, but through this notion, the visibility reinforces the normalization, instead of generating the ambiguity. Consequently, disrupting (in)visible violence, it seems, cannot necessarily depend on the ambiguities of meat consumption, especially when taking into account the remainder of carnism’s rationalizations.

Mythmakers and Institutional Support

Could cultured meat, in theory, disrupt the “meatocracy” Joy (2010) claims western democracies currently embody (p. 91)? It is difficult to conceptualize such disruption, but a brief note should be made about how this section will identify mythmakers. Because of the ambiguities related to material and immaterial functionality, institutions of carnism will be identified as meat-producing companies and governments who reinforce institutional carnism; mythmakers will be identified as institutions and individuals who reinforce carnism, but may not hold material power in as explicit a manner as the institutions of carnism. As a theoretical example, a school teacher who reiterates the “Three N’s” (normality, necessity, and naturalness) of carnism may be considered a mythmaker – or “myth-perpetuator” – but the teacher does not hold as much material power over animal life as a company that specializes in meat production. If the teacher were also a farmer who sold meat to local stores, then that individual’s business could be considered an institution of carnism at a smaller scale. This distinction will be important for identifying cultured meat’s theoretical disruptive possibilities.

The ability for cultured meat to disrupt the institutional support of carnism has always been contestable. Mark Post, often considered the “face” of cultured meat, has acknowledged, as early as 2013, that cultured meat would not spell the end of livestock farming (“Industry Leaders Say...,” 2013). Primarily, in a capitalist system of market instability and investments, there has always been the looming concern that cultured meat companies could be bought out by industrial producers, allowing for the current near-monopolistic system to diversify the products on offer while still profiting from industrial meat production (Stephens et al., 2019, p. 7). Sonya McCullum Roberts, Cargill Protein’s president of growth ventures in 2018, presented the company’s investments in Memphis Meats as a commitment to simultaneously maintaining its current practices while also expanding into new, “sustainable” directions (Ishmael, 2018). As outlined in Chapter 2, industrial meat companies have not been the most substantial investors in cultured meat, and have yet to show signs that they plan on producing cultured meat, at a high volume, any time soon. However, the rhetoric coming from both cultured and industrial meat companies, in recent years, has indicated a cooling of the imagination of “disruption;” instead, a more nuanced picture has emerged in which cultured meat may share shelf space with industrial meat, and industrial producers may launch their own products. The only still imaginable way for cultured meat companies to disrupt the productive institutions of carnism is to

become bigger than current industrial meat producers; if such a feat would even be possible is one question, but other problems remain.

Do cultured meat companies actually have an incentive to disrupt the institutional support for carnism? Cultured meat companies are already gaining a reputation for notorious secrecy, and if Melzener (2021) et al.'s claims hold any legitimacy (pp. 9-10), companies are prone to becoming active – instead of merely passive – actors in the perpetuation of violence towards animals. Whistleblower laws could, in theory, prevent cultured meat companies from the scorn of activists and those concerned with animal liberation, much in the same way that industrial companies are currently protected by institutional support and legislation (Joy, 2010, p. 33). The disruptive possibilities seem to go in the opposite direction; political discontent with cultured meat could disrupt its market potential through laws on nomenclature, as well as how government organizations go about regulating the production of cultured meat. Cultured meat companies would likely not have an incentive to disrupt the institutions of carnism, as they may ultimately rely on the legitimizing possibilities offered by such institutions. If governments do not come out swinging against cultured meat, it is theoretically possible for producers to benefit from support offered by institutions who still maintain the structures of carnism. One recent example of this potentiality can be seen in GFI President Bruce Freidrich's lamentation that the US government put only \$5 million into alternative protein research in 2020, arguing that the number "should be billions" (Kauffman, 2021). If such desired support were ever acted upon, it would serve as a potential example of the state acting in a way which reinforces carnism, instead of disrupting it.

Cultured meat would have to initiate a substantial ideological shift amongst policymakers and the public they (supposedly) represent, as well as disrupt the economic structures that cultured meat producers will have to rely on, in order to disrupt the institutions of carnism. Now, if one accepts the notion that cultured meat is "ontologically ambiguous," then it is still possible – in theory – for cultured meat to disrupt the mythmaking of carnism. However, once again, such a claim is contestable. Cultured meat's inability to truly separate meat from animal means that even the ambiguity surrounding "meat" may still do little to liberate the animal from its status as a resource, or as meat. Furthermore – as will be discussed in more detail in Chapter 6 – cultured meat relies on the logic of meat consumption for its legitimacy. If cultured meat, as proponents claim, is essentially traditional meat, just in different form, then cultured meat fails to disrupt the assumptions surrounding traditional meat in proponent efforts to conflate the two. Consequently, what cultured meat has supposedly been built to disrupt requires deeper investigation. Meat, as an idea, is required for cultured meat's legitimacy, and with it, the linking of animal to the idea of "meat," despite claims that a "delinking" is possible. It seems, then, that much of this disruption relates to disrupting the environmental and economic impacts of industrial meat production; but if cultured meat shares shelf space, or even becomes one with industrial meat production, then its disruptive capacity seems to be nonexistent. For individuals who are viewed as mythmakers, some changes may be made to how they engage with the carnist ideology, but the overall logics and commitment remain present. Even if some say that "meat no longer comes from a dead animal," there is no reason to presume that individual is thinking about the living animal, and its condition, in terms beyond meat consumption.

Finally, there are likely still many who would claim that even if cultured meat fails to disrupt the institutions and mythmaking of carnism, its alleged environmental capabilities are still disruptive, and can potentially disrupt some of industrial meat's environmental devastation. However, I reiterate the concerns raised in the literature and discourse review; the environmental claims are not well-founded, and are facing increasing challenges. If such claims are to be legitimized, cultured meat will likely already have to be in mass production, and if the environmental promises turn out to be unfounded, cultured meat cannot be rendered legitimate as a disruptive tool through these notions.

Cognitive Dissonance and Rationalized Visibility

The Three N's

Jonsson (2016) argues that cultured meat signals the increasing efforts to more efficiently turn feed into meat; in the process, cultured meat proponents inevitably assert that some form, or kind, of meat is necessary (pp. 733-734). The question of whether cultured meat actively reinforces carnist cognitive dissonance and rationalized visibility will be engaged in the next chapter; here, the focus is on whether cultured meat could disrupt such notions.

Therefore, using Jonsson's claims, the "necessity" of industrial meat could be theoretically disrupted, as one moves away from a belief in necessary industrial meat, to a belief that some other form of meat is necessary. However, by that logic, there is little room for cultured meat to disrupt, overall, the view of meat as "necessary." Cultured meat fails to disrupt the notion that meat eating is normal, and also fails to disrupt the notion that meat eating should remain normal. Such a theoretical disruption would call cultured meat's very existence into question; if meat were viewed as abnormal, and cultured meat is to serve as a replicable replacement for traditional and industrial meat, why would cultured meat be exempted from such views of abnormality? Here, the theoretical possibility of disruption presents itself; if meat eating is still viewed as normal, the processes of delivering meat to the table can be made abnormal, offering a disruptive opportunity for cultured meat. However, such a notion still needs to be questioned, but only when the other N's are taken into account.

The view that meat eating is natural has been difficult to disrupt, even with the presentation of historical evidence that meat consumption has always faced ideological and material questions. Due to the highly industrial, and highly technical, production of cultured meat, it would seem as if cultured meat does offer a possibility for disrupting this view of "naturalness." Yet, proponents have been careful to avoid celebrating the "unnaturalness" of cultured meat production, and consumer acceptance literature has questioned the impact of attempting to frame cultured meat as natural (Wilks et al., 2019a and 2019b). Cultured meat, in actuality, depends on the notion of meat eating as a natural process and practice; if meat eating is seen as unnatural, that poses a risk beyond cultured meat itself being seen as unnatural. Profit margins, sales, and reasons for eating cultured meat, could all come undone if the practice of meat eating, overall, comes to be seen as "unnatural," or, at least, unjustifiable. As Joy warns against, the notion of meat eating as "natural" conflates natural and justifiable actions (Joy, 2010, pp. 108-109), so it is important to ask what cultured meat might actually disrupt – the notion that meat eating is natural, or that it is justifiable? Cultured meat is an attempt to

justify meat consumption, if in a different form; the conflation of justifiable and natural means that cultured meat, in essence, also justifies itself as natural, even if the production process is not one with nature, but, instead, highly industrialized. Industrial meat may not be seen as “natural,” but its products are seen as natural to consume, even if the products themselves are industrialized and highly processed. The complicated ways that “natural” is used, in relation to meat consumption and production, renders cultured meat unable to disrupt the multitude of ways that meat is presented as natural. As well, local production may be seen as a natural reaction to cultured meat, and consequently, local producers could use cultured meat to justify their “natural” products, indicating a failure to disrupt carnism at smaller scales.

The supposed necessity of cultured meat has already been engaged with through the citation of Jonsson (2016) at the beginning of this section, but there are other forms of necessity to assess. First, the “protein myth” cannot be disrupted by cultured meat. Cultured meat, in a capitalistic system, will likely depend on regular consumption of meat to maintain profit margins and competitiveness; proponents are unlikely to acknowledge the protein myth, as it would essentially discourage people from consuming cultured meat as frequently. Proponents have been trying to move the discussion away from cultured meat being a “delicacy,” an effort that likely would not be assisted by a simultaneous acknowledgment that Western countries are overconsuming protein. Second, the myth of the economic imperative to eat meat is unlikely to be disrupted by cultured meat producers. Proponents, if cultured meat were to ever see mass-marketization, would not want to claim that there is not an economic benefit, or imperative, to consume their products. As with any company in a competitive system, there will be a goal of maintaining frequent and long-term customers; even if companies do not explicitly claim that there is an economic imperative, it is inherently built into carnism’s relation to competitive economics.

Third, the myth of animal overpopulation seems as if it is prime for disruption because of cultured meat. Cultured meat has been promoted as a way to drastically decrease the animal population used for meat, and while the numbers have increased from “5 or 6” to “20,000” just for cows, the basic principles of cultured meat production do indicate that the reduction of the animal population is a possibility. However, such a claim fails to account for the distribution of power in a carnist system, as well as the failure to engage with potential post-carnism. In a theoretical scenario, a subscriber to the overpopulation myth may respond to cultured meat by saying, “If they are not being used for meat, are we just releasing them into the wild? If so, their population will explode; either we hunt them for the purpose of population management, or we slaughter them to prevent over-population.” Cultured meat, in coupling animals and meat, renders the animals released from its consideration at risk of being victims to the overpopulation myth. In a theoretical scenario in which cultured meat producers select their animals for production – enough to supply 100% of the products once supplied by industrial meat production – there is no obligation for proponents to care about the remaining animals who have not been selected for such production. In a carnist system, in which institutions and individuals create and maintain a demand and desire for meat, those animals will likely not automatically be deemed “free” or “liberated;” the failure of cultured meat to disrupt animals as “meat” leaves them at risk of merely being classified as another form of meat. Without a vision of post-carnism, especially in terms of political

obligations to animals, there is no guarantee of protection for animals from the harms that may come at the hands of those who subscribe to the myth of overpopulation; furthermore, local producers could benefit from such claims, bringing animals from industrial to local settings for their eventual slaughter.

Returning to the concept of normality, it seems as if cultured meat, even if it presents certain productive processes as abnormal, cannot fully rupture the view that meat is normal, natural, or necessary. Furthermore, it even seems as if the failure to disrupt can open new possibilities for the reiteration of carnist principles and rationalizations. The overpopulation myth readily provides rationalization for the normality of meat eating, given its alleged necessity. Cultured meat fails to disrupt because, ultimately, meat's abnormality offers rationalization for its normality. The ambiguity of meat, and the reasons for carnism's promulgation, depend on the absent referent, serving as a simultaneous awareness of the condition and its inherent oddness, as well as a continued dependence on the condition for the provision of stable rationalizations.

Internalized Carnism

If cultured meat fails to disrupt the Three N's, can it, at least, disrupt internalized carnism? Once again, it is important to recall that Joy's (2010) classificatory scheme (pp. 116-131) identifies rationalizations which can be used by both institutions and individuals, so there is a need to account for both material and immaterial matters.

In terms of objectification, cultured meat does not disrupt the objectification of animals and their lives. The animal is still viewed, essentially, as a cell depository which needs to be made more efficient; it will still be the legal property of the companies producing cultured meat; and it will remain difficult to speak about animals beyond the objectified level. While the animal could, in theory, not be sent to death, the theoretical possibility does not mean that animal life is not subject to objectification under cultured meat. Furthermore, because of the focus on animal cells, one could argue that the animal is further objectified, as its living components are presented as being separate from – and potentially more important than – the animal itself. This matter will be developed in further chapters, but at this juncture, there is no reason to believe that the objectification of animals under carnism could be disrupted by a product that still isolates the animal as a resource, and maintains complete control over its life and well-being.

In regard to deindividuation, cultured meat, on its surface, presents minor disruptive possibilities under some classificatory schemes. If “the pig in the backyard” were ever to come to fruition, it is possible that individuals could see the animal as an individual, potentially one even named, rather than as just a subject of the carnist system. However, the issue here is that individualization should not be presumed to be enough to automatically counteract carnist practices and ideology. Even if an animal is named and connected with individually, household farms have long been sites of violence towards animals, demonstrating that connection with animals does not guarantee them liberation from the status of meat. Furthermore, one must consider the material status of animals. A company may set up a “town square” or “pig in the backyard” for individuals to visit, but such an action does not mean that the animal is not subject to a form of commodified deindividuation. At most, cultured meat

offers the possibility for the ambiguities of carnism to come to light through reindividualization, but whether such ambiguities are acknowledged and rectified is another matter entirely, and cultured meat does not lend itself well to the idea that deindividualization can be reckoned with.

Dichotomization, simply put, is likely to go undisrupted as a result of cultured meat. Cultured meat depends on current categorizations of animals for its products – cows, chickens, and pigs are primary examples. Because cultured meat is aiming to provide a different form of these products, it cannot risk disrupting the idea that cows, chickens, and pigs, are edible. If meat animals are classified as inedible, cultured meat has limited reason to exist. The reasons for such schemes are not necessarily affected or impacted by the presence of a product that is meant merely to replace the way that meat is produced; cultured meat depends on the same animals carnist companies currently depend on. Commentary on other cultures and their dichotomies will be revisited in Chapter 7; at this point, it is enough to note that dichotomization is unlikely to be disrupted.

Neocarnism

Hopkins (2015) argues that media coverage surrounding cultured meat has over-emphasized the importance of vegetarian reception of cultured meat, representing it as a barrier to cultured meat adoption, despite vegetarians' likely not being the proper subject of cultured meat promotion (p. 264). There has always been a tension between cultured meat and veganism; despite support for cultured meat from organizations such as PETA, cultured meat has often been presented as making up for the failures of veganism. Mass adoption of vegan practices is seen as unlikely by many proponents, creating the impetus for cultured meat. However, even if these tensions are overstated, it is important to ask whether cultured meat can disrupt neocarnism.

Compassionate carnism cannot be disrupted by cultured meat, because cultured meat – in its continued linking of animal and meat – moves the focus from animal life to animal welfare. Cultured meat is often considered humane, in the face of industrial meat, though the conclusions of Melzener et al. (2021) demonstrate that such “humanity” still fails to account for animal life and death (pp. 9-10). Cultured meat could allow animals to live in less squalor, depending on the actions taken by companies or states, but that does not equate to a disruption of the compassionate carnist rationalization scheme. Cultured meat may be a form of compassionate carnism.

Biocarnism is unlikely to be disrupted by cultured meat, as cultured meat is unlikely to present itself as unhealthy. Now, if biotechnological innovations were to allow for “modifications” to the healthiness of cultured meat, then it is theoretically possible that the notions of meat and health could undergo some transformation; however, there is little reason to believe that notions of meat being “ethically exempt” for health reasons will be disrupted by the presence of cultured meat. Whether proponents try to claim that cultured meat is healthier than a vegan diet is another matter; such a notion is dependent on the proponents and the purposes of their efforts.

Ecocarnism cannot be disrupted by cultured meat, because cultured meat is industrial. Ecocarnism tends to focus on production methods and their supposed “naturalness,” and even if cultured meat “makes traditional meat abnormal,” the “unnaturalness” of the production process of

cultured meat is unlikely to be ignored. Efforts at legitimizing “the pig in the backyard” are unlikely to sway those who subscribe to ecocarnism, because the actual production methods are still industrialized, highly scientific, and require substantial biotechnological education. Proponents may play into ecocarnist beliefs about processed vegan foods to try to offer a selling point, but the tensions surrounding naturalness cannot be removed. That being said, Wilks et al. (2019) do claim that their research finds little evidence that the naturalness focus has much impact on consumers; however, whether consumers, overall, can be seen as “ecocarnists,” or not, is another matter. Most consumers may not subscribe to ecocarnism, so it will be important for future research to account for individuals not just as consumers, but ideologues. Nevertheless, the preliminary evidence indicates that not only does cultured meat fail to disrupt ecocarnism, but it may end up reinforcing it, in the eyes of some.

Concluding Remarks

Proponents and advocates may argue that the efforts of this chapter have been unfair, a placement of lofty expectations on a prospective product. I would respond by indicating that cultured meat cannot exist in a vacuum; if it is to be presented as a disruptive entity, what it would actually disrupt should be a point of considerable inquiry. Under theories of animal welfare, cultured meat may be far more revolutionary. However, the concern of this dissertation is the larger liberation of animals, and cultured meat’s relationship to such theoretical liberation.⁴¹ It is still within possibility that cultured meat has more of a disruptive impact in the future; however, using the frameworks offered by anthroparchy and carnism, it is at least possible to place such claims in a certain context, and test their viability within systemic theorization.

Ultimately, it does not seem as if cultured meat has much potential to disrupt either anthroparchy or carnism. The inability to disrupt these systems reveals a great deal of overlap between the two theories. For one, both systems depend on a coupling of the concepts of “meat” and “animal;” both face instability if the animal is not categorized as meat. However, it is key to identify in whose interests such categorizations are maintained; producers of meat, overall, have no real incentive to change such categorizations, nor does the public who perpetuates positive views of meat consumption. Both systems also reveal that the ambiguities of “violence” require more detailed assessment. Physical and symbolic violence are broad concepts, but the ability to disrupt various conceptualizations, in both systems, remains limited. Coercion, potential slaughter, and continued reiterations of similar structures of violence permeate both anthroparchy and carnism, even when one imagines a world without industrial meat. The material and immaterial realms of consideration, across both systems, indicate that the animal remains under anthropocentric control, with little change in actual status. Consequently, both systems come across as near-unshakeable, even when considering a technology as biotechnologically innovative as cultured meat. The implications for animal futures are alarming.

That being said, both systems also have their own considerations. In particular, anthroparchy demonstrates that cultured meat is unlikely to have a notable impact on nature and natural status. An assessment solely from a carnism perspective may not necessarily allow for such a claim to be brought

⁴¹ It is this concern which is influenced by the CAS component.

to fruition, or at least, as anything more than an aside. While cultured meat may not be marketed as a tool for natural liberation – and, furthermore, cultured meat’s relationship to natural processes and resources has always been of little focus in the academic discourse and literature – it is still fair to assess its relationship to natural entities, and anthroparchy indicates that such a relationship may go mostly unchanged.

It is important to stress that cultured meat is not a silver bullet, even if such a claim seems as if it should be basic logic. No single product can be expected to undo systemic structures and practices; yet hype is a powerful tool, able to create excitement and hope that can eclipse more realistic projections and notions. Furthermore, during times of postmodern capitalism, in which revolutionary notions are packaged and repackaged as sellable items and experiences, products and technological innovations can receive more attention in place of genuine revolutionary action, especially if ideologies can be marketed as products. Such a notion is in keeping with the ideas of Fisher (2009), but needs to be reiterated as an important reminder of the current (post)capitalist predicament. Anthroparchy and carnism are both large, comprehensive systems, so it is important to investigate whether reactions to them can also be rendered ineffective not because they are so radical as to disrupt these systems, but because they emerge from inherent logics in these systems.

There is a strong need to move beyond the idea that cultured meat can be “disruptive.” The comprehensiveness of anthroparchy and carnism, as all-encompassing systems, means that whatever emerges from their logic(s) can do more than fail to disrupt. Especially in the possible reactions to cultured meat, one can already see the possibilities that cultured meat may passively reinforce the principles of these systems. A focus on this aspect of cultured meat will arise in the next chapter.

However, at this juncture, there is one more matter to address. All of the work of this dissertation can be easily dismissed because of the infancy of cultured meat; “it has not come to fruition, so there is no need to imagine its failings and successes.” While I do not deny the appeal of such a notion, such claims could also be sent in the other direction. Proponents have been relying on the ambiguity of cultured meat to promote its prospective product; an imagination has formed well before any “reality” has been able to formulate. There is a distinct possibility, at every step of the way, that material reality might play out differently than predicted, and the projections of this work become obsolete. However, the imagination of cultured meat has allowed statements to go into an ether, an imagination without any systemic background, without the possibility of being bounced back, serving the interests of only a few. Placing a limit on the possibilities of these claims serves to provide a better idea of their potential strengths and weaknesses, even if it must be recognized that both the promises and responses may be relegated to an “historical dustbin,” depending on what the future holds.

Chapter 6: The Narrative of Reinforcement

Introduction

In the previous chapter, I demonstrated that there is considerable reason to question the narrative of cultured meat's "disruptive" capacity. Throughout the chapter, a tension emerged in which cultured meat's failure to disrupt certain aspects of anthroparchy and carnism led to the possibility that these systems could not be disrupted because of the underlying logic(s) of cultured meat itself. However, a failure to disrupt should not necessarily be considered an "end-point;" it is important to ask whether cultured meat could reinforce aspects of carnism and anthroparchy, especially considering the proximity to notions and practices surrounding meat consumption. It is these logics which will be assessed in this chapter. Before conducting this assessment, I will provide an overview of this general narrative.

Despite many proponents promoting a narrative of disruption, this narrative has always been counter-balanced by an effort to reassure consumers of "traditional" meat that their consumption habits would not be disrupted. Instead, such practices would be altered behind the scenes; what was in front of them, on store shelves, would be what they always remembered. This simultaneity relies on powerful imagery, in which private companies overtake other private companies and struggle on behalf of the consumer to address the flaws in the products being consumed. A revolution without the participation of most of the populace, contained within the context of the capitalist system, emerges from such a narrative. However, the imagery presumes that such disruption can be done "cleanly," which this dissertation argues is unlikely. Consequently, the consumer/producer dynamic reiterates the simultaneity of the disruption/reinforcement narrative; consumers can continue on without disruption, but production would be disrupted substantially, to an indeterminable degree.

Beyond matters of consumption habits, cultured meat proponents have also reinforced the importance of meat as an entity of nutrition, cultural connection, and personal enjoyment. In attempting to market cultured meat as a "replacement," proponents maintain an awkward position in which meat *overall* is important, but *certain variations* can meet the criteria of this importance better than others. Cultured meat, then, finds itself in competition with other products, such as plant-based meat and traditional meat, but also defends these products against visions of a food system without meat. Because of the role of the animal in cultured meat production, proponents are also advocating for the continuation of animal subjugation – albeit in various and reduced forms – to the food system and its related demands. As a result, tensions can emerge, best demonstrated by the continued interest in vegetarian and vegan disinterest in cultured meat; cultured meat proponents, while primarily focusing on "traditional meat" consumers, are also hoping to get others "back to tradition," albeit in a different form, which is not in keeping with the data on vegetarian/vegan preferences for plant-based meats over cultured meat (Bryant and Barnett, 2020, p. 22).

The reinforcement of the importance of meat overall takes numerous forms, which will be of focus throughout this chapter. However, the general narrative of cultured meat, in essence, cannot afford to disrupt the stability of meat and the commitment to it amongst consumers, producers, and other groupings. What will be important to assess is how notions surrounding the animal are reinforced

by such narratives, especially when considering efforts to separate animal from meat. This chapter continues the process of answering research question #3: what narratives have arisen surrounding cultured meat, and what are the implications of these narratives for various interpretations of the human-animal-natural condition?

The Difference between Active and Passive Reinforcement

The narrative of disruption is easier to identify throughout the cultured meat discourse because it has been maintained as an active selling point for many proponents. However, in comparison to narratives of disruption, the narratives of reinforcement are not rendered in such an explicit manner. Disruption has been an effective narrative because it provides more evocative imagery; merely replacing what consumers already consume is less exciting than presenting a narrative of upheaval and revolutionary capacity without the actual revolution. Consequently, identifying the narratives of reinforcement can be difficult, and the notion of “reinforcement” is more difficult to define than disruption.

I will adopt a definition of reinforcement which attempts to identify how cultured meat narratives and ideas can reiterate and perpetuate the mechanisms of anthroparchy and carnism, in both material and immaterial ways, and in consideration of the impacts on animal, nature, and human beings. Reinforcement, then, can function in two important ways.

I identify passive reinforcement as a failure to disrupt anthroparchal and carnist mechanisms. For example, in the previous chapter, cultured meat was presented as lacking the possibilities to disrupt anthroparchal politics. Such a failure to disrupt said politics can be considered a form of passive reinforcement, leaving the mechanisms mostly unchallenged, despite potential promises of change. I identify active reinforcement as a commitment to maintaining the mechanisms of anthroparchy and carnism. Here, active reinforcement allows one to identify matters which go beyond merely a failure to disrupt, and instead, can help to determine what cultured meat producers and proponents may contribute to in order to maintain a familiar, general-productive arrangement. For example, the previous chapter identified the possibility that cultured meat is a form of compassionate carnism; this chapter, using the notion of active reinforcement, can allow for this claim to be expanded and understood through a more thorough lens. I have created the passive/active reinforcement system in order to provide a way of discussing reinforcement in greater detail; because narratives of reinforcement have not been given thorough critical treatment across the discourse, I argue that it is important to not only identify it in action, but provide nuanced tools for differentiating its actual functionalities. To date, the strongest assessment of disruption and reinforcement in cultured meat discourse stems from the work of Evans and Johnson (2021), who have assessed problem framing in cultured meat discourse, and have made reference to the concepts of disruption and reinforcement. The distinction between passive/active reinforcement, in this dissertation, will be helpful in expanding the disruption/reinforcement dichotomy, in order to come to a stronger understanding of potential underlying intentions, unintended results, and the implications of such discourse on animals. Consequently, the following assessment will make a concerted effort to identify what functions as active or passive reinforcement, which will occur alongside recognition of overlap between the two. To use an

analogy, the difference between active and passive reinforcement is akin to the difference between first-degree murder and manslaughter charges. It is important to identify whether damaging notions and practices are actively designed to be so, or are the result of unintentional disregard and incomplete consideration; this distinction adopts the logic of distinguishing between murder charges in which there may have been foresight and planning, or poor judgment without malicious intent.

While this chapter will concern itself more with active reinforcement, passive reinforcement is important to identify, especially because of the simultaneity of cultured meat. Given the role of underlying narratives in cultured meat promotion, it is necessary to consider the possibilities for certain aspects to be passive and active at the same time. For example, could a failure to disrupt (in)visible violence be considered both passive and active reinforcement? In terms of passive reinforcement, the opaqueness of cultured meat producers plays a considerable role; however, it may not be enough to explain the actual material conditions that cultured producers may obligate animals into existing within, necessitating the identification of a more active reinforcement. With this distinction in mind, this chapter will follow a similar structure to the previous chapter, and will bring together observations about the overlap between anthroparchy and carnism following the assessment of cultured meat and reinforcement within each framework.

The Potential Reinforcement of Anthroparchy

The OEM Framework

The previous chapter postulated that cultured meat is unlikely to disrupt the status of animals and nature under the OEM framework. While some limited possibilities for altered status can be theorized, the actual possibilities for such changes are difficult to identify. However, it is important to consider whether the lack of disruptive possibilities is an example of passive or active reinforcement.

To begin this assessment, the status of the oppressed animal, in a material sense, needs to be considered. Pigs, chickens, cows, ducks, turkeys, geese, fowl, goats, sheep, and marine life are all considered oppressed under the OEM framework because of the fate that all of these animals, within the system of industrial meat production, will face (Cudworth, 2014, p. 29). The previous chapter put forward that there has been a failure to consider the status of animals who would continue to face violence under a cultured system of production, as well as a failure to consider the status of animals who would be “released” from current systems of production. The latter animals, I argue, have their status passively reinforced by cultured meat discourse and proponents. Proponents may argue that they are not obligated to consider the status of animals who would, theoretically, no longer be under their control in a system of cultured production, but it is this lack of obligation which creates passive reinforcement. The animals who would not be part of cultured meat’s production, but are labeled, under anthroparchy, as “meat,” are still likely to face an eventual slaughter if they were to be bought and used by other companies or entities. The lack of consideration for the non-cultured “meat” animal passively reinforces the oppressed status that they face under the OEM framework, as there is a failure to disrupt the status within which the animal exists. Even if the animal is no longer a victim of

“industrial, traditional” production, that is only part of the consideration as to what renders the animal oppressed.

For the animals who would remain subject to a cultured system of production, their status as oppressed is susceptible to being actively reinforced. Such reinforcement occurs in a few ways. First, if Melzener et al.’s (2021) claims are accurate (p. 9-10), cultured animals could still be slaughtered once they are no longer productive; in taking their lives, producers would actively reinforce the status of animal as meat, and furthermore, animal life as the subject of productive forces and human demands. Second, the status of animal as meat remains undisrupted, which is required for the legitimization of cultured meat. For example, a duck cannot lose its status as “meat” if it is to be cultured for its cells to be turned into “meat.” Even in a theoretical scenario in which no animal life is lost in the process of producing cultured meat, the status of that animal as both meat and a source of meat has to be maintained for the interests of cultured meat producers. Such a scenario may be seen as an “improvement,” but oppression can still occur without the taking of animal life, especially if the animal is subjected to harsh living conditions and a subjugation of its life as an object of productive interest (Cudworth, 2014, p. 29). A disruption to the status of the animal as oppressed is not only unlikely, but could actually threaten the bottom line for producers. If the animal is no longer “meat,” then what is to be meat, other than natural entities turned into an image of “meat?”

