Eating for the post-Anthropocene
Alternative proteins, Silicon Valley and the (bio)politics of food security

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Eating for the post-Anthropocene: Alternative proteins, Silicon Valley and the (bio)politics of food security

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January 2018
This thesis is dedicated to the memories of my grandma Marjorie Meredith and granny Nancy Sexton – two amazing and fiercely intelligent women. I wish I could have finished this in time to show you both.
Abstract

This thesis explores the emergence of a new generation of alternative proteins (APs) – including cellular agriculture, edible insects and plant-based proteins – that aim to provide more sustainable, healthy and ethical alternatives to conventional livestock products. It examines APs within the broader context of Anthropocenic debates, situating this activity as a reaction to contemporary food-related ‘crises’ and, ultimately, as solutions for global food security. Drawing on interviews, policy analysis and visceral autoethnographic work in the leading hubs of recent AP activity in Europe and the US, the thesis demonstrates how APs both reinforce (‘simulate’) and challenge (‘disrupt’) the existing imaginaries, materialities and political economic factors of the global food system.

Through exploring this negotiation between simulation and disruption, the thesis critically examines the enthusiastic and at-times bombastic promissory narratives that have characterised the sector to date. It calls into question to whom and in what ways APs cause disruption, arguing that while they have indeed disturbed the geographies, actors and practices involved in protein production, the political economic underpinnings of the global food system (i.e. inequality, bio-corporatisation, Western-based power) remain largely intact. Drawing on Foucauldian thought, the thesis also argues that APs represent a new site of food biopolitics – introduced as the ‘biopolitics of edibility’ – through which we see a continuation of consumer responsibilisation wherein personal food choice acts as a means for creating a better self and planet. By analysing the material and discursive strategies used to make APs into ‘food’, the thesis also explores these products as an important case for thinking through the material and visceral (bio)politics of eating, as well as the limits of disgust and mistrust posed by food-technology interactions and the precarious relationship between (non)human bodies.

Through its theoretical and empirical contributions, the thesis intervenes in critical food geography by bringing together recent debates on the geographies of production and consumption, the material and visceral politics of eating, and the biopolitics of food. It also engages with economic geography and STS theorisations of innovation to think through the material and promissory trajectories that APs have taken to date. Through examining the negotiation of simulation and disruption, the recent AP movement is problematised as both entangled and implicit in politics around ‘good’ eating and the individualised project of Anthropocenic solutions.
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Abbreviations

AP  Alternative protein
BSE  Bovine spongiform encephalopathy
CEO  Chief Executive Officer
CIWF  Compassion in World Farming
ELI  Environmental Law Institute
FAO  United Nations Food and Agriculture Organisation
FDA  US Food and Drug Administration
FMD  Foot and Mouth disease
GATT  General Agreement on Tariffs and Trade
GFI  Good Food Institute
GMO  Genetically-modified organism
IARC  International Agency for Research on Cancer
LA  Los Angeles
LCA  Life-cycle analysis
MAFF  Ministry of Agriculture, Fisheries and Food
NFE  Net food-exporting state
NFI  Net food-importing state
NRT  Non-representational theory
PAG  Protein Advisory Group
RHM  Rank Hovis MacDougall
SCP  Single-cell protein
STS  Science and Technology Studies
SU  Singularity University
UN  United Nations
UNICEF  United Nations International Children’s Emergency Fund
USAID  United States Agency for International Development
vCJD  Variant Creutzfeldt-Jakob disease
WFP  World Food Programme
WHO  World Health Organisation
WWI  World War 1
WWII  World War 2
Acknowledgements

This thesis could not have been possible without the support, guidance and saintly patience of a number of people. The first round of thanks must go to my primary supervisor Mike Goodman. I have been very fortunate over the last four years to have received your unwavering support, expertise and enthusiasm for this project, even when you had to read what seemed like the hundredth draft. Thank you for your guidance throughout this journey, and I look forward to more projects in the future.

To others who have acted in a supervisory role and/or generously offered their time to read drafts and give invaluable advice at various stages of the project – thank you Nikolas Rose, David Evans, Neil Stephens, Bronwyn Parry, Christopher Leite, Isaac Scruff, Alex Loftus, Marianne Ellis, Tanja Schneider, Ben Wurgaft, and Colin Sage. Many thanks also to Dan Crossley and Anna Cura for your considerable support and warmth during a brilliant internship. I am grateful to the Economic and Social Research Council for funding the PhD, and to King's Geography Department, King's Graduate School, King's Faculty of Social Science & Public Policy, and the KCL Mary Clark Travel Bursary for a number of small grants to support fieldwork and attendance of conferences. Many thanks must also go to my interviewees for very generously offering their time and insights on their work in a fascinating area of food innovation.

I can say with 100% certainty that this thesis would not have materialised without the friendship and moral support of everyone in the 6th floor office, and some very special friends in particular – Sophie, Gustav and Julian, our regular chats over tea and cake were a lifeline. Claire and Jo too, thank you for opening your home on countless occasions and for sharing your amazing cooking skills and maple whiskey. To Kate Whincup, thank you for coming to the rescue with hilarious texts, phone calls, and trips away on countless occasions – these have been the best antidote during periods of writer's block and general PhD stress. To Jonas, it's been great to have a research comrade as we've both tried to make sense of this emerging food sector. And Abi, what a journey this has been! Here’s to many more adventures and thank you for your endless inspiration and enthusiasm for working towards a better food system.

And lastly, to my family, and in particular to Brett and my parents – for all the times you helped me practice presentations, listened to me think through ideas when I was stuck, and told me again and again that I would get it all finished in the end. I truly can't ever thank you enough for helping me get here, and for your unwavering love and support for everything I do.
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1.1 The ‘proteins of tomorrow’

In August 2013, the first ever public tasting of a 'lab-made' burger was broadcasted worldwide from a television studio in west London. The burger, produced by vascular physiologist Mark Post and his team at Maastricht University, had been grown from cow muscle cells outside (in-vitro) the animal body using tissue engineering techniques. In the same year, the United Nations’ Food and Agriculture Organisation (FAO) published a 201-page report advocating insects as a viable path to global food and feed security (van Huis et al 2013). Around the same time headlines were also being made in the high-tech world of Silicon Valley as a new generation of plant-based protein companies were gaining multi-million dollar investments from the world’s biggest names in tech and venture capital, including Bill Gates (Microsoft), Biz Stone (Twitter), Sergey Brin (Google), and Vinod Khosla (Khosla Ventures). Reports buzzed through the media that Bill Gates ‘could not tell the difference’ between these new products and their animal-derived counterparts (Brownstone 2013), leading him to personally hail the movement as the ‘future of food’ (Gates 2013a).

Despite their different approaches, these alternative proteins (APs) share a unifying goal: to create more sustainable, healthy and ethical alternatives to conventional livestock products, while at the same time remaining viscerally equivalent in terms of taste, appearance, texture and functionality (e.g. cooking methods). The confluence of these events in 2013 was, and remains, striking. It seemed that the ‘proteins of tomorrow’ had suddenly materialised, and done so all at once. What had originally been planned as a thesis on cultured meat was suddenly expanded across a new pantheon of AP products. Virtually every week I would hear of another plant-based or insect start-up being founded, and it did not take long for others to extend and modify the methods behind in-vitro or ‘cultured’ meat to other animal products (milk, egg whites, gelatine), forming a group of ventures that would later become known as ‘cellular agriculture’.

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1 ‘Conventional livestock’ refers in this thesis to the species (e.g. ruminants, poultry, pigs) and products (e.g. beef, lamb, chicken, pork) that dominate both Western animal agriculture and increasingly global livestock markets due, in part, to the rising Westernisation of diets worldwide (Steinfeld et al 2006).
Much of the initial excitement generated by these APs was based on their respective promises of what the future of food could look like. To many they signalled a logical, hopeful and importantly taste-full future that – for many eaters – previous protein analogues had yet to adequately accomplish. Instead this future promised ‘real’ meat, dairy, eggs and other animal products, simply made from different raw materials and methods. Better yet, it also promised the potential to feed larger populations for a fraction of the environmental, human health and animal welfare costs of current livestock production. The future thus not only tasted good, it would also be better for all: eaters of animal-based foods could continue enjoying their favourite products; nutritional profiles could be tailor-made for specific human health needs; farm animals would no longer have to be slaughtered or kept in intensive environments; there would be considerable reductions in water, feed and land use, thereby leading to decreased greenhouse gas (GHG) emissions; antibiotic use in food production would be reduced; inefficiencies and waste could be minimised by growing only specific cuts of meat; and, protein/calorie-deficient populations could be provided for with fewer ecological and economic costs.

In light of these claims, the promise of APs can ultimately be distilled into a simple statement that was made by a research participant during this project (a co-founder of a US-based AP company) and has featured repeatedly in the discourses of the sector: that is, APs promise “the same, but better”. They aspire to be foods that are at once novel and acutely familiar, a bridging between an innovation-driven future and a respect for deeply rooted social, cultural and visceral expectations and practices. As such, the latest APs represent both a break from and continuation of contemporary agri-food practices in different ways.

The exploration of APs as both a disturbance to and reinforcement of the status quo represents a central interest of this research project. It is these seemingly opposing poles that have driven both the narratives and materialities of APs to date; a careful balancing act between difference (disruption) and sameness (simulation) upon which

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2 Fieldwork interview (San Francisco, October 2015).
rests the ultimate goal of consumer acceptance and, in turn, considerable commercial success if increasing shares in the global protein market can be directed to APs.³

Yet added to these aims is another, more moral-laden concern, one which frames APs not only as a lucrative business opportunity but also as the pathway to socioecological salvation at the global scale. Such a promise comes at a time characterised by increasing ‘social anxiety’ (Jackson & Everts 2010) regarding the multiple tipping points currently faced by the planet and its inhabitants, and to which current livestock systems have been revealed as major contributors (Steinfeld et al 2006) – from climate change, declining natural resources, and desertification, to rising antibiotic resistance, zoonotic pandemics, non-communicable diseases (e.g. obesity, heart disease), and systemic animal welfare concerns. This ‘perfect storm’ of crises (Godfray et al 2010), coupled with projected growth in both global population numbers and demand for animal-derived foods (Alexandratos & Bruinsma 2012), represent just some of the many contemporary issues that point to the chronic unsustainability of current and projected human activities, a trajectory that already threatens irreversible and global-scale damage.