Regarding the natural and microbiotic entities which are identified as exploited under the OEM framework (Cudworth, 2005, p. 64), I posit that their status would be passively reinforced by cultured meat. The natural resources which are used to maintain traditional industrial production would likely still be exploited in order to maintain a cultured system of production, primarily because the animals in question still require food and water. Land would also still be required to house these animals, though how much remains a question that can only be answered in time. Though cultured meat could, in theory, reduce the size of a complex system such as the Industrial-Grain-Oilseed-Livestock Complex (Weis, 2013), that does not mean that cultured meat inherently disrupts our understanding of the role of these natural entities, nor the relationship human beings/societal structures have to these natural entities. Such a lack of disruption can be seen as passive reinforcement, but it is important to note that cultured meat proponents would not need to actively reinforce the status of these natural entities for a few reasons. Primarily, cultured meat is not presented as an absolute disruption of the status of natural entities. As such, natural resources are considered an important, but secondary, matter. Discussions of cultured meat’s impacts on climate do not necessarily engage with the immaterial and symbolic status of exploited natural resources; instead, these discussions focus on cultured meat’s contributions to the availability of these resources (Tuomisto and de Mattos, 2011; Mattick et al., 2015a and 2015b; Sinke and Odegard, 2021). Whether there is an active intent by proponents to maintain this distinction cannot be answered in a satisfactory manner, given the concerns about underlying motivations that researchers may have in regard to work that may or may not be published (Purdy, 2020, p. 46). On the surface-level, it is reasonable to assert that passive reinforcement is maintained, as natural resources would still be exploited in the name of maintaining oppression of “meat” animals. In consideration of natural resources which would not be used by cultured meat producers, again, their status would be passively reinforced; it is doubtful that cultured meat proponents would actively reinforce the status of

marginalized natural entities, especially because Cudworth (2005) identifies marginalization as a disregarding of nature as insignificant or irrelevant (p. 64).

Under the OEM framework, the material and immaterial status of animal and nature go undisrupted. However, looking at active and passive reinforcement allows for a better understanding of the repercussions of such failings. For the animals who are “freed” from industrial-traditional meat production, they face either a passive disregard for their status as meat animals – potentially leading to continued material violence – or an active reinforcement of their status as meat, continuing the subjugated status in both material and immaterial senses. Animals whose status is reinforced by cultured meat are likely to face continued oppression, which raises the question, once more, of whom cultured meat will ultimately benefit.

Structure-Networks

Anthroparchal Relations in Production

The previous chapter proposed that cultured meat did not substantially disrupt anthroparchal relations in production. While certain human-nature relations could be altered, depending on what is required for cultured meat production, the likelihood remains low. For animals, cultured meat poses no easily, or broadly, identifiable disruptive potential. However, what needs to be determined is whether such an inability acts as a passive or active reinforcement.

If one reduces cultured meat solely to its “scientific” qualities,⁴² I posit that cultured meat passively reinforces anthroparchal relations in production. Cultured meat cannot be produced outside of a highly industrial, technical, and biotechnologically complex setting; ambitions such as the “pig in the backyard” are efforts to re-contextualize this industrialization, despite appearing as a disruption to the industrial processes overall. Yet it is not necessarily the intent of proponents, or producers, to produce cultured meat through highly industrial means. Because there is not a viable alternative to producing cultured meat in non-industrial settings, it is impossible to use such a scenario to determine, definitively, whether producers would choose between an “industrial” and “non-industrial” mode of production. However, what can be reasonably argued, at this juncture, is that the production process, in and of itself, passively reinforces anthroparchal relations in production. While a move to a “cultured” system of production may change which actors are viewed as important in the production process – medium producers would become vital, for example – that does not change their levels of industrialization. Furthermore, while the logics of capital accumulation, in relation to cultured meat, would also lead to passive reinforcement of the modes of production, a scenario of such modes of production being disrupted under systems without capital accumulation remains questionable. A socialist economic system would have to be explicitly anti-industrial in order to disrupt the modes of production required for cultured meat, an idea which clashes with the common industrial modes and approaches of Marxist-influenced socialism (Robinson, 2019, pp. 18-59; Anarchist Federation, 1995; Carson, 2016; Gordon, 2009; Landstreicher, n.d; Pfeffer and Parson, 2015, pp. 126-140; Gosselin, 2015); the likelihood of such a scenario is questionable, and would lead one to ask whether “non-industrial” cultured meat would even

⁴² Its chemical, molecular composition, and how it is producible/reproducible.

exist in such a system. That is not to say that authors have not demonstrated that there are possibilities for a reconciliation between Marxism and nonindustrial naturalism (Kowalczyk, 2014; Painter, 2016; Foster & Clark, 2018), but there are numerous quandaries – outside of the scope of this section – which raise concern that such a reconciliation will be difficult to achieve. Therefore, cultured meat is disposed to passively reinforce current modes of production when one looks solely at how it is produced.

For animals and nature, however, their status is actively reinforced by cultured meat. To reiterate, if Melzener et al.'s (2021) vision is accurate (p. 9-10), then animals – under a cultured system of production – would still face an eventual slaughter, actively reinforcing their status as expendable commodities instead of individual or collective beings. The designations of animal as “meat” and nature as “natural resource” are likely to be actively reinforced by those producing cultured meat, especially in a system of private companies and capital accumulation – even if Vergeer, Sinke, and Odegard's (2021) proposition of “socially oriented” capital investment were to come into play, it is still unlikely that such companies and organizations would want the status of animals and nature to be disrupted. Whether non-capitalist systems would disrupt such relations in production would depend on an explicitly anti-anthroparchal development, in which animals and nature are removed from the relations of production, or are subjected to a highly differentiated productive relationship. However, such changes would possibly require an idea far different from “production” or “productivity,” which would conflict with the overall idea of cultured meat, in which animals provide meat from their cells in the name of greater efficiency. Even in a theoretical scenario in which an anarchist society seeks out formerly domesticated animals for an immortal cell-line, in order to “reduce the time spent on boring and repetitive tasks” (McLoughlin, 2001, p. 7), the animal's status is still one with meat, and underlying such a conception is one of productivity and efficiency.

Cultured meat, in its simultaneous active and passive reinforcement of anthroparchal relations in production, highlights the interconnections between anthroparchy and different systems of economy and governance, such as capitalism, socialism, and anarchism. The status of the animal goes beyond capitalism, yet disruptions to capitalism call into greater clarity what might be needed to change animal status under anthroparchy. Consequently, the animal's status is dependent both on a greater conception of animal and natural status under anthroparchy, as well as changes to human systems of production and governing.

Anthroparchal Domestication and Reproduction

Cultured meat is likely to depend on the domestication of animals to maintain legitimacy as a “stable” source of food. The notion of a food-secure society, which relies on (cultured) meat production, does not align with visions of animals freed and liberated from their relegated status as meat. For example, Wurgaft's (2019) vision of “the pig in the backyard” (pp. 189-194) depends on an animal in a materially situated, clearly demarcated backyard – the backyard is not a metaphorical reference to a vast nature one can see out of the domestic window. Private companies, in a capitalist system of production, are unlikely to want their source of cells to become insecure, as such insecurity could affect profit margins and product supply chains. Companies that might specialize in the acquirement of “wild” animal cells will presumably want their products to fetch as high a profit margin as possible, even

assuming the possibility of immortal cell lines; such products, such as ANJY's proposed "\$900 Lion Burger" would be higher priced, becoming a luxury commodity for a considerable few. State-run entities would, similarly, want to lower the costs of production and maintain food security; economically and productively, it would make sense to maintain animal domestication, in some form, for the purposes of cell-obtainment. Smaller-scale communal systems would feasibly be impacted by issues of resources and ability; sending small groups out to find animals for cell-culturing would be a far more difficult task than capturing animals and keeping them at some small-scale level, unless said societies are anarcho-vegan, which is not an inherent guarantee without explicit consideration of animal being (Dominick, 2015). Consequently, cultured meat is prone to actively reinforcing anthroparchal domestication, unless there is a significant societal shift which would accept absorbing the risks associated with leaving animals undomesticated.

It is important to address domestication before reproduction, because reproductive productivity depends on the efficiency of the domestication to which animals are subjected. Now, whether or not cultured meat producers will actively or passively reinforce such anthroparchal domestication is a question which requires certain scenarios to investigate. One might presume that cultured meat producers could actually disrupt such domestication; if, as Adams (2010) puts forward, the majority of animals currently consumed are adult females and children (p. 21), cultured meat producers could consciously integrate more male animals into their systems of production, bringing greater equality to the productive process. However, there is little reason to presume that such a scenario is probable – or desired – because cultured meat actively reinforces many of the industrial processes of meat production. In order to maintain a stable supply of animals to harvest cells from, female animals will still be subjected to breeding processes which are determined by the demand for efficiency and product provision. Even if the number of reproduced animals could be reduced, such reproduction will still be required for system maintenance, barring theoretical scenarios of immortal cell lines. Meatable notes that it currently gets its pluripotent stem cells from clipped umbilical cords, a method it considers "less invasive;" even if less invasive, the implications of its approach to production, especially if ever adopted by producers as a whole, are numerous for female animals, who will be required to reproduce a steady enough supply of umbilical cords for production (Morrison, 2022d). However, here, the political compositions of the systems in question must be accounted for. Imagining a system of anarchistic "cultured" production – which seeks out wild animals for cell production⁴³ – this scenario still calls into question the role of the female animal. If a disease were to spread through the female part of a wild animal population, massively impacting the reproductive cycles on which human communities base their food system, then the female animal is not liberated from anthroparchal domestication. Instead, her status as an animal, whose reproductive cycles are depended on for food system stability, is actively reinforced. Regardless of context, cultured meat, in and of itself, actively reinforces anthroparchal reproduction, even if matters of scale could still see considerable change.

⁴³ It should be noted that there is not an explicit theory of anarchist cultured meat production – or at least, to the best of my knowledge, I have been unable to find one. However, mentalities such as those seen in McLoughlin (2001), when considered alongside Wurgaft's (2019) "pig in the backyard" imagery, can be combined to identify what one could develop as an imagined system, even if there has yet to be such commentary.

Anthroparchal Politics

In order to disrupt anthroparchal politics, cultured meat would have to inspire, or obligate, political systems to change the status of animal as meat and nature as natural resource; as Cudworth (2005) notes, the various ways that anthroparchal politics are maintained, either through action or inaction, can be changed depending on the direction and drive of the actors in question (p. 68). The previous chapter established that there is a low likelihood of such disruption; in order to determine whether such a lack of disruption leads to active or passive reinforcement, however, requires further assessment.

Should the underlying material and immaterial basis for anthroparchal politics be maintained, even in a shift to a theoretical system of cultured production, passive reinforcement is probable. Cultured meat proponents and producers do not have particular incentive to disrupt the current structure of anthroparchal politics, which is important for the maintenance of animal status, as well as natural resource use and access. Consequently, the benefits that cultured meat proponents would gain from the continued maintenance of anthroparchal politics would result in passive reinforcement.

However, a change to the structure and structuring of anthroparchal politics, from outside of the cultured meat apparatus, could result in proponents and producers becoming much more active in their reinforcement of anthroparchal politics. For example, if a political party were to arise, in a democratic system, promising to take transformative action on industrialized food production, cultured meat producers may have an incentive, in order to protect their businesses, to actively reinforce anthroparchal politics through various means such as lobbying, misinformation campaigns, etc. Such a theoretical scenario would mean that cultured meat proponents would be utilizing lobbying to influence policy in favor of company desires; various levels of food system lobbying could be utilized, ranging from the types of big corporations (Lauber, Rutter, and Gilmore, 2015), to the more fractured approach seen in recent lobbying-group splits (Evich, 2019), or even at the small-scale level (Stanescu, 2010, p. 28). Currently, cultured meat producers themselves have been victim to lobbying and misinformation campaigns, such as the one the American Egg Board launched against JUST, in which one member of the board even joked about putting a “hit” out on JUST’s CEO (Mohan, 2016). However, such matters do not guarantee that cultured meat producers and proponents would not rely on similar tactics against those which threaten their status and business. The Alliance for Meat, Poultry, and Seafood Innovation, established in 2019 by UPSIDE Foods, Eat Just, BlueNalu, Finless Foods, Fork & Goode, Artemys Foods, and Orbillion Bio (Alliance for Meat, Poultry, and Seafood Innovation, n.d.), explicitly cites public education and “advocacy” as their chief goals. While there is no guarantee that this organization will be used nefariously, the underlying mechanisms of food lobbying can be utilized by all such organizations. Cohen et al. (2022) have recently identified a proliferation of producer organizations, including the APAC Society for Cellular Agriculture; the Israeli Cultivated Meat Consortium; the CulNet Consortium; the Cultivated Meat Modeling Consortium; CellAg UK; the Alternative Protein Council; Cellular Agriculture Europe; and the Advanced Regenerative Manufacturing Institute, all of which could – theoretically – develop lobbying capacity for various purposes. Therefore, it seems probable that the only way to act against such forces is to abolish the capitalist system which allows for lobbying and private-sector campaigns (Pickard, 2013).

Yet, for animals and nature, such a shift may not be enough, and anthroparchal politics may still be actively reinforced by cultured meat. In a state-run economic system, cultured meat is inclined to incentivize the political status of animals as meat and resources, as well as nature as a series of resources for human ends, because cultured meat depends on animals to be classified as “meat,” and nature as a “resource,” regardless of the goals of a state. A rejection of cultured meat, wholesale, in such a political system would be a disruption to proponent efforts; however, if the system in question accepts the validity of cultured meat, or even prioritizes it as a method of food production, anthroparchal politics would remain anthropocentric, objectifying, and overpowering for the animals in question, even with the presence of cultured meat. A political system built around questions of animal status and potential liberation – however that liberation may be defined – would disrupt cultured meat instead of being disrupted by cultured meat. In anthropocentric political systems, however, the control of animal and natural life remains an important component of anthroparchal political life, which will potentially incentivize producers and proponents to actively reinforce anthroparchal politics.

Violence

The promise of cultured meat as a “nonviolent” form of animal food production has served as a legitimizing source of questionable validity. For one, if the Melzener et al. (2021) proposition of animal slaughter were to come to fruition (p. 9-10), then cultured meat proponents and producers would fail to fulfill even the basic concept of cultured meat, as slaughtering animals, once they reach the end of their maximum efficiency, would be an active reinforcement of anthroparchal violence.

If one accepts a vision of cultured production in which the animal is not killed at the end of its efficiency cycle, however, the type of reinforcement becomes more difficult to identify. For example, would physical coercion which recalls the slaughtering process – such as holding an animal down and using instruments to harvest its meat – be a passive or active reinforcement of anthroparchal violence? Here, it is key to look at the issue of extent. If one looks at the recollection of the slaughtering process as an exclusively symbolic matter, then one could consider such symbolism a passive reinforcement; proponents and producers cannot necessarily help that the process for harvesting animal cells recalls elements of the industrial slaughter process, but if the end result is not similar, then calling it “active” reinforcement could be seen as an overzealous attack on cultured meat producers.

If one extends the analysis to the material existence of the animal, however, an argument could be made for active reinforcement. The physical confinement and coercion the animal would potentially face in a cultured system of production is a form of material violence, especially if the animal is presumed not to be an active factor in the consideration of symbolic violence. Even if the animal is not killed for its meat, the continued repression of its existence actively reinforces the anthroparchal overpowering of the animal for human interests. Furthermore, one must consider the spectacle of anthroparchal violence. A “pig in the backyard” could be presented as existing in an open, natural space, even if its daily life is lived in a confined industrial setting. Here, anthroparchal violence is simultaneously hidden and actively reinforced. By hiding the reality of animal existence, proponents and producers would actively reinforce the animal’s status as meat; as an entity unworthy of consideration

in relation to its daily life; and as an overpowered subject, controlled entirely by violent productive forces.

Anthroparchal violence, regardless of the end result, is seemingly predisposed to be actively reinforced by cultured meat. Though arguments can be made for a more “passive” reinforcement, such claims are likely to emerge in relation to a mostly symbolic understanding of the animal; these arguments could even reiterate claims of cultured meat as a disruptive entity. However, the material reality the animal faces, under cultured production, remains one in which coercion has a high probability of being applied to the animal in both material and immaterial ways, potentially even ending with the taking of the animal’s life, depending on matters of economic efficiency and political sensibility.

Cultures of Exclusive Humanism

As discussed in the previous chapter, material liberation of the animal from the slaughterhouse setting does not completely liberate the animal from the constraints of anthroparchal cultures of exclusive humanism. If liberated from a slaughterhouse, the animal is likely to still be labeled as some form of meat, or may not be labeled at all, as it becomes “un-conceptualizable,” obligated into an abyss of unclear status and standing. The question, though, is whether cultured meat passively or actively reinforces this shift in status. Here, one must look at the economic system in question. Cultured meat proponents may be inclined to actively reinforce the animal’s status as meat not just for the sake of cultured meat itself, but for maintaining a steady supply of cell-producing – or even slaughter-able – animals. Maximizing the profit made from animals will be a core focus of cultured meat producers, incentivizing active reinforcement in the process. However, in systems not focused inherently on profit, the animal’s status may be passively or actively reinforced depending on the anthropocentric tendencies in question. For example, in a theoretical anarchistic-communal system, animals may be “released” once a cell line is obtained; such a release does not guarantee that the animal’s status as meat suddenly dissipates once released. It could be captured by another entity in this system, still subject to its status as meat; or it may never be thought of again, which might protect the animal in a certain material sense from anthroparchal violence, but fails to address the animal’s status as something worth conceptualizing beyond meat. Because of the ambiguous definition Cudworth (2005; 2014) provides for cultures of exclusive humanism, there are numerous possible considerations which will have to be addressed in other works (p. 69; p. 29); however, a preliminary assessment indicates that cultures of exclusive humanism, depending on contextual matters of importance, are set to be actively and passively reinforced in multiple ways.

Cudworth (2005) also notes that it is important to identify intrahuman cultures of exclusive humanism (p. 69). The efforts of proponents to present cultured meat as “disruptive” often focus on matters of animal death; issues related to human-on-human relations tend to arise in terms of consumers. Consequently, there has been a considerable gap in cultured meat discourse, in which issues beyond consumer status are not addressed. For example, Adams (2010) has argued that many global food taboos are related to meat, and often privilege male consumption, potentially offering an explanatory variable for why famine affects women to such a considerable degree (p. 48-50). Could cultured meat disrupt such a trend? Here, proponents would find themselves in an awkward position, as

the replacement of traditional meat is considered an essential component of cultured meat's potential success. However, it is improbable that proponents would want to highlight the issue that such a replacement would also continue to perpetuate the underside of meat's impacts on immaterial human relations. If cultured meat merely "fills in for" traditional meat, it is mostly inevitable that meat's symbolic issues come with cultured meat. Bailey (2007) posits that the masculinity associated with meat-eating obligates those who do not eat meat (or, at least, as much meat) to the status of effeminate, non-hetero-normative failures (p. 43-45). There is nothing about cultured meat which offers the explicit possibility of disrupting such perceptions, and if proponents were to disrupt such perceptions, they would have to take explicit political stances while, potentially, appealing simultaneously to the subjects of such political critiques. The consumer acceptance themes present in the wider literature indicate that producers and proponents want as many people as possible consuming cultured meat; it is far more feasible for producers and proponents to claim that such matters are not their concern than it is for them to take stances which potentially alienate parts of their consumer base.

It is reasonable to claim that cultured meat proponents would either passively or actively reinforce intrahuman cultures of exclusive humanism on the basis of their marketing goals. Producers who want to maximize their consumer base are more likely to passively reinforce such cultures through inaction; ignoring larger immaterial concerns would be more profitable than trying to address them explicitly. Producers who want to specialize by aiming for a specific consumer base may actively reinforce such cultures – or, in different terms, such a prospect "points toward the potential for tailored communication strategies at an industry level" (Baum et al., 2022, p. 8). For example, a cultured meat company might market its products as "real manly meat," actively reinforcing masculine insecurities regarding heteronormativity and status, consequently profiting from said reinforcement (Potts and Parry, 2010; Adams, 2020). There is little reason for companies to attempt to disrupt intrahuman cultures of exclusive humanism unless these cultures were to actively threaten their bottom line.

Intrahuman cultures also do relate to the larger anthroparchal culture overall; there is no guarantee that human cultures which are rendered "effeminate" are inherently less violent towards animals. For example, Purdy (2020) posits that his journey to discover his queer identity relied extensively on the preparation of meat dishes (p. 207-210), and Pilgrim (2013) has identified currents in ecofeminist thought which actively reinforce the supposed importance of meat consumption, though in these instances as a form of opposition to patriarchal structures of violence (p. 114-115). Consequently, one could argue that even those who are victims of overpowered intrahuman cultures of exclusive humanism can actively reinforce their own forms of violence and exclusive humanism towards animal and nature. It is also necessary to consider that certain schemas for understanding the relationship between identity and meat can simultaneously complicate long-reinforced notions of meat-eating and identity, creating a complicated labyrinth of potential framings and debates (Johnston, Baumann, & Oleschuk, 2021). Therefore, it is important to consider the numerous debates which lie ahead; however, it is doubtful that cultured meat would disrupt such debates in a comprehensive manner, leading to a multitude of ways in which active and passive reinforcement are simultaneously present.

The Potential Reinforcement of Carnism

(In)visible Violence

The previous chapter introduced the idea of reinforcement in relation to (in)visible violence, arguing that the failure of cultured meat to disrupt (in)visible violence in both material and immaterial senses simultaneously creates the possibility of reinforcing such violence. The question, then, becomes the nature of this reinforcement. While proponents and producers may not actively set out to reinforce (in)visible violence, the functionality of their enterprise, and the status of animal life as meat, still generates the possibility that such reinforcement is active.

There is little incentive for cultured meat proponents to render violence towards animals visible outside of the purposes of product promotion. The violence of industrial animal agriculture, in its current state, has generated discomfort amongst (some) consumers; cultured meat producers are using this discomfort to promote their products as a rectification of this wrong. However, this visible rendering is desirable for producers only to a certain degree. If such visible violence were to lead to further questions about the overall treatment of animals, especially in other industrial settings, cultured meat proponents could unwittingly be obligated to address matters of material coercion and conditions which could make consumers more uncomfortable with the practice of meat consumption. Producers are still prone to wanting (in)visible violence as a common practice towards animals, unless rendering such violence visible, to a degree, can work as a selling point. This scenario presumes that producers can produce such meat without killing animals, and furthermore that producers will not be producing both cultured and “traditional” meat. In a system in which producers produce both types – maybe even selling the meat of a dead animal who formerly was harvested for cells, presuming that immortal cell lines are considered economically undesirable – (in)visible violence would actually be essential for producers, masking both the failed promises of cultured meat, and the material conditions animals face in such a system.

In an immaterial sense, cultured meat still reinforces the visibility of (in)visible violence, constantly calling to attention the violent ends that animals face, yet doing so in metaphorical and symbolic terms which disconnect the individual from a consideration of the animal’s “true” material and immaterial conditions. Even amongst those who begin to question the “naturalness” of traditional meat, violence can still be normalized the further one moves away from the supposed “naturalness.” For example, some may view industrial meat production as “unnatural” the more they are exposed to cultured meat; however, they may advocate for an idealized consumption of “local” meat as a counter-balance to the “unnaturalness” of industrial meat. They could also comment that both industrial and cultured meat are “unnatural,” but that does not suddenly negate the consideration of meat as “natural” overall; it merely alters the context for “natural” considerations. The interlinking of meat and “nature” remains actively reinforced by cultured meat, because the context of how meat is consumed remains unaltered for purposeful reasons. An industrial cultured system can still generate desire for the antithesis of a “closer-to-nature” meat production system as well. The plausibility of proponents and producers going on the attack against “natural” sources of meat, especially when some proponents are actively trying to take part of the market share from traditional industrial producers, is questionable;

furthermore, because of the perception of cultured meat as unnatural, “poking the bear” of naturalness, and the (in)visibility of such violence in relation to questions of nature and naturalness, is theoretically not on the agenda for proponents and producers. Therefore, reinforcement of (in)visible violence is often active, but can take on passive characteristics depending on the interests of producers and proponents.

Mythmakers and Institutional Support

There is little incentive for proponents and producers of cultured meat to disrupt the mythmakers and institutional supports of carnism – whether at the individual or institutional level – given the normalization that these entities have given to the concept of “meat,” and animals’ linkage to “meat” in general. Disrupting such support to any substantial degree runs the risk of alienating individuals from meat by clarifying the “matrix” of cognitive dissonance and rationalized visibility (Joy, 2010, p. 115-116). However, of key concern is what happens as a result of this lack of incentive. Does cultured meat passively or actively reinforce the mythmakers and institutional supports of carnism? In order to begin answering this question, one must look at who, and what, is involved in such institutionalization.

If there is no major public reaction to a cultured system of production – specifically, a reaction which leads to a mass movement away from “industrial forms” of meat or “meat” in general – it is conceivable that cultured meat would passively reinforce the currently existing mythmakers and institutions of carnism, barring those which may be a threat to a producer’s bottom line. Here, however, one must consider that only producers who specialize specifically in cultured meat may want to disrupt institutions which threaten their bottom line; for example, farmer associations may be seen as a threat to companies who are producing only cultured versions of these products. These associations may not be as threatening to companies that produce both cultured and traditional products, and furthermore, one must consider the degree to which meat companies are already an issue to such groups, given the role of the private sector in monopolizing and consolidating the production of animals and animal products (Deese, Fazili, and Ramamurti, 2021). Consequently, one must consider the underlying motivations, as well as needs, of groups involved in these considerations. A farmer association may view cultured meat as a threat to its overall mission – the Cattlemen Association’s nomenclatures challenges are an example (Radke, 2018a) – yet certain farmers may still be the ones selling foodgrains and oilseeds to companies attempting to produce their own cultured meat with their own stock, should companies ever adopt such an approach, which can only be speculated upon at this time because of the stage of cultured meat’s development. The all-encompassing nature of carnism and capitalism, in simultaneity, renders certain mythmakers and institutions as reliant on entities which may also threaten their existence.

For the most part, however, the institutions and mythmakers which normalize meat consumption are likely to be passively reinforced by cultured meat. For example, dietary guidelines which reinforce the perceived nutritional importance of meat can be imagined as being passively reinforced by producers and proponents who refer to such guidelines in reference to their products. There would be no discernible incentive to disrupt such pre-existing support for the normalization of its

products. Even in a state-run system, so long as the narrative of the state supports the narratives of carnism, the prospects of proponents actively introducing destabilizing narratives and visions, which could undermine the legitimacy of cultured meat itself, are low.

Mythmakers and institutions which actively go against cultured meat, however, could be an entirely different matter. Presuming cultured meat producers could ever reach a point in which their lobbying efforts would mirror those of current industrial producers (or even certain small-scale producers) – a figure which ranges from \$83+ million since 1998 (OpenSecrets, n.d.) to \$200 million since 2000 (Physicians Committee for Responsible Medicine, 2021) – challenges to cultured meat could result in an active reinforcement of the tenets of carnism. For example, in a theoretical scenario in which environmental organizations actively protest cultured meat – should its environmental impacts be negative – proponents could respond by deploying mythmakers and institutions both in opposition to the claims of environmental organizations, as well as entities which reinforce the importance of cultured meat's role in the perpetuation of carnism. Narratives of cultured meat being nutritionally vital or holistically important could be perpetuated as a counter-balance to the concerns of these theoretical environmental organizations; in the process, carnism would be actively reinforced by the role and narratives of pro-cultured-meat mythmakers and institutions. Of course, whether cultured meat producers could reach such theoretical heights in actuality is a different matter, but even in its current state, cultured meat still tends to actively reinforce the importance of carnist narratives, which often results in the reinforcement of the importance of the institutions which perpetuate these narratives.

It is important to note that class is an ambiguous factor in the perpetuation of carnist myths. Joy (2010) highlights a lawsuit filed against Oprah Winfrey, after a British Mad Cow Disease scare led Winfrey to declare she would not eat another burger (p. 91). Despite the claims the claimants made of overwhelming losses stemming from the comment, Winfrey did ultimately win the case, though much of that victory may have stemmed from US District Judge Mary Lou Robinson's decision not to move the case through the agriculture disparagement law under which the original suit was filed; the reduction of the case to a simple business defamation matter avoided what might otherwise have been a considerable precedent (Pressley, 1998). While Oprah may not have been silenced by an overall legal ruling, the case did demonstrate that even high-profile celebrities could be prone to issues should they challenge the overall carnistic narrative. The mythmakers and institutions of carnism maintain an immensely comprehensive system of ideological and material justification, and because cultured meat producers find themselves in a precarious position, the likelihood of their challenging such a system is highly questionable – even if there are proponents who wish to disrupt carnism, the chances of their being able to do so are low, automatically generating conditions for a constrained reinforcement, mostly passive but potentially active, overall.

Cognitive Dissonance and Rationalized Visibility

The Three N's

The previous chapter indicated that cultured meat will be unable to disrupt the Three N's (naturalness, necessity, normality) of carnism, even though there are some narratives which present

surface-level disruptive possibilities. Here, I will demonstrate the ways in which cultured meat reinforces the Three N's.

In cultured meat's targeting of industrial meat, the carnist perception of meat's overall necessity is actively reinforced. Now, given the global presence of industrial meat, it would initially seem as if the efforts of cultured meat proponents are disruptive; to disrupt the overall industrial production of meat would result in wide-scale, systemic shifts, changing carnism as it is known. However, beyond the actual possibility of such a scenario, cultured meat – in its primary targeting of industrial meat production – keeps the focus on “industrial” meat, in place of a focus on “all” meat. Non-industrial meat is not the focus of (most) cultured meat proponents, and consequently their “necessity” goes unquestioned. However, such reinforcement, at this juncture, comes across as merely passive – what makes the reinforcement active is how cultured meat is promoted and presented. Cultured meat is not just presented as being antithetical to industrial meat, but also as having its own benefits over other alternatives, such as plant-based meat and larger changes such as veganism. This issue is best summarized by Ishmael (2018):

‘we are committed to growing our traditional protein business and investing in innovative new proteins to ultimately provide a complete basket of goods to our customers,’ said Sonya McCullum Roberts, president of growth ventures, Cargill Protein. ‘Our investment in Memphis Meats is an exciting way for Cargill to explore the potential in this growing segment of the protein market. Memphis Meats has the potential to provide our customers and consumers with expanded protein choices and is aligned with our mission to nourish the world in a safe, responsible and sustainable way.’