The recognition of the scope and scale of human impacts on ecological systems has led geoscientists to recently declare a new geological epoch, known as the Anthropocene (Crutzen & Stoermer 2000). The response to this diagnosis across the Academy and public realm has been prolific, leading Lorimer (2017, 121) to recently comment that the term ‘Anthropocene’ “seems to have captured an intellectual zeitgeist, providing a plastic and catchy label for a common curiosity and anxiety about the state and future of Earth after the ‘end of Nature’”. Amongst its many impacts, the diagnosis has signalled a new approach to Earth System thinking in which the interconnectedness of nature-society relations is firmly acknowledged (a revelation that has of course been long advanced in the social sciences (Whatmore 2002; Latour 2004; Harrison, Pile, & Thrift 2004; Castree 2005)). Yet in recognising the social as an entangled and inseparable aspect of the natural, Anthropocene proponents have gone so far as to elevate humans to the centre of the crisis narrative – that is, and as the name suggests, humans (Anthropos) are presented as both primary threat and saviour to planetary wellbeing. As

³ To put such economic prospects in some context, in 2014 the ‘retail equivalent value’ of US meat production was estimated at USD $85 billion (Capik 2014).
will be discussed later, critics have challenged this hubristic reading and warned of the politically-charged implications that rest on certain decisions currently being debated, such as the epoch’s official starting date (Malm & Homborg 2014; Hamilton 2015; Haraway et al. 2016).

This thesis views APs as a materialisation of the anthropocentric reading of contemporary crises. In other words, it is argued that APs symbolise a product of the contemporary ‘age of anxiety’ (Dunant & Porter 1996), particularly food-related anxieties (Griffith & Wallace 1998; Jackson 2010; 2015), in that they represent a materialisation of the dual logic of Anthropocenic debates – a logic that on the one hand claims ‘humans are the problem!’, and on the other, ‘humans are the solution!’ This perspective is exemplified by Steffen et al.’s (2011, 749) recent ‘call to arms’ in light of the Anthropocene diagnosis: “we are the first generation with widespread knowledge of how our activities influence the Earth System, and thus the first generation with the power and responsibility to change our relationship with the planet”.

The aspirations of APs to offer ‘the same but better’ thus extend beyond creating delicious products and new market opportunities; the stakes are set at the level of planetary survival itself. As AP narratives claim, it is by accepting and assimilating these novel products into our personal eating practices that a better future for people, animals and planet can be realised. Central to AP development is thus to offer individuals a way of harnessing our ‘power and responsibility to change our relationship with the planet’, and in doing so bring about what this thesis calls the ‘post-Anthropocene’ – an era defined by the projected success of overcoming current Anthropocenic crises, and ushering in a new age of climate stability and food security in which everyone has access to safe, nutritional, ethical and tasty protein foods.

In its examination of APs as a form of ‘eating for the post-Anthropocene’, the thesis has two central aims: first, to empirically contribute to existing AP scholarship (e.g. Stephens 2010; van der Weele & Driessen 2013; Jönsson 2016) that has, to date, remained largely Euro-centric and siloed in its analysis of the different types of end products (i.e. cellular agriculture, insects and plant-based proteins). This thesis attends to these previous trends by broadening its analysis across the spectrum of recent APs, and considering US-based activity in this sector.
Second, the thesis uses a food geography lens to critically examine the recent AP sector. This critical approach is not intended to advocate against (nor indeed for) the development of APs; it is instead adopted to look beyond the face-value of their promissory claims and more thoroughly consider their material, (bio)political, spatial, and political-economic implications. At the same time, APs are also used as a lens to look ‘back at’ the global agri-food system today – in other words, to consider what their emergence reveals about contemporary understandings and practices of (animal) food and eating, and the geographies, materialities, anxieties and political-economic relations that underpin them. This approach is taken with the echoes of a long history of promises by previous food technofixes in mind, all of which have failed to fully realise the techno-utopian visions of planetary salvation and social equality their proponents originally claimed (e.g. Shiva 1991). The thesis thus takes seriously the hype that surrounds APs, the ambitions and motivations of their developers, and the very real material, ideological and discursive shifts that already have and are projected to occur with the growth of a global AP sector. In sum, then, the thesis is structured around two overarching questions: first, what do the latest APs ‘mean’ in biopolitical, spatial, political-economic and material terms for the agri-food system today and in the future; and second, what do they reveal about the *contemporary moment* of food production and consumption. In attending to these questions, the thesis problematises this new sector as both entangled and implicit in contemporary politics around ‘good’ eating and the individualised project of Anthropocenic solutions.

### 1.2 Research questions and objectives

#### 1.2.1 Situating APs

To undertake the research aims described in the previous section, the thesis proposes a threefold approach. The first conducts two separate but interrelated tasks: it begins by ‘mapping’ the recent AP movement, setting the scene for who is involved, what products are being developed, and what promissory narratives, geographies and target audiences are being mobilised (Chapter 2). Building on this context, Chapter 5 conducts a genealogy that works to situate these APs amidst a long history of other non-animal protein products (e.g. single-cell proteins, Quorn), and their relations to the changing political economies and policy discourses of global food security over the last century.
This genealogy is significant because as far as the author is aware, no history of these particular protein analogues, including and up to the latest APs, has been researched or written through a social scientific lens. Drawing on Foucauldian methodology, this work conducts a ‘history of the present’ to uncover the lines of power that have been crucial in the emergence of different APs over the last century (including the most recent activities), and the particular ‘regimes of truth’ (Foucault 1995) that have worked to present them as the necessary solutions to global food security.

This analysis thus serves to contextualise the latest AP movement within both historical and current strategies of global food security. In doing so, it builds on literatures that have examined the relationship between changing problematisations of food security at the global policy level and the consequent legitimisation of certain actors and responses into the project of feeding the world (Maxwell 1996; Shaw 2007; Jarosz 2011). Key to this research objective then is to understand how the issue of food security is currently problematised in official policy discourses and the ways in which this has created an enabling environment for the particular development trajectories of the latest APs. It is argued that animal protein has become a central concern of contemporary food security thinking, and has led to calls for ‘innovative’ (i.e. alternative) solutions. Due to the particular framing of the ‘animal protein problem’ in these discourses – namely, as an issue of insufficient and inefficient supply in the face of growing demand – there has been a distinct and rationalised turn towards technical solutions, such as APs, that serve to mitigate global food insecurity through the creation of ‘better’ market products. Moreover, it is the specific actors of Silicon Valley that have been declared by global agencies such as the United Nations (UN) as the necessary creators of such solutions (Mis 2016). We thus see a distinct shift whereby the Valley has become rationalised as the leading geographical and ideological hub of global food security strategies, a development that both reinforces and creates new political economies, spatialities and materialities of agri-food systems, and indeed of global development.⁴ Such trends have the potential to establish new social hierarchies across food production-consumption networks (Goodman 1999) as protein production becomes increasingly distanced to the realms of Valley techno-science and new, powerful industrial mediators emerge as the leaders in global food security agendas.

⁴See related work on Valley-based philanthrocapitalism (McGoey 2016).
This invites closer exploration of the development trajectories of APs. It raises important questions about precisely who and what type of expertise is shaping this development, and how transparent and democratic this process is. Such questions tie into current conversations in the fields of (economic) geography, STS and sociology about the degree to which activities within synthetic biology, bioengineering and other sciences should be open to ‘non-experts’ and ‘local knowledge’ (Marris 2001; Whatmore 2009; Marris & Rose 2010; Mohr & Raman 2012; Frow & Calvert 2013; Devonshire & Hathway 2014), and the privileging of science and technology in modern notions of what counts as ‘innovation’ (Godin 2008, 2012).

Yet the specific role of place-based culture in shaping innovation trajectories has received less attention within this scholarship. For example, while economic geography literatures have done much to show the spatial, scalar and cultural embeddedness of innovation practices, these analyses have largely been occupied with determining the role such factors play in the ‘successfulness’ of producing innovative outcomes. Conversely, STS has been shown to exhibit “a rather generic notion of space” (Truffer 2008, 978) and place (Furlong 2010) in its interrogation of technological innovation. There is consequently much scope to more fully theorise the role of place-based culture in innovation pathways. Going beyond the sole metric of successfulness and allowing greater significance to local specificity, the thesis thus asks a different question: what does it mean to ‘do’ innovation in Silicon Valley? That is, how does this specific geographical location contribute to the ways in which innovative solutions, such as APs, are valued and materialised? Such an enquiry is imperative given the large concentration of AP activity within the Valley to date, and the increasing turn by global agencies to this specific high-tech ecosystem for solutions to global food security (Mis 2016). In sum, these lines of enquiry (conducted in Chapter 6) are motivated by an overarching question of what it means for Silicon Valley to have become the new ‘problem-solvers’ of feeding the world, and how this geographical and ideological shift has contributed to the emergence of APs as ‘rationalised’ solutions to global food security.

To attend to these themes, the following questions and sub-questions will guide the thesis’ analysis:
1. Why and how have APs become key to the future of food/food security at this contemporary moment?

a. Who is involved, what products are being developed, and what promissory narratives, geographies and target audiences are being mobilised?

b. How have the latest APs – in the context of other protein analogues – developed as a bioeconomy, and done so in the particular way they have?

c. In what ways have current anxieties about (and beyond) food been made ‘material’ through APs?

d. Why has so much AP activity to date concentrated in Silicon Valley?

e. What role (if any) does the geographical place and culture of Silicon Valley play in the development of APs as food security solutions?

1.2.2 Materialising biopolitics

As previously noted, the latest AP movement has to date been characterised by a prolific array of promissory narratives that have promoted multiple environmental and (non)human benefits. As Chapter 2 will show, these claims have emerged across a range of outputs, from technical studies such as speculative life-cycle analyses (LCAs) (e.g. (Fiala 2010; Tuomisto & Teixeira de Mattos 2011) and biomedical reviews (Datar & Betti 2010; Post 2012), to the promotional discourses of AP companies and advocacy groups. The critical role promissory narratives play in the discursive, ontological and material development of novel technologies is widely established in STS literatures (e.g. Brown & Michael 2003). Regarding APs, this role has mostly been examined within the specific context of ethical promissory narratives (e.g. Stephens 2013), yet there is much scope to explore others. As mentioned earlier, a theme that has surfaced repeatedly within AP discourses is the idea of responsibility and a perceived ‘moral duty’ to support these innovations due to their potential to realise the post-Anthropocene – that is, their potential for solving global food insecurity and related crises by providing more sustainable, healthy and ethical options to conventional animal foods (Hopkins & Dacey 2008; Stuart 2013).

Over the last century, similar and related promises have been made by developers of other innovative foodstuffs, ranging from industrial foods to genetically-modified crops, and now the first transgenic animal product, AquAdvantage salmon (Reardon 2012).
These dynamics lend themselves to Michel Foucault’s concept of ‘biopolitics’ and the idea that through certain discursive and material techniques individuals may be ‘governed at a distance’ through capillary forms of power, maintained and extended by external authorities often across the public and private sectors (e.g. government, corporations, NGOs). The goal of these mechanisms of power is to encourage individuals to take on the ‘project of the self’ (Rose 2007), working to optimise their own personal welfare (i.e. ‘managing one’s existence’) and that of the social body (Foucault 1990; 2008). There has been a recent turn within food studies to explore these types of biopolitical dynamics; all have sought to show how products such as seafood (Mansfield 2012a), raw milk (Paxson 2008), and white bread (Bobrow-Strain 2008) have been framed by corporations and state actors as safer, healthier and more ethical than their counterparts so as to increase consumer acceptance, generate demand and, ultimately, create economic value (Holloway et al 2014).

To date, however, this theoretical lens has not been applied to novel foods such as APs. Moreover, the improvement of specifically non-human welfare (e.g. the environment, animals) as an additional goal of biopolitical mechanisms has been under-studied. To consider the biopolitical dynamics of APs, this thesis makes the case for bringing existing food biopolitics literatures into dialogue with recent critical geography and social science studies on ‘things becoming food’ (Roe 2006; see also Vialles 1994; Probyn 2011; Evans & Miele 2012). Through this analysis, conducted in Chapter 7, I argue that the very processes by which APs are being materially and discursively made into ‘food’ by their developers represents new biopolitical potentialities; what I refer to as the biopolitics of edibility. It is in this negotiation of AP edibility – conducted across multiple levels, from the molecular and material makeup of the end products, the practices created around them, and the framings used in consumer-facing discourses – that we find another example of APs as both simulation and disruption to the status quo, as they work to materially and discursively become and not become the same as conventional meat, milk and eggs. As will be argued, underpinning this dance of (un)making animal foods is the materialisation of a new site of food biopolitics, whereby consumers are responsibilised to accept APs as edible and incorporate them into their daily eating habits in the name of bringing about a post-Anthropocene world.

To attend to these themes, the following questions will be explored:
2. **What are the biopolitical implications and mechanisms of the recent AP movement?**

   a. How are APs situated within the broader context of ‘responsible consumption’?

   b. What are the discursive and material mechanisms by which APs are being made into ‘food’?

   c. In what ways does this process of edibility formation represent a reinforcement of/divergence from previous cases of food biopolitics?

The perceived “vital materiality” of different APs is also of paramount importance to this enquiry (Bennett 2010), as recent studies have shown how the ‘liveliness’ of matter such as animal foods brings with it perceived benefits (e.g. optimised health) and risks (e.g. pathogens, moral defilement) (Douglas 2003 [1966]; Fiddes 1991; Chiles 2013). Examining the precarious relationship between bodies that eat and bodies that are eaten is thus critical for understanding how perceptions of food as both desirable and ‘edible’ are shaped (Mol 2008; Scrinis 2012).

### 1.2.3 The visceral biopolitics of APs

Much of the literature on the biopolitics of food has examined how the assemblages of experts and their discourses and techniques have created increasingly ‘docile bodies’ at the consumer level (Bordo 1993; Bobrow-Strain 2008; Mansfield 2012a). However, it must not be assumed that eaters are completely passive in this arrangement; as will be shown, there is potential for a kind of ‘biopolitics in reverse’ to simultaneously develop (Pickett 1996; Andrée 2002; Heyes 2006), and examining this potentiality in the context of APs will form a key part of this study. As Stephens (2013) highlights, “the promissory, the material, and the ontological work together” in people’s understanding of APs, yet reinterpretation and resistance is an important part of this process. A large part of this fluidity is of course due to the fact that the latest APs are still in the early stages of development and so their narratives, materialities and ontological status remain relatively fluid. However, as existing food biopolitics literatures show, even when dominant narratives, materialities and ontological understandings exist around innovative food products (usually promoted in private/public sector discourses), it remains possible for individuals to shape and resist these whilst also being simultaneously shaped by them (Heyes 2006). Exploring the potential for these dynamics to work in a multi-directional way will form an important part of this project’s
focus in understanding how the biopolitics of APs have become literally embedded within their material and discursive development.

A key form of this biopolitics-in-reverse that the thesis examines is the distinct and widespread ‘yuck factor’ that has to date characterised public response to the latest APs, a reaction that is largely due to perceptions of undesirable taste, sensory expectations and provenance. As Guthman (2015, 2531) observes, there are limits to the techno-industrialisation of food that make “certain food inventions unacceptable”. While a number of AP literatures have called attention to this resistance and suggested strategies for overcoming the barriers to consumer acceptance, much more can be explored regarding the reasons behind these negative responses.

For example, and as mentioned above, in recent years a growing literature has sought to uncover how we come to perceive certain substances as not only desirable but also as ‘edible’ (Vialles 1994; Roe 2006; Probyn 2011). A crucial part of this edibility formation entails the everyday practices of food and eating, and the visceral and discursive performance of the end products. Building on the discussions of Chapter 7, the thesis continues its exploration of the biopolitics of edibility by examining how closer analysis of embodied food-eater relations can reveal new insights into the decision-making behind, and public attitudes towards the latest APs. This builds on important work by feminist geographers (e.g. Hayes-Conroy & Hayes-Conroy 2008; Longhurst et al 2008) who have challenged Cartesian divisions between the rational, objective senses (sight, sound) and those considered too bodily, emotional and base (touch, taste, smell) to convey reliable truths about the world. Instead these authors and others (e.g. Brady 2012) have sought to elevate the sensory realm as ‘worthy’ of scholarly enquiry, and reveal it to be a crucial lens through which to interrogate current politics around food and eating. As will be discussed in the methods chapter (Chapter 4), such work has involved the development of innovative methodologies for better ‘getting at’ the more visceral aspects of food-eater interactions: these have ranged from growing food (Sandover 2013), attending meal times within institutional settings (Miele 2017), cooking and eating with research participants (Longhurst et al 2008; Hayes-Conroy 2010; Piper 2013), and conducting autobiographical work on personal experiences and practices of eating (Mol 2008; Longhurst 2012).
Building on this work, the thesis develops a visceral auto-based methodology, referred to as a visceral autoethnography, and uses this to further explore the biopolitics of edibility and taste by reflecting on the author’s personal interactions with a particular AP product – Beyond Meat’s ‘chicken’ strips – during fieldwork. Through these different encounters, the thesis examines the performance of simulation and disruption conducted through the various material, discursive and visceral components of the AP product, and how this performance worked to make certain things ‘matter’ and ‘not matter’ to me (Evans & Miele 2012) as I engaged with the product in different ways and contexts (including purchasing, cooking and eating). It also explores how my sensory engagements in particular challenged the ‘truth claims’ and responsibilisation mechanisms that the product promoted. Such observations contribute further insight on how, through the latest APs, the visceral has been opened as a new site of biopolitics. Yet at the same time, a visceral analysis challenges the notion of biopolitical mechanisms producing only ‘docile bodies’, instead revealing sensory interactions and expectations of food to be a powerful barrier to the increasing penetration of capitalism into agricultural life (Goodman *et al* 1987), as well as a key factor in the consumer behaviour-attitude gap (Vermeir & Verbeke 2006).

The following questions will guide the thesis’ analysis of these themes:

3. **How are the biopolitics of eating and organoleptic taste materialised through the development pathways of APs?**
   a. What role does the visceral play in AP development, and consumer reception to APs? In particular, how do the visceral properties of APs influence the ways eaters ‘sense and make sense’ (Evans & Miele 2012) of both the products as ‘good’ food and themselves as ‘good’ eaters?
   b. What role does public (dis)taste for conventional animal foods and food technology play in AP development?
   c. In what ways are current tastes for, and visceral expectations of conventional animal foods being challenged/reinforced by APs?