Depending on who controls the narrative surrounding cultured meat, it can become a product which actively reinforces the necessity of other animal products, part of a “complete basket.” Other products, such as plant-based meat, are also subject to the same predicament, but cultured meat, in its expected reliance on animal oppression and the tying of animal to meat, actively reinforces meat's necessity. Both the disruptive failings of cultured meat, as well as the possible scenarios of product diversification, continue to reiterate the notion that meat is “necessary.”

Proponents and producers are also likely to depend on the notion that meat is “necessary” in order to encourage consistent sales and customer bases; it would be abnormal for a company to argue that its food-product is unnecessary, at least in some form. The nature of cultured meat advertising and promotion will presumably determine whether such reinforcement is passive or active; messages which appeal to a sense of anxiety about meat and campaigns against it will presumably use active reinforcement, while passive reinforcement would probably be seen in advertising and promotion campaigns which appeal less to a sense of anxiety, and more to a sense of community and participation in societal spectacle.

The “naturalness” of meat is also predisposed to be reinforced by cultured meat, but the matter of passive vs. active is more difficult to determine. Cultured meat producers, as demonstrated by the literature on consumer acceptance, are in a predicament. The role of perceived “naturalness” cannot be easily determined in relation to consumer interest in cultured meat, so proponents and producers are

attempting to normalize cultured meat as “the same as you already know,” yet are also trying to mask the innate industrialism of its production. Consequently, it is conceivable that cultured meat will reinforce the “naturalness” of meat in a passive manner – meat, overall, will be presented as natural, and cultured meat, as a final product, would be just as natural. Iñigo Charola – the CEO of Biotech Foods – has been quoted as saying that “mankind has been doing agriculture for thousands of years, and this is what we are doing here. We are doing cellular agriculture, no more and no less. The process is as natural as any other we use nowadays” (Quetteville, 2020). The process of producing cultured meat is unlikely to be at the forefront of promotion to the general public, barring the promises of supposed “animal freedom from death.”

However, the conflation of “natural” and “justifiable,” which Joy (2010) highlights, raises some further concern (p. 108-109). Especially depending on what happens to animal life in a cultured production system, it may be in the interest of cultured meat companies to actively reinforce the conflation of what is natural and what is justifiable. The physical coercion of animals, the symbolic control, and the potential taking of animal life in a cultured system of production, all indicate that cultured meat proponents may still need to mask certain elements of the production process. An effective way of doing so might be to argue that producer actions are justifiable because they are natural, the inevitable end point of animal agriculture which maintains control of nature, animals, and natural animal life. While that might run the risk of rupturing the “masking” of cultured meat’s industrialism, it may be an effective way to justify, within the carnist system, the action of cultured producers towards animals, as questioning the justifiability of its actions may be more difficult if those actions are “natural,” in keeping with a long-term “human nature.” The matter of passive and active reinforcement is going to depend on who is questioning what aspects of a cultured production system, but there will be considerable incentives to make sure the naturalness and necessity, imposed by carnism, is still seen as “normal.”

Finally, a few specific manifestations of the Three N’s should be commented on. First, the “protein myth”⁴⁴ can be anticipated as being passively reinforced by cultured meat and its proponents, unless promotional and protectionist campaigns require the “protein myth” to be continually perpetuated by cultured meat. If more individuals turn against the “protein myth,” proponents may attempt to actively reinforce it in making the case for continued high-level cultured meat consumption; however, if the protein myth goes mostly unchallenged, it is difficult to envision a scenario in which proponents will do more than take advantage of the myth’s maintenance for their purposes. Second, the myth of economic imperative is seemingly reinforced in the same way as the protein myth; where a disruption of this myth might threaten an economic bottom-line, proponents are more likely to launch campaigns of active reinforcement. If this myth continues apace, proponents are prone to passively reinforcing it.

The question of the “overpopulation myth,” however, is a different matter. The previous chapter demonstrated that cultured meat is unlikely to disrupt this myth, because the continued linkage of animal to meat, as well as the inability to disrupt wider societal structures and beliefs, renders

⁴⁴ Please revisit “The Three N’s” section of Chapter 4 for a reminder of this idea.

cultured meat as an ineffective tool for upsetting this myth. However, I argue that proponents have actively reinforced the overpopulation myth. There is truth in the focus of cultured meat proponents; the industrial meat system has produced a massive overpopulation of every productive species. Yet, in an immaterial sense, cultured meat provides a simple solution to this problem: culture a smaller number of animals. In presenting this simple narrative, in which CEOs of these companies want to “kill fewer animals, protect the environment, and reduce malnutrition” (Weissmueller, 2019), proponents have, in a symbolic sense, wiped the non-cultured animals from the face of the imagined earth. There is no identifiable theme in the literature and discourse on where the animals who are not cultured will go if they are not being cultured – while Chriki, Ellies-Oury, & Hocquette (2021) recently asked “what will be the future of animals if we do not need them,” the question is only given a few short paragraphs, primarily focused on ecosystem services and anthropocentric desires (p. 39). Consequently, much remains up to the imagination. An underlying possibility is that non-cultured animals would be slaughtered; if they are not meat, they are not imaginable, and it is foreseeable that the animal will be turned into meat before it is imagined beyond meat. Proponents, whether intentionally or not, have actively reinforced the connection of animal as “meat,” and, consequently, they have also contributed to the inability to imagine the animal beyond meat. Here, the difficulties in relying on a proposed biotechnological product as a revolutionary tool are at their clearest.

Internalized Carnism

The previous chapter demonstrated the theoretical failure of cultured meat to disrupt the objectification of the animal. However, this point can be developed further by viewing the narrative surrounding animal cells as an active reinforcement of the animal’s objectification. Jonsson (2016) has called into question whether Catts and Zurr’s claims of viewing cells “differently” is actually a reiteration of a modernist belief on controlling nature; in trying to grant agency to cells, their reliance on human maintenance turns them into “semi-living” objects under human control (p. 854). The act of culturing animal cells actively reinforces the animal as an entity subject to human mastery, scientific intervention, and productive efficiency. Culturing cells allows producers to maximize the productivity without the possible failings of the animal, such as the animal getting sick, failing to grow as expected, etc. The animal cannot be understood, in and of itself, should it be presented and viewed as a depository for cells, the “most” important part of meat production. The animal must actively be viewed as a “thing” and not a “being” or “animal” worthy of consideration outside of the object.

The reinforcement of deindividualization will likely depend on the proximity to the animal being cultured. If cultured meat ever could be reduced to “5 or 6” animals, there may rest a possibility for those culturing the animal to see the animal as an individual, and not an abstraction representative of its entire grouping. Though even such individualization is still subject to metaphorical difficulties, as highlighted by Derrida (2008), individual engagement and rupturing can be imagined. However, the difficulty is that such a scenario cannot be imagined in particularly good faith. If one takes the “20,000” figure from Melzener et al. (2021, p. 9-10), and puts it against the 87 tissue engineering companies identified in Chapter 2, each company would still own 229 beef cows each (presuming, in this scenario, that all companies end up working on beef – such a scenario is not going to happen, but can still accentuate the overall point). The relational capacity towards individualizing animals, especially in an

economic system focused on maximum productivity, feasibly reinforces the deindividuation of animal life in both passive and active manners. Passive reinforcement would stem from the inability to overcome the difficulties in producing animal products in a way which disrupts carnism; active reinforcement would stem from the animals' being placed into such situations of deindividuation in the first place.

Finally, dichotomization is disposed to being passively reinforced by cultured meat producers. Again, cultured meat proponents and producers want to replace the current products people consume with the "same product, but in a different way." Consequently, companies would not have reason to disrupt the idea that a pig is meat. That being said, producers may present themselves as being "more adaptable," potentially able to produce meat from different animals should the dichotomies of carnism ever be disrupted; in claiming an advantage over other forms of production, proponents do envision some form of adaptability that does not always require active reinforcement of carnist dichotomization. However, this possibility creates new dilemmas, which will be discussed in the next chapter.

Neocarnism

The previous chapter posited that cultured meat may be a form of compassionate carnism – I will develop this point further by claiming that cultured meat is a form of compassionate carnism, which automatically qualifies as an example of active reinforcement. Cultured meat, if it results in animal death, can still fill the criteria of "compassionate carnism" by arguing that animals can be subjected to a more peaceful death due to the smaller number of animals in non-industrial situations. The implementation of "humane" practices by companies can maintain the promise of compassionate carnism, even if animal death is still the end result. If cultured meat can be produced without animal death, the question of the animal can still be moved from one of "life" to "welfare." The animal is still subjected to objectified oppression by way of the controlled existence it will face under a system of cultured production; the question of consideration, for proponents, is likely to focus only on animal welfare, or how well the animal is living in the context of its oppression. Proponents may not intentionally maintain the focus on animal welfare, but the requirements of capitalism, combined with the functionality of mass industrial production, mean that animal life, in and of itself, cannot afford to be the subject of focus without the possibility of a significant questioning of the carnist logic.

If cultured meat cannot be produced without the taking of animal life, then it is possible that proponents and producers will actively reinforce biocarnism, specifically the notion that what is important for human health can be exempted from ethical consideration (Joy, 2016, p. xi-xii). If cultured meat can be produced without such a loss of life, then ethical debates may not threaten the bottom line quite as much, which could result in a mere disinterest in the subject, and by virtue of such disinterest, a passive reinforcement. However, if large numbers of animals are still subject to potential death, it may be in the interest of proponents and producers to not only come across as a strong example of compassionate carnism, but to also reinforce, actively, the ideas of biocarnism. Such a scenario does depend on a theoretical back-and-forth between animal liberationists and cultured meat proponents, so the likelihood – so long as industrial meat producers are also part of the overall food system – is small, but the possibility of such a debate still looms, potentially providing impetus for biocarnist rationale.

In terms of ecocarnism, the implausibility of cultured meat's disrupting the perception of its production as industrial, at least to any substantial degree, is considerable. However, it is important to look at reinforcement in terms of relevance. To those who do not subscribe to a strict ecocarnist schema (Joy, 2016, p. xi), in which any "industrial" aspect renders meat "unnatural," the industrialism of cultured production may not be enough to impact consumption patterns; consequently, producers can be viewed as passively reinforcing ecocarnism. Industrial production will always call attention to its "lack of naturalness," but such a lacking may not be enough to deter those who engage with ecocarnism only sparingly. For example, an individual who complains that modern food is unnatural, yet still consumes said food routinely, might be viewed as a "passive" ecocarnist whose ecocarnism is passively reinforced by cultured meat. However, for those who take great issue with industrial production, and who actively subscribe to ideas of ecocarnism, cultured meat may ultimately reinforce the ecocarnism of these individuals in an active manner. For example, in a scenario in which a company launches an effort to present its cultured products as "natural," an ecocarnist producer of meat, or an ecocarnist consumer, may believe that such a campaign is deliberately misleading, and a continued example of our "detachment from nature." Consequently, their commitment to the ecocarnist schema is actively reinforced by the presence of cultured meat, and could be further reinforced by cultured meat proponent efforts to "poke the bear of naturalness."

Neocarnism, overall, tends to be actively reinforced by cultured meat. Though certain passive scenarios arise throughout this assessment, the industrial and scale-specific factors of cultured meat production generate scenarios in which producers may need to actively reinforce neocarnism on behalf of their economic status. Furthermore, compassionate carnism and cultured meat are tightly connected, which raises concern that the perpetuation of cultured meat may further reinforce the narrative of compassionate carnism, offering another confusing addition to the "basket" of meat consumption options.

Concluding Remarks

Proponents of cultured meat may reiterate their theorized critiques of the last chapter in the context of this chapter's conclusions—primarily, that too many expectations are being placed on cultured meat at too early a time. Such claims, however, are more difficult to reconcile when taking into account what has emerged from the focus on reinforcement. The failure of cultured meat to disrupt the vast majority of anthroparchal and carnist aspects does not suddenly end cultured meat's engagement with these larger systems; it is important to consider what might stem from such inabilities.

Between anthroparchy and carnism, reinforcement specifically highlights the material and immaterial difficulties which face animals and nature in regards to cultured meat. Under both systems, the perception of animal as meat is continually and dynamically reinforced by cultured meat, especially in relation to direct material violence. Furthermore, the possibilities for both anthroparchy and carnism to be further reinforced by cultured meat demonstrate the need to consider these systems in tandem with other systems, especially those of productive forces and relations. Both systems expose the issues with the revolutionary rhetoric and imagery used by cultured meat proponents. Not only does the product, itself, fail to fulfill the revolutionary potential that some have claimed, but the re-

contextualization of cultured meat in different productive arrangements of anthroparchy and carnism reveals cultured meat's capacity to further reinforce the status of animals in a wide variety of systemic variations. Consequently, what cultured meat can actually change is highly questionable.

The matters of reinforcement, under both frameworks, also – to a stronger degree than disruption – reveal the importance of looking at the underlying intentions of proponents and producers, as well as consumers and individuals. Many producers and proponents may not actively seek to harm animals, but the constraints of linking animal to meat, combined with the constraints of the economic and productive systems in question, demonstrate that producers are more likely to adhere to the systemic requirements of anthroparchy and carnism, rather than disrupt these requirements at the risk of destabilizing their entire reasons for existing and perpetuating cultured meat. Furthermore, while proponents may not be able to overcome certain matters, it is important to consider how cultured meat reinforces certain perceptions, amongst individuals and groups, of anthroparchal and carnist notions. I argue that the introduction of active and passive reinforcement is helpful in identifying intentional vs. unintentional repercussions, and better clarifies the implications of the cultured meat discourse overall.

Most importantly, though, the matter of reinforcement calls on proponents and producers to be more forthright regarding what cultured meat is setting out to do, and what it realistically can do. The idea of cultured meat's serving as a "replacement" should, in theory, obligate those participating in cultured meat discourse to clarify, to a greater degree, what "disruption" actually means. To disrupt the very act that one is supposedly replacing demonstrates the need for a much more clarified and thorough discourse. Furthermore, these matters should demonstrate, to those concerned with animal life and liberationist discourse, the need to clarify what is actually needed to obtain "animal liberation." Can a product which actively reinforces the animal's status as meat be expected – nay, even relied upon – to liberate the animal from its status as meat? The answer seems as if it should be obvious, but current discourse has often treated cultured meat as a distant, theoretical possibility of biotechnological promise, instead of a present-day anomaly that creates pressing questions for the future of animal life both within and outside of the global food system.

With these notions in mind, I do reiterate that these conclusions are theoretical; cultured meat's current state makes these claims impossible to test to absolute capacity. As well, some matters are in need of more specified assessment. For example, intra-human cultures of exclusive humanism need to be identified by a wider variety of theorists in order to give a greater sense of the actualities involved in such cultures. Nonetheless, the conclusions of this chapter remain an important starting point for those who may be concerned with just how far cultured meat can actually go in reaching the overall rhetorical goals of proponents.

However, it is also important to consider one further possibility. Disruption and reinforcement, on the surface, provide a more complete picture of cultured meat's possibilities. What cannot be disrupted can be reinforced in a variety of ways, possibly simultaneously. To stop at this point, however, would undermine the considerations that arise from both disruption and reinforcement. For example, the status of animals who are "released" from current traditional industrial animal agriculture has been a constant theme throughout this assessment. Would these animals be slaughtered en masse by those

who subscribe to the tenets and principles of anthroparchy and carnism? Would they be granted a new status, and, if so, what will that status be? Furthermore, could that change in status affect other animals or living beings, potentially those “outside” of animal agriculture and cultured production? If a failure to disrupt leads to reinforcement, it is also fair to consider whether reinforcement could lead elsewhere. Cultured meat, and the visions of its potential global adoption, may not live up to many promises, but that does not mean that all variables have been considered; the following chapter will take into consideration what has been identified so far, and push forward into the possibilities of new situations and contexts for animal life in relation to cultured meat.

Chapter 7: The Narrative of Expansion

Introduction

The vision of cultured meat as a simultaneous entity, disruptive in its continued reinforcement of normality under new terms, has been a long-identifiable narrative in the overall discourse, even if sometimes inconsistent. Occasional anomalies, however, have arisen; these anomalies engage, in a theoretical manner, with what cultured meat can do *beyond* replacing the everyday. For example, Milburn (2016) – in his paper on the ethics of cultured meat – posits that culturing human meat could eliminate the human-animal hierarchy, essentially “leveling the playing field” (p. 256-257). Milburn’s paper is serious in tone, but such considerations are often dismissed in the overall discourse; Wurgaft (2019) grants a one-page Freudian assessment to the topic in his book before dismissing the idea overall (p.164-166), and other assessments on the topic frame the matter as a general ethical consideration, instead of something specifically related to cultured meat (Piazza and Mclatchie, 2019). However, I argue that the cannibalism angle is merely a small component of an emerging, yet implicit, narrative in cultured meat discourse in which cultured meat represents not just a disruptive reinforcement of current practices of consumption, but a possible manner to expand such practices in new ways. I have identified three important components of this proto-narrative, which are identified in the subsections of this introduction. These components have appeared in the past two or three years in a more explicit form, but are a small part of the overall discourse; small parts, however, are still important to consider. Before engaging with these components, I will briefly define expansion.

I define expansion as the further development of anthroparchal and carnist practices and systems in ways which could integrate previously excluded entities; change or alter the status of certain entities under anthroparchy and carnism; or link previously unlinked entities together in productive terms. This expansion can be both material and immaterial, as it is important to identify where an immaterial expansion might occur, especially prior to a theoretically actualized material expansion. As the subsequent examples will demonstrate, expansion is wide-ranging but highly theoretical, especially at a time when cultured meat’s prospects are being called into increasing question as demonstrated in Chapters 2 and 3. Nevertheless, the imagination which leads to, and stems from, narratives of expansion must still be engaged with in order to better understand cultured meat’s relationship to, and place within, anthroparchy and carnism.

In 2019, the Australian company VOW Foods made headlines for two reasons: first, the introduction of its cultured kangaroo products to the overall discourse and proto-industry; second, its ambitions to build a “Noah’s Ark” of animal cells (Harvey, 2019c). The idea, the company indicates, is to “build a cell library for the purpose of developing new food experiences.” A direct quote from VOW’s president best clarifies the purpose of this ark: “at the moment we have only domesticated for food production less than 1% of what’s in nature so there are many unlocked food secrets to explore in the other 99.6%.... Nature has incredible diversity so there is great potential to create new food experiences. Our cell library will discover and catalogue new flavor, texture, and nutritional profiles” (Fortune, 2019). The actualities of this ark are mostly unknown, though it has been claimed that 11 animal types have been indexed in this cell library, with six of them “plated” (rendered into food) (Berry, 2021). Despite minimal information, VOW’s claims are still important to acknowledge and engage with.

The company is not just discussing the creation of food products in country-specific contexts; for example, this proposal is not merely a way to ensure that countries which consume horse meat have an adequate supply of horse cells. Here, this imagination is meant to introduce consumers to the “secrets” of the world, of which many of us may have no knowledge. This sentiment is no longer held by just one company. Similar logics of collecting/archiving/banking animal cells for food and market expansion can be seen in the efforts of Mogale Meats, a company which recently emerged claiming that they are developing a biobank of wild animals throughout Africa (“Announcing the Innovators,” 2021). Beyond the idea of a cell-bank, Primeval Foods and ANJY Foods have recently emerged as companies perpetuating the rhetoric of VOW. ANJY Foods is currently raising seed funding for its \$900 “Lion Burger” (“Lion Burger, n.d.); Primeval Foods held a taste test for various Zebra, Lion, and Tiger products in the first half of 2022 (“Primeval Foods...,” 2022; Askew, 2022a; Harley, 2022), and has expressed a desire to produce black panther, Bengal and Siberian tigers, and white lions (Tonkin, 2022a). Primeval Foods uses similar rhetoric when compared to VOW, promising to use the possibilities of cultured meat to “explore what is beyond the tip of the iceberg” (“Process,” n.d.). The company has also claimed that “no other animal has been domesticated since the agricultural revolution... the trillion dollar market is ‘wide open’ for start-ups who are willing to double-down on ‘innovative ideas’” (Askew, 2022a); these claims are further developed by positing that animals currently domesticated for meat production are only due to the ease of domestication, not on the basis of nutritional content, which the company seems to believe is better obtained from exotic animals (Tonkin, 2022a).

Beyond considerations of the animal other, insect meat has slowly become a prominent component of future food systems discourse and is being integrated as part of comparative analysis for numerous meat alternatives (Weele et al., 2019). Those who doubt the effectiveness of insect meat as a tool of sustainability often discuss matters of scale and technology; proponents typically highlight claims of insect meat’s supposed reduction in emissions, water and land use, rapid growth rates, and higher food conversion efficiency, especially relative to animal agriculture (Rubio et al., 2019, p. 2). However, the possibilities for culturing insect meat have only recently been engaged with by Rubio et al. (2019). The authors claim that, compared to avian and mammalian cells

invertebrate cell cultures require fewer resources and are more resilient to changes in environmental conditions, as they can thrive in a wide range of temperature, pH and osmolarity conditions. Alterations necessary for large-scale production are relatively simple to achieve with insect cells, including immortalization, serum-free media adaptation and suspension culture. Additional benefits include ease of transfection, nutrient density, and relevance to seafood organisms. To advance insect-based tissue engineering for food purposes, it is necessary to develop methods to regulate the differentiation of insect cells into relevant cell types, characterize cell interactions with biomaterials with an eye toward 3D culture, design supportive bioreactor systems and quantify nutritional profiles of cultured biomass (Rubio et al., 2019, p. 1).

Similar to Edelman et al.’s (2005) publication – which introduced interested parties to the productive possibilities of cultured meat – the promises of cultured insect meat are lofty; however, in comparison to Edelman et al., Rubio et al. (2019) envision a future in which cultured insect cells “may allow for [a] generation of entirely new food products that expand the frontiers

of taste and nutrition.... [S]uccessful release and adoption of food products generated through insect cell culture will require a tactful approach to public relations and marketing to ensure consumer comfort and receptivity” (p. 10). Such claims demonstrate a commitment not just to replacing current foods, but to expanding what is available to consumers beyond non-cultured possibilities. A recent NASA and Canadian Space Agency (Deep Space Food Challenge, n.d.) challenge awarded \$25,000 to Deep Space Entomoculture, a company set on creating a device which generates food from insect cells in the context of deep space travel, a vision which integrates cultured insect cells into the frontier of the imagination regarding space exploration and potential colonization. The company Future Fields is also proposing that fruit flies may be important for reducing the cost of growth media used in cultured meat production (Watson, 2022c).

Insects are not the only “non-animal” entities to be swept up in the comprehensive visions of biotechnologically innovative food futures. Ongoing research has sought a greater integration of plant-life into the cell-culturing process. Nowogrodzki (2018) and Jones et al. (2021) highlight research which has “decellularized” plants of their cells (a process which removes the cellular compartments of live tissues, creating acellular scaffolding) (Sciencedirect, 2021); as these plants feed their cells with similar structures to that of animal cells, researchers have managed to coax human stem cells to grow into beating heart tissue using the decellularized skeleton of a spinach leaf. While this research is quite early, and is often misrepresented as “meat growing on trees,” such a process demonstrates the possibilities for integrating nature into cultured meat production beyond feedgrains and land, but instead as part of the production process itself. Research into using plants as growth factors is also ongoing, with recent interest in the use of tobacco plants in cultured meat production receiving notable media attention (“From Tobacco to Meat,” 2022).

Plant life is not the only factor to consider. Southey (2019) introduces the company Solar Foods as specializing in making “protein out of thin air,” which the company calls Solein. Such presentation does not accurately reflect the reality of this company’s work, which is instead to make protein additives from carbon dioxide, air, electricity, and an unidentified “proprietary organism;” this protein would be used as an additive for “yeast, ready-made meals, bread, and yogurt” (Southey, 2019). Solein, Chowdury (2019) notes, is only being produced at 1 kg a day, but the company claims that its product is “100 times” more environmentally friendly than any comparable protein source (Southey, 2019). Furthermore, despite supposedly being more environmentally friendly than even cultured meat, Solar Foods is promoting Solein as a “platform technology” for companies which “scale-up beyond their means,” proposing the possibility for cultured meat to disconnect from current industrial animal agriculture sources for its potential products (Southey, 2019).

Beyond the solar energy used for Solein, Hanumante (2020) highlights the efforts of companies such as Calysta, Bluestar Adisseo, and String Bio, which are attempting to apply the principles of methane-based animal food for human-based food consumption. Methane-based foods are already being highlighted as environmentally friendly (Hanumante, 2020), and are not the only “alternative” food source for animals in the industrial and non-industrial animal agriculture system. Companies such as Afrimash, BSF Farming, and articles by authors such as Heugten and McComb-Liz (2019) are

demonstrating that insects are already being increasingly integrated, both theoretically and practically, into the food system as an alternative or additive to feedgrains and oilseeds used for animal food. Afrimash even notes that flies are already often consumed by human beings. Such demonstrations envision a future in which animals are being fed alternative, more “sustainable” foods, and even humans may someday consume similar food sources.

These examples demonstrate that there is considerable interest in the possibilities for expanding the idea of cultured meat, as well as changing what is used to feed the animals (and humans) in, or surrounding, a potential cultured system of production. However, similar to considerations of disruption and reinforcement, it is important to ask what, more precisely, these entities are expanding. The vision of new products and possibilities reiterates the common notion of the individual as a consumer; larger systemic considerations are especially absent, given that these matters have only recently arisen in the discourse. Consequently, it is important to clarify what implications arise from such expansionist narratives, even if their actual material possibilities are questionable. The following assessments will look at the components of anthroparchy and carnism in reference to the previously identified components of the expansion narrative. This chapter offers the final response to research question #3: what narratives have arisen surrounding cultured meat, and what are the implications of these narratives for various interpretations of the human-animal-natural condition?

The Expansion of Anthroparchy

The OEM Framework

Given the difficulties cultured meat will likely have in becoming fully realized, the idea that the world’s remaining 99.6% of undomesticated animals will become part of the food system anytime soon comes across as unlikely. However, the imagination of VOW Foods, I argue, is emblematic of proponent inability to engage with animal existence beyond the purposes of their proposed food products. To even imagine such possibilities – let alone attempt to act on them – raises the possibility that the 99.6% vision could impact the world’s remaining animal population. Much of this population, if it is not productive, can be considered “marginalized,” forgotten about and disregarded by productive forces (Cudworth, 2005, p. 64). To suddenly or over time become the subject of interest to productive forces is to run the risk of these animals’ moving from marginalized into exploited or oppressed categories.

Obviously, such a shift would require monumental changes to material existence. In a capitalist system, such productive forces would have to have enough expendable income to launch projects – with high degrees of possible failure – to obtain cells from the 99.6% in the wild. Or, companies would have to have tremendous resources to domesticate the undomesticated, a point I will develop further in the next section. In a state-run cultured system of production, the state would presumably manage such systems. In an imagined “pig in the backyard” communal system, animals in certain regions could become the subjects of domestication in the name of taste-palate expansion; or, a global network of decentralized cell-sharing and animal-sharing could be developed so that different backyards could swap animals out for other delicacies. Meatech 3D Ltd. (2021) has even declared that “from the Sahara to the Antarctic, cultured meat can be produced anywhere,” an ambition which integrates the localized visions

of “the pig in the backyard” with globalized possibilities. Regardless of the actual prospects for any of these imagined systems, their introduction to the general imagination of cultured meat discourse demonstrates that the status of the “undomesticated” animal is not stable. Furthermore, the 99.6% vision does not distinguish on the basis of sentience, but taste – therefore, the vision offers another reason to look beyond sentience as a measure of how oppressed, exploited, or marginalized an animal might be. Instead, their status as a productive entity, and their obligation to act as such an entity, serves as a better lens for considering what might change in the status of a wide-range of undomesticated animals, including many who are currently considered endangered.

Insect meat demonstrates that natural entities are in the process of having their status shift under anthroparchy. A black soldier fly might once have been merely marginalized, a non-factor during the consideration of pesticide application and agricultural practice. Now, however, companies may feed flies to their animals, or produce flies as food for other animals, or even for human consumption; regardless of how aware the fly might be of its status, insects – from crickets to roaches – are being imagined as productive entities for the purposes of human consumption, both directly and indirectly. Cultured insect meat offers a further productive possibility in which insects might be prevented from engaging with their specific behaviors and obligated into being productive entities. Furthermore, if one takes the Melzener et al. (2021) matter of potential animal slaughter as an end-result, and applies it to insects (p. 9-10), one might be able to imagine a fly being cultured for a cell line, and then squashed in order to be mixed with a company’s new brand of fly food for pigs. As well, if cultured insect meat can overcome the issues of resource use better than cultured animal meat, one can even imagine a system in which insects are cultured in order to produce more sustainable food for animals in an industrial production system, consequently linking the exploitation of one being to the oppression of another. Future Fields, in making its case for the use of flies in culture medium, presents insects as “the most efficient bio-conservation systems in the world,” signaling a desire to use insects – even presenting them as superior to other growth ingredients – rather than continue to merely marginalize them (Watson, 2022c).

While new methods of engaging with air and plant life may not necessarily lead to oppression under Cudworth’s (2005) framework, it is certainly possible to envision an intensification of their exploitation, as well as an expansion of what entities are exploited. Decellularization, for example, does not necessarily oppress plant life as a form of violence, but it intensifies the use of plant life as a component of the production process itself; furthermore, different plants may be integrated as part of the production process, meaning that previously marginalized plant-life could become exploited, or plants currently exploited in other anthroparchal productive processes could become further exploited by their integration in cultured systems of production. While most decellularization currently focuses on spinach, it is fair to ponder the possible implications for other plants. For example, a recent study advocates for greater use of decellularized grass in cultured meat production; the authors of the study are quoted as saying that “we can directly replace the animals with the grass they eat,” though it is noted that cows are still needed to provide cells which will ultimately be applied to these decellularized grass scaffolds (Brehaut, 2021). Not only is the animal replaced in the imagery of this scenario, but grass becomes further integrated into the productive process. Green onion bulbs, celery, apples, and jackfruit

have also been identified as potentially suitable for decellularization in the production process, a proposal which would repurpose a variety of edible plants as part of the process of harvesting cellular meat (Bomkamp et al., 2022, p. 20; Seah et al., 2022, p. 318). Solein involves the exploitation of carbon dioxide, air, water, electricity, and an “unidentified proprietary organism” for the purposes of offering a nutritional bolster to current and prospective products. The “sentiency” of Solein is highly dubious, but its use could be further intensified should the demands of cultured meat go “beyond their projected scales,” consequently intertwining solar energy and meat production under the OEM framework. In an ironic way, the oppression of animals in industrial food production has led to a greater release of methane emissions in animal agriculture; using what is essentially cultured methane to potentially feed the animals which feed certain groups of human beings marks an exploitation of the oppressed through an imagined self-sufficiency of the OEM framework. Similar to the logic of decellularized grass used above, the animal gets replaced – in the sociocultural imagination – by its products and byproducts, and its natural emissions become “fixed” in a circle of ultimate sustainability in which every aspect of animal existence is biotechnologically captured, fixed, and rendered productive. Such imagination, in a sense, “solves” the problem of animality by repackaging their limitations as consumable, sustainable products, while also placing them in a predicament in which “nature” and “natural processes” are harnessed to fix the animal’s “nature,” a continued reminder of the difficulties in understanding animals and nature as “one.”

While some imagination has been given to how human meat could change the human-animal hierarchy, I argue that the OEM framework demonstrates the importance of moving away from the human reference point. It is more probable that animals, plants, insects, and air would be exploited and oppressed, under the OEM framework, for the purposes of food production well before humans become integrated as part of that food system as completely productive – instead of consuming – forces.

System Networks

Anthroparchal Relations in Production

If the 99.6% vision were to come to any true materialization, undomesticated animals would become productive forces, expanding anthroparchal relations in production to a much larger group of natural entities. Of course, the actual likelihood is questionable, but even a lightly successful – let alone moderately successful – effort to integrate parts of this 99.6% would mark a significant expansion. Here, animals which tend to be hunted could be integrated as part of the productive food system; depending on the status of animal death under a cultured system of production, these animals could be sentenced to a death in an industrial setting; a lifetime in a new environment for the purposes of consistent food supply; or a “catch and release” of variable disruptive capacity for animal and ecosystem. The expansion of anthroparchal relations in production depends on the actors involved in the relations of production. Depending on the private company and its goals, the genuine and advertised desires of the consumer population, and the institutional support private companies receive, one can engage with a possible future in which private interests encroach much farther than ever before, a form of “new world discovery” in the interest of product variety and capital accumulation. However, there is no guarantee that cultured production, handled by a state, would not also partake in similar territorial encroachments

and expeditions to increase the variety of meat available for its population – such a scenario is especially concerning, depending on the ideological drives of the state and the status of different meats. Under anarchistic conditions, the barriers and borders of the world can be imagined as dissipated, but that does not guarantee that the remaining 99.6% would not be encroached upon in the interest of cell culturing; avoiding such scenarios in productive relations would require an explicitly anti-anthroparchal development.

The presence of insect meat as a focus of food system imagination demonstrates that insects are being viewed as potential subjects of productivity; culturing them perpetuates this productive relationship further. However, how exactly this expansion in productive relations would work is an interesting matter. One can imagine an industrial system of production in which large facilities are built which house millions of insects, easily gassed or mashed into a food product. For insects who might be milked, such as cockroaches, one can imagine a facility with thousands of them hooked to milking machines. But culturing them (Rubio et al., 2019), in theory, could liberate the insect from these imagined facilities – there would likely not be the same need to house flies in massive facilities if a smaller number can be housed for the purposes of cell-culturing. Of course, here, one finds a repeated cycle of cultured meat discourse; would cultured insect meat actually liberate the insect, or would the insect merely be subjected to a different productive relationship? Future Fields frames their work on insect-based culture mediums as being actively beneficial to insects; “it’s an ethical solution. The big problem with factory farming is we’re putting sentient creatures into conditions they should not be experiencing or would not normally experience in the wild. That’s totally the opposite with insects. We are ultimately creating conditions these insects like: damp, dark, moist, crowded environments and we go the extra mile to ensure our fruit flies are happy. We’ve also consulted with entomologists to ensure our insects are being treated as ethically as possible” (Watson, 2022c). Here, the company frames its work as creating ethically acceptable conditions for supposedly non-sentient creatures in order to solidify efficiency and productive capacity.

Furthermore, cultured meat and plant/air life must be considered in tandem with one another. If cultured meat proves costly and “unnatural” to produce, decellularization may become a way to integrate plants into the production process (though, given the chemical aspect, it is also possible that such decellularization is also environmentally harmful and “unnatural.”) If Solein were to be commonly used as a nutritional additive for cultured meat production, and methane-capturing could be used to feed the animals who are raised for the purposes of cultured production, then cultured meat production would generate a widely expanded set of anthroparchal relations in production, which theoretically could disrupt the socially constituted categories which reference the physical categories of natural difference. However, such a change would likely result in “nature” being a larger umbrella term for increasingly productive entities all interlinked to each other in such a way that the physical referent loses its categorical status (Cudworth, 2005, p. 34), which is difficult to conceive of as a break in the anthroparchal understanding of “nature.”

All three of these components demonstrate that cultured meat serves as a beginning point for an imagined expansion of anthroparchal relations in production, which integrates numerous other natural entities into the food system as subjects of productivity. Not only a far cry from a supposed

disruption, the 99.6% goes well beyond the reinforcement of anthroparchy, opening up the possibility for a wider set of living beings to be considered “meat.” Cultured insect meat manages to introduce the struggles of cultured meat to new beings. Plant and air life are being imagined not just on their own, but in reference to cultured meat’s potential success or failure, generating opportunities for companies to successfully accumulate capital by competing, or cooperating, with cultured meat producers and proponents.

Anthroparchal Domestication and Reproduction

The 99.6% offer an interesting conundrum in relation to cultured meat and anthroparchal domestication/reproduction. Cultured meat, in theory, disrupts the vast number of animals domesticated and killed for meat; however, this vast number arises from only a small percentage of globally domesticated animals. In an imagined scenario in which two companies hold a duopoly of cultured production, and are able to domesticate the remaining 99.6%, how many animal populations would be under the control of these companies, how large would the herds be, and under what contexts would these animals live? Regardless of the actual likelihood, the scenario points to incoherence in cultured meat rhetoric in which a decreased size in domesticated animal populations is supposed to occur alongside a potential increase in the number of animals integrated into cultured meat production systems. While a move into the 99.6% might be envisioned through VOW’s cell library, that would offer VOW a monopoly that other companies might not appreciate; consequently, it might make more sense for each company to build its own cell library, or to merely domesticate some of these animals in order to avoid having to make use of another company’s cell library. Similar issues arise in a scenario in which each country builds its own cell library following a theoretical socialist revolution; if the revolution does not occur in a way which mirrors the old dreams of a globally unified socialist government, and instead sees some countries adopt socialism while others do not, then one can envision competitions for animal cells and cell libraries occurring at nation-to-nation levels.

Furthermore, one should consider the issue of reproduction in relation to the 99.6%. Consistent supplies of animal cells, unless immortal cell lines become common, would require a reasonable supply of animals. For an endangered animal population, it may be in the interest of private companies to manage animal reproduction to get certain groups to reach a desirable population level; taking the Melzener et al. (2021) figures of 20,000 for a beef herd (p. 9-10) into account, it might even be in the interest of private companies to invest in increasing such populations out of endangerment in order to justify slaughtering these animals once they reach the end of their “culture-able” cycles, maximizing profit as much as possible. Integrating the 99.6% into a cultured system of production, even in a strictly immaterial sense as a “possibility,” renders the animal vulnerable to human visions about what the animal should be, and therefore, what might be needed to get the animal to fulfill its duties once under that status. The limited protection certain animals may have when merely marginalized can be envisioned as eroded in this scenario; instead of being ignored and left to fend for themselves, the 99.6% may find itself prone to greater intervention and productive interest in ways which, inevitably, bring along matters of reproduction and population size.

The domestication of insects offers another interesting moment of potential expansion. Bote (2020) presents research on waxworms as a possible remedy to global plastic pollution because of microorganisms in their gut which can break down plastic effectively, though potentially this “solution” to plastic pollution would come at the expense of bee populations. To even produce the studies on waxworms requires the domestication and reproduction of insects in order to have a sustainable supply; it is unlikely that insect meat production, even in cultured form, would differ. While one could envision a cultured insect meat company – should one ever exist – building an outdoor facility with strict netting to prevent insects from escaping, it is most probable that such a company would want to maintain insects in a facility which makes access as easy as possible for the purposes of cell culturing. Insect reproduction would, presumably, be closely monitored and promoted, or disrupted, depending on the needs of the company. The idea of an insect being grabbed out of nature and used for cellular production comes across as disingenuous, especially given the material difficulties in catching insects; even a communal-anarchist population would be incentivized to keep insects in some sort of containment unless this population can produce immortal cell lines, which would depend heavily on resources and education to manage. For insects who are not already subject to such productive relations, cultured insect meat, alongside greater interest in insect meat in general, offers further possibilities for the world’s insects to become subjected to expanded relations in anthroparchal domestication and reproduction.

Plant and air life demonstrates some of the difficulties in how “nature” is considered. For example, decellularized plants are a reasonably clear case of expanded domestication under anthroparchy. Should a cultured system of production come into being which makes greater use of decellularized plants in the production process, there would be considerable impetus to maintain domesticated plants specifically for the purpose of such a production process. By contributing to the demand for domesticated plants, decellularized production could expand the number of plants utilized in such a system. Furthermore, if an uncommonly consumed plant were found to be appropriate for decellularized production, a new plant could become integrated into anthroparchal cultured production. However, in comparison, solar energy and methane cannot be domesticated in the same way. One can grow a plant for decellularization in a green house, or in a garden, or in a monoculture field which stretches for acres and acres. Solein and methane foods would privately benefit from the production of air as a food, but air cannot be privatized in quite the same way; it is still a common good that can be accessed for all, except in cases where a clean version of air is privatized to replace contaminated air that would be a common good otherwise. Considering “domesticated solar energy and methane” is different from acknowledging privatized access and capital accumulation of air. Nevertheless, cultured production is giving rise to an imagination in which air becomes integrated into food production and boosts the productivity, as well as sustainability, of the subjects of cultured production. Therefore, air should be assessed when looking at anthroparchal domestication, but with the recognition that the terminology of domestication may not apply particularly well.

Regardless, the three components demonstrate considerable possibilities for expanded anthroparchal relations in production and domestication, in which more animals, insects, and plant life become the potential subjects of material and immaterial matters of productivity and management. What must be considered, however, is how such domestication and reproduction might be facilitated.

Anthroparchal Politics

The three components may not necessarily expand anthroparchal politics as a whole, but certainly could expand who (and what) is subjected to anthroparchal politics. As much as one might want to imagine FDA/USDA hearings on cultured human meat, it is more important, I argue, to consider the expansion of anthroparchal politics in relation to animal and natural life.

Culturing the remaining 99.6% of undomesticated animal life may require that the reinforcement of anthroparchal politics be expanded to reinforce how animal life is governed. For example, already domesticated animals are subject to current regulations of meat and animal life, but undomesticated animals are subject to different regimes such as wild animal protections (Kymlicka and Donaldson, 2012; 2014). The already limited protections, however, may erode if private companies (or states) were to advocate for a change in the political status of these animals, as well as a change in their regulation. Moving an endangered animal to a “cultured meat” animal would continue to reinforce the animal as meat, but expand such reinforcement by advocating for more animals to be considered “meat” that could be cultured. Now, in situations where such an expansion may not be entirely desirable, or might result in major political tensions, anthroparchal politics may not allow such an expansion. For example, politicians in rural areas who take into account the interest of pro-hunting groups may advocate on behalf of these groups in opposition to expansionist cultured meat groups; much would depend on ideological commitment and lobbying efforts. However, the 99.6% represents the simultaneous instability and stability of anthroparchal politics; for animals, their status is subject to theoretical changes of massive scale, but for human interests, expanding what is considered “meat,” and therefore, subject to anthroparchal politics, perpetuates the legitimization of anthroparchal politics across a societal level, and is more akin to minor quibbling than anything else.

Insect meat marks further considerations of anthroparchal politics. Depending on a country level context, different organizations would likely be put in charge of regulating the insect meat supply; further issues could arise if cultured insect meat were to be allocated between different organizations. However, by even considering such possibilities, insects become the subject of expanded anthroparchal politics. Furthermore, if insects become defined as a potential source of meat, their change in status might subject them to increasingly scrutinized and managed anthroparchal politics. Often, insects are marginalized in anthroparchal political considerations, viewed as mostly insignificant. Even during environmental advocacy efforts, insects tend not to be a particularly major subject unless they attain a certain status, such as bees. However, even here, greater status does not guarantee against marginalization. Turning insects into meat, cultured or not, renders the insect subject to an unfamiliar regulatory scheme, expanding the impacts of anthroparchal politics in the process.

Plant and air life do mark a more complicated consideration, as the production of decellularized plants, Solein, and methane foods would likely align with current environmental regimes and standards regarding plant and air domestication and management. However, once again, such considerations do not change the issue that more entities may become subject to a wider array of anthroparchal politics and subsequent considerations. For example, governance surrounding methane emissions may need to account, to a greater degree, for methane’s role in food production if companies were able to

proliferate methane-based foods for both animal and human; such a consideration places methane in more anthroparchal-political terms, regardless of whether such governance were to ever actually be realized. Mapping the relationship to anthroparchal politics would require mapping numerous current governance regimes, but it is likely that the presence of this component would contribute to an expanded array of anthroparchal politics.

Violence

Anthroparchal violence towards the 99.6% will presumably depend on the composition of a cultured system of production. Taking into consideration the previous chapters, cultured meat is unable to truly disrupt anthroparchal violence towards animals, and tends to materially and immaterially reinforce this violence. However, such violence has only concerned animals commonly consumed for food, and primarily in a Western context. The 99.6% goes beyond country-by-country differences, and imagines a massive variety of animals as meat.

If cultured meat production mirrors the vision of Melzener et al. (2021, p. 9-10), in which the end-result for animals is potential slaughter, the 99.6% could be domesticated, cultured, and then killed once they are no longer efficient, allowing companies to achieve maximum profit possible by selling “cultured” and “traditional” versions of exotic meats. In a system which does not kill the animal at the end of its usefulness, material violence is still a consideration; the formerly marginalized 99.6% who are used for cell-culturing purposes may be obligated into crowded housing, repeated medical procedures, and violations of personal liberty and sensibility. Even if one alters this vision from a capitalist to a socialist system, the issues arising from industrial domestication and violence are still present. Proponents may respond by arguing that the 99.6% would only be harvested for a cell library contribution once or twice, not requiring domestication. However, the animal still has to be captured, held down, given a biopsy, and then monitored for health issues following the biopsy before release. Material and immaterial-symbolic violence is still present even if one imagines a “non-violent” ending for the animal. Furthermore, the act of exploring deep into the world’s jungles, seas, caves, etc., puts human beings on a mission of immense exploration and interaction with wilds which may not necessarily see such engagement, all in the interest of taste palates, capital accumulation, and food production. The violence of productivity expands tremendously, and especially for this undomesticated 99.6%. While companies such as Primeval Foods claim that they “select a small sample of tissue from the healthiest wild animals” as said animals “continue to enjoy” their lives, the company does not actually discuss the process of obtaining these cells, nor their plans for post-biopsy monitoring of animals, such as the elephants who make for an “exceptional umami experience” (“Process,” n.d.).

Cultured insect meat expands the question of anthroparchal violence to insects, raising some admittedly difficult questions. For one, the individual existence of insects comes into sharper question; certainly not liberated from human demands, insect meat integrates insects into a comprehensive system of production and anthroparchal violence, subjecting them to processes and patterns they were once exempted from. The discussion of the life and death of insects often relates to their cells (Dickinson, 2019) and not the actual insect as a being. While insects have tended not to receive the same ethical consideration as animals, increasing concern regarding insect sentience demonstrates that

the matter should not be considered “objectively resolved” (Tucker, 2016; King, 2017). Of course, if one argues that an insect may not want to live in a lab or housing unit, harvested for some cells and then potentially killed afterwards (or in the process), then cultured insect meat (as well as “traditional” insect meat) is an expansion of anthroparchal violence to the insect world. Furthermore, even if one accepts Cudworth’s (2005) claims surrounding sentience (p. 64), it is difficult to deny that culturing insect cells places insects in a symbolically similar position to that of cultured animals, meaning that immaterial violence may still be recalled even if one claims that sentience negates the insect’s potential experience as being comparable to that of the animal other. That being said, Future Fields argues that no one can claim to have an ethical diet because “we cause quadrillions of deaths of insects every year just by growing plants” (Watson, 2022c), proclaiming that the act of growing plants and harvesting are symbolically – and materially – equal to the act of shooting/stabbing an animal, regardless of intentionality. A nihilistic holism emerges in the company’s rhetoric, in which their actions are ethically sound – no matter how violent, or reminiscent of violence – because the actions of others are, in their eyes, equally unethical. It is difficult to see how any being or entity, then, is to overcome violence towards itself, or others.

In terms of plant/air life, their treatment does not mirror the violence towards animals; decellularizing plants and harvesting solar (and methane) does not involve the physical coercion, medical procedures, or explicit taking of a life that cultured meat may involve. Consequently, it is easy to say that anthroparchal violence towards nature is not expanded by these practices, but one must recall Cudworth’s (2005) conceptualization of symbolic violence, in which the recollection of physical violence can be used to determine symbolic violence (p. 69). Here, one could argue that these processes do not recall physical coercion, but others could claim that there is a larger, broader symbolic violence to consider. Authors such as Gaard (2016) and Sinclair (2016) are likely to claim that such an approach reiterates the “humanist” plant/animal dichotomy, and should be abolished in favor of a holistic system of assessment. Though Adams (2016) responded to Sinclair by arguing that observation negates such a claim, I argue that the plant/air life component offers further complexity. In this situation, decellularized plants are integrated as part of the productive process while also being stripped cells; the capturing of solar and methane is not comparable in the sense that one can identify an entity, or potential “being,” that faces a similar process to the decellularized plant. However, the plant is not automatically oppressed in the same way as the animal, as there is no discernible way to measure a plant’s response to being decellularized. Though symbolic violence can be argued as being present in the decellularization process, it is recalled only through equating such an experience with an animal or human being. The plant, itself, does not scream in terror, or react in pain, or face an existentially notable death in the same way as an animal (or human, for that matter). Consequently, I posit that one should be careful in arguing that anthroparchal violence is expanded by the plant/air life component; expansion can quickly be turned into arguments about “equality” and “holism” which are merely distractions from the animal – and insect – condition in a cultured system of production. However, CAS scholars who have rejected “sentience” may find that this issue highlights the potential need for some form of sentience to defend against claims that animals are nothing more or less than the rest of us, thus delegitimizing considerations of the violence of their condition. The tensions between the ecofeminist and CAS

approaches to sentience are exemplified in this instance, and demonstrate the need for clarification of sentience in relation to anthroparchy.

What all components demonstrate, however, is that anthroparchal violence is prone to being expanded, both materially – should a cultured system of production ever come into existence – and immaterially in the current cultured meat discourse and imagination. The 99.6%, the insects of the world, and a wider variety of natural life come to be part of an expansive system of production, and furthermore, these entities become more interconnected *as matters of production* than ever before; Mattick et al.'s (2015) claims of a “new wave of industrialization” stemming from cultured meat (p. 11946) take on a significantly more concerning tone when one considers to whom or what the violence of this system might be applied.

Cultures of Exclusive Humanism

Instead of breaking this section down by the three components, a different approach will be taken. All three – the 99.6%, cultured insect meat, and plant/air life – when considered in tandem with one another, demonstrate that cultured meat does possess possibilities for expanding anthroparchal cultures of exclusive humanism. In breaking down the “barriers” previously erected under anthroparchy, such as the barrier between insect and animal life and the role of plants in the actual production process, cultured meat creates theoretical opportunities for expanding human domination and control over “nature” as it is commonly understood. All three components assume a culture of exclusive humanism which can maintain, and expand, material and immaterial control over animal and non-animal life in various forms. Beyond failing to disrupt, and consequently reinforcing, cultured meat poses new issues for animal and natural life, potentially rendering these entities more prone to control, and furthermore to the logics of productivity and capital accumulation under anthroparchy. However, these concerns do need to be understood as dependent on various assumptions which may never come to fruition. The 99.6%, cultured insect meat, and plant/air life all depend on variously complicated biotechnologies finding wide adoption and major profitability, all of which is not a guarantee, especially when one considers the economies of scale issues highlighted by Humbird (2020) which have yet to be resolved regarding ongoing cultured meat efforts. Nevertheless, for the imagination of cultured meat to reach such a point where these components can be identified and extended to the degree that I have extended them in this chapter is a demonstration of the need to maintain some concern over what cultured meat introduces in its visions of a “radical” future.

While some have argued that cultured meat will break these barriers, I argue that such claims rest on limited criteria. Returning to Milburn's (2016) proposal for cultured human meat as a way to dissolve the human/animal binary, there is a failure to engage with whether cultured meat would dissolve intrahuman cultures of exclusive humanism, especially in relation to larger systemic considerations. Racial and gender-based disparities are still common in anthropocentric considerations such as income disparity. Would there actually be any reason to assume that cultured meat could disrupt such systems? Not particularly, because while the theory of human and animal meat sharing shelf space as a “humbling force” sounds appealing, it fails to account for whether certain human meat might sell for higher costs than other meat, and why such cost disparities might exist. “Meat” is not just

a general category, as different animals are held in higher regard as meat than others for various reasons. The 99.6% represents the possibilities for animals to be further divided on the basis of possibilities for capital accumulation; merely rendering “human” as “meat” does nothing to address hierarchical structures which currently dictate anthroparchal cultures of exclusive humanism, nor the relationship between such cultures and socioeconomic arrangements such as capitalism, communism, etc. Furthermore, if human meat were to ever sell at a higher cost than that of animal meat, one could claim that cultures of exclusive humanism are continually reinforced through their expansion into marketization, leading one to lament that even as meat, humans value themselves over animals.

The three components demonstrate the urgent need to arrive at a stronger definition of cultures of exclusive humanism, especially in the face of the potential impacts of these components on various natural populations. Questions of cultured meat and cannibalism do have their place in the discourse, but the considerations of anthroparchy, in relation to the three components, serve as a reminder that animal, insect, and natural life are prone to great impacts stemming from the cultured imagination.

The Expansion of Carnism

(In)visible Violence

The most obvious expansion of carnist (in)visible violence can be theorized through consideration of the 99.6%; if the world’s undomesticated animals become subject to various degrees of (in)visible violence for a cultured system of production, expansion is an inevitability stemming solely from the mere proposal of a “culturable” 99.6%. The exact nature of this (in)visible violence would depend on the composition of a cultured system of production, but to ask how the 99.6% might “fit” into such a system presumes substantial possibilities for a differentiated human-animal relationship, where at one point in time, such a relationship was not as discernible.

As discussed in the previous chapters, the notion of cultured meat being nonviolent is questionable, and though there are varying degrees to which aspects of the violence can be made visible, there is no particular incentive for producers – whether private sector, public, or anarcho-communal, or any variety therein – to make visible all aspects of carnistic violence. Such an impetus may become especially important in a system of “99.6% + 0.4% production,” in which animals once considered irrelevant to wide-scale meat production become subject to such considerations. For example, the status of a sloth is currently one of being a funny, lethargic animal, once a popular internet meme. Turning a sloth into meat would integrate the animal into a system of (in)visible carnistic violence, but it is unlikely that producers would want to make the process of violence truly visible. Even if consumers might be aware that they are consuming the meat of a sloth, producers and consumers can enter (or maintain) an implicit contract in which consumers do not need to see the process of seeking out a sloth in order to subject it to a medical procedure, or of the sloth being slaughtered and turned into meat. The invisibility of violence can still make it visible through the role of individual and collective imagination; there is no guarantee, however, that this process would be ruptured just because a wider variety of animals is integrated into the process. Some might argue that endangered and “cute” animals

would be exempted from this claim because of the discomfort people would feel with eating their meat; however, proponents and producers could claim that such meat is ethically sourced, and therefore there is little-to-no ethical frustration for potential consumers. In presenting such a possibility, the animal's "special" status could be eroded; if all animals can be turned to meat, what need is there to protect animals beyond their status as meat?

Admittedly, one possibility exists which could undermine my argument. If traditional and cultured producers not only share shelf space, but even produce both types of meat – which is only a theoretical possibility at this juncture, as the recent purchase of Biotech Foods by JBS is not enough to declare that such a future is imminent (Feedstuffs, 2021) – the 99.6% takes on more concerning tones. If the meat of an endangered animal can be produced in a cultured manner, there may be market incentive, whether for competition's sake or profitability's sake, to also produce "traditional" endangered animal meat. Consequently, market incentives could drive producers to produce both traditional and cultured versions of the 99.6%. Though the actual likelihood would depend on logistical probability, likely guaranteeing that a full version of this vision does not come to realization, the possibilities are still endless in a certain sense. Even an expansion to "1%" from "0.4%" could mean that more animals are subjected to both cultured and traditional forms of production. Such a possibility, one might argue, would raise awareness about the plight of meat animals, and consequently, would trigger a public reaction to carnistic (in)visible violence. However, such an argument fails to address the role of producers and proponents in legitimizing and normalizing carnist (in)visible violence; producers could claim that their mass breeding and domestication programs contribute to an increased population that cannot be attained through traditional conservation efforts, demonstrating not just the power of the private sector, but their alleged ability to contribute to environmental sustainability goals. There is no "clear-cut" future in regards to the 99.6%; considering them potential subjects of carnism means that all forms of carnist (in)visible violence could be possible.

The expansion of insect meat, however, does pose some difficulties for carnist theory. For those concerned with carnism, it has been difficult enough to have animals considered as subjects worthy of moral and ethical consideration in a variety of realms; the prospects for getting people to think of insects in and of themselves, instead of merely as components of human productivity and survival, are low (Shelomi, 2021). Yet cultured insect meat may bring some of these questions forward. Insects do not receive particular consideration of their life status despite the likelihood that both cultured insect meat and regular insect meat will depend on dead insects (Shelomi, 2021; Huis, 2019; Pali-Schöll et al., 2018). Especially if sentience is rejected as the way of engaging with animals and the natural world, insect sentience would also be taken off the table, leaving one to ponder about the status and lives of insects. Does a fly deserve the same ethical consideration as a cow? Do roaches live their own lives when not under human control, and what considerations need to be given to such life? The rhetoric of Future Fields demonstrates that the supposedly non-sentient can be discussed in ethical terms.

A system of insect meat, especially if it is considered more environmentally sustainable than industrial and cultured meat production systems, would still be a system of violence, albeit with some "difficulties in translation." While a fly or mosquito may not scream in terror like an animal, the fly or mosquito – unlike the plant or air – can fly away from the swatter or swatting hand. Such a prospect

opens the possibility that the fly is attempting to avoid violence, and in a system of (cultured) insect meat production, the insect may be attempting to escape a system of (in)visible violence, regardless of how aware of its situation the insect might be. Not only does (cultured) insect meat represent an expansion of what/who is subjected to (in)visible violence, but it also may necessitate a greater moral consideration, one which comes into conflict with varying degrees of ecological-ethical theories and runs the risk of coming across as “increasingly disconnected” from reality; nevertheless, (cultured) insect meat proposes a rapidly expanding and unfamiliar future, rife with difficulties for a variety of considerations. The rhetoric of Future Fields best embodies this point; even in what seems to be in poor faith, the company does still posit some form of ethics in the treatment of insects, and by extension, the possibility of debate surrounding ethical and unethical treatment.

Mythmakers and Institutional Support

As the previous section indicated, expanding cultured meat production to the 99.6% runs the risk of rendering a variety of animals as subjects to carnist systems of production. The success of such an expansion would, admittedly, have to have institutional and mythmaker support – as Joy (2010) argues that mythmakers and institutional support are key components of carnism (pp. 87-104) – which does present the possibilities for some inconsistency. Individual mythmakers in certain contexts may not support wider systemic pushes for expanding the net of domesticated meat; as an example, even if a company offers cultured koala bear meat, there is no guarantee that individual mythmakers will strictly cohere to what is offered by institutions. This matter does reveal that the relationship between smaller-scale mythmakers and larger institutions is more complicated than a simple “top-down” or “bottom-up” creation of demand and production. Yet, it is this complication which also reveals the possibilities for the exercise of influence. Especially in a globalized system of production and cultural transcendence, cultured meat offers the possibility of overcoming certain classifications. For example, Joy (2010) notes that women from the Quito area of Ecuador have an intense emotional bond with chickens comparable to that of Western dedication to cats and dogs, which is especially seen in the emotional reaction to the eventual selling of the chicken for slaughter, a reaction which is considered one of sadness (p. 119-120). Cultured chicken meat might be seen as a form of relief to the emotional feelings of these individuals, but the possibilities stemming from being offered such cultured products also point to the animal’s status, as meat, still being reinforced by cultured meat. Such consideration as “meat” could be expanded elsewhere; in the “global village,” who is a Westerner to refuse cultured dog or cat meat on the basis of cultural practice, especially if the animal is not “harmed” in the cultured system of production? And who might an Ecuadorian be to refuse Western cultured chicken meat given the “overcoming” of harm to animals? Private companies, and entities involved in the global market of meat and animals, are inclined to break cultural barriers down, as much as possible, in order to expand markets in the name of profit and capital accumulation.