1.3 **Thesis outline**

To attend to these research aims and objectives, the thesis proceeds as follows: Chapter 2 introduces the recent AP movement and sets the scene of who the main players are, where in the world they are based, what products have been developed to date, and
what truth claims, imaginaries and target audiences have been mobilised. Added to this, it also reviews the existing landscape of AP scholarship, tracing debates from scientific analyses of viability to critical reflections on the spatial and ethical implications posed by these novel foods. Through this review it is identified that scholarly attention on the recent AP movement has largely remained in the fields of sociology, ethics, the biosciences and consumer studies. With a few notable exceptions (e.g. Jönsson 2016), the latest APs have yet to be examined through a critical agri-food/geography lens, an approach this thesis argues offers important contributions to existing analyses of this subject.

To develop this argument, Chapter 3 begins with a review of agri-food debates that have traced the modern advancement of techno-industrial capitalism within global agri-food systems. Such debates are identified as a useful starting ground for the thesis’ analysis of APs, particularly taking inspiration from Goodman & Watts (1994) and Goodman (2004) in examining developments in agri-food systems not in terms of neat and distinct paradigm shifts, but rather as evolutions involving both continuance and divergence.

However, it is argued here that to more fully analyse APs as both continuance and divergence from current agri-food practices requires an extension of existing debates in this field, centred along the themes and research objectives described above. The rest of the chapter introduces the theoretical concepts that underpin these objectives and are subsequently advanced in the empirical chapters.

Chapter 4 outlines the methodological design of the research project. This provides an overview of the methods used, the process of selection and access to research participants, analysis of data, and reflections on positionality in the research process. The thesis then turns to its empirical contributions. Chapter 5 conducts a genealogy of APs – both current and historic – and their relation to the changing policy discourses of global food security. Amongst its findings, this chapter reveals a shift in current food security discourses that have served to legitimise both the turn to technical solutions such as APs and the declaration of Silicon Valley as the new ‘problem-solvers’ of feeding the world. Chapter 6 builds on these observations by examining the relationship between the place-based culture of Silicon Valley, the politics of global food security, and the material and ideological pathways of AP development. Discussion then turns to
the biopolitical implications of APs in Chapter 7, focussing in particular on the material and discursive processes of edibility formation as a new form of food biopolitics. Chapter 8 builds on these observations by further interrogating the visceral biopolitics of APs, taking the discussion of ‘things becoming food’ literally into the field via my own personal bodily experiences. Finally, the thesis concludes in Chapter 9 with an overview of the project’s contributions and suggests potential avenues for future research.
CHAPTER 2 | Setting the scene: The ‘new’ proteins

Over the course of this project, there has been a rapid expansion (and attrition rate) of ventures actively involved in the development and advocacy of the latest generation of APs. The recent AP movement is thus a highly dynamic landscape, with new actors emerging almost as fast as others fall victim to the challenges of the start-up and novel food business scenes.

A select few, however, have been chosen for closer analysis in the thesis. This selection is based on the particular cellular agriculture, insect and plant-based initiatives – both private and non-profit – that have represented a core momentum of the latest AP movement and are the most well-known players in the sector. They include companies, advocacy groups and venture capitalists that have all played instrumental roles in shaping the AP space: from being the first to create material proofs of concept (e.g. Mark Post) or reach $1 billion company valuations (e.g. Hampton Creek), to becoming established as the leading hubs through which researchers, funders and policymakers are connected to the goal of AP development (e.g. New Harvest, Good Food Institute). Some date back to the beginnings of this more recent movement – a time that can be traced tentatively to the late 1990s, with a notable rise in activity in the first decade of the 2000s – while others have emerged over the last five years (although, as will be shown in Chapter 5, the heritage of the recent AP movement can be traced back much further than this period). This section introduces the actors that form the primary case studies of the thesis, before reviewing recent academic debates on the latest AP movement.

2.1.1 Cellular agriculture

Cultured meat is perhaps the most famous of the cellular agriculture family, largely due to the burger tasting event that occurred in 2013 in London. In a paper following the event, Post (2014) describes the burger’s creation. First a biopsy of muscle tissue was taken from a living cow, from which satellite cells were separated and placed in a growth medium (to date, foetal calf serum has been the most widely used though it is

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5 See Chapter 4 for further discussion of the rationale behind the project’s choice of case studies.
6 For ease of reading, terms such as ‘APs’ or the ‘AP movement’ refer to activities during the early 21st century, unless otherwise stated.
hoped a synthetic alternative will be developed to reduce economic and ethical costs.\(^7\)

Once in the medium, the cells divide and after 7-8 weeks batches of 1.5 million cells were placed in a collagen gel. The cells were formed into a ring-like structure wherein they naturally contract. After sufficient muscle maturation (typically 3 weeks) a muscle fibre was formed. Post (2014) calculated that 10,000 fibres were used to create the 85g beef burger that was presented in London in 2013.

The burger was the end product of a project that had begun in 2009, led by Mark Post at Maastricht University. It followed a 2005-2009 study funded by the Dutch government during which a group of Netherlands-based scientists and an industrial meat producer formed the In Vitro Consortium (Jönsson 2016). It was later revealed that Google co-founder Sergey Brin was a primary investor in Post’s cultured burger, which reportedly cost €250,000 (US$325,000) to create (Fountain 2013).

Since the burger event Post has co-founded Mosa Meats as a spin-off company to his research at Maastricht University. Other companies that employ similar production methods are Modern Meadow in Brooklyn, NY, and Memphis Meats in San Leandro, CA. Modern Meadow recently debuted prototype cultured meat jerky at a press event, but the company is predominantly focussing on developing animal leather through cell culture. At the time of writing, Memphis Meats is one of five cultured protein start-ups to graduate from IndieBio, a biotechnology accelerator programme in San Francisco (with an additional but now rebranded programme in Cork, Ireland).\(^8\) Memphis Meats was founded by two academics, cardiologist Uma Valeti and stem-cell biologist Nicholas Genovese, and Will Clem, a BBQ restaurant owner and biomedical engineer. Their most prominent activity to date has been the creation of a prototype cultured beef meatball and chicken nugget, both of which were presented and tasted at high-profile press events (Zaleski 2016; Bunge 2017). Both Memphis Meats and Mosa Meats have predicted that their cultured meat products will be on the shelves by 2021 (Wellesley 2017).

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7 Another method is to create continuous cell lines through genetic/chemical engineering that theoretically would provide ‘immortalised cells’, thereby reducing dependency on fresh tissue samples (Stephens et al forthcoming). This approach is currently being used in the New Harvest-funded cultured turkey project at North Carolina State University.

8 www.indiebio.co/
Other cellular agriculture ventures beyond meat products have since appeared. Perfect Day (formerly Muufri) was the first non-meat venture within the cellular agriculture family. It was founded in 2014 by New Harvest’s Isha Datar, Ryan Pandya (a biological and chemical engineer graduate), and Perumal Gandhi, (a Master’s student in biomedical engineering) to produce milk in cell culture. Although sharing principles with the cultured meat process, the methods employed by Perfect Day do not involve any animal-based cells as the source material. Instead yeast cells are genetically engineered to produce milk proteins (casein and whey), to which other micronutrients and water are then added to create milk “from the bottom up” (Muufri 2014). This process has since been categorised as ‘acellular’ production due to the end product containing ‘no cellular or living material’ (New Harvest 2016), while Stephens et al (forthcoming) use the term ‘fermentation-based cellular agriculture’. In 2014, the team were accepted on to an IndieBio programme in Cork, Ireland to develop an initial proof of concept. During this time they gained considerable media attention, leading to a meeting with Hong Kong-based venture capital firm, Horizon Ventures, who subsequently invested $2 million seed funding in the company. Gandhi and Pandya, with two additional employees at the time of writing, are now based in the San Francisco Bay Area and are working towards their Series A funding round and an improved prototype. The majority of cellular agriculture ventures to date are based in the US, with exceptions in Maastricht, Netherlands (Mosa Meats, co-founded by Mark Post) and Tel-Aviv, Israel (SuperMeat). Joining Memphis Meats and Perfect Day in California are Clara Foods (egg whites) and Geltor, formerly Gelzen (gelatine). In addition to Modern

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9 New Harvest (2016) refer to cultured meat as a ‘cellular agriculture product’, so-called because it is made of ‘living or once-living cells’. This contrasts with what they term ‘acellular agriculture products’ which ‘contain no cellular or living material’. The products of Perfect Day and Clara Foods are examples of this latter grouping. Stephens et al (forthcoming) instead suggest ‘tissue engineering-based cellular agriculture’ and ‘fermentation-based cellular agriculture’ to better capture this distinction and to address the potential confusion between having ‘cellular agriculture product’ as a sub-category of the collective group name of ‘cellular agriculture’. This thesis adopts the nomenclature of Stephens et al (forthcoming) when distinguishing between the sub-categories, and uses ‘cellular agriculture’ to refer to the movement of cell-based protein ventures as a whole.

10 The typical funding model for Silicon Valley start-ups begins with a ‘seed’ phase (usually between $500,000 to $2M). This is followed by Series A during which the company develops a more substantial long-term business model and more sophisticated prototypes. Series B supports the company’s transition from the development stage, with investment in this round helping companies to expand their teams and refine the final product. Series C is the final round and is designed to help companies scale; capital raised in this phase can, in certain cases, reach to the hundreds of millions (see Delventhal 2017).
Meadow (leather; meat jerky), Affineur (coffee) are also based in Brooklyn, New York. The small but slowly rising number of academic research projects – led predominantly by PhD students – have been largely based in North America, with an exception being one now-terminated project at King’s College London, UK.