Even without market consideration, however, the animal’s status as meat is still prone to expansion due to the actions of mythmakers and institutional support. For example, in a communal “pig in the town square” scenario, one can imagine that various individuals, in their communities, may be urged to volunteer their animals – or whatever animal they can find – for a new “flavor of the month.” The pet, or the pest in the backyard, could become a target, surrendered to the town square in order to

be subjected to a biopsy in order to maintain the food supply. Even the animals who are not considered “meat,” once the 99.6% matter is considered, could become “meat” in the eyes of those who control the remainder of their lives. Such a scenario is especially probable if the “meatmaker in the kitchen” vision was possible; one does not need to rely on the authority and productive capacity of large companies or communities if the household’s meat supply is as simple as turning the household pet into a simultaneous meat-producing machine. Such matters demonstrate that turning the 99.6% from undomesticated to domesticated also holds troubling promise for already domesticated beings.

For insects and plant/air life, the expansion of carnist institutional support will still depend on the dynamic between institutions and meatmakers, as well as consumers and producers. Insect meat is proving a “hard sell” in many places (Weele et al., 2019, pp. 508-510; Gómez-Luciano et al., 2019, p. 5). Plant and air considerations may not receive such a backlash, and could be integrated into a cultured system of production so long as these entities do not become significantly disruptive to governments and other institutions. Should the production of methane and solar foods for the purposes of feeding animals disrupt other grains and oilseeds used for animal food, then institutional support may not be guaranteed, but the overall prospects of some sort of institutional reaction specifically to this component are questionable. Insect meat, however, is another matter, as insects – not being subject to carnism in a widespread sense up to this point – are usually marginalized to such a degree that they are not part of the public imagination except, mostly, as a frustration. Turning them into meat could change their status, but also reinforce it further for those who are opposed to the consumption of insect meat. Consequently, the prospects of carnist-institutional support being expanded for insect meat are questionable, but it is also fair to posit that it is too early to even broach such a subject.

Cognitive Dissonance and Rationalized Visibility

The Three N’s

Regarding the 99.6%, the proposition further normalizes meat consumption by expanding which animals could become the subject of “everyday” meat. While some might argue that creating meat from “exotic” animals would call to attention the perceived abnormality of certain cultural norms and practices (across the cultural spectrum viewing of “the other”) the presence of the 99.6% could create a new normalization. VOW’s quote about current production stemming from “less than 1%” of natural life, in a certain sense, makes current practices seem abnormal not because they are ethically uncomfortable or environmentally unsound, but because they are not ambitious enough, serving as an inadequate reflection of human potential to produce as wide a variety of products and experiences as possible. Primeval Foods takes this point further, arguing that “today, we eat so much more meat than our ancestors,” a claim that is juxtaposed with the company’s expansionist ambitions to make it seem as if the meat we are eating today is still not enough, as if it is abnormal to not push for more types of meat (“Process,” n.d.). Primeval also claims that traditional species “have reached their limit” in satisfying consumer demands for “new culinary experiences.”

Of course, one might propose that such an idea could rupture the “necessity” of meat eating; if the remaining 99.6% of animals are turned into meat, could we really say that we are consuming too

little protein, or that the animals of the world would become so overpopulated that humanity would collapse, or that the economic incentive is no longer needed? Each of these claims, however, fails to account for the creation of “necessity.” Proponents could argue that a wider variety of cultured meat offers greater possibilities for more diverse protein attainment. The economic incentive is a matter of scale; proponents could argue that the 99.6% must be continually consumed at high levels in order to maintain the scale of such a system which produces a vast quantity of diverse meats. Finally, the overpopulation myth (Joy, 2016, pp. 110-112) might see a certain “nipping in the bud,” given the vast control over animal life that the 99.6% represents; however, it is also theoretically possible that the production of cultured and traditional 99.6% could lead to greater population changes which require management from the private sector or state. There is no guarantee that excessive abundance inherently disrupts the carnist “necessity” of meat eating; the control of narratives of desire and demand could go in a different, expansionist direction.

The “naturalness” of meat eating would likely be expanded by the 99.6% component. If human domination of animal life is natural – and the natural expression of said domination is the killing of animals for meat – then what is more natural than humans conquering the entirety of the animal kingdom? Whether such “natural” domination is justifiable would not be disrupted by the presence of the 99.6%; instead, further violence towards the 99.6% could be seen as a return to a “natural” dynamic with animals, regardless of whether such a “return” is justifiable. This concept will be developed more in consideration of neocarnism, but at this juncture, the 99.6% presents the possibility of expanding the “naturalness” of meat consumption to animals once considered irrelevant to such conceptions of meat and animality.

For insects, the three N’s are more difficult to identify in relation to expansion. Despite Afrimash’s (n.d.) claims that black soldier flies can be consumed by human beings, such a claim is likely going to be viewed as abnormal by a wide variety of actors, and for a considerable period of time. While certain ideological understandings are shared between animal and insect meat – such as the “self-sacrificing” living being seen in Afrimash’s promotional material – there is not widespread ideological support for insect meat (Weele et al., 2019, pp. 508-510; Gómez-Luciano et al., 2019, p. 5). To normalize (cultured) insect meat, there would likely need to be widespread ideological change. Such a change might be theorized as arising from a realization that insect meat is natural; if other beings eat insects, and some human beings eat insects, then it must be natural for all, with the inhibition merely being a social construction. This notion, however, is unlikely to be accepted by those with such an inhibition. Here, the human separation from nature would be used to justify (cultured) insect meat as unnatural – we, as human beings, do not stoop to the level of various animals, as we eat animals, and, therefore, insect meat consumption is unnatural. As well, some may argue that insect meat consumption is an issue of poverty and environmental constraint, meaning humans who consume insects are obligated into doing so – and may have culturally normalized doing so – because of various material conditions related to food system structure under capitalism and overall food distribution (Lombardi, 2014). The likelihood of “naturalness” leading to (cultured) insect meat consumption is questionable. However, the “necessity” of insect meat does pose some expansionist possibility. For example, an article by Baker (2021) opens with the headline: “They’re healthy, they’re sustainable. So why don’t humans eat more

bugs?” Environmental sustainability considerations may lead to top-down support for insect meat as a potential necessity, especially in the face of global climate change. However, responses to these arguments, best demonstrated by internet user “cockydoody” (2019), indicate that bottom-up resistance to such claims will likely persist, so the prospects of cultured insect meat becoming normalized by way of “necessity” are still questionable. Nevertheless, the necessity angle does raise questions for the future expansion of cultured insect meat.

Finally, plant/air life components offer some complicated expansionist possibilities. Decellularized plants, Solein, and methane-foods continue to normalize meat consumption by being proposed as “biotechnologically important” ways to improve (cultured) meat production. Decellularized plants may be a more “natural” way to contribute to cultured meat production; Solein may be a “natural” way of improving the nutritional composition of cultured meat products; and methane-based animals foods may be seen as a reasonably “natural” way of feeding meat-animals in the face of global climate crises. Each of these components offers some way of expanding the normalization of meat consumption in new directions through the greater integration of plant and “natural” life into the production process.

The “naturalness” of these components, however, rests on shaky ground. While these components use plant and air in the processes of production, such uses can be seen as an unnatural approach to engaging with plant and air life. The biotechnological use of plant and air life may come across as unnatural in a metaphorical and symbolic sense; however, if such processes become important for maintaining human consumption of meat, and the nature of such consumption therein, then it is possible that an “unnatural” set of processes becomes normalized in the name of maintaining the “natural” human progress of meat consumption. An ambiguity does arise in attempting to discuss the conflation of “natural” and “justifiable” when thinking about “natural” life as a force in meat production, calling to attention the difficulties in using the word “natural” to discuss both environment and deterministic behavior simultaneously.

Necessity is expanded by the plant and air life components, as all are presented as potentially being necessary in order to render cultured meat – and food in general – as more sustainable. Especially in the case of Solein and methane-based foods, both are presented as contributing to improving the sustainability of meat consumption and production – whether cultured or traditional – offering rationalizations for both their inherent necessity, and their necessity in relation to a variety of potential food futures. The necessity of decellularized plants is questionable, depending on whether research efforts are successful in rendering such entities as desirable for cultured production processes. However, Solein and methane-based foods do present themselves as necessary, and given the potential shortcomings of cultured meat, such necessity must be treated as potentially more viable, on certain grounds of justification, under carnism.

Internalized Carnism

The 99.6%, as a concept, serves as an expansion of internalized carnism. For one, the proposal of the concept functions as objectification, and, consequently, subjects the majority of the animals of

the world to the concept of “potential meat.” The proposal marks an immaterial expansion of carnist objectification; of course, whether such objectification is translated into genuine material conditions is another matter, the actual likelihood being low. However, the presence of this possibility opens up further questions of objectification for a multitude of animals who may be classified in other objectifying ways, or who exist so far outside the imagination of the majority that they do not even register for consideration. For example, the birds and wildlife one might feed are not domesticated, but one could objectify the animal beyond merely “wildlife,” and instead as meat, were someone to decide that the animals should start “earning their keep.” A major factor for this objectified status is the role of property; if private companies begin domesticating the undomesticated, and are legally granted the ability to do so, objectification moves beyond the individual level to the wider systemic level, which poses greater difficulties for those attempting to resist such trends of objectification.

The social construction of animal categories, in its deindividualization of animal life, can be greatly expanded by cultured meat, though I also argue that expansion reveals the degree that objectification already occurs in this process. As discussed in the mythmakers section above, different cultures have different attachments to a variety of animals, meaning that some cultures come to value chickens in the same way some cultures value dogs and cats (Joy, 2010, pp. 119-120). Cultured meat poses difficult prospects for already domesticated animals. For one, animals who belong to a “domesticated” category of an overall “undomesticated” species may lose some of the individualization that they have been granted by being considered separate from the current carnist system. As an example, dogs in the West are generally considered “exempt” from being meat, but the likes of wolves and foxes – distant relatives – are currently hunted, and cultured meat production could further erode the distinctions should the meat of all of these animals be produced “harm-free.” Furthermore, the global distribution of cultural standards could alter the deindividualized status of animals. Producing cultured meat of animals considered “pets” in one culture and “meat” in another holds the possibility of eroding various cultural standards for what counts as “pets” and “meat,” especially if a cultured system of production arose in which one could even offer individual animals for meat production. This erosion may lead to further objectification as well as simultaneous individualization and deindividualization; in a “pig in the town square” scenario, one could surrender his or her pets, turning them into a meat machine for the larger community, leading to questions about whether the animal is seen as an individual being or another mode of efficient meat production. This matter leads to a final point of concern. Even in contexts where animals are recognized as “individuals,” they are still subject to the interests of capital; Joy’s (2010) example of emotional bonds to chickens demonstrates that the bond does not prevent the chicken from being sold and turned into meat (pp. 119-120). Deindividualization also depends on larger material matters, and can transcend any personal bonds between human and animal, consequently pointing to the need to understand deindividualization beyond mere personal failing.

Alongside the deindividualization matter, dichotomization is likely to be expanded by the 99.6%. For example, the worthiness of ethical consideration is often determined on the basis of whether or not an animal is “cute” or “ugly” (Joy, 2010, p. 122). How many of the 99.6% are “cute,” how many are “ugly,” and how might this classificatory schema affect animal life? If most of these undomesticated

animals are “ugly,” they may not receive popular consideration for their well-being, though even “cute” animals could still become subject to cultured practices because of the belief surrounding cultured meat and “nonviolence.” Certain dichotomizations could be expanded by cultured meat, and others destabilized; ultimately, the manifestation of such changes would be determined by what forms of cultured production were to be developed.

In terms of plant and air life, internalized carnism is not particularly applicable. One is unlikely to build a bond with an individual plant that is comparable to the (potential) bond developed with an animal; the modes of engagement are too different, as one cannot play or relax with a potato as one can a chinchilla. Air is even more difficult to engage with, as air cannot be individualized. However, insects do pose some interesting dilemmas. The mere act of producing insect meat is objectification; insects are seen as objects for consumption, or as potential contributions to production processes. The expansion of objectification under carnism is possible with the greater integration of both “traditional” and “cultured” insect meat. Dichotomization could see some expansion with the consideration of insects. For example, insects who contribute “more” to biodiversity could be valued to a much greater degree than an insect who does not contribute “as much.” For example, bees are valued – symbolically, at least – significantly more than other insects, despite all insects contributing to ecosystems in a variety of forms (Rader et al., 2016). The expansion of dichotomization, however, would depend on the actual expansion of (cultured) insect meat in relation to climate change mitigation strategies and other forms of engagement with insects.

Deindividualization, however, serves as the most difficult point of expansion. It is easy to argue that insect “individuality” is a myth; they come across as near robotic, laser-focused on collective goals such as hives and ant colonies. Yet individual insects can still make themselves prominent. A fly who never gives up creates a certain frustration for the human subject, especially in comparison to a fly who leaves after one or two swats. The individuality of insects can likely never be determined as one might determine the individuality of animals; the modes of life and engagement are too separated from one another, rendering the chance of developing an emotional bond to a moth lower than a bond to a horse, for example. Yet such difficulties do not automatically mean that insects do not live individual lives, or at least, have some sort of individual engagement with life in and of itself. Traditional and cultured insect production is, by its functionality, a form of deindividualization, but merely “individualizing” an insect is unlikely to disrupt the deindividualization process. More commentary will be needed on this subject matter in another forum, but the presence of a potential insect individuality creates reason to consider the possibilities that (cultured) insect meat expands carnist deindividualization.

Neocarnism

Given cultured meat’s reinforcement of compassionate carnism, the 99.6% expands who this compassionate carnism is applied to. Undomesticated animals who have not been the subject of meat production could be considered matters of “welfare,” subjected to changed conditions and dependent on human advocacy for an improvement to their new conditions and environment. Such a shift of conditions is a disruption of animal life in the interest of capital accumulation and profits, which would be a far cry from original proponent rhetoric of a completely disrupted meat production system.

However, the 99.6% proposal also calls into question how “welfare” is defined. Imagining a scenario in which cell libraries are not established, but cultured meat producers seek out undomesticated animals for the occasional biopsy, their environments and patterns are still at risk of substantial disruption, regardless of how “peaceful” the actual biopsy process might be. “Welfare” is a broad term that can be manipulated easily, turned into a matter of narrow-focus so as to avoid more complicated discussions about the daily lives and desires of the animal other.

Whether the 99.6% would expand biocarnism is a different matter. Unless new information were to be introduced which claims that the protein of certain animals is “more healthy” than the protein of others, it is likely that the 99.6% would merely be presented as providing a wider variety of ways to obtain “necessary” protein for consumers. The potential expansion of biocarnism would depend on the provision of new “information” or new sales pitches, which create potential health crazes and practices. However, establishing the possibility of an expanded biocarnism is a futile exercise, given cultured meat’s current state; after more is discussed about cultured meat’s relationship to health and nutrition, biocarnism should be revisited.

In terms of ecocarnism, the 99.6% does offer some interesting possibilities. I have already posited that ecocarnism is likely reinforced in the eyes of those opposed to cultured meat on the basis of its “industrialism.” If cultured meat remains highly industrialized, then expanding what animals are produced by such a system would not be a likely way to overcome the association of cultured meat and industrialism. Here, ecocarnism is demonstrated as a commentary on the methods of harming animals and the contexts therein. The underlying logic of “small farm” regimes and “nonindustrial meat” essentially implies that to slit an animal’s throat in an industrial barn is unnatural, but to do so on the family farm is more in keeping with a poorly defined “nature,” despite a relationship between small farm and industrialism that has been greatly complicated by postindustrial capitalism and political discourse (Stanescu, 2010; 2017). As such, the 99.6% could still be integrated into ecocarnist consideration, especially when one considers how all forms of engagement with animals interact with both carnism and socioeconomic systems. For example, an industrial producer could introduce the cultured meat of raccoons to the global market. In an imagined scenario in which raccoon meat becomes more normalized, ecocarnist producers could emerge with “local, natural raccoon meat,” attempting to obtain a market share of this expanded production by marketing products in opposition to large-scale industrial production. Under carnism, industrial and non-industrial modes of production are linked more tightly than Joy (2010; 2016) has theorized so far; culturing the remaining 99.6%, especially under a system of “shared shelf space,” generates the possibility that a wide variety of meat comes to shelves in both “industrial” and “local” forms, both “cultured” and “traditional.” The actual probabilities of such a system, obviously, can be questioned, but the immaterial cultured imagination allows for such a scenario to be envisioned.

Insect meat does not fit well into the neocarnist schema; it is unlikely that the welfare of insects will receive attention comparable to that of animals, limiting the possibilities of compassionate carnism for insects. Though Future Fields’s rhetoric may indicate otherwise, the company’s claims may not land with an uninterested public. (Cultured) insect meat could be seen as a form of biocarnism, depending on the efforts to argue that insect meat is healthier and more environmentally friendly than traditional

animal meat; however, biocarnism towards animals is currently a popular notion, whereas insects are not viewed by many as a viable method of obtaining nutrition. Profound changes would have to occur before biocarnism and insect meat became a particularly relevant consideration. In terms of ecocarnism, again, some are arguing that eating insect meat is natural, and by its nature, it is “more” natural than traditional industrial production of animal meat. However, to reiterate what has already been argued in this chapter, the definition of “natural” is ambiguous and subject to manipulated use; the way one speaks of “natural” insect meat consumption is far different from another who might focus on whether such “naturalness” is common to human beings who are, to a degree, separate from the “food chain.” In this instance, more must be done to establish what is meant by “natural” before returning to the possibility of an expanded ecocarnism through (cultured) insect meat.

In terms of plant and air life, neocarnism is again not particularly relevant, though still worth consideration. First, compassionate carnism cannot be engaged with because the “welfare” of a decellularized plant is not discussable on the same terms as the welfare of a living animal.⁴⁵ Furthermore, biocarnism could be expanded through the greater integration of plant and air life into the productive process; the more nature is integrated into a harm-free mode of production, the more exempt it is from ethical consideration. However, such a notion depends on the environmental promises being actualized. Finally, ecocarnism has to be considered, once more, in light of fluid definitions of “natural.” Some may view the further integration of plant and air life into cultured production processes as “natural,” a way of returning to a relationship with nature in which humans consider natural possibilities. Others, however, may view the integration of air and plant life as “unnatural,” an obligation of natural entities into unnatural productive processes and forces separate from what one might consider “nature.” Plant and air life may help expand cultured meat’s overall force, but whether such integration is “natural or unnatural” would have to be considered in greater detail alongside an expansion on what is meant by “natural.”

Concluding Remarks

In response to the arguments that I have made in this chapter, proponents may respond by claiming that these notions are examples of a close-minded alarmism, a neo-luddite reaction to the promises of a more radical future. There is, admittedly, a difficulty in speaking of the theoretical expansion of anthroparchy and carnism without coming across as a severe pessimist. However, this chapter is not an explicit development about a “real” future, but a reflection on the rhetoric and imaginative possibilities stemming from discourse on and surrounding cultured meat, as well as what these possibilities could, in theory, mean for the natural world and what lives in said world. Especially when considering the role of hype and imagination in the attempts to create a cultured meat industry,

⁴⁵ It should be noted that Jainism and “fruititarianism” do equate animal welfare and natural welfare on a similar plane of existence, but that does not mean that the modes of engaging with welfare are similarly operable. For example, one may wait until a tree drops fruit before eating the fruit so as not to pick it off the tree; comparing such a waiting period to discussions on how and whether to house animals, and how an animal may feel in that situation vis-à-vis its welfare, indicates that different terms and ideas need to be sorted out before a similar, holistic “welfare” could be applied, especially as compassionate carnism deals specifically with animal welfare, not the plant life animals may utilize therein.

grandiose utopias deserve just as much critical assessment as repulsive dystopias, especially if utopia for one is dystopia for another. The most dystopian takes on cultured meat – such as Kleeman’s (2020b) claim that it is part of a shift that will render women, vulnerable people, and the empathetic as obsolete in a society disconnected from nature by the extremes of technology (p. 334) – still focus solely on the human being. The undersides of this biotechnology have to be considered for the larger world, especially if cultured meat, as Milburn (2016) might argue, serves as potential rupturing of the human-animal hierarchy; one must ask what comes after this rupture, and engage with the possibility that a reborn version of that hierarchy may emerge from the space that the previous hierarchy once occupied.

Certainly, the components this chapter highlights – the 99.6%, (cultured) insect meat, and plant/air life – all demonstrate the importance of expanding the dialogue between anthroparchy and carnism. The relevancy of what is “more” important, in terms of animal liberation and environmental sustainability, is greatly reduced when one looks at the extent all of these components may become integrated with one another as the subject of both anthroparchal and carnist productive forces. Neither theory can fully encapsulate these connections on their own; anthroparchy cannot necessarily provide a potential theory on the ideological drivers of insect meat, while carnism cannot quite account for the engagement with plant/air life that cultured meat may necessitate. While the non-99.6% components may also have separate aspects from cultured meat – as a theoretical collapse of support for cultured meat does not guarantee that insect meat and Solein would fade away with it – there are inter-linked dynamics which must be considered. Furthermore, all three components present a vision of an increasingly commodified natural world, so even in a general sense, they are linked together through the presentation of a biotechnologically fueled shift in capital accumulation opportunities and socio-cultural arrangements. The complicated nature of these linkages will, admittedly, require more mapping beyond the possibilities of this chapter, but the overarching case for concern has been made; moving beyond solely “industrial-traditional” meat, integrating new animals and natural elements into the production process and consumer palate in the process, poses considerable issues for the status of non-human life.

There is no denying – at least, in good faith – that any number of comprehensive visions of an “expanded” anthroparchy or carnism are prone to failure depending on the actual, material developments of cultured meat. However, this exercise is not futile, but should instead be viewed as a process of preparing all concerned parties for a wider variety of possible futures, as well as potential issues which could arise from these changes. For example, CAS has not often engaged with the prospects of insects as meat; however, increasing calls to turn insects into meat are likely going to raise questions regarding the scale and scope of both the field’s problematization of meat and its concern for those who are subjected to the status of meat. While some minor ground-work has been laid– such as McCance’s (2013) assessment of global religions and cultures such as Jainism – (cultured) insect meat may further necessitate an expanded theory of carnism and anthroparchy, potentially occurring simultaneously with an integration of more animal lives to meat production. I argue that now, defined as the present and near-future, is an ideal time to engage with the copious possibilities stemming from cultured meat. Engaging with these prospects after a cultured system of production has been realized

leads to revelations instead of predictions; the helpfulness of such a sequence, especially for the animals subject to the productive systems of anthroparchy and carnism, is likely limited.

Overall, this chapter demonstrates, once again, the importance of putting proponent rhetoric to the test, applying it to a context beyond the ether of general visions of a hazy “revolution.” Especially in the case of VOW Foods and other such companies, the rhetoric of their founders has gone unchallenged, instead treated as an exciting possibility for consumers. The promises of cultured meat must be mapped, and tested, at every stage; it is not enough to claim that animals will generally be treated better, only to not apply that claim to the notion of the 99.6% and consider what “better” means for these animals. The question, now, is how to maintain this approach to cultured meat beyond the context of this dissertation. What is needed to treat cultured meat in a more critical manner, especially in the face of an uncertain future, will be the subject of the final chapter of this dissertation.

Chapter 8: Concluding Observations

Introduction

Through this work, I have attempted to demonstrate the need for a wider array of critical assessments regarding cultured meat and its existence in a variety of systemic contexts. To say that current cultured meat discourse is fragmented and idiosyncratic would be to engage in a process of understatement; contradicting the Singapore market approval is Humbird's (2020; 2021) assessment which calls into question whether cultured meat can ever achieve its productive vision, let alone price parity. There will likely be a plethora of clashing assessments, overviews, and arguments surrounding cultured meat in the near future, especially as more production facilities are developed while, simultaneously, increasing attention is paid to the incoherence of past and ongoing narratives.

This dissertation has put forward a specific assessment of cultured meat which invites opposing views and contrasting systemic assessments. For example, Chapter 2 is a basic overview of the reasoning for avoiding the label "cultured meat industry" at this current time; specific economic theorizations and assessments, with different standards for what constitutes an "industry," may be applied in opposition to the claims of this work. Other authors may oppose this dissertation's presentation of the themes present in cultured meat discourse and rhetoric as they are identified in Chapter 3. As an example, Hansen et al. (2021) claim that "consumer acceptance of cultured meat seems to be undervalued and understudied. This is even more true for studies on consumer acceptance in different social and cultural groups" (p. 2). Such a statement stands in contradiction to this dissertation's literature review, which claims that consumer acceptance is a prominent theme across the literature, due both to specific studies and consumer acceptance's role as a common component of the summative literature. This dissertation's specific presentation of the overall discourse, especially through the narratives of disruption, reinforcement, and expansion, will likely be met with opposition, both from those concerned with overwhelming critiques of cultured meat, as well as those who oppose the use of systemic frameworks such as anthroparchy and carnism. Despite these likely critiques, I argue that the dissertation is relevant, and contributes positively to the overall cultured meat research canon for an array of reasons which will be discussed in the subsequent section. Following this discussion, I will address the potential limitations of this dissertation. Finally, before concluding remarks, I will offer observations and insights into what aspects of cultured meat discourse and research can be improved as the realm moves forward into an ambiguous future.

The Contributions of This Dissertation to the Wider Literature and Discourse

The application of anthroparchy and carnism to the subject of cultured meat marks an original contribution to the cultured meat literature and discourse. While there have been assessments of cultured meat which are influenced, if not guided, by critical animal studies approaches – inherently engaging with questions of carnism and anthroparchy – this dissertation goes about such assessment in an explicit manner. The explicitness of this application is important. This assessment connects cultured meat to anthroparchy and carnism's internal components, instead of merely referring to these systems in broad terms. For example, Jonsson's (2016) assessment of cultured meat proponents' "necessitating" meat through their rhetoric is not tied to the theory of carnism. While its treatment of the subject

matter through the notion of “constructions of potentiality” is perfectly valid, contextualizing the supposed necessity of cultured meat through the component of cognitive dissonance and rationalized visibility allows for a different perspective on the creation, and impact, of this developed “necessity.” It also allows this “necessitation” to be contextualized in systemic terms. A general tying-together of cultured meat and carnism is not entirely sufficient when considering explanatory necessity; it is important to look at the underlying mechanisms which perpetuate and functionalize carnism, and how cultured meat both impacts these mechanisms and is impacted by said mechanisms.

Another example of this matter can be seen with anthroparchy. There has not been an effort to assess cultured meat’s relationship to the wider “environment” beyond recognition of potential environmental benefits/impacts, or what natural components could be integrated into cultured meat production. By tying cultured meat to anthroparchy, the types of, and changes to, productive relations vis-à-vis cultured meat can be theorized to a stronger degree. Obviously, other theories exist outside of anthroparchy, and I encourage scholars to take a similar approach with different theories; even starting with theories that Cudworth (2005) critiques, such as deep ecology, could be helpful in identifying various interpretations of cultured meat’s relationship with, and impact on, environment. The goal with this theoretical framework is to demonstrate the diversity of considerations which are being obfuscated by works which are not backed by a strong, comprehensive theoretical framework of their own. I argue that the dissertation has demonstrated, successfully, the importance of tying cultured meat to larger theories.

Beyond the matter of systemic theorization, however, rests the question of what type of systemic framework should be applied to the subject of cultured meat. Another original contribution of this dissertation is the application of systemic frameworks which explicitly attempt to overcome conventional anthropocentric approaches to analysis. This dissertation has demonstrated that visions of cultured meat maintain an assortment of implications for animal and natural life, with most of these visions containing alarming implications which are not being addressed by cultured meat discourse writ large. One of the benefits of both anthroparchy and carnism is that neither theory erases the human outright, so there is ample room for the discussion of capitalism, (post)modernism, and other human-centric modes of existence and organization in relation to cultured and traditional meat. However, both frameworks make clear that animal and natural life must be comprehensively and adequately addressed, not merely rendered as a small – if nonexistent – part of common approaches. Such an approach is especially relevant when considering that consumers (and, possibly, producers), are not considering animals and natural life in implicit or explicit ways; Baum et al.’s (2022) study found that their samples of potential consumers responded to critiques of conventional meat in their acceptance of cultured meat, but this consideration was only on a general basis, not because of specific concerns for animal welfare or environmental impact (p. 8). These frameworks have been beneficial for this dissertation, generating an approach which accounts for animal and natural functionalities, existences, and needs. Furthermore, as more questions arise regarding cultured meat’s potential expenses and environmental impacts, I argue that it is important to not lose sight of cultured meat’s theoretical impacts on a wider variety of entities, especially at the potential expense of further normalizing meat consumption. A failure on the part of cultured meat should not be seen as more reason to “return to

normality;” the theoretical framework serves as a continual reminder that cultured meat is not the end-all-be-all for animal and natural entities.

I am aware that there will be readers who ignore, whether purposefully or not, the anti-anthropocentric efforts of this dissertation. However, there is still original material for these types of readers. The dissertation offers an original contribution to the overall literature and discourse by consolidating various perspectives, and claims, about cultured meat. While works by Purdy (2020) and Wurgaft (2019) have brought together a commendable mixture of perspectives into popular literature, there has been a need for a conglomeration of claims through more rigorous assessment. For example, while ethical questions have been pondered in popular literature, this review more explicitly identifies what literature has critiqued the ethical claims of cultured meat, what literature reinforces the claims of said ethics, and what avenues are still to be considered and explored. Another clear contribution is this dissertation’s review of the environmental theme which runs constant through the discourse. This dissertation demonstrates, succinctly, that the environmental benefits of cultured meat are not established and are in need of far greater quantitative and qualitative scrutiny. This argument offers an important contradiction to claims such as those by Newton and Blaustein-Rajo (2021), who propose that the environmental benefits of cultured meat are “well explored” (p. 1). Most literature reviews related to cultured meat tend to be sector-specific; for example, consumer acceptance literature inevitably reviews the literature related to consumer acceptance. Such a practice is appropriate in those contexts, but there is a need for an approach which compares and contrasts a plethora of literature on cultured meat, whether academic, media, or popular.

As well, this dissertation does stand in opposition to the wide-spread claims of a “cultured meat industry,” as well as Mouat et al.’s (2018; 2019) claims that cultured meat is a “proto-industry.” Such an argument is original, serving as a call to limit the legitimacy that is granted to cultured meat through proponent rhetoric, essentially demanding that the claims be validated after a specific point of performance is achieved, not prior. This dissertation, admittedly, does not provide a clear claim as to what that specific point of performance should be; this matter would serve as an ideal place for greater economic and industry theorization on the topic of cultured meat. However, at this juncture, it is still important to recognize the limits in describing cultured meat production as an “industry” at a time when such claims may further reinforce beliefs which are not well developed. The dissertation also demonstrates the need for a more robust, up-to-date database of information on cultured meat companies and news stories, as current efforts are scattered and inconsistent, and make the development of clearer narratives more difficult. The informational approach to cultured meat has not been consistent up to this point, nor has it been of much focus in current discourse; this dissertation demonstrates yet another area worth addressing.

This dissertation also makes an original contribution through the “disruption, reinforcement, and expansion” narratives. Specifically, the expansion narrative has yet to be addressed in explicit and critical form in the wider discourse. While the ontological ambiguity theme has addressed the narratives of disruption and reinforcement, these narratives have not yet been juxtaposed with the idea of expansion. Furthermore, all three narratives have yet to be tested in relation to anthroparchy and carnism; much of the ontological ambiguity work, as well as ethical literature, has addressed cultured

meat either in particular anthropocentric frameworks – such as Alvaro’s (2019) virtue-oriented approach – or without reference to systemic theories, instead working within and around the cultured meat discourse itself, lacking a clear distinction of the limits for this type of discourse-assessment. This dissertation has asked, in specific terms, what cultured meat will disrupt, reinforce, or expand in a systemic sense. Furthermore, this dissertation utilizes the benefits of the theoretical framework to address both material and immaterial matters, in reference to both anthropocentric and non-anthropocentric concerns, which has not been common in cultured meat discourse so far. Ontological ambiguity and ethical literature may make some reference to animal life, but it is not often made clear what aspects – whether material or immaterial – are being considered, nor in what larger context. Consequently, I took an approach which has allowed me to demonstrate, in more effective terms, the implications of what might be meant when one says that cultured meat “will be disruptive,” or that cultured meat “will offer new opportunities.” This approach has also granted me the ability to engage with other approaches which are not found in the literature. For example, there has not been any Marxist or socialist theorization about cultured meat, despite the potential implications for labor and workers. CAS scholars often are anarchist – at least, those who adhere to the Institute of Critical Animal Studies mission statement and definitions (n.d.) – but much of their work has not necessarily engaged with various visions of anarchism and how cultured meat may “fit” into these visions. The moments of engagement I have offered within the narratives serve as an original call for a comprehensive acknowledgment of cultured meat amongst those who are concerned with labor, production, and societal structuring. The narrative approach engages with current material possibilities and theoretical, imaginative visions of cultured meat production in the same space, offering clarity regarding what cultured meat could, in theory, do or not do for human, animal, and nature. With these points in mind, it is important that I recognize the potential limitations of this study.

The Potential Limitations of This Dissertation

This dissertation is a theoretical enterprise. The study did not rely on the collection of data which emerged from fieldwork or scientific studies, and instead engaged – using secondary data in the form of scholarly articles, popular writing, news items, and reports – with theoretical questions of “what might/could be” instead of “what is,” which does provide several potential limitations. Primarily, individuals who are looking for “definitive” answers to questions surrounding cultured meat will not find said answers in this work. Such a design choice was not necessarily the goal from the beginning of this research project, as different approaches were engaged with and attempted. An early iteration of this dissertation was attempted with the goal of consulting global policy makers, as governance commentary on cultured meat, at the time, was even less prominent than it currently is, which made it desirable for me to pursue some sort of empirical contribution to rectify this point; the efforts to attain their participation in the study did not elicit sufficient responses.⁴⁶ Yet, even if the original design had gone as

⁴⁶ I am unable to offer any firm reason as to why the efforts did not elicit sufficient responses, as I received only one (polite) response to my initial inquiries, of which there were 30+. Possible reasons include: the expectations of the original study design which included an initial survey and a follow-up interview; the lack of familiarity with cultured meat, as public knowledge of cultured meat, as of 2019, was more inconsistent than it currently is; and the general time-consuming nature of governance work, may all be reasonable guesses as to why the inquiries were unsuccessful. Whether I would have been more successful, if I pursued interviews with cultured meat

I argue that such a project would not have been able to make some of the contributions that this dissertation has made. The theoretical underpinnings of cultured meat require attention, regardless of how quantifiable these underpinnings actually are in any sort of ontological or epistemological sense at this – or any – point in time.

There is also the issue of rapid evolution. Cultured meat, being an ongoing project, is subject to sudden news stories which change and alter the context of work at a considerably difficult pace. For example, Chapter 2 of this dissertation has undergone multiple updates to reflect the sudden announcements of new production facilities and funding drives throughout 2022. Esco Aster and JUST's new facility (Tan, 2021c & 2021d) poses new prospects that were not particularly prominent prior to September of 2021. Because of the ongoing shifts in the cultured meat "sphere," any work which attempts to provide an easily quantifiable, empirical "snapshot" of cultured meat will run the risk of being out of date quickly. However, work which does not at least attempt to provide some sort of snapshot, and instead accepts certain theoretical aspects of cultured meat outright without critical assessment, runs the risk of presenting an inadequate portrait of cultured meat efforts. Consequently, the theoretical aspect of this dissertation was chosen not just because of the secretive nature of cultured meat production, nor solely because of the need for greater assessment of the theoretical underpinnings of cultured meat, but also because the approach allowed a degree of fluidity in contextualizing a small "snapshot" of cultured meat produced from commonly accessible secondary sources.

That being said, there is no denying that a purely theoretical assessment can be a limitation. Collins and Stanton (2018) stress that theory is not a limitation in and of itself, but can be an issue for researchers, especially those who apply theory in "rigid and dogmatic" ways (p. 9). The authors also argue that choosing specific theories for centering runs the risk of creating myopic work (Collins and Stanton, 2018, p. 9). This dissertation does, indeed, center specific theories instead of collecting novel data with the hopes that a narrative, or theory, will emerge from the data (Collins and Stanton, 2018, p. 9). Yet much of the argumentation offered by Collins and Stanton (2018) – reflective of many common arguments about the difference between qualitative and quantitative assessment – presumes there is enough data that one can explore, free from the limitations of theory, in order to emerge at a more enlightened understanding. As the literature review demonstrates, the data that is available often focuses on consumer acceptance; the unavailable data rests within the offices and facilities of cultured meat producers, presuming such data even exists. The rest of the data available to the public tends to also be theoretical; Humbird's (2020; 2021) analysis utilizes a wide variety of presumed methods of production, rendering this data as theoretical even if it has some basis in reality through its engagement with modified common-practice methods and costs. Access to the "important" data is off-limits to many researchers at this time, yet the hype and imagination surrounding cultured meat continues unabated.

proponents, is a matter on which I can only speculate. While journalists like Kleeman and Purdy have had success interviewing CEO's, and entering company spaces, I am unsure an academic source – especially one with certain ideological commitments – may have been accepted to the same spaces in a similar manner. There is also no guarantee that the data I collected would be more accurate than the data collected from secondary sources, given industry opaqueness.

Choosing not to assess cultured meat because data is “lackluster” is to place an arbitrary and inappropriate limitation on overall cultured meat research. I argue that the application of theoretical frameworks in this dissertation, in place of robust empirical assessment which builds on primary instead of secondary sources, is an unavoidable limitation – or, at least, could only be avoided in poor faith. Some matters, such as the standing of animals, cannot be completely verified at this time when it is unclear where animals would even be housed for cultured meat producers to utilize. However, the subject can be engaged with, in the imagination, through the application of theory.

Another limitation regarding the theoretical frameworks relates to their relative newness. Anthroparchy’s emergence in 2005, and carnism’s emergence in 2010 (even with earlier murmurings) do not give one the sense that the theories have been tested by “the weight of time,” so to speak. Readers could fairly ask why I did not opt for older theories, such as deep ecology or speciesism, and some could charge that even broader theoretical applications such as Marxism or various anarchist theories would have been more appropriate, especially given the references made to such theories throughout the entirety of the dissertation. I would respond to such claims by making clear that this dissertation utilized the theoretical frameworks specifically as a starting point for what will have to be a larger theoretical research enterprise, complete with various expanded frameworks and debates about perspectives which should be utilized in relation to cultured meat. Anthroparchy and carnism, as presented by Cudworth (2005) and Joy (2010), are explained using a relatively straightforward, insulated approach, in which the functionalities and mechanisms for these systems are laid out in piece-by-piece fashion. Given that there has been little theoretical engagement with the underlying ideology of cultured meat, I argue that it is important to begin with a more straightforward, smaller-scale theoretical approach, rather than attempting to mix and match numerous large-scale theories which require not just an assessment of cultured meat, but an assessment of other theories which are both adjacent to and in opposition of the core theories selected for such an analysis. I do not claim that anthroparchy and carnism are the only way to understand cultured meat going forward; in fact, I welcome other approaches. I do posit, though, that there is a need to start relatively simple so as to provide some idea of the potential implications of cultured meat on animals and nature before debates on theory are set in place in relation to cultured meat.

To build on this point further, I will provide an example of how this work can be expanded. Specifically, on the subject of carnism, Wrenn (2016) argues that carnism is a poor substitute for speciesism, and, furthermore, that carnism is itself a form of speciesism. Wrenn argues that Joy’s focus on flesh and meat reduces the scope of consideration, acting as its own form of erasure in terms of who is considered as part of anti-carnist activism’s focus. While Wrenn’s (2016) assessment also levels charges of the erasure of veganism, which contradicts Joy’s (2016) development of neocarnism, her arguments do reflect concerns that I have raised throughout this dissertation. Yet carnism’s focus on the flesh cannot necessarily be avoided in relation to cultured meat, as this novel biotechnology proposes the possibility that the animal exploited for entertainment could also be the animal exploited for flesh and food. It is here where cultured meat demonstrates its implications for both theories; whether one focuses on flesh or being, cultured meat creates concerning prospects for all entities in terms of their role in the creation of meat. Understanding social interactions with animals – which Wrenn (2016) does

admire in Joy's work – is only part of the picture, demonstrating the need for a more dynamic and comprehensive assessment on cultured meat going forward. Therefore, I posit that there is ample room for the expansion of the theoretical assessment present in this dissertation, both in terms of theoretical negation and synthesis, and in terms of what theories can be mixed and matched when applied to cultured meat. Essentially, though, a more limited theoretical beginning point can help to establish what points of inquiry may need specific, and potentially urgent, attention.

I do also argue that this dissertation needed to avoid overly complicated debates in order to arrive at some sort of conclusion on the state of cultured meat and what may be needed to engage with cultured meat in the near future. There is no denying that this approach has its limitations, preventing both grand theorization and abstract negation from taking place. For example, were there space, I would have liked to engage with Rosati's (2012) reading of Debord's theory of the Spectacle in relation to Deleuze and Guattari's (1983) understanding of nature, in which there is "no difference" between human and nature (Rosati, 2012, p. 357). Engaging with such a prospect in relation to cultured meat would have been a welcome – even important – excursion into the difficulties of defining natural as a matter of justification, or perception, or as an actual entity. Taking into account Debord's understanding of pseudo-nature and scarcity adds another layer of complexity to the question of what is "natural" and how such questions impact animal and organic life. However, I opted against such expansiveness not just because of the spatial limitations of the work, but to place a degree of constraint on the work, with the goal of preventing the analysis from becoming sprawling at a time when basic questions surrounding cultured meat still need to be addressed in some form.

It is here where I note the final limitation to consider. Because of the precarious nature of this dissertation, it could be rendered irrelevant at any time – it is an issue I take no pleasure in acknowledging, especially because it is prone to leave readers wondering why they have bothered with the work up to this point, but it is unavoidable. Given the increasing revelations about cultured meat's potential costs, there is always the prospect that cultured meat could become a thing of the past, a futuristic vision that could not overcome the industry it once set out to disrupt in some form. If such an event occurred, the pressing nature of the arguments contained in this dissertation would no longer be so pressing – at least, to a degree. I do posit that, regardless of what happens to cultured meat going forward, the arguments of this dissertation remain relevant. Understanding the mentality behind cultured meat, as well as the theoretical implications of its underpinnings, is still important, serving as an inquiry into the perception of animals and the (in)stability of their economic and social categorization. This work calls on readers to engage with the animal world to a greater degree than any work on cultured meat up to this point, save for Poirier's (2018a; 2018b; 2019) ethical assessments of cultured meat. Even if the animal world is not impacted by cultured meat in exceptional form, it is still important to engage with the visions of what could have been, why these visions ever came to fruition, and whether the fragments of these visions might continue to impact animals and natural life going forward. Even if cultured meat itself is a catastrophic failure, I argue that the expansion narrative demonstrates that the logic and mentality of cultured meat could live on, especially through biotechnological interventions on nature. Anthroparchal concerns would remain relevant even if

cultured meat never went flying off the shelves, giving sound reason for keeping cultured meat in theoretical consideration, regardless of its material prospects.

The primary matter to concern ourselves with, from this point forward, is how to better engage with cultured meat as a subject of research, discourse, and general concern. Whether such research seeks to build upon this dissertation, overcome its limitations, or set out on another path entirely, it is likely that there will continue to be research and inquiry into cultured meat. However, if such inquiry reflects the trends and patterns which have defined such discourse up to this current historical juncture, it is important to consider whether research is poised to perpetuate a limited research agenda of questionable benefit. The subsequent section proposes some possible ways of overcoming a continuation of a discourse that, so far, has not been critical enough of its practices and ramifications.

Recommendations for Future Cultured Meat Research and Discourse

Even if cultured meat fails to reach the goals of its early proponents, the first recommendation I make for researchers, and all other parties interested in cultured meat, is to pay attention to the theoretical underpinnings of cultured meat alongside its material manifestations. Cultured meat is not well understood in wider socio-cultural and systemic contexts across the discourse. It is easy to speak of cultured meat in its own bubble as a fascinating biotechnological development with wide implications, but such discussion is divorced from the wider contexts of anthroparchy and carnism. Economic systems and store shelves are not the only relevant matters when considering cultured meat, or at least, should not be rendered as the only relevant matters. It has been telling, I argue, that cultured meat has been presented as a savior of many animal lives, and yet most of this commentary hardly observes the animal, and certainly fails to render its life as present for anything other than being a cell depository. Research which has commented on animal life, such as Jonsson (2016), still often filters the consideration of animal life through an anthropocentric lens. This practice is not, I argue, appropriate to inherently condemn; there are a variety of interesting concerns related to cultured meat, and so long as this research fits the parameters of sound research, its existence is not inappropriate. Maintaining an exclusively anthropocentric research agenda, however, will limit the scope of what cultured meat literature, research, and discourse can address. I propose that any, and all, research and discourse on cultured meat should consider the following questions:

1. Through what systemic framework should these revelations be analyzed?
2. Is this framework explicitly or implicitly anthropocentric?
3. Can the framework be adjusted for non-anthropocentric consideration, or should another framework be applied simultaneously to balance both anthropocentric and non-anthropocentric interests?
4. If neither approach from question three can be implemented, how could future research address the animal and natural condition in ways stemming from the work in question?

An important element arising from these questions relates to material and immaterial consideration. As this dissertation demonstrates, material and immaterial matters are relevant for cultured meat, and especially so regarding the animal condition. Numerous debates about the relevance of either could not

all be addressed in this dissertation, and will admittedly pose problems for researchers. For example, considering the symbolic presentation of animal as “meat” in cultured meat promotion, can such immaterial symbolism be explicitly linked to material suffering? If so, how, and if not, what are the implications for animals if such links are considered “illegitimate?” These questions are common whenever dealing with the subject of animal existence, but cultured meat brings with it the prospect of renewed debates and new frustrations which need to be navigated with reasonable care.

This dissertation has attempted to provide some model for navigating these complicated debates, using theories which consider both material and immaterial conditions with the underlying notion that there is an ambiguous relationship between the two forms. Of course, for committed materialists or immaterialists, such an approach will be left wanting, unable to capture the entirety of the ways that each approach understands, comprehends, and addresses reality (or a lack thereof). However, I argue that there must be some form of middle ground between the two – or, at least, there must be an effort to find some sort of middle ground, even if it is never found. The animal condition is one in which its material existence depends, greatly, on both the immaterial and material considerations and practices of anthropocentric systems and human practices. An animal is directly impacted by the farmer or hunter in a material sense, but the immaterial discussion and ideas surrounding that animal’s life are also important in explaining the manifestation of this material relationship. Cultured meat is unlikely to crystallize in only one form or another; Buscemi’s (2013) notion that cultured meat will be the “last frontier” of human detachment from the animal as meat (p. 953) is an implication with material and immaterial considerations for the animals supposedly detached from meat. What does it mean for animals, materially, if they are no longer viewed as “meat?” Are government programs going to be developed to house said animals? Are households going to be expected to adopt and absorb animals expelled from “meat?” Or will these animals be slaughtered in order to not be dealt with? Beyond the material, what does it mean for the animal to be separated from meat? What are they being separated into – a new categorization, or an abyss of nothingness in which they have no discernible identity, status, or perception? What does such an argument entail for the allegedly “liberated” animal to no longer be perceivable? Going from tradition to a void may not be the liberationist dream that some imagine. These questions, whether they are addressed or not, should act as a specter over cultured meat discourse, a reminder that the simplification of animal life simultaneously simplifies academic practice and debate. Even if such debates are perceived as “ridiculous” by the majority of those involved in the cultured meat discourse, I welcome those who would make such claims to refute the arguments here, to disprove that cultured meat might have any negative impact on the material and immaterial animal condition, however said condition ultimately comes to be defined. The cultured meat discourse has been lackluster in its treatment of the noneconomic, non-productive world, and rectification is necessary.

It is this issue which brings me to another recommendation. There is a clear need for a robust set of critical perspectives on cultured meat. Proponents may respond to such a claim by arguing that I am attempting to galvanize a literature which completely disregards the viability of cultured meat. However, I would respond by claiming that even if cultured meat comes to be completely viable, the implications of its practices and impacts must still be treated through a critical lens. There has been

critical literature on cultured meat, but there is a need for an increasingly dynamic and complex base of critical literature. Specifically, this literature needs to come from a stronger base of critical theory. At this current juncture, much of the critical work on cultured meat has been ad hoc, a small collection of diverse perspectives which focus on a limited range of matters, such as proponent rhetoric or scalability. These matters are essential, but should be fleshed out with a wider variety of critical work. This variety can only be achieved, however, with the presence of more academic fields and perspectives which offer commentary on cultured meat. A clear demonstration of this necessity relates to Bryant (2020), who dismisses concerns about cultured meat's impacts on agricultural labour as a "holding onto the past" that cannot be expected to be continually perpetuated (p. 4). A Marxist theory of labor, applied to cultured meat, could not only counteract such a claim, but could better contextualize cultured meat as a productive force, rather than continue situating it as a disruptive entity in a system in which what cultured meat would disrupt is not entirely clear.

A wider variety of critical perspectives would not only validate this dissertation's notion that cultured meat discourse requires expansion in order to maintain its legitimacy, but could also offset the concerns of Chriki and Hoquette (2020) of a stagnating research agenda. Their assertion that there have been no major advances in the research on cultured meat, despite the proliferation of new publications, has recently been undercut by Humbird (2021) and Risner et al. (2021). However, their claim still holds weight, especially if one looks beyond the issue of technical cultured meat production and scalability. Their claim can be overcome, I argue, with a wider body of research which goes beyond holding out a hope that there will eventually be enough technical breakthroughs (or failures) to constitute an expanded, and progressing, discourse and research agenda. Especially considering the balance of power with cultured meat, companies and proponents are in control of the means of production at this time, and many revelations are likely to depend on their consent and transparency. While efforts should be made to overcome this dependence, such as expanded investigative journalism into the production facilities of cultured meat companies, there is more than enough to address outside of the technical limitations.

It is this matter which brings me to another recommendation. Cultured meat researchers, investigators, and interested parties must consider the role of predictive and reactive research. Cultured meat research has often been predictive in a certain sense; papers such as Tuomisto and de Mattos's (2011) LCA are predictive, presenting cultured meat as environmentally sustainable well before proof-of-concept was even established. It is fair to argue that this type of prediction needed to be treated in a more critical manner; some may go even further, arguing that the authors should have waited for a model production facility before beginning to apply LCAs. However, there is a difference between balancing predictive and reactive research, and swinging the pendulum too far in one direction. Reactive research can provide a better, more empirically "strong" analysis, as it is more effective to present the results of something that has already happened than it is to present the results of something that may or may not happen. But a move towards primarily reactive research runs the risk of failing to account for potential shocks which, by the time reactive research realizes such shocks, could already be causing considerable damage for natural and animal life. In the case of cultured meat, for example, assuming the following theoretical scenario, the sudden adoption of an animal-free medium may depend on an

environmentally unfriendly medium with its own implications. If such a case is considered in a reactive, instead of predictive manner, then the research may not mean quite as much if said natural sources are already facing difficulties stemming from their integration into the production process. There is room for both predictive and reactive research on cultured meat, but it does mean that authors would have to face the prospect that their predictions may not withstand the test of time; an LCA may become outdated almost as quickly as it was developed. With the rapid development of cultured meat, such a prospect cannot be avoided, and should instead be viewed as a contribution to a changing, turbulent field in which the disproving of certain predictions is still helpful for others attempting to qualify, and clarify, what a world of cultured meat might look like.

The previous points, however, still do not address the final matter which I argue needs to be engaged with, that point being the implications of cultured meat for animal liberation theory. If the overall discourse surrounding cultured meat can be considered idiosyncratic, ineffective, and lacking in thoroughness, the discourse surrounding cultured meat and animal liberation can be considered in even more dire terms. Animal liberation – in comparison to the concept of animal welfare – has strongly enunciated goals; the freedom of animals from coercive violence and murder in food and laboratory settings, and the erasure of animal exploitation in a wider variety of fields. These goals, however, given their immensity, can often be talked about without comprehensive discussion of what happens after liberation. The pressure to eliminate industrial meat production often focuses on liberating animals currently held in such systems; the discussion as to where the animal goes once the slaughterhouse is eliminated is often viewed as a matter to be engaged with once enough societal change has occurred as to make such a goal potentially achievable.

This dissertation has demonstrated, however, that cultured meat poses numerous quandaries for animals – and the natural world – which current liberation theory may not be prepared for. The implications of Melzener et al.'s (2021) model of a “cultured-to-slaughtered” system, especially when taken into consideration alongside the 99.6%, show why cultured meat cannot be automatically considered a disruptive, radical tool, especially not one for the purposes of animal liberation. As this dissertation has made clear, the actual likelihood of such a scenario coming to complete fruition is low; however, shifts in this direction still pose material risks for the animals who could become “cultured, then slaughtered,” as well as immaterial risks of the animal being symbolically and literally rendered more hidden as the narratives of cultured meat and animal welfare entrench themselves further. Even if cultured meat fails to come to fruition, the discourse has already offered a symbolic entrenchment of carnism and anthroparchy in which the animal is made even less relevant as its welfare is supposedly accounted for in the production process. Simple narratives surrounding whether the animal dies, or not, in a system of cultured meat production must be resisted through a stronger clarification of what animal life actually looks like under such a theoretical system. Animal liberation theory is well-equipped to bring to light the animal condition, but must be conscious of the limitations of focusing primarily on current industrial, “traditional” production.

(Cultured) insect meat also poses some considerable questions for animal liberation theorists. Most insects have not been considered particularly relevant to veganism or animal liberation matters, with a major exception being the issue of honey and bees, specifically in relation to the seizing of the

spoils of their labor for human interests. The integration of insects into meat production may soon provide impetus for offering greater consideration to insects as the potential subjects of liberation, especially insects which are subjected to industrial methods of production. Cultured insect meat is also likely to depend on industrial, biotechnological coercion and objectification, which creates conundrums for liberation activists and theorists. How best does one advocate for living beings of such different manifestations, and how does one do so without running the risk of alienating individuals by comparing animals to what are viewed as “lesser beings?” Should such advocacy completely separate the two entities, even if they both become subjected to industrial systems of production and violence? Answers can be developed, and I argue that it is coming time to commence such developments, especially given the connections demonstrated in this dissertation. Some liberation theorists may argue that I have made these connections in poor faith, as an effort to engage in an “all or nothing” unification which will inevitably create difficulties for advocates. Such accusations are certainly not the intention of this body of work; there are difficult, but important, questions ahead, all of which will be engaged with to varying degrees at varying times. It is important to avoid erasing these considerations entirely, especially at a time when insect meat is seeing greater advocacy in governance, private sector, and NGO rhetoric.

The expansion narrative of this dissertation also points to the need for careful consideration regarding plant and natural life in relation to cultured meat. Wrenn (2016) warns against “post-speciesism,” which advocates a holistic “circle of life” that allows for the erasure of systems and practices of violence towards animals in the name of a larger “connectedness.” These concerns were engaged with, in this dissertation, in reference to ecofeminist interpretations of animal life and meat (as well as in relation to prior discussions of cultured insect meat and plant/air life). However, that does not mean that the natural world is an entirely separate entity in this overall realm of consideration. The integration of plant life in cultured meat production, and the application of the logics of cultured meat production to insects and the natural world, point not just to the need to consider anthroparchy and carnism, but to the need for considering the connections between plant and animal life at varying scales. This point does not automatically legitimate the idea that pulling a carrot out of the ground for the purposes of cultured meat production is equivalent to taking an animal out of nature and incarcerating it for the purposes of culturing its cells. Instead, I am advocating for a continued effort to identify where connections can be recognized between animal and plant subjugation, and where the life-forms (and human perceptions thereof) vary too wildly for such connections to be claimed. A continual limitation of the cultured meat discourse to a simple “disruption” rhetoric runs the risk of diluting the overall effectiveness of this discourse; however, swinging the pendulum to a perspective in which “we are all one in one system” runs the risk of erasing considerable material – as well as immaterial – differences which will be affected and impacted by cultured meat.

Most importantly, though, cultured meat demonstrates the need for “post-anthroparchy” and “post-carnism” visions of the world which imagine what comes after anthroparchy and carnism. While this matter can also be applied to speciesism, Marxism, anarchism, etc., I will highlight the theoretical frameworks used in this dissertation as a point of reference. I have demonstrated, throughout the dissertation, that cultured meat continues to accentuate the inability to imagine animals outside of anthroparchal and carnist terms. If animals are not productive, nor exploitable, it is hard to actually

define them under anthroparchy and carnism. Are they valued members of society? Are they entities completely outside of societal boundaries and concerns, despite these boundaries' having been consistently eroded throughout time? Will new types of classifications be needed for animals should cultured meat production become commonplace – presuming that a pig who is not cultured is not just slaughtered by traditional producers, what would that pig be classified as, why, and how?

This dissertation, I argue, has demonstrated that cultured meat's supposed "liberationist" possibilities are liberating only in a strictly destructive sense. To be liberated from one form of production to another, from one type of meat to another, or from exploited to non-existent, is a difficult-to-justify form of "liberation." The discourse has presented cultured meat as "disruptive" without acknowledging that the animal, under anthroparchy and carnism, exists in a certain Russian-doll situation, in which it is moved from one form of production to another. How to break free of the doll is a far more complex question than how to move the animal from one doll to another, but this dissertation demonstrates, through its extremities, that such questions need to be engaged with.

It is here, once again, where the point of diversified fields and approaches are needed in relation to the subject of cultured meat and "post-" anthroparchy and carnism. Theories of animal liberation are inherently intertwined with theories of human systems of existence, a matter best demonstrated by the lack of political theory surrounding cultured meat. Calls for "pigs in the backyard or town square" are not tied to theories of political life and economic existence. Are these town squares to exist in cities hollowed out by capitalist atomization and postindustrial labor? Would they better fit into a vision of techno-anarchism or some form of "small-scale" socialism? Can they overcome the inherent contradictions which plague local food systems as alleged bastions of questionable sustainability (Newman, Ling, & Peters, 2013)? These questions are difficult to answer not just because cultured meat discourse tends to be limited in its scale and scope, but because of the tensions which exist regarding anthropocentric and non-anthropocentric theories and activisms. These tensions cannot be overcome simply by evaluating cultured meat, but must instead be continually addressed through assessments of cultured meat and what its implications may mean for anthroparchy, carnism, and those who wish to build a world beyond anthroparchal and carnist practices.

The essential, overarching point which emerges from this dissertation is that cultured meat needs to be treated in a robust, critical manner; the propositions of cultured meat proponents and producers should not be accepted purely at face-value. That is not to say that all proponents or producers are inherently anti-animal, or are attempting to scam investors and the public with fanciful promotions of little value. However, all entities exist within various systems of power, both in a human-human sense and in a human-nonhuman sense. Capitalist interests are unlikely to be of benefit for exploited animal populations, but it is unwise to presume that the end of capitalism marks the end of animal exploitation, and it is further unwise to presume that animals are oppressed only by and through capitalism. Cultured meat, as a promising but concerning biotechnology, holds wide-scale implications which require wide-scale assessment; the piecemeal approach that has arisen in the larger discourse so far, looking at themes of consumer acceptance and future research, is not enough to capture what should be necessary considerations.

This dissertation also demonstrates the difficulties in considering cultured meat in an insulated sense. There are implications beyond the commodified food system which, even if the tangibility is unlikely, are still in need of critical analysis and investigation. For example, this dissertation demonstrates that the “meatmaker in the kitchen” vision, regardless of its actual prospects, raises some concerns regarding the status of pets. Pets, in certain contexts, are exempted from being rendered as meat; this definition does not mean that pets are protected overall from anthropocentric violence and practices, but they do tend not to be considered as meat, sentenced to an inevitable slaughter and consumption. The meatmaker in the kitchen, as a vision, alters that status for the animal; if a household could turn the family pet into a source of meat and a cellular depository that does not require going to the grocery store, it is possible that an ambiguous status subsumes the pet. What happens to “pets” if the status of being a pet does not prevent them from also being a source of food or commodification? Such a prospect introduces the notion that research on cultured meat should not remain focused solely on the production of “traditional meat animals;” while this focus is important, those concerned with human-nonhuman relations in a variety of sectors should engage with the possible implications of cultured meat. Such theorizations would also likely be helpful in better identifying the ways that meat and animal impact entities which are not necessarily a part of a food system. While anthroparchy and carnism are helpful frameworks for making these identifications, the study of meat often focuses – and for good reason – on animals traditionally rendered as meat. Assessments which move beyond this framework will have to be more explicit in the reasons for evaluating the condition of animals who are not necessarily commonly viewed as meat, but such an approach should be developed and supported, especially given the revelations of this dissertation. Though the primary concern should still be what is likely ahead in terms of cultured meat production, again, the theoretical underpinnings of the imagination surrounding cultured meat must be investigated, tested, and unraveled to the most thorough degree possible. Various human-human matters, such as intersectionality theory, would also be wise to pay more attention to cultured meat; taking into account the issues identified in Chapter 6, cultured meat’s aspirations of “replacement” should be tested in all contexts, especially in relation to the more negative social symbolism and imagination surrounding meat. These concerns have not been present in the cultured meat discourse, and such matters should be addressed not only in the interest of academic thoroughness, but with the goal of developing a more comprehensive assessment of meat’s wide-ranging implications for sociocultural practices and developments. A variety of approaches can be utilized – Wolpa’s (2016) assessment of cultured meat in relation to art is a good starting point for those outside traditional political, philosophical, or sociological theory – but, again, any starting point is worthwhile.