Other key influencers in this space include advocacy groups dedicated to supporting and promoting cellular agriculture. During the early 2000s the non-profit organisation New Harvest was founded by Dr Jason Matheny, now led by Isha Datar and based in Brooklyn, New York. New Harvest began as an online hub for those interested in cultured meat research, and the organisation has since played a pivotal role in connecting researchers, funders and entrepreneurs, as well as engaging with policymakers to address regulatory challenges to cultured meat and other cellular agriculture products. Notable events in New Harvest’s lifespan include Matheny advising the Dutch government in 2004 to fund research into cultured meat, which led to projects at Utrecht University as well as the establishment of the In Vitro Meat Consortium (Graham 2014). New Harvest was also instrumental in securing funding for Mark Post’s research at Maastricht University which resulted in the creation of the burger (Stephens 2010). New Harvest hosted a conference on cellular agriculture in San Francisco in July 2016, with plans for a second event in New York in October 2017. They also co-hosted the First International Symposium on Cultured Meat with Post in Maastricht in 2015, a conference which now runs annually and is currently the main European gathering of researchers, entrepreneurs and funders in the cellular agriculture calendar.

Another notable advocacy group that has recently emerged is the Good Food Institute (GFI). Based in Washington, DC, the non-profit organisation describes itself as helping to support the future of APs ranging from cellular agriculture to plant-based proteins. Amongst the activities it carries out are supporting already established AP companies, fostering aspiring AP entrepreneurs, educating governmental bodies on the benefits of APs, and connecting AP ventures with funding opportunities. GFI’s director is renowned animal activist Bruce Friedrich, formerly at PETA, who is also a Managing Trustee in

venture capital fund New Crop Capital which specialises in AP solutions. Friedrich has been a vocal proponent of the term ‘clean meat’ in place of in-vitro or cultured meat, a shift that has been met with mixed reviews within the sector. For Friedrich (2016), the use of the term ‘clean’ is both a clearer and “more accurate” way of describing cultured meat; in his words:

“...‘clean meat’ is similar to ‘clean energy’ in that it immediately communicates important aspects of the technology...When we talk about the fact that this meat is “clean,” our conversations immediately focus on the aspects of this technology that are the most relevant and beneficial for consumers: namely, that this meat is cleaner than the meat from slaughtered animals, both in terms of basic sanitation and environmental friendliness.”

Concerns have been raised elsewhere in the sector about the moralising and condemnatory overtones of this term due to the implied message that conventional animal foods, and those who eat them, are always and inherently ‘dirty’. This is just one example of the moralising dynamics that are examined in more detail in Chapters 7 and 8.

2.1.2 Insects

Entomophagy (the human consumption of insects) and insect farming have long been established practices in non-Western countries (van Huis et al 2013). It has only been in the last five years however that edible insect ventures (both production and consumer-facing) have gained momentum in the West, most notably in Europe and the US. Those producing insects in North America include Entomo Farms, Big Cricket Farms, and Tiny Farms (although the latter had yet to open commercially at the time of writing). Consumer-facing brands include Six Foods, Chapul, Bitty Foods and Exo in the US; Eat Grub, CroBar and Ento in the UK; and, Bugalicious and Insecta in the Netherlands (House 2016). Companies and research projects developing insects as animal feed have also risen, such as Ynsect (France), AgriProtein (South Africa), Entobel (Vietnam) and PROTEINSECT (a European-wide research initiative). Of the consumer-facing brands, products have largely ranged from protein bars and confectionery foods (e.g. crackers, cookies), to flours and powders intended for baking

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12 www.newcropcapital.com/.
13 Fieldwork interview, London (October 2016).
and/or as supplements for drinks (e.g. smoothies) and meals (e.g. breakfast cereals). Some companies sell whole insects for home-cooking and novelty foods such as scorpions set within boiled sweets, but these product types are much less frequent. Crickets are the most commonly used insect species in these ranges, followed by mealworms, buffalo worms and grasshoppers.

Many of these products are stocked in specialist health stores, though a few ranges (mostly in the US and Netherlands) are available in more mainstream food retailers. Insect-themed cafés, restaurants and pop-up dining experiences have also featured over recent years in larger urban centres such as London, Austin and New York; an example includes Eat Grub’s recently launched monthly supper club in Highbury, London, that allows guests to sample Thai-inspired insect dishes accompanied by craft beers and insect-based cocktails (Eat Grub 2017).

2.1.3 Plant-based proteins

Plant-based analogues have a long history in human diets (Davies & Lightowler 1998; Shurtleff & Aoyagi 2014). What distinguishes the latest generation of plant-based APs, however, is the geographies of their production – i.e. Silicon Valley and surrounding areas – and the marriage of food with Big Tech in their production methods. One of the most renowned of this group is Beyond Meat. Founded in 2009 by Ethan Brown, the company is headquartered in Los Angeles. It has attracted investment from some of the highest profile names in Big Tech and business, including Bill Gates, Twitter co-founders Biz Stone (a renowned vegan) and Evan Williams, Seth Goldman (the founder of Honest Tea) and venture capital firm Kleiner-Perkins Caufield & Byers, one of the first firms to invest in Amazon and Google (Brownstone 2014; Fehrenbacher 2014). The company currently offers a selection of plant-based ‘chicken’ strips (Southwest-style, Grilled and Lightly Seasoned) and two ‘beef’ crumbles, and recently launched a ‘beef’ burger (“The Beast”). The ‘chicken’ strips are made with a mixture of soya and pea proteins whereas the ‘beef’ crumbles use only the latter, which - the company claims - makes them the only soya-free and gluten-free beef alternative on the market (Beyond Meat 2014).

The importance of the sensory properties of Beyond Meat’s products has been repeatedly stressed by the company since its inception. Their mission is to achieve a texture, appearance, taste and functionality that cannot be distinguished from
conventional meat. Brown does not simply wish to compete with existing meat analogues such as Quorn, but to also compete with meat itself by delivering “a seamless experience for carnivores, like shifting from one meat to another” and ultimately inspiring a mass transition away from animal-based proteins (Watson 2014). He believes that the technology behind his products is the key to achieving greater success than existing meat analogue brands; the exact process is patent-protected but it is known to have been developed in collaboration with scientists at the University of Missouri and involve large extruders which “use steam, pressure and cold water to knead and knit the proteins and plant fibres into a specific physical arrangement” (Brown 2013).\(^\text{15}\) To date public reviews have largely praised its convincing meat-like texture and the Beyond Chicken, Beef and Beast ranges are currently available in Whole Foods stores across the US and in a number of other health and specialist food retailers. A prominent moment in the company’s history was the successful negotiation with Whole Foods in Boulder, CO, to have the Beyond Meat burger stocked in the meat case with other conventional meat cuts and products (Leber 2016).

Another high-profile company developing meat (and cheese) alternatives from plant proteins is Impossible Foods, founded in 2011 by Stanford biologist and physician Patrick O. Brown. Based in Redwood City, CA, latest figures place the company’s total equity at $182 million raised over a series of four funding rounds,\(^\text{16}\) with eight investors including Horizon Ventures, Bill Gates, Khosla Ventures and Google Ventures.\(^\text{17}\) The company has made headlines most recently due to its development of ‘plant blood’. Derived from a plant-based version of the heme molecule also found in animal blood, ‘plant blood’ is intended to more fully replicate the metallic taste and colour of red meat, thereby bringing meat analogues considerably closer to the conventional meat experience (Fehrenbacher 2014; Rusli 2014). The company has since launched its Impossible Burger in the US, targeting mid- to high-end restaurants rather than food retailers.

\(^{15}\) The lead scientists initially involved in Beyond Meat’s development were Professor Fu-hung Hsieh and food researcher Harold Huff, both based at the University of Missouri.

\(^{16}\) www.crunchbase.com/organization/impossible-foods#/entity.

\(^{17}\) In 2015 it was reported that the company had declined an acquisition offer between $200-300 million from Google (MoneyTimes 2015).
Egg protein has also received the attention of Silicon Valley. Hampton Creek Foods – now rebranded as ‘Just’ – was founded in 2011 by Josh Balk (Senior Director of Food Policy at the Humane Society of the United States (HSUS)) and CEO Joshua Tetrick to address the current ethical and environmental issues of intensive chicken farming. The initial aim of the San Francisco-based company was to replace “all factory-farmed eggs in the US market” by targeting manufacturers of processed foods which use egg as an ingredient (e.g. pasta, baked goods). However, after discussions with Whole Foods the food retailer was interested in a consumer-facing branded product, thus leading Hampton Creek to develop their first range of Just Mayo products (an eggless mayonnaise made with pea protein). Their products have since expanded to include salad dressings and cookie dough, and can be found in a range of low- to high-end food retailers across North America and China. The company also negotiated a deal with the Compass Group, one of the biggest food distribution businesses in the US, which resulted in Hampton Creek products becoming the primary ranges across multiple US universities and other institutions. At the time of writing, latest figures report that the company has raised $120 million over five funding rounds from 26 investors, including Khosla Ventures, Horizon Ventures, Founders Fund and Google co-founder Eduardo Saverin.18

2.2 Conversations so far: A review of AP scholarship

Given that the particular AP ventures discussed in this thesis are a relatively new phenomenon, academic scholarship on their activities remains similarly nascent. Of the studies that do exist, these can be broadly categorised into four distinct themes: (1) scientific reviews of the prospects and challenges of the different AP technologies; (2) studies on consumer attitudes and acceptance; (3) considerations of the ethical and spatial implications of APs; and, (4) critical analyses of the promissory narratives of APs. The following section provides a brief overview of these four themes, before then identifying how this thesis seeks to build on them.

2.2.1 Prospects and challenges I: Cultured meat

To date scientific reviews on cellular agriculture have mainly focussed on cultured meat, and range from discussions on production methods to environmental analyses of an industrial-scale cultured meat sector. While the first patented method for cultured meat production was filed in 1999 by Willem van Eelen in the Netherlands, Benjaminson et al's (2002) study a few years later is generally considered the first successful attempt to grow in-vitro edible muscle. The team, funded by NASA, used skeletal muscle explants from goldfish to create in-vitro fish fillets. The project was intended to explore possibilities of meat production during space travel, both as a source of nutrition and also crew morale. While the study presented promising findings and the taste tests were generally positive, NASA later ceased funding of the project (Stephens 2010).

Discussion of the potential avenues and challenges for applying skeletal muscle tissue-engineering techniques – previously limited to regenerative medicine and other biomedical applications – to meat production have since continued (e.g. Edelman et al 2005; Datar & Betti 2010; Post 2012). Amongst the challenges highlighted, the main concerns typically focus on scaling production to be competitive with conventional meat systems, the need for further research into translating biomedical techniques to meat production (e.g. establishing safe and stable cell lines from livestock animals), producing economically and ethically-sound alternatives to current growth media, and the significant obstacle posed by consumer rejection (Datar & Betti 2010; Post 2012; Bhat et al 2015; Kadim et al 2015). However, developments made over the last decade in regenerative medicine, stem cell technology and bioengineering are seen as holding great promise for improving the economic efficiency and scalability of cultured meat production. It is anticipated that with further research efficiencies in cell culture techniques can be made so as to enable the translation of these primarily medical-based technologies to meat production (Moritz et al 2015). To achieve full mimicry of conventional animal meat, further work is also needed to develop efficient culture methods for other compositional matter in meat (e.g. fat tissue, blood vessels), and for

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19 Cell lines refer to “a population of cells that can be sustained indefinitely in controlled conditions, growing the cell numbers so they can continuously replace the existing stock and generate enough cells to be harvested for research or production use” (Stephens 2010, 397). Within medical contexts, the development of cell lines has been conducted with human, rat and mouse cells; thus a significant knowledge gap exists in translating these methods to agricultural animals (Datar & Betti 2010).
enabling muscle fibres to grow large enough to fully simulate the texture of conventional cuts of meat (Post 2014).

Another major stream of cultured meat literature has concerned its environmental impacts. A small number of hypothetical life-cycle analyses (LCAs) have been conducted to assess the potential GHG emissions and land, water and energy use from industrial-scale production of cultured meat. Based on these metrics, some project the environmental-footprint of cultured meat to be substantially lower than conventional meat production, particularly when compared with beef (Fig. 1) and in the event that liberated land could be reclaimed for environmental services (Fiala 2010; Tuomisto & de Mattos 2011; Tuomisto & Roy 2012; Tuomisto et al 2014; Sun et al 2015). Others have expressed more caution in their results: for example, Mattick et al (2015b) state that while cultured meat may require smaller quantities of land and agricultural inputs, these advantages could be negated by the substantial energy requirements needed to industrially replicate the biological processes (e.g. digestion) of livestock animals. All studies acknowledge a considerable degree of uncertainty due to current knowledge gaps regarding exactly how cultured meat methods might be scaled up, plus current ambiguity over the precise inputs (e.g. growth medium) and processes (e.g. ‘exercising’ the muscle fibres) of production. In addition to environmental impacts, calls have also

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![Fig. 1: “Comparison of primary energy input, greenhouse gas (GHG) emissions, land use, and water use of cultured meat production with conventionally produced European beef, sheep, pork and poultry per 1000 kg edible meat as a percent of the impacts of the product with the highest impact in each impact category (Supporting Information for details of the data used).” (Tuomisto & de Mattos 2011, 6122).](image)
been made for further investigations into the economic and social implications of large-scale cultured meat production (Mattick et al 2015a; Stephens et al forthcoming).

While comparable assessments are yet to be conducted for the other products within the cellular agriculture family, it is anticipated that they will share many of the same prospects and challenges of cultured meat identified in these literatures. However, a number of key informants in the sector told me that the composition of conventional milk, eggs and gelatine is much simpler than meat, and as such it is expected that the development time for the rest of the cellular agriculture group will be much shorter and (relatively) less technically challenging than for cultured meat.

2.2.2 Prospects and challenges II: Insects and plant-based proteins

As of October 2016, a total of six LCAs had been conducted on five edible insect species (Halloran et al 2017). Oonincx et al (2010) and Oonincx & de Boer (2012) are typically cited as the earliest studies and pre-date the 2013 FAO report (van Huis et al 2013). Oonincx et al (2010) evaluated GHG and ammonia (NH$_3$) emissions for five insect species – mealworms, house crickets, migratory locusts, sun beetles and Argentinain cockroaches – each at different stages of maturation, while Oonincx & de Boer (2012) conducted an LCA on mealworms.\(^{20}\) The first study concluded that insects could provide a more sustainable meat alternative due to four of the five species emitting lower GHGs than pigs and ruminants, and all five species producing much lower NH$_3$ than conventional livestock.\(^{21}\) Oonincx & de Boer (2012) found similar positive results in which they assessed the global warming potential (based on GHG emissions), land use and energy use of mealworm production. In comparison with conventional milk, chicken, pork and beef production, the authors found global warming potential and land use to be much lower for mealworms; however, due to mealworms requiring ambient temperatures, energy use was higher than milk and chicken production, and at a comparable level to pork and beef.

Since these early studies, others have completed similar assessments of large-scale production of black soldier flies (Smetana et al 2016), cricket farming in Thailand

\(^{20}\) While the latter two species are not considered edible the authors state they were examined due to their potential as a source of protein extraction, and offer a time and resource efficient option for large-scale production (Oonincx et al 2010).

\(^{21}\) These evaluations are based on CO$_2$eq./kg of mass gain (Oonincx et al 2010).
(Halloran et al 2017), semi-intensive snail farming in Italy (Zucaro et al 2016), and the water footprint of mealworms (Miglietta et al 2016). Other LCAs have been conducted on different insect species fed on waste streams, both in the contexts of producing human food directly (Lundy & Parrella 2015) and as an alternative animal feed (Salomone et al 2017). While accounting for variations according to different species, maturation stage, rearing environments and feed-type, these analyses – along with the FAO’s 2013 report – generally conclude positive results overall and thereby present insects as a more environmentally-friendly alternative to conventional livestock. An exception however is Lundy & Parrella’s (2015) study of crickets in which they argue the environmental gains of cricket production compared with conventional livestock will depend on the nature and quality of the insect diet and the systems of livestock production they are compared to: for example, the authors found limited reductions in ecological impacts when feeding crickets a similar diet to intensively-reared chickens. However, they highlight that other insect species may provide more efficient alternatives than crickets.

There is a relatively established literature on the nutritional value of insects, in part due to the long history of entomophagy and its relation to food security in numerous non-Western contexts. Many studies have served to highlight the importance of insects in the diets of particular populations, both nutritionally and culturally (DeFoliart 1995; Bukkens 1996; Banjo et al 2006; Ramos-Elorduy 2008; van Huis et al 2013). More recently, analyses have turned to consider the role of insects in global diets as a potentially healthier alternative to conventional livestock. Findings have shown that many species – per kg – are lower in saturated fats and cholesterol, and have favourable levels of iron, fibre, protein and other micronutrients (van Huis et al 2013). In the event of edible insects developing as a global industry, the need for appropriate food safety practices has also been raised (Belluco et al 2013). In addition, current regulatory ambiguity and a lack of standardised practices for the rearing, processing and selling of insects as food and feed, low consumer awareness (and thus demand) of already established insect markets, and consumer aversion to insects as food have all been identified as further barriers to the expansion of the edible insect sector (van Huis et al 2013, 154).
Comparisons between the production systems of conventional livestock and plant-based protein have also received growing attention in recent years, particularly as the ecological and health impacts of the former have come under increased scrutiny (Steinfeld et al 2006). Climate benefits of transitioning from animal-intensive to plant-based diets have been repeatedly shown (Stehfest et al 2009; Scarborough et al 2014; Springmann et al 2016), often based on the latter systems requiring less water, energy and land (Pimentel & Pimentel 2003). For example, Harwatt et al (2017) found that substituting beef for beans in US diets would directly contribute 75% towards the nation’s 2020 target of reducing GHG emissions. In the UK, Milner et al (2015) conclude that even modest dietary changes towards plant-based foods would result in considerable GHG reduction, as well as marked improvements in public health. Further studies point to a link between consumption of plant-based foods (e.g. fruit, vegetables, whole grains, nuts) and lowered risks of cancer, cardiovascular disease and other chronic illnesses, thought to be due to certain nutritional components including beneficial fatty acids, antioxidant vitamins, protein, fibre and phytochemicals (Hu 2003; Tuso et al 2003; Forum for the Future 2016). There is a growing consensus that a transition towards a larger proportion of plant-based production and consumption in place of animal-derived foods would result in considerable environmental, health and ethical benefits (de Boer & Aiking 2011; Sabaté & Soret 2014).

2.2.3 Consumer acceptance and the ‘yuck’ factor

A key challenge identified across all of the APs discussed in this thesis is consumer acceptance and, in turn, adoption into everyday consumption practices. Consumer studies on cellular agriculture have to date largely focused on cultured meat. Initial gut reactions amongst participants have tended towards negative feelings (e.g. disgust, suspicion), often due to the perceived unnaturalness and dystopian visions of industrialised and ‘soulless meat’ (van der Wele & Driessen 2013; Laestadius 2015; Laestadius & Caldwell 2015). The majority of studies report a range of positive and negative feelings (Hocquette 2015; Verbeke et al 2015): a Finnish study found relatively low levels of support for cultured meat (Vinnari & Tapio 2009), while separate assessments conducted in Belgium and the Netherlands showed that with further discussion the yuck factor was reduced due to participants considering cultured meat in relation to current industrial livestock practices (van der Wele & Driessen 2013;
Verbeke et al 2015; see also Stephens et al forthcoming). These results are further supported by Bekker et al’s (2017) recent study which showed that increased knowledge of the proposed sustainability benefits of cultured meat affected participant attitudes, with many expressing greater willingness to try it. The authors conclude that consumer attitudes towards cultured meat are both content- as well as affect-based.