Concluding Remarks

The logic of cultured meat, even with the growing realization of its costs and potential detriments, is likely to survive in many forms. Recent developments point to the possibilities of cultured wood (Toussaint, 2021), chocolate (UC Davis Health System, 2022), and coffee (Southey, 2021c); JUST has announced plans to construct another cultured meat production facility in Qatar (Janiec, 2021a); and investments are continuing apace. Whether a “cultured revolution” actually changes the world’s food system and productive prospects, or merely revolutionizes in a distinctly consumerist sense, this

dissertation has made the case for treating cultured meat as more than a matter of general interest, but as an entity with a set of prospects and concerns. This current historical juncture – at least, in the history of cultured meat – should, I argue, serve as an opportunity to greatly reform and revise the general discourse. At minimum, greater care needs to be taken when discussing cultured meat. It is not “environmentally beneficial in comparison to traditional meat;” it has been theorized as being superior, but such theory has been called into such question that the possibilities require far more investigation before being considered “agreed upon.” The alleged ethical superiority must be treated as suspect, prone to collapse depending on costs of production, externalities, and the larger systemic frameworks which cultured meat exists within. Disruption, as a concept, needs to be defined more thoroughly; a nebulous reference to a “disruptive capacity,” without the development of what this capacity supposedly exists within, is merely a misnomer that should not be continued in the general discourse.

There is no denying that this dissertation presents a near-overwhelmingly negative view of cultured meat. There will be proponents who insist that the barriers can be overcome. These barriers, as convincing as certain rhetoric may be, need to be understood as being larger than current discourse would stipulate. Even if the science of cultured meat is sorted out – which there is no guarantee that such sorting is possible – the larger sociopolitical and economic considerations will remain relevant. Consequently, a tempering of the hype surrounding cultured meat is urgently needed, both from proponents and critics. As negative as this dissertation has been, I am aware that certain elements are unstable and could change quickly; the issue of cultured medium is one such example. A plant-based, low-emissions alternative would eliminate a key concern regarding cultured meat, and could validate certain proponent claims. However, these developments still need to be considered in tandem with wider systemic elements; on their own, any such scientific or productive breakthroughs may not be enough to, as an example, stop a company from slaughtering an animal when it reaches the end of its cellular-productive capacity. Greater care is needed when discussing cultured meat as a larger context, not just within larger contexts.

Some activists and proponents may be concerned that such a focus will distract from discussion surrounding industrial and traditional meat, the idea being that critiquing a prospective biotechnology may allow for the normalization and legitimization of current forms of consumption and production. Such concerns have validity, but can be overcome. A continued commitment to considering cultured meat in the context of the overall animal condition can allow concerned individuals to continually address the larger contexts that animals live under and within. A “one or the other” approach is not nuanced or well developed; any use of the animal, as a subject turned into meat through wider sociocultural practices, can be critically investigated and critiqued regardless of the developments of cultured meat. It is essential to work towards an answer regarding whether cultured meat has a beneficial impact on the animal or not; such a revelation does not have to guarantee a continued commitment to current meat practices.

Considering the animal condition is the most important aspect of this dissertation’s originality; even the most ethically suspicious work on cultured meat has tended to present the animal in a sense of being a theorized ethical subject. This dissertation has asked – nay, even demanded – that readers consider the animal in a wide variety of contexts, whether as symbol or as a living being who wakes up

and faces a new day like the rest of us. I use this colloquial imagery to reiterate the importance of work which considers cultured meat's impacts on animals in a wide variety of senses. Derrida (2008), in discussing his cat seeing him nude one fateful day, set about attempting to unravel the cat's "symbolic responsibility" by discussing the individual, signed cat, whose name would survive its existence, but would not survive the symbolism bestowed upon it (p. 9). This dissertation has taken a somewhat different approach; it has called upon readers to consider both the immense symbolic responsibility of the animal alongside the individual animal who may never be named but could be given a name, and who could survive its material existence through the individual act of naming. This dissertation calls on readers to continue this approach by avoiding the typical anthroparchal and carnist trappings of the animal acting solely as symbol or resource. Symbol must be addressed, but so must the daily lives of each and every animal, especially if one is to understand the true, comprehensive impact of cultured meat. Even if certain theorized aspects are unlikely to come to fruition, it will not be inappropriate to ask what impact such theories would have on the material existence of animals should such innovations come into existence. A similar mentality should be applied to natural and environmental life as well; especially if cultured meat fails to meet its environmental goals, it is necessary to identify why such failings occurred, whether they can be rectified, and what the detriments might be if such revelations are not dealt with until after a wide-scale transformation to a cultured system of production. The complications of cultured meat, regardless of their theoretical scale, must be navigated, especially at a time of climate anxiety and institutional instability. The over-simplified discourse surrounding cultured meat requires willing participants to change; I propose that this dissertation can serve as a starting point for a more varied, detailed, and effective discourse.

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Appendices

Appendix A: CBT/GFI Industry Amalgamation

Company Name	Area of Focus	Location	Year Founded	Information Source	Total Investment (Until September 5, 2022)	Additional Information Sources
Singcell	Contract Development & Manufacturing	Singapore	2020	GFI	N/A	“Eat Beyond’s SingCell...” (2021); “Eat Beyond Portfolio Company SingCell...” (2021)
3D Bioprinting Solutions	Inputs (3D Bioprinting)	Russia	2013	CBT	N/A	N/A
CellulaREvolution	Inputs (Bioreactor Production)	United Kingdom	2019	CBT/GFI	\$0.23 MM (GFI); \$0.47 MM (Seed) [CBT]: Keighley (2022): £1.75 MM (\$2.03 MM USD)	N/A
Berkley Lights	Inputs (Acceleration/Set-Up)	United States	2011	CBT	\$185 MM (Undisclosed Series/Series E)	N/A
Brooks Automation	Inputs (Automation Provider)	United States	1978	CBT	BRKS: US	N/A
Ospin Modular Bioprocessing	Inputs (Bioreactor Production)	Germany	2014	GFI	N/A	N/A
Unicorn Biotechnologies	Inputs (Bioreactor Production)	United Kingdom	2020	GFI	N/A	Wolf (2021)
Cultured Blood	Inputs (Cell Culture Media + Artificial Cardiovascular System)	Netherlands	2019	GFI	N/A	Cultured Blood (n.d.)

Agulos Biotech	Inputs (Cell Culture Media)	United States	2017	GFI	N/A	N/A
Multus Media	Inputs (Cell Culture Media)	United Kingdom	2019	GFI	N/A	N/A
SiCell BioTechnologies	Inputs (Cell Culture Media)	China	2019	GFI	\$0.25 MM (Seed)	N/A
Mogale Meat Company	Inputs (Cell-Based Biobank for Antelopes & Wild Cattle)	South Africa	2020	GFI	N/A	CULT Food Science Crop (2021); Ho (2021i); Kerr & Selby (2021)
Cellivate Technologies	Inputs (Culture Medium)	Singapore	2019	GFI	N/A	N/A
CellMeat	Inputs (Culture Medium)	South Korea	2019	GFI	\$0.85 MM (GFI); \$4.5 MM (Pre-Series A) (Ho, 2021)	Ho (2021i); Albrecht (2021b)
Blue Heron Biotech	Inputs (Gene Synthesis)	United States	1992	CBT	N/A	N/A
Evonetix	Inputs (Gene Synthesis)	United Kingdom	2015	CBT	\$14 MM (Seed)	N/A
Gene Universal	Inputs (Gene Synthesis)	United States	2016	CBT	N/A	N/A
Molecular Assemblies	Inputs (Gene Synthesis)	United States	2013	CBT	\$19 MM (Seed, Series A)	N/A
Bene Meat	Inputs (Micro-Bioreactor Production/Miscellaneous Research)	Czech Republic	2020	GFI	N/A	Ho (2021e)
Kerafast	Inputs (Reagents)	United States	2011	CBT	\$3.2 MM (Unidentified series)	N/A
Myo Works	Inputs (Scaffolding)	India	2017	GFI	N/A	N/A
Novel Farms	Inputs (Scaffolding)	United States	2020	GFI	N/A	N/A
Ark Biotech	Inputs (Bioreactors)	United States	2021	GFI	\$8.5 MM	"Ark Biotech" (n.d.).
Cultimate Foods	Inputs (Cultivated Fats)	Germany	2021	GFI	N/A	N/A
Fermify	Inputs (Bioprocess Equipment)	Austria	2021	GFI	N/A	N/A
Optium	Inputs (AI Platform)	Israel	2019	GFI	N/A	"Optium" (n.d.).
iLabs	Inputs	United	2021	GFI	N/A	N/A

	(Infrastructure & Testing Platform)	States				
Meatafora	Inputs (Scaffolding)	Israel	2021	GFI	N/A	N/A
Micro Meat	Inputs (Infrastructure Scaling)	Mexico	2021	GFI	\$0.125 MM	"Micro Meat" (n.d.).
Future Fields	Inputs (Growth Medium)	Canada	2017	CBT/GFI	N/A	N/A
Heuros	Inputs (Culture Medium)	Australia	2017	CBT/GFI	N/A	N/A
Cellular Agriculture Ltd	Inputs (Bioreactor Production)	United Kingdom	2016	GFI	N/A	N/A
Excell	Inputs (Scaffolding)	United States	2019	GFI	N/A	N/A
Biomimetic Solutions	Inputs (Scaffolding)	United Kingdom/Brazil	2017	GFI	\$0.05 MM (Seed)	N/A
Matrix Meats	Inputs (Scaffolding)	United States	2019	GFI	N/A (Undisclosed Seed)	N/A
Joyn Bio	Microbial Engineering	United States	2018	CBT	\$100 MM (Series A)	N/A
Manus Biosynthesis	Microbial Engineering	United States	2011	CBT	\$19.7 MM (Seed, Series A)	N/A
Perfect Day	Microbial Engineering (Animal Free Dairy Proteins)	United States	2014	CBT	\$201.51 MM (Seed, Series A, Series B, Series C)	N/A
Geltor	Microbial Engineering (Beauty/Animal Nutrition)	United States	2015	CBT	\$114.25 MM (Seed, Series A, Series B)	N/A
Spiber	Microbial Engineering (Brewed Proteins)	Japan	2007	CBT	\$188.5 MM (N/A)	N/A
Biftek	Microbial Engineering (Cell Culture)	Turkey	2018	CBT/GFI	N/A	N/A
Avansya	Microbial Engineering (Cellular Fermentation)	Netherlands	2019	CBT	N/A (Undisclosed DSM/Cargi)	N/A

					II Funding)	
DMC Biotechnologies	Microbial Engineering (Cellular Fermentation)	United States	2014	CBT	\$10.3 MM (Series A)	N/A
Isobionics	Microbial Engineering (Cellular Fermentation)	Netherlands	2008	CBT	N/A	N/A
Clara Foods	Microbial Engineering (Egg Protein)	United States	2014	CBT	\$16.8 MM (Series A; Series B Unknown)	N/A
Glycosyn	Microbial Engineering (Human Breast Milk)	United States	2002	CBT	\$14 MM (Series A)	N/A
Ginkgo Bioworks	Microbial Engineering (Organism Production)	United States	2008	CBT	\$1,069.12 MM (Seed, Series A, Series B, Series C, Series D, Series E, Ferment Consortium Investment Vehicle)	N/A
C16 Biosciences	Microbial Engineering (Palm Oil)	United States	2017	CBT	\$4 MM (Seed)	N/A
Arzeda	Microbial Engineering (Protein & Pathway Engineering)	United States	2008	CBT	\$15.2 MM (Series A)	N/A
Codexis	Microbial Engineering (Protein & Pathway Engineering)	United States	2002	CBT	\$CDXS	N/A
Conagen	Microbial Engineering (Protein & Pathway Engineering)	United States	2010	CBT	\$30 MM (Undisclosed 2020)	N/A
Bolt Threads	Microbial Engineering (Spider Silk)	United States	2009	CBT	\$213 MM (Series A, Series B, Series C, Series D)	N/A

Modern Meadow	Microbial Engineering (Yeast Cells)	United States	2011	CBT	\$53.5 MM (Seed, Series A, Series B)	N/A
Culture Biosciences	Microbial Engineering (Fermentation)	United States	2016	CBT	\$20.5 MM (Seed, Series A)	N/A
Bruno Cell	Research and Development (Funding)	Italy	2020	GFI	N/A	Bruno Cell (n.d.)
Luyef Biotechnologies	Research and Development (Licensing)	Chile	2019	GFI	N/A	N/A
IntegriCulture	Tissue Engineering & Inputs (Foie Gras, Chicken, Cell Culture Media, Cellular-Agriculture Infrastructure)	Japan	2015	CBT/GFI	GFI: \$2.73 MM (Seed); CBT: \$10.1 MM (Seed and 2020 Series A); The Straits Times: \$16.4 MM (2022 Funding Status)	Coyne (2021b); Watson (2020f); IntegriCulture (n.d.); “How Climate Change and Overfishing...,” 2022).
Hoxton Farms	Tissue Engineering (Animal Fat)	United Kingdom	2020	GFI	Synbiobeta (2021): \$2.7 MM	Synbiobeta (2021); O’Hear (2021);
Lab Farm Foods	Tissue Engineering (Beef & Chicken)	United States	2019	CBT/GFI	N/A	Schnettler (2020)
BioBQ	Tissue Engineering (Beef Brisket)	United States	2018	GFI	N/A	Marston (2021b)
Aleph Farms	Tissue Engineering (Beef)	Israel	2016	CBT/GFI	\$14.4 MM (Series A) + \$105 MM (Series B)	i24News (2021); Ben-David (2022b); Ashkenazi (2021b); Askew (2021a); Crawford (2021a); Aleph Farms (2021); Lim (2021); Wolf (2020)
Mosa Meat	Tissue Engineering (Beef)	Netherlands	2015	CBT/GFI	\$9.09 MM (Series A)	McCormick (2021); CB

					+ \$85 MM (Series B)	Insights (2021); Goldman (2021); Rankine (2021); CBT (“Mosa Meat, n.d.”); Southey (2020e)
Mzansi Meats	Tissue Engineering (Beef; Meatballs; Burgers)	South Africa	2020	GFI	N/A	Vegconomist (2020); Ho (2021c); Wilder (2021)
Ohayo Valley	Tissue Engineering (Beef)	United States	2020	GFI	N/A	Jong (2021)
SeaWith	Tissue Engineering (Beef)	South Korea	2020	GFI	Neo (2021): \$7 MM (Series A)	Neo (2021c); Albrecht (2021c)
MeaTech	Tissue Engineering (Beef, Chicken, 3D Printing)	Israel	2019	GFI	\$1.99 MM (Seed) + \$28 MM (American Depository Shares Offering)	“Meatech 3D Ltd. – Annual Report” (2021)
UPSIDE Foods (Formerly Memphis Meats)	Tissue Engineering (Beef, Chicken, Duck)	United States	2015	CBT/GFI	GFI: \$22 MM (Series A); CBT: \$181.103 MM (Seed, Series A, Series B); Watson (2022g): \$400 MM (Series C)	CB Insights (2021); MediaPost (2021); Carrington (2018); Kateman (2020); Bhavana, Askshay, & Gayathri (2020)
Ants Innovate	Tissue Engineering (Beef, Pork Belly)	Singapore	2020	GFI	N/A	Ants Innovate (n.d.)
Gaia Foods (Shiok Foods Subsidiary)	Tissue Engineering (Beef; Seafood; Lamb; Pork; Mutton)	Singapore	2020	GFI	GFI: \$0.13 MM; Ferrer: \$12.6 MM (Series A)	Ferrer (2021); Quek (2021a); “Shiok Meats Acquires...” (2021); Begum (2021c)

Orbillion Bio	Tissue Engineering (Bison, Sheep, Deer)	United States	2019	GFI	\$0.94 MM	Watson (2021u)
Cell Farm Food Tech	Tissue Engineering (Bovine Stem Cells)	Argentina	2019	GFI	\$0.20 MM (Seed)	McGovan (2021)
MagicCaviar *Eggs*	Tissue Engineering (Caviar & Oocytes)	Netherlands	2020	GFI	N/A	Vegconomist (2021c); Ho (2021g)
Cubiq Foods	Tissue Engineering (Chicken Fat)	Netherlands	2018	CBT/GFI	\$14 MM (Private Equity)	CubiqFoods (n.d.); Dutta (2020); Poiniski (2021)
ClearMeat	Tissue Engineering (Chicken)	India	2018	CBT/GFI	N/A (Undisclosed Seed)	N/A
Just	Tissue Engineering (Chicken)	United States	2011	CBT/GFI	GFI: \$372.53 MM (Series E) + \$97 MM & \$170 MM (Additional Funding) + \$200 MM (Qatar Investment Authority Round)	Andersen (2021); Watson (2021n); Hoffman (2021); Hussey (2021); McCormick (2021); Scipioni (2020); Gilchrist (2021)
SuperMeat	Tissue Engineering (Chicken)	Israel	2015	CBT/GFI	\$4.22 MM (Seed)	Ben-David (2021d); Xinhua (2021); "New IDTechEx Report..." (2021); Marston (2020c); Supermeat (n.d); The Chicken (n.d); Globertrender (2020)
Future Meat Technologies	Tissue Engineering (Chicken, Lamb, Beef)	Israel	2017	CBT/GFI	\$16.6 MM (Seed, Series A) +	Shieber (2019); CBT ("Future Meat

					\$27MM (February 2021 Funding Round) + \$347 MM (December 2021 Series B Funding Round)	Technologies”) ; “Nestle Eyes Control...” (2021); Ali (2022b); “How BeReal is Winning...” (2022); Ramkumar (2022)
Jellatech *Gelatin*	Tissue Engineering (Collagen & Gelatin)	United States	2020	GFI	Green (2021): \$2 MM (Seed)	Green (2021a); Watson (2021p)
Biomilk	Tissue Engineering (Cow & Human Breast Milk)	Israel	2018	GFI	N/A (GFI); \$2 MM Coca-Cola Investment (Solomon, 2021)	Solomon (2021b)
Nissin Foods Group	Tissue Engineering (Diced Steak)	Japan	1972	CBT	TYO: 2987	Nissin Food Holdings (2019); CBT (“Nissin Food Groups,” n.d.)
Diverse Farm	Tissue Engineering (Duck, Chicken, Aemono, Foie Gras)	Japan	2020	GFI	N/A	Ho (2021f)
Mission Barns	Tissue Engineering (Duck, Chicken, Pork)	United States	2018	CBT/GFI	\$3.49 MM (Seed) + \$24 MM (Series A)	Watson (2021aa); Ho (2020b); Marston (2020b; 2020c)
Avant Meats	Tissue Engineering (Fish Maw)	China	2018	CBT/GFI	N/A (Undisclosed Seed)	Mia (2021); Ho (2021d); Marston (2020a); Vegconomist (2019); CBT (“Avant Meats,” n.d.); Albrecht (2021a); Tan (2021b)
SeaFuture	Tissue Engineering	Canada	2017	CBT	N/A	RocketReach

Sustainable Biotech	(Fish)					(n.d.)
Gourmey	Tissue Engineering (Foie Gras)	France	2019	CBT/GFI	GFI: N/A (Undisclosed Seed); CBT: \$2 MM (Seed); \$10MM (Seed)	Sage (2021); Mollard-Chenebenoit (2021); Gross (2021); Gourmey ("Frequently Asked Questions," n.d.)
Peace of Meat (Meatech Subsidiary)	Tissue Engineering (Foie Gras, Fat)	Germany	2019	CBT/GFI	GFI: \$0.779 MM (Seed); CBT: \$4.8 MM (Seed)	McLennan (2021); SEC Filings (2021); Proveg (2020); Cleene (2019)
Appleton Foods	Tissue Engineering (Ground Beef)	Canada	2016	CBT/GFI	N/A	N/A
ArtMeat	Tissue Engineering (Horse, Sturgeon)	Russia	2019	GFI	N/A	Artmeat (n.d.)
BIOMILQ	Tissue Engineering (Human Breast Milk)	United States	2019	CBT/GFI	\$3.5 MM (Series A)	N/A
VOW Food	Tissue Engineering (Kangaroo; Alpaca; Goat; Rabbit; Lamb; Pork)	Australia	2019	CBT/GFI	Berry (2022b): \$7 MM	Prodanovic (2020); Palmer-Derrien (2020); Ho (2021a)
CellX	Tissue Engineering (Lab-Grown Pork)	China	2020	GFI	\$4.8 MM	Chow & Patton (2021); Ho (2021k)
Magic Valley	Tissue Engineering (Lamb)	Australia	2020	GFI	N/A	Ho (2021h); Marston (2021); McLennan (2021); Stuchbery (2021)
Evolved Meats Inc	Tissue Engineering (Unspecified Meat Products)	Canada	2021	Buxton (2022a)	\$2 MM (Seed)	N/A
Ochakov Food Ingredients	Tissue Engineering (Meatloaf)	Russia	2019	CBT	N/A	Starostinetska ya (2019); Banis (2019);

						Interfax (2019)
Wild Earth	Tissue Engineering (Mice for Pet Food)	United States	2017	CBT/GFI	GFI: \$15.55 MM (Series A); CBT: \$11.45 MM (Seed, Series A)	N/A
Turtle Tree Labs	Tissue Engineering (Milk)	Singapore	2019	CBT/GFI	GFI: \$9.47 MM	Vegconomist (2021c)
Because Animals	Tissue Engineering (Mouse, Pet Food)	United States	2016	GFI	\$2.5 MM (Seed)	Peters (2021a); "Because, Animals..." (2021)
SciFi Foods (fka Artemys)	Tissue Engineering (N/A)	United States	2019	GFI	Watson (2022a): \$22 MM (Series A); "SciFi Foods Rebrands" (2022): \$29 MM (Series A + Additional Funding)	Hall (2022).
Balletic Foods	Tissue Engineering (N/A)	United States	2017	CBT/GFI	N/A (Undisclosed Seed)	N/A
BioTech Foods (Acquired by JBS)	Tissue Engineering (N/A)	Spain	2017	CBT/GFI	\$2.77 MM (Series A) + 3.7 M Euro (Government Grant) + JBS \$100 Million (2 Projects)	"Lab Meat: the Futuristic Revolution..." (2021); EthicaMeat (n.d.); Morrison (2020b; 2021e)
Craveri Laboratories (BIFE)	Tissue Engineering (N/A)	Argentina	2019	CBT	N/A	N/A
Fork & Goode	Tissue Engineering (N/A)	United States	2018	GFI	\$3.54 MM (Seed)	N/A
HigherSteaks	Tissue Engineering	United	2018	CBT/GFI	GFI: \$0.02	Ho (2020a);

	(N/A)	Kingdom			MM (Seed); CBT: N/A	Pritchett (n.d.)
Mirai Foods AG	Tissue Engineering (N/A)	Switzerland	2019	GFI	GFI: N/A; TheSpoon Tech: \$2.4 MM (Seed); \$4.5 MM (Seed) (Huwiler-Flam, 2021)	Huwiler-Flamm (2021); Wilder (2021); Ellis (2021).
Innocent Meat	Tissue Engineering (N/A); "Cultured Meat as a Service"	Germany	2018	GFI	N/A	Southey (2021d)
Bond Pet Foods	Tissue Engineering (Pet Food)	United States	2015	CBT	\$1.2 MM (Seed)	Murphy (2019); CBT ("Bluenalu," n.d.); Leeuwen (2020)
Pristine Pet Foods	Tissue Engineering (Pet Food)	United States	2020	GFI	N/A	N/A
New Age Meats	Tissue Engineering (Pork)	United States	2018	CBT/GFI	GFI: \$0.95 MM (Seed); CBT: \$4.7 MM (Seed)	Brodwin (2018); Selby (2020)
Joe's Future Food	Tissue Engineering (Pork)	China	2020	GFI	CB Insights: \$13.55 MM (Series A)	CB Insights (2021); Holland (2021); Ellis (2021)
Meatable	Tissue Engineering (Pork, Beef)	Netherlands	2018	CBT/GFI	GFI: \$12.5 MM (Seed); CBT: \$21.5 MM (Seed 1 and Seed 2); \$47 MM (Series A); \$60 MM (Total Complete d Value as	"Agronomics Limited Portfolio Company Update: Meatable" (2021); "Bill Gates Asks Rich People..." (2021); Coyne (2021b); Ali (2021e); Meatable

					of October 2021)	(2019); Watson (2021i); Rodríguez-Fernández (2019); Watson (2020a)
Blue Ridge Bantam	Tissue Engineering (Poultry)	United States	2020	GFI	N/A	N/A
Wild Type	Tissue Engineering (Salmon)	United States	2017	CBT/GFI	\$16 MM (Seed, Series A)	Lamb (2019); Peters (2021b)
Alife Foods	Tissue Engineering (Schnitzel)	Germany	2019	GFI	N/A	Alife Foods (n.d.)
BlueNalu	Tissue Engineering (Seafood Production)	Canada	2017	CBT/GFI	\$24.5 MM (Seed, Series A) + \$60MM (Convertible Note Financing)	Ali (2021c); Blue Nalu (n.d.); "IDTechEx Discusses..." (2021)
Cell Ag Tech	Tissue Engineering (Seafood Production)	Canada	2018	GFI	N/A	N/A
Finless Foods	Tissue Engineering (Seafood Production)	United States	2016	CBT/GFI	CBT/GFI: \$3.75 MM (Series A); \$7MM - \$14MM (Unknown Series); Barreira (2022): \$34 MM (Recent Funding Round)	CB Insights (2021); Watson (2021k); Watson (2022e)
Planetary Foods	Tissue Engineering (Seafood Production)	Germany	2019	GFI	N/A	N/A
Bluu Biosciences	Tissue Engineering (Seafood Production)	Germany	2020	GFI	N/A (GFI); \$8.2 MM (Shieber, 2021) (Ho, 2021),	Vegconomist (2021a); Ho (2021b); Shieber (2021)
Cultured	Tissue Engineering	United	2020	GFI	\$1.5 MM	Laclaire

Decadence	(Seafood Production)	States				(2021); Yahr (2021)
Umami Meats	Tissue Engineering (Seafood Production); Inputs (Cell Lines & Cell Cultured Media)	Singapore	2020	GFI	N/A	Crunchbase (n.d.)
Shiok Meats	Tissue Engineering (Shrimp, Crab, Lobster)	Singapore	2018	CBT/GFI	GFI: \$5.11 MM (Seed); CBT: \$4.8 MM (Seed); \$12.6 MM (Series A) \$20 MM (Mulia, 2021); The Straits Times: \$30 MM (2022 Funding Status)	Mulia (2021); The Monitor (2021); Akshatha (2021); Shiok Meats (n.d.); Ferrer (2020); Reuters Staff (2020); "How Climate Change and Overfishing..." (2022)
Space F	Tissue Engineering (Unspecified Cultured Meat Products)	South Korea	N/A	N/A	7 billion won (\$5USD MM) (Unknown series funding) ("ESG is one...", 2021)	("ESG is one...", 2021)
Ivy Farm	Tissue Engineering (Unspecified Cultured Meat Products)	United Kingdom	2019	N/A	White: £16.5MM (\$20MM USD approx.) (Unclear seed/series rounds) (2021)	White (2021a)
NewCo (Tnuva Group + Pluristem Therapeutics)	Tissue Engineering (Unspecified cultured meat products)	Israel	2022	N/A	Harvey: \$7.5 MM + further \$7.5 MM	Harvey (2022); "Israel's Pluristem and Tnuva..."

					option within 12 months (\$40 million pre-launch valuation)	(2022); "05:18 EST Pluristem..."(2022)
Edge Foods	Tissue Engineering (Beef, Veal, Pork, Chicken)/Inputs (Bioprocessing Infrastructure and Equipment)	United States	2022	GFI	N/A	N/A
Good Dog Food	Tissue Engineering (Pet Food)	United Kingdom	2022	GFI	N/A	N/A
Pearlita Foods	Tissue Engineering (Shellfish)	United States	2022	GFI	N/A	N/A
Ambi Real Food	Tissue Engineering (Beef/Veal)	Brazil	2021	GFI	N/A	N/A
ANJY Foods	Tissue Engineering (Ground Meat, Rare Animals [Lion])	Croatia	2021	GFI	N/A	N/A
Another Fish	Tissue Engineering (Whitefish Fillet)	Canada	2021	GFI	N/A	N/A
Bluefin Foods Inc.	Tissue Engineering (Seafood)	United States	2021	GFI	N/A	N/A
e-Fishient Protein (Biomeat Foodtech and Volcani Center Joint Venture)	Tissue Engineering (Tilapia)	Israel	2021	GFI	N/A	N/A
Fisheroo	Tissue Engineering (Surimi)	Singapore	2021	GFI	N/A	N/A
Forsea Foods	Tissue Engineering (Seafood [Eel])	Israel	2021	GFI	N/A	N/A
Jimi Biotech	Tissue Engineering (Beef, Veal, Algae)	China	2021	GFI	N/A	N/A
Meat Tomorrow	Tissue Engineering (Pork, Beef, Veal)	Denmark	2021	GFI	N/A	N/A
Meatleo	Tissue Engineering (Beef)	Canada	2021	GFI	N/A	N/A
Meatosis	Tissue Engineering (Seafood)	Israel	2021	GFI	N/A	N/A
Mermade Seafoods	Tissue Engineering (Shellfish)	Israel	2021	GFI	Gradstein (2022):	N/A