At the end of 2016, New Harvest – in collaboration with the Environmental Law Institute (ELI) – conducted the first US focus groups on attitudes towards cultured meat and other cellular agriculture products (Hart Research Associates 2017). The results were similarly stratified in terms of positive and negative reactions. None of the participants had heard of the term ‘cellular agriculture’ prior to the study, and most related this and the ‘cultured meat’ nomenclature to associations with science and technology, genetically-modified organisms (GMOs), science fiction and ‘unnatural’ products. While some saw potential benefits of cellular agriculture to improve agricultural efficiency and meet rising population food needs, others expressed concern regarding unintended consequences and the potential of ‘opening the door’ further to scientific interventions on modern living.

A number of consumer studies concerning insects have shown that visceral factors play an important role in acceptance amongst Western consumers. Megido et al (2004) found that slimy textures, or the visible presence of body parts (e.g. legs, head, antennae) reduced the likelihood of adoption for many participants. Cultural associations are also a barrier as many Western participants viewed insects as dirty, creepy or as pests rather than as a food source (Lensvelt & Steenbekkers 2014). To overcome the yuck factor, some have suggested introducing entomophagy at a younger age (Tranter 2013), and creating products with ground-up rather than whole insects to avoid the visceral disgust of visible body parts (Rumpold & Schluter 2013; van Huis et al 2013). House (2016) calls for further research on the practices of insect eating and consumption, arguing that existing studies have largely focussed on predicted consumption behaviour at the population level. Instead he contends that much more can be learnt from research on early adopters in the West and understanding the different factors that have already contributed to their adoption and, importantly, repeat consumption of insects.
Consumer acceptance of plant-based proteins is typically predicated less on feelings of disgust than visceral dissatisfaction. Many consumers – particularly men – reportedly find the texture, appearance and taste of plant-based APs inferior and/or unpleasant in comparison to animal foods (Hoek et al 2011). Some consumers also note the unfamiliarity of preparing vegetarian meals as a barrier to plant-based eating (Schösler et al 2012) The high cultural value of meat has also been identified as an obstacle to increased adoption of plant-based products: although dietary shifts towards plant-based foods are rising, particularly amongst younger populations (Marsh 2016), there remains a strong cultural association between animal meat and notions of power, masculinity, virility and nutritional superiority that are typically absent in relation to plant-based proteins (Adams 1990; Fiddes 1991; Kubberød et al 2002a).

However, recent figures show that sales of plant-based APs have dramatically increased over recent years, with retail sales in the US experiencing an 8.1% rise between 2016-17 to the value of $3.1bn (Watson 2017). These trends have in part been attributed to rising concerns of the ecological and ethical impacts of current livestock practices (Mintel 2017). Other factors include increased associations between animal foods – particularly red meat – and negative health impacts (Kubberød et al 2002b), and also food safety concerns in light of recent food scares (e.g. avian flu, BSE, foot and mouth) (Berndsen & van der Pligt 2004). The chewy texture and potential presence of ‘bodily’ matter in meat (i.e. gristle, blood vessels, skin) have also led to a reduction in meat consumption for certain demographics (e.g. young women) (Kubberød et al 2002a).

2.2.4 Spatial and ethical (re)imaginings

As described above, environmental and health benefits have been recurring themes of the claims associated with cellular agriculture, insects and plant-based proteins. Added to this are promises of more ethical systems of protein production. Both cellular agriculture and plant-based proteins have often been framed as a ‘victimless’ form of protein production given their potential to remove the need for the intensive rearing and slaughter of animals. In the case of cultured meat the potentiality for entirely new, more compassionate relations between humans and food animals has also been explored, such as livestock living happily as companion animals while their cells are harvested pain-free for their human neighbours (van der Weele & Driessen 2013; van der Weele & Tramper 2014). In doing so, there is potential for animal eating to become
an accepted vegetarian or vegan practice (Miller 2012). It may create a scenario in which the current disconnect between animal (life) and meat (death) that many eaters exhibit is no longer a moral dilemma: as Hopkins & Dacey (2008, 594) suggest:

"While in vitro meat is in some sense an animal product, it does not have to be an animal part. In fact, what in vitro meat would do is to create a new physical reality that actually does match up with the self-deceptive and self-serving situation many consumers already imagine when they buy meat at a grocery store. Consumers pretend meat is a disembodied material that does not have its source in a killed, feeling, animal. With in vitro meat, however, this disembodiment is real rather than imagined and is morally relevant."

Given this potentiality, the authors conclude that it might be “our moral obligation to develop” cultured meat (ibid, 579), a sentiment that has been suggested elsewhere by other commentators (Stuart 2013; Sage 2014; Schaefer & Savulescu 2014).

Ethical arguments of this kind have been less prevalent in the promissory narratives of insects, arguably due to this AP still requiring the farming and killing of animals. These necessities have precluded certain organisations (e.g. GFI, PETA) from supporting edible insect development, often on the grounds that insects present a far greater ethical dilemma than conventional livestock if counted in number of lives lost per kg of meat. However, some approach this ethical question through the lens of potential suffering, arguing that insects lack a sufficiently sophisticated nervous system to experience pain and thus present a less morally perilous option than conventional livestock (Meyers 2013). Reassurances that insects are ‘happy’ with small amounts of space have also featured in the narratives of insect advocates to counter concerns of the intensive farming model being transferred to a new type of livestock.23

Visions of new geographies of production have also been evoked. For cellular agriculture this has largely been framed through imaginings of protein production divorced from animal bodies and relocated to clean, high-tech and expertly-controlled settings of industrial and/or urban spaces (e.g. New Harvest 2017). A shared vision across all APs is that, due to efficiency gains, considerable areas of land could be released from current livestock production and transferred to wildlife conservation and other ecological services (Tuomisto & de Mattos 2011). As Welin & van der Weele

22 Personal conversation with animal welfare organisation during fieldwork (2015).
23 Fieldwork interview, SF Bay Area (October 2015).
(2012) suggest, factors such as these point to a potential future of improved human relations with animals and the environment.

Tied to this notion of spatial reconfigurations has been a recurring vision of APs as a solution of more (abundance) from less (land, water, energy etc.). This framing has featured particularly in the context of predicted food scarcity due to increasing global populations and rising climate instability. The idea of APs as spatially shrinking protein production while being able to feed more people has been a powerful narrative. Jönsson (2016, 735) observes how cultured meat is often evoked as a “fleshly cornucopia of endless meat supply” through which “a single biopsy could theoretically feed the world”. Similar perceptions have been reported for edible insects: in her paper ‘The world in a box?’, Yates-Doerr (2015) notes how insect researchers perceive a more food-secure future materialising through the small test boxes of insects in their labs. As Jönsson (2016) suggests, these “hopes for new food production systems are also hopes for new socio-spatial configurations” that promise greater care and engagement with the environment, more compassionate (non)human relations, and a techno-utopian vision of abundance wherein food production is liberated from current spatial and ‘natural’ limits.

2.2.5 Critical viewpoints: Unpacking the promises of APs

In addition to hopeful visions and technical reviews, there are also those who have applied a critical lens to the latest APs. These can largely be divided into those who have problematised and/or directly challenged the claims made by AP advocates, and others who have sought to unpack the ‘work’ being done by these promissory narratives.

Of the studies that have problematised APs, some have attempted more tempered analyses of the implications – both positive and negative – of these future foods. Welin et al (2012) highlight that while novel technologies may answer existing ethical dilemmas, they also produce new questions and obligations. Hopkins & Dacey (2008) examine an extensive range of moral issues relating to cultured meat (that are arguably also relevant to other APs), from concerns of food safety and transparency to perceptions of technofixes as ‘moral cowardice’. Another prevalent discussion point has focussed on the extent to which APs solve or exacerbate the controversial notions of ‘happy animals’ and ‘humane meat’, and whether they are inherently (dis)respectful to
animals and the environment (Schaeffer & Savulescu 2014; Stănescu 2016). Welin (2013, 33) also notes that the potential socio-spatial reconfigurations of APs – such as the relocation of protein production to industrial and/or urban centres – may for some be viewed “as a serious threat to a living countryside and could trigger popular protest”. Yet while highlighting possible tensions and the need for continued critical analysis, all of these authors remain generally hopeful of the potential for APs to create, in different ways, a more ethical and sustainable food system.

More critical opinions, however, have also been voiced. In contrast to proponents of the ‘animal liberation’ narrative, Miller (2012, 45) has questioned the moral acceptability of APs such as cultured meat becoming viewed as vegetarian and vegan foods. Such an eventuality, he states, risks maintaining the centrality of animal foods in human diets and the existing power imbalances between (non)humans (see also Sexton 2016). In his view, cultured meat exists “not as a radical solution to the violent subjection of nonhuman animals within industrial capitalist cultures, but rather as a further symptom of the remarkable extent of this violence” (ibid, 45). Miller also voices concerns of cultured meat representing the continued turn to technofixes over less politically-favourable socioeconomic reforms. This critique is shared by Giampietro (2016a, 52) who describes cultured meat as “a classic example of a techno-fantasy generated by the Cartesian dream of prediction and control”. In another contribution within the same publication, Giampietro (2016b) also questions the ability for this AP to successfully challenge the political economic ‘lock-ins’ of the global food system, of which he identifies vested industrial interests in grain subsidies as a major obstacle to disturbing current livestock production. In other critical analyses, Sexton (2016) raises concerns over recent plant-based APs encouraging a selective consumer ‘gaze’ that obfuscates the problematic health, environmental and ethical consequences made material in their end products and supply chains.