					\$1.5 MM (Presumed Seed)	
Primeval Foods	Tissue Engineering (Lion, Tiger, Zebra)	United Kingdom & United States	N/A	“Process” (n.d.); “Primeval Foods...” (2022); Harley (2022); Askew (2022a)	N/A	N/A

Appendix B: Investors

Investor	Type	Location	Portfolio	Investment Rounds	Information Source
SOSV/Indie Bio	Venture Capital/Accelerator/Incubator	USA	GFI: New Age Meats, Finless Foods, Because Animals, Memphis Meats, Multus Media; CBT: Hyasynth Bio, Geltor, Pembient, Perfect Day	10 (2019); 4 (2020);	GFI/CBT
Unovis Partners/New Crop Capital (Unovis Asset Management)	Venture Capital	USA	GFI: Blue Nalu, Aleph Farms, SuperMeat, Memphis Meats, Mosa Meat, Artemys Foods; CBT: Geltor	8 (2019); 2 (2020);	GFI
Stray Dog Capital	Venture Capital	USA	GFI: Memphis Meats, Aleph Farms, BlueNalu, Because Animals, SuperMeat, Mosa Meat; CBT: Geltor	7	GFI/CBT
CPT Capital	Venture Capital	United Kingdom	GFI: BlueNalu, Memphis Meats, Aleph Farms, Mosa Meat, Turtle Tree Labs; CBT: New Culture, VitroLabs Inc, Motif FoodWorks, Impossible Foods, Perfect Day, Clara Foods, JUST, Geltor, Modern Meadow, Bolt Threads	5 (2019); 4 (2020)	GFI/CBT
Strauss Group (TAE: STRS)/ The Kitchen FoodTech Hub	Corporation, Accelerator/Incubator	Israel	Aleph Farms	4	GFI
Beyond Investing	Venture Capital	Switzerland	BlueNalu, Gourmey, Shiok Meats, SuperMeat	4	GFI
Veginvest	Venture Capital	USA	BlueNalu, SuperMeat, Mosa Meat, Shiok Meats	3 (2019); 2 (2020)	GFI
Blue Horizon (Zurich)	Venture Capital	Switzerland	SuperMeat, Finless Foods, Mosa Meat, BIOMILQ, Cubiq Foods	3 (2019); 3 (2020)	GFI
Social Starts	Venture Capital	USA	Peace of Meat, Finless Foods, Gourmey, Novel	3 (2019); 3 (2020)	GFI

			Farms		
Agronomics (LON: ANIC)	Venture Capital	United Kingdom	BlueNalu, Meatable, Shiok Meats, CellX, Mosa Meat, SuperMeat	3 (2019); 6 (2020)	GFI
IndieBio	Accelerator/Incubator	USA	GFI: New Age Meats, Finless Foods, Mosa Meat; CBT: Clara Foods, Geltor, New Age Meats, Memphis Meats, Pembient	3	GFI/CBT
Starlight Ventures	Venture Capital	USA	Fork & Goods, SuperMeat, Finless Foods	3	GFI
Tyson Ventures	Corporate Venture Capital	USA	Future Meat Technologies, Memphis Meats	3	GFI
Artesian	Venture Capital	Australia	Avant Meats, TurtleTree Labs, Cell Farm, Orbillion	3	GFI
Humboldt	Venture Capital	USA	CellX, Meatable, Memphis Meats	3	GFI
EIT Food Accelerator Network	Accelerator/Incubator	Belgium	BioFood Systems, Aleph Farms, Mosa, Peace of Meat	2 (2019); 2 (2020)	GFI
Lever VC	Venture Capital	USA	Avant Meats, Mission Barns, CellX, TurtleTree Labs	2 (2019); 2 (2020)	GFI
Big Idea Ventures	Venture Capital	USA	Gourmey, Shiok Meats, Gaia Foods, Novel Farms, Orbillion, Peace of Meat	2 (2019); 4 (2020)	GFI/CBT
BlueYard Capital	Venture Capital	Germany	Meatable	2	GFI
Jesselson Investments	Family Office	Israel	Aleph Farms	2	GFI
Peregrine Ventures	Venture Capital	Israel	Aleph Farms	2	GFI
Technion Research and Development Foundation	Venture Capital	Israel	Aleph Farms	2	GFI
Nutreco	Corporation	Netherlands	BlueNalu	2	GFI
Henry Soesanto	Angel (Individual)	Philippines	Future Meat Technologies, Shiok Meats	2	GFI
Artis Ventures	Venture Capital	USA	Modern Meadow	2	CBT
BABEL Ventures	Venture Capital	USA	Mission Barns, Finless Foods	2	GFI

California Institute for Quantitative Biosciences	Accelerator/Incubator	USA	Mission Barns, Wild Type	2	GFI
Clear Current Capital	Venture Capital	USA	BlueNalu	2	GFI
Cargill	Corporation	USA	Memphis Meats, Aleph Farms	2	GFI/CBT
Draper Associates	Venture Capital	USA	Because Animals, Finless Foods	2	GFI/CBT
Fifty Years	Venture Capital	USA	GFI: Memphis Meats; CBT: Memphis Meats, Geltor, VitroLabs Inc.	2	GFI/CBT
HarrisonBlue Ventures	Venture Capital	USA	Future Meat Technologies, Finless Foods	2	GFI
Impact Assets	Impact Investing	USA	Shiok Meats, BlueNalu	2	GFI
Maven Ventures	Venture Capital	USA	Wild Type	2	GFI
Root Ventures	Venture Capital	USA	Wild Type	2	GFI
S2G Ventures	Venture Capital	USA	Future Meat Technologies	2	GFI
Spark Capital	Venture Capital	USA	Wild Type	2	GFI/CBT
Y Combinator	Accelerator/Incubator	USA	Shiok Meats	2	GFI
Siddhi Capital	Venture Capital	USA	Avant Meats	2	GFI
208 Seed Ventures	Angel Group	USA	Avant Meats	2	GFI
Alumni Ventures Group	Venture Capital	USA	Artemys Foods, Cultured Decadence	2	GFI
Eat Beyond Global	PE/Buyout	Canada	TurtleTree Labs, SingCell	2	GFI
Green Monday	PE/Buyout	Hong Kong	TurtleTree Labs	2	GFI
Grid Exponential	Accelerator/Incubator	Argentina	Cell Farm	1	GFI

Blackbird Ventures	Venture Capital	Australia	Heuros	1	GFI
New South Wales	Government	Australia	VOW Foods	1	GFI
Inter Alloys	Corporation	Austria	Biotech Foods	1	GFI
Agentschap Innoveren & Ondernemen	Other (Flemish Agency for Innovation & Entrepreneurship Adjacent)	Belgium	Peace of Meat	1	GFI
European Commission	Government	Belgium	Meatable	1	GFI
Richard Branson	Angel (Individual)	British Virgin Islands	Memphis Meats	1	GFI
Bits x Bites	Accelerator/Incubator	China	Future Meat Technologies	1	GFI/CBT
Dao Ventures/ Dao Foods International	Impact Investing	China	Mission Barns	1	GFI
Five Seasons Ventures	Venture Capital	France	GFI: Memphis Meats; CBT: Memphis Meats, Impossible Foods, Perfect Day, Clara Foods, JUST	1	GFI/CBT
Future Positive Capital	Venture Capital	France	Meatable	1	GFI
Atlantic Food Labs	Venture Capital	Germany	Meatable	1	GFI
Good Seed Ventures	Venture Capital	Germany	SuperMeat	1	GFI
PHW-Gruppe	Corporation	Germany	SuperMeat	1	GFI
ProVeg Incubator	Accelerator/Incubator	Germany	ClearMeat	1	GFI
Gastrtrophe	Accelerator/Incubator	India	ClearMeat	1	GFI
The Pearse Lyons Accelerator	Accelerator/Incubator	Ireland	Higher Steaks	1	GFI
Neto Malinda Trading (TAE:	Corporation	Israel	Future Meat Technologies	1	GFI

NTML)					
Ophectra Real Estate & Investments	Corporation	Israel	MeaTech	1	GFI
Research Fund of Barzilai Hospital	Other (Research Fund)	Israel	MeaTech	1	GFI
Technion Israel Institute of Technology	University	Israel	Aleph Farms	1	GFI
Yissum	Venture Capital	Israel	Future Meat Technologies	1	GFI
B-Engine	Venture Capital	Italy	Finless Foods	1	GFI
Vis Capital	Venture Capital	Italy	Finless Foods	1	GFI
A-Five	Government	Japan	IntegriCulture	1	GFI
Beyond Next Ventures	Venture Capital	Japan	IntegriCulture	1	GFI
Euglena (TKS: 2931)	Corporation	Japan	IntegriCulture	1	GFI
Glocalink	Other (Venture Capital)	Japan	IntegriCulture	1	GFI
MTG Japan (TKS: 7806)	Corporation	Japan	IntegriCulture	1	GFI
Yakumi Investment	Angel Group	Japan	Finless Foods	1	GFI
M Ventures	Corporate Venture Capital	Netherlands	Mosa Meat	1	GFI
Hatch Blue	Accelerator/Incubator	Norway	Finless Foods	1	GFI
Enterprise Singapore	Corporation	Singapore	Shiok Meats	1	GFI
Innovate 360	Accelerator/Incubator	Singapore	Shiok Meats	1	GFI
New Protein Capital (Vis Vires)	Venture Capital)	Singapore	Aleph Farms	1	GFI
Moira Capital Partners	Venture Capital	Spain	Cubiq Foods	1	GFI
nanoGUNE Business Incubator	Accelerator/Incubator	Spain	Biotech Foods	1	GFI

Emerald Technology Ventures	Venture Capital	Switzerland	Future Meat Technologies	1	GFI
M-Industry	Venture Capital	Switzerland	Aleph Farms	1	GFI
Seier Capital	Venture Capital	Switzerland	SuperMeat	1	GFI
U-Start	Venture Capital	Switzerland	Finless Foods	1	GFI
Atomico	Venture Capital	United Kingdom	Memphis Meats	1	GFI
Backed VC	Venture Capital	United Kingdom	Meatable	1	GFI
Firstminute Capital	Venture Capital	United Kingdom	GFI: Fork & Goode; CBT: VitroLabs Inc.	1	GFI/CBT
Jörg Mohaupt	Angel (Individual)	United Kingdom	Meatable	1	GFI
Manta Ray Ventures	Venture Capital	United Kingdom	Future Meat Technologies	1	GFI
Taavet Hinrikus	Angel (Individual)	United Kingdom	Meatable	1	GFI
Advisors Fund	Venture Capital	USA	Memphis Meats	1	GFI
Albert Wenger	Angel (Individual)	USA	Meatable	1	GFI
Alpha Impact Investment Management	Impact Investing	USA	Shiok Meats	1	GFI
Better Ventures	Venture Capital	USA	Mission Barns	1	GFI
Cantos Ventures	Venture Capital	USA	Mission Barns	1	GFI
Charles Songhurst	Angel (Individual)	USA	Meatable	1	GFI
CRV	Venture Capital	USA	Wild Type	1	GFI
Everhope Capital	Venture Capital	USA	BlueNalu	1	GFI
For Good Ventures	Venture Capital	USA	Wild Type	1	GFI
Gates Ventures	Venture Capital	USA	Memphis Meats	1	GFI
Griffith Foods	Corporation	USA	BlueNalu	1	GFI
HB Ventures	Venture Capital	USA	Future Meat Technologies	1	GFI

Hemisphere Ventures	Venture Capital	USA	Finless Foods	1	GFI
Ikove	Venture Capital	USA	Matrix Meats	1	GFI
Inevitable Ventures	Venture Capital	USA	Memphis Meats	1	GFI
Keen Growth Capital	Impact Investing	USA	Because Animals	1	GFI
Kimbal Musk	Angel (Individual)	USA	Memphis Meats	1	GFI
Mission Bay Capital	Venture Capital	USA	Wild Type	1	GFI
Olive Tree Capital	Venture Capital	USA	Finless Foods	1	GFI
Plug and Play Tech Center	Accelerator/Incubator	USA	Finless Foods	1	GFI
Pulmuone Foods USA	Corporation	USA	BlueNalu	1	GFI
Rich Products Ventures	Corporate Venture Capital	USA	BlueNalu	1	GFI
Sergey Brin	Angel (Individual)	USA	Mosa Meat	1	GFI
Sumitomo Corporation of Americas	Corporation	USA	BlueNalu	1	GFI
Supernode Ventures	Venture Capital	USA	New Age Meats	1	GFI
Suzy Welch	Angel (Individual)	USA	Memphis Meats	1	GFI
Threshold Ventures	Venture Capital	USA	Memphis Meats	1	GFI/CBT
VU Venture Partners	Venture Capital	USA	Finless Foods, Integriculture	1	GFI
Westcott	Family Office	USA	Memphis Meats	1	GFI
Softmatter	Venture Capital	USA	Finless Foods	1	GFI
Purple Orange Ventures	Venture Capital	Germany	Mission Barns, CellX, BIOMILQ	1 (2019); 2 (2020)	GFI
Real Tech Fund	Venture Capital	Japan	IntegriCulture, Shiok Meats	1 (2019); 2 (2020)	GFI/CBT
Bell Food Group (SWX: BELL)	Corporation	Switzerland	Mosa Meat	1 (2019); 2 (2020)	GFI

KBW Ventures	Venture Capital	United Arab Emirates	Memphis Meats, Turtle Tree Labs	1 (2019); 2 (2020)	GFI
Sailing Capital	Private Equity Firm	China	Impossible Foods	N/A	CBT
Horizons Ventures	Venture Capital	Hong Kong	Impossible Foods, Perfect Day, Modern Meadow, Demetrix	N/A	CBT
Nan Fung Group	Private Conglomerate	Hong Kong	JUST, Bolt Threads	N/A	CBT
Aggrinovation	Investment Fund	Israel	Future Meat Technologies	N/A	CBT
Cool Japan Fund	Public-Private Fund	Japan	Spiber	N/A	CBT
Louis Dreyfus Company	Corporation	Netherlands	Motif FoodWorks	N/A	CBT
Prince Khaled Bin Alwaleed	Angel (Individual)	Saudi Arabia	Geltor, Memphis Meats, JUST	N/A	CBT
Temasek Holdings	Government (Holding Company)	Singapore	Modern Meadow, JUST, Bolt Threads, Perfect Day	N/A	CBT
VisVires	Venture Capital	Singapore	Aleph Farms	N/A	CBT
Anchorage Capital Group	Venture Capital, Private Equity	USA	Motif FoodWorks	N/A	CBT
B37 Ventures	Venture Capital	USA	Perfect Day, Clara Foods	N/A	CBT
Breakthrough Energy Ventures (Bill Gates)	Venture Capital	USA	Memphis Meats, Impossible Foods, Ginkgo Bioworks, Motif FoodWorks, DMC Biotechnologies, Sustainable Bioproducts	N/A	CBT
Boxgroup	Venture Capital	USA	Memphis Meats, Geltor	N/A	CBT
Breakout Ventures	Venture Capital	USA	Modern Meadow	N/A	CBT
Cavallo Ventures	Venture Capital	USA	Geltor	N/A	CBT
Continental Grain Company	Corporation	USA	Modern Meadow, Impossible Foods, Perfect Day, Memphis Meats	N/A	CBT
Cultivan Sandbox Ventures	Venture Capital	USA	Geltor	N/A	CBT
Evolv	Venture Capital	USA	New Culture	N/A	CBT

Ventures					
Formation 8	Venture Capital	USA	Bolt Threads	N/A	CBT
Foundation Capital	Venture Capital	USA	Bolt Threads	N/A	CBT
Founders Fund	Venture Capital	USA	Bolt Threads, Wild Earth	N/A	CBT
Food For Thought Worldwide	Venture Capital	USA	Geltor	N/A	CBT
Iconiq Capital	Private Investment Firm	USA	Perfect Day, Modern Meadow	N/A	CBT
Kholsa Ventures	Venture Capital	USA	Amyris, Impossible Foods, JUST	N/A	CBT
Nelstone Ventures	Venture Capital	USA	Manus Biosynthesis	N/A	CBT
Powerplant Ventures	Venture Capital	USA	JUST	N/A	CBT
TSVC Capital	Venture Capital	USA	Ginkgo Bioworks	N/A	CBT
Verus International	Corporation	USA	Perfect Day	N/A	CBT
Viking Global Investors	Hedge Fund	USA	Ginkgo Bioworks, Motif FoodWorks, Joyn Bio, Impossible Foods	N/A	CBT

Appendix C: Prototypes, Cost, and Market Introduction Claims

Company Name	Prototype Status	Cost	Detailed Explanation	Claims for Market Introduction	Additional Information Sources
IntegriCulture	Cell-Based Foie Gras; Beef (P)	N/A	PD	2021 (Foie Gras); 2023 (Processed Meats); 2025 (Cultured Beef)	Coyne (2021b); Watson (2020f); Integriculture (n.d.)
Hoxton Farms	Animal Fat (Prototype in Development)	N/A	PD	N/A	Synbiobeta (2021); O'Hear (2021)
BioBQ	Beef Brisket (P)	N/A	PD	N/A	Marston (2021b)
Aleph Farms	1-2. oz Steak (2018); Cultivated Ribeye Steak (Unknown Size) (2021)	\$50 (2018); Unknown (2021)	PD (2018); ND (2021)	2022	i24News (2021); Ben-David (2022b); Ashkenazi (2021b); Askew (2021a); Crawford (2021a); Aleph Farms (2021); Lim (2021); Wolf (2020)
Lab Farm Foods	Chicken Nuggets/Pork Liver Pâté (P)	N/A	PD	N/A	Schnettler (2020)
Mosa Meat	Beef Patty (2013 Proof of Concept)	\$280000-\$300000 (2013); \$100 (Serving, 2021); Burgers €9 (Future Projection)	MD	N/A	McCormick (2021); CB Insights (2021); Goldman (2021); Rankine (2021); CBT ("Mosa Meat, n.d."); Southey (2020)
Mzansi Meats	Meatballs (2019)[30% cell-based, 70% plant-based]; Burger (2022) (P)	N/A	PD	2024 (Restaurant Introduction)	Vegconomist (2020); Ho (2021c); Wilder (2021); Caboz (2022)
Ohayo Valley	"A5 Grade Wagyu Ribeye Beef" (P)	N/A	PD	N/A	Jong (2021); Kiernan-Stone (2021)
SeaWith	Beef via Algae Medium (P)	"\$3 kg by 2030"	PD	2023	Neo (2021c); Albrecht (2021c)
MeaTech	Chicken Fat	N/A	MD	2026-2028	McLennan

	(700 g Single Production Run); Steak (104 g)				(2021); “MeaTech 3D Ltd. – Cultured Fat Biomass...” (2021); “MeaTech 3D Ltd. – MeaTech Group Manufactures...” (2021); “3D Printing Meets...” (2021)
UPSIDE Foods (Formerly Memphis Meats)	Beef Meatball, Chicken, Duck (P)	\$18000/lb. (pre-2018); \$2400/lb. (2018); \$50 (small piece, 2021)	MD	N/A	CB Insights (2021); MediaPost (2021); Carrington (2018); Kateman (2020); Bhavana, Askshay, & Gayathri (2020)
Ants Innovate	N/A	N/A	N/A	N/A	Ants Innovate (n.d.)
Gaia Foods (Shiok Foods Subsidiary)	Thin Beef Slices; Minced Shrimp (P)	N/A	PD	2022 (Commercialization)	Ferrer (2021); Quek (2021a); “Shiok Meats Acquires...” (2021); Begum (2021c)
Orbillion Bio	Bison, Sheep, Deer (P)	N/A	PD	2023	Watson (2021u)
Cell Farm Food Tech	N/A	N/A	N/A (No Working Website)	N/A	McGovan (2021)
MagicCaviar *Eggs*	N/A	N/A	N/A	N/A	Vegconomist (2021c); Ho (2021g)
Cubiq Foods	Cultured Omega-3 (P)	N/A	N/A	2022	CubiqFoods (n.d.); Dutta (2020); Poiniski (2021)
ClearMeat	Minced Chicken (P)	N/A	PD	N/A	Ho (2021ca)
Just	Chicken Nuggets	\$17 (Set Meal); \$50 (Produced Nugget)	MD	2021 (Restaurant & Food Delivery Introduction)	Andersen (2021); Watson (2021n); Hoffman (2021); Hussey (2021);

					McCormick (2021); Scipioni (2020); Gilchrist (2021)
SuperMeat	Beef and Poultry; Cultured Chicken Burger (50% cell-based)	\$35 (Burger)	PD	2022	Ben-David (2021d); Xinhua (2021); "New IDTechEx Report..." (2021); Marston (2020c); Supermeat (n.d); The Chicken (n.d); Globertrender (2020)
Future Meat Technologies	Steak, Chicken & Lamb (P)	Steak: \$10 per pound; \$4 if combined with plant-based -- Chicken: \$4 per 100 g	PD	2022	Shieber (2019); CBT ("Future Meat Technologies"); "Nestle Eyes Control..." (2021)
Jellatech *Gelatin*	Gelatin & Collagen (P)	N/A	PD	N/A	Green (2021a); Watson (2021p)
Biomilk	Cow & Human Breast Milk (P)	N/A	N/A	N/A	Solomon (2021b)
Nissin Foods Group	Non-Mince Beef (1-3 grams)	N/A	PD	N/A	Nissin Food Holdings (n.d.); CBT ("Nissin Food Groups," n.d.)
Diverse Farm	N/A	N/A	PD	N/A	Ho (2021f)
Mission Barns	Bacon/Duck Fat (P)	N/A	PD	N/A	Watson (2021aa); Ho (2020b); Marston (2020b; 2020c)
Avant Meats	Fish Maw Product (2019); Fish Fillets (2021) (P)	N/A	PD	2023-2024	Mia (2021); Ho (2021d); Marston (2020a); Vegconomist (2019); CBT ("Avant Meats," n.d.); Albrecht (2021a); Tan

					(2021b)
SeaFuture Sustainable Biotech	N/A	N/A (One employee, prospects unknown)	N/A	N/A	RocketReach (n.d.)
Gourmey	Foie Gras (P)	< \$1,180 per kg	PD	2023-2024 (Goal)	Sage (2021); Mollard-Chenebenoit (2021); Gross (2021); Gourmey ("Frequently Asked Questions," Gourmey, n.d.)
Peace of Meat (Meatech Subsidiary)	Chicken Nuggets [80% Plant-Based, 20% PoM Fat Prototype]; unclear if intended prototype for long-term production)	N/A	PD	2023	McLennan (2021); SEC Filings (2021); Proveg (2020); Cleene (2019)
Appleton Meats	Beef and Chicken (Prototype Cannot be Presumed)	N/A	N/A (No Working Website)	N/A	The Canadian Press (2019); Appleton Meats (n.d.)
ArtMeat	N/A	N/A	N/A	2023	Artmeat.pro (n.d.) [NOTE: website has gone offline]; Vevolution (n.d.)
BIOMILQ	Cultured Breast Milk (P)	N/A	PD	N/A	N/A
VOW Food	Kangaroo Dumplings, Alpaca Chili Tamara, Goat Cheeseburger Slider, Rabbit, Lamb, Pork (P)	N/A	PD	N/A	Prodanovic (2020); Palmer-Derrien (2020); Ho (2021a)
CellX	Black Pig (P)	N/A	PD	2025	Chow & Patton (2021); Ho (2021k)
Magic Valley	Lamb (P)	N/A	PD	2022-2023	Ho (2021h);

					Marston (2021); McLennan (2021); Stuchbery (2021)
Evolved Meats	N/A	N/A	N/A	N/A	N/A
Ochakov Food Ingredients	Meatloaf (40g)	900,000 Rubles (\$14 000USD)	PD	2023	Starostinetskaya (2019); Banis (2019); Interfax (2019)
Wild Earth	Dog Food (P)	N/A	PD	N/A	Marston (2022)
Turtle Tree Labs	Lactoferrin (P)	N/A	PD	N/A	Vegconomist (2021c)
Because Animals	Mouse Cookie for Cats (P)	N/A	PD	2022	Peters (2021a); "Because, Animals..." (2021)
SciFi Foods	N/A	N/A	N/A	N/A	N/A
Balletic Foods	N/A	N/A	N/A	N/A	N/A
BioTech Foods (EthicaMeat)	Fish Maw & Fish Fillets (P)	N/A	PD	N/A	"Lab Meat: the Futuristic Revolution..." (2021); EthicaMeat (n.d.); Morrison (2020b; 2021e)
Craveri Laboratories (BIFE)	N/A	N/A	N/A	N/A	N/A
Fork & Goode	N/A	N/A	N/A	N/A	N/A
HigherSteaks	Bacon/Pork Belly (P)	N/A ("Thousands of Pounds per Kilogram")	PD	N/A	Ho (2020a); Pritchett (n.d.)
Mirai Foods AG	N/A	N/A	N/A	N/A	Huwiler-Flamm (2021); Wilder (2021); Ellis (2021); StartUp Ticker (2021)
Innocent Meat	N/A	N/A	N/A	N/A	Southey (2021d)
Bond Pet Foods	N/A	N/A	PD	N/A	Murphy (2019); CBT ("Bluenalu," n.d.); Leeuwen (2020)
Pristine Pet	N/A	N/A	N/A	N/A	N/A

Foods					
New Age Meats	Sausage (P)	\$5 per link/\$23 lb.	PD	PD	Brodwin (2018); Selby (2020)
Joe's Future Food	Pork (P)	N/A	PD	N/A	CB Insights (2021); Holland (2021); Ellis (2021)
Meatable	Pork; Muscle Tissue (P)	\$10,000/lb; \$100,000 per 4.5 kilos	PD	2023-2025	"Agronomics Limited Portfolio Company Update: Meatable" (2021); "Bill Gates Asks Rich People..." (2021); Coyne (2021b); Ali (2021e); Meatable (2019); Watson (2021i); Rodríguez-Fernández (2019); Watson (2020a)
Blue Ridge Bantam	Turkey Meat (P)	N/A	N/A	N/A	N/A
Wild Type	Spicy Salmon Roll (Unknown Size)	\$200USD	PD	N/A	Lamb (2019); Peters (2021b)
Alife Foods	N/A	€ 19.50	N/A	N/A	Alife Foods (n.d.)
BlueNalu	Yellowtail Amberjack (P)	N/A	PD	Late 2021	Ali (2021c); Blue Nalu (n.d.); "IDTechEx Discusses..." (2021); Saigol & Kewon (2020)
Cell Ag Tech	N/A	N/A	N/A	N/A	N/A
Finless Foods	Tuna (P)	N/A	PD	N/A	CB Insights (2021); Watson (2021k)
Planetary Foods	N/A	N/A	N/A	N/A	N/A
Bluu Biosciences	Salmon, Trout, Carp (Prototype Introduction 2022)	N/A	PD	2023-2024	Vegconomist (2021a); Ho (2021b); Shieber (2021)
Cultured	Lobster (1/2 g)	N/A	PD	"A Few Years" as of	Laclaire (2021);

Decadence				2021	Yahr (2021)
Umami Meats	N/A	N/A	N/A	N/A	Crunchbase (n.d.)
Shiok Meats	Shrimp (Unknown Size), Lobster (Unknown Size); Dumpling (Unknown Size)	\$50/kg (Shrimp); N/A (Lobster); "Thousands of Dollars per Kilogram" (Dumpling) (Handley, 2021)	PD (Shrimp); ND (Lobster)	2021 (Restaurant Introduction); 2022 (Market Introduction); 2023 (Commercialization)	Mulia (2021); The Monitor (2021); Akshatha (2021); Shiok Meats (n.d.); Ferrer (2020); Reuters Staff (2020)
Space F	Pork (Unknown Size, Two Separate Prototypes); Beef (Meatballs, Unknown Size); Chicken (Fillets and Nuggets)	N/A	PD	N/A	Buxton (2022a & 2022b)
Ivy Farm	British Mince Meat (P)	N/A	ND	2023	Ivy Farm (n.d.a, n.d.b, n.d.c); "Ivy Farm Urges..." (2021)
NewCo (Tnuva Group + Pluristem Therapeutics)	Unknown Proof of Concept Prototype to be Presented in 2022	N/A	N/A	2023	Singh (2022)
Edge Foods	N/A	N/A	N/A	N/A	"Edge" (n.d.)
Good Dog Food	N/A	N/A	N/A	N/A	"Good Dog Food" (n.d.); "Agronomics Reveals..." (2022)
Pearlita Foods	Oysters (Prototype Status Current Cannot be Presumed)	N/A	N/A	N/A	Ettinger (2022); Wolf (2022)
Ambi Real	Beef (P)	N/A	N/A	N/A	Ambi Real Food

Food					(n.d.)
ANJY Foods	Lion Burger (No Prototype at this Stage)	\$900 Sale Price (No Other Information)	ND	N/A	“Lion Burger” (n.d.); “For Investors” (n.d.)
Primeval Foods	Zebra Sushi Rolls (Unknown Size); Tiger Steak (Unknown Size); Lion Tacos (Unknown Size)	N/A	ND	N/A	“Primeval Foods...” (2022); Askew (2022a); Harley (2022)
Another Fish	N/A	N/A	N/A	N/A	N/A
Bluefin Foods Inc.	N/A	N/A	N/A	N/A	N/A
e-Fishient Protein (Biomeat Foodtech and Volcani Center Joint Venture)	Tilapia Fish (P)	N/A	N/A	N/A	“New Cultivated Seafood...” (2022)
Fisheroo	Surimi (Prototype Creation Ongoing)	N/A	N/A	N/A	Big Idea Ventures, LLC (2021)
Forsea Foods	N/A	N/A	N/A	2025	Lan (2022).
Jimi Biotech	N/A	N/A	N/A	N/A	N/A
Meat Tomorrow	N/A	N/A	N/A	N/A	N/A
Meatleo	N/A	N/A	N/A	N/A	N/A
Meatosis	N/A	N/A	N/A	N/A	N/A
Mermade Seafoods	Scallops (P)	N/A	N/A	N/A	N/A