Critical reviews have also focussed on the role of promissory narratives in the evolution of APs. As previous literatures have shown – particularly within STS – promises regarding a novel technology’s benefits and opportunities are instrumental in shaping both its discursive and material trajectories (Brown & Michael 2003). This is particularly relevant to cellular agriculture: as we have seen, while the movement has had some high-profile unveilings of a small number of products, it has to date been
predominantly characterised by discourses on the anticipated benefits it will bring to food production. Following Stephens (2013), we can thus think of cultured meat and the broader cellular agriculture movement as a ‘promissory science’ – that is, a phenomenon that “exists more in the speculations and promises of its supporters than in terms of scientific results and marketable products” (Hedgecoe, cited in Stephens 2013, 162). While the number of material products is currently much higher for insects and plant-based proteins, the literatures reviewed above reveal how these APs have likewise evolved through an array of promissory claims concerning both their viability and their potential benefits.

Such narratives have been shown to serve a number of important purposes: one such example is the normalisation of these innovations as ‘food’. Stephens & Ruivenkamp (2016) argue that the discursive and material presentation of APs within familiar eating contexts – such as preparing, cooking and eating cultured meat as a burger in 2013 – works to transition APs from ‘unidentified ontological objects’ (Stephens 2013) to instead become matter ‘in place’ (Douglas, cited in Stephens & Ruivenkamp 2016). A second function of technological promises is to attract personnel, publicity and, crucially, capital for continued research and development. Stephens (2013) notes that the vision of cultured meat as ‘animal liberation’ has been influential in shaping both the landscape of stakeholders involved in the sector (i.e. by attracting people motivated by this particular cause), as well as the material development of the technology itself (e.g. the development of synthetic growth media to replace foetal bovine serum). Framings of APs feeding the world and solving global ecological, health and ethical crises have also served to capture media hype and the attention of investors. Post (2014) describes that the 2013 cultured burger event was primarily motivated by the aim of gaining private sector and public interest, as the failure to do so earlier in the research project had resulted in the Dutch government terminating the team’s funding.

With some key exceptions (Miller 2012; Pluhar 2010; Jönsson 2016), critical discussions of the prominent role private investment has played in the recent AP movement have been largely absent. Jönsson (2016) calls attention to the pathways of AP development that have already been shaped by the conditions of private funders: for example, the requirements by Sergey Brin for Post and his team to work in isolation from the usual academic channels of scientific research (see also Andreotti 2014); to
change from the original launch product of a sausage to a hamburger; and, to host a high-profile publicity event that amplified the vision of cultured meat as a ‘silver bullet’ solution to an array of global crises. Not only are these factors reminders of the increasing influence of private capital on the trajectories of scientific research, but they also further entrench the “well-rehearsed story of innovators delivering biocapitalistic salvation” (Jönsson 2016, 739).

2.3 Conclusion

While this existing scholarship has contributed important insights on the recent AP movement, this thesis argues there are a number of aspects that remain critically understudied. To date, there have been few attempts to ‘zoom out’ and consider APs within the broader contexts of the geographies, materialities, political economies, and biopolitics of the contemporary agri-food system. This is the task I attempt in the thesis, and in doing so hope to contribute not only to AP scholarship by providing a critical food geography lens on this sector, but also to ongoing debates across critical food studies, visceral geography, economic geography, political economy and alternative food research.

What follows in this study, then, is an attempt to situate APs within the ‘bigger picture’ of modern food production and consumption. Central to this task is to examine questions that have yet to be fully addressed in previous AP scholarship, such as those concerning the shared timing of this recent AP movement (‘why now?’), its particular geographies (‘why Silicon Valley?’), production methods (‘why high-tech?’), and choice of end products (‘why burgers, mayonnaise or cookies?’). To attend to these questions, the thesis turns to recent thinking across agri-food debates, economic geography, and critical food studies to consider the recent AP movement within the following contexts: first, how APs both simulate and disrupt previous patterns of capitalist penetration into agricultural life through technoscience; second, how current and historic links between food and social anxieties can reveal insights into the shared timing and geographies of the latest APs; third, how APs both simulate and disrupt existing trends of food biopolitics and the moral economies that characterise modern-day eating; and fourth, how the sensory properties of APs reveal the visceral realm as a new site of biopolitics,
through which the expansion of agri-capitalist interests and the fate of the post-Anthropocene are being managed. The thesis now turns to a more in-depth review of these literatures, and how they contribute to the empirical analyses conducted in the later chapters.
CHAPTER 3 | Literature review

The aim of this chapter is to situate the thesis’ contributions within existing critical food scholarship and introduce the theoretical concepts that underpin its analysis. It begins with a brief review of recent agri-food debates, highlighting how previous discussions help to contextualise APs as the latest case of industrial penetration into agricultural processes. These debates also serve to highlight the tensions and contradictions inherent to ‘alternative’ foods, and the pitfalls of treating the post-production sphere as passive and apolitical. While these studies provide a useful starting ground to examine the ways in which APs represent both simulation and disruption to existing agri-food practices – and ultimately as a form of ‘eating for the post-Anthropocene’ – it is argued that engagement with critical thinking elsewhere in food geography and other social sciences is needed to more fully attend to the research questions of this project. The chapter proceeds with a review of these further debates, bringing together recent discussions on responsible consumption, social anxiety, and the visceral (bio)politics of taste and edibility. The chapter concludes with a summary of the main points.

3.1 Situating APs in agri-food debates: From structural Marxism to the consumer turn

Early agrarian theory by authors such as Marx, Weber and Kautsky has continued to occupy debates within agri-food studies over the last century (Marsden 1990). At the core of the Agrarian Question, first posed by Kautsky in 1899, was the problematisation of what he saw as the increasing penetration of capitalism into agricultural processes. A particular factor he identifies as driving this transformation is the influx of industrial means into food production:

"Bold prophets, namely those chemists gifted with an imagination, are already dreaming of the day when bread will be made from stones, and when all the requirements of a human diet will be assembled in chemical factories ... But one thing is certain. Agricultural production has already been transformed into industrial production ... Economic life even in the open countryside, once trapped in eternally rigid routines, is now caught up in the constant revolution which is the hallmark of the capitalist mode of production."

(Kautsky, cited by Goodman & Watts 1994, 1)
Through the increasingly ‘industrial character’ of agriculture (Goodman & Watts 1994), Kautsky was an early voice in forecasting a future in which nature has been completely brought into and reproduced through the domain of industrial mechanisms, a trend he predicts will ultimately lead, amongst other things, to the demise of small family-run farms under larger agro-powers (McLaughlin 1998).

This structuralist Marxist reading has continued to inspire agri-food discussions (Marsden 1990). From the writings of Lenin and Chayanov in the early 20th century to the resurgence of early agrarian theory during the 1970s, 80s and 90s (Marsden et al 1986), such literatures have approached the agrarian question primarily through the lens of social relations of production – that is, analysis has centred on revealing how the countryside has been refashioned through, and in the image of, the processes and logics of the capitalist industrial complex (Goodman et al 1987). These studies have sought to disturb the veil of commodity fetishism and expose the unequal social relations produced by the extension of primitive accumulation into agriculture. Examples of such relations have been explored through the dispossession and consolidation of rural, landless workforces, the increasing privatisation of the means of food production, and the transition to ‘Fordist’ regimes of agriculture that mirrored the assembly lines and mass consumption practices of other industrial sectors (Marsden 1992) (although see Goodman & Watts (1994) for a critique of Fordist analyses).

The landmark study of Goodman et al (1987) reveals two specific and parallel mechanisms by which capital accumulation has worked to ‘outflank’ nature (Murdoch et al 2000) in agricultural production: appropriationism and substitutionism. The former relates to the ways in which natural processes are replaced by industrial production methods as a means of overcoming the natural limits to continued profit extraction (e.g. land and space, biological time, genetic variety). Substitutionism refers to the replacement of foodstuffs with ‘non-agricultural components’ as the ultimate move in bypassing the biological vagaries and capital limits of food production. The authors chart these two processes through the cases of farm mechanisation, the Green Revolution, product ‘fractionation’, bio-chemically fabricated foods, and the more recent turn to biotechnology.

Added to these concerns, the interrelated rise of globalisation became a central focus of agri-food debates during the 1990s, with many turning to political economy to theorise
this transition. Under this broad analytical church discussions largely sought to make sense of the logics and material impacts of the expansion of agriculture across transnational scales and spaces – from its incorporation into ‘global regimes’ of international politics and trade systems (Friedmann 1982, 1993; McMichael 1994, 2009; Margulis 2014), to the shift towards ever-longer supply chains, larger-scale production models, standardised practices, and the concentration of power to smaller numbers of global agribusinesses (Marsden et al 1986; Acre & Marsden 1993). In these analyses, capital accumulation – typically exercised through transnational agribusiness – remains the central driving force responsible for these trends; as such, we find globalisation largely conceived as “the latest stage in the development of the capitalist space economy” (Murdoch et al 2000, 111).

The political-economic approach has, however, been challenged for its enduring lack of specificity in its treatment of the food system. By remaining at the level of global trends and tending towards essentialist assumptions of inevitability, critics argue that the possibility for, and empirical evidence of, on-the-ground resistance and ‘customisation’ is severely overlooked (Goodman & Watts 1994; Marsden 1995; Jackson 2004). As Murdoch et al (2000, 109) highlight, while parallels can certainly be drawn between the globalisation of agriculture and other industrial sectors, they note that “in other important respects, the development of the food system follows its own course” [my emphasis]. Acknowledging this specificity, Marsden (1995) argues, is essential for understanding the uneven development of rural spaces that continues to emerge despite mainstream trends towards globalisation and standardisation.

The multiple ways in which agriculture resists capital appropriation has been well documented (see Page (1996) for a comprehensive review). A core motivation of these literatures has been to produce a more ‘active’, ‘embedded’ and heterogeneous reading of the food system that acknowledges the material and socio-political, as well as economic, processes that shape its development (Marsden 1995). An influential strand of this agenda has worked to highlight the agency of nature in shaping food system practices. Goodman et al (1987) provide an early example of this: while their study clearly exhibits political-economic tendencies in its focus on the industrial ascendency over agriculture, the authors abandon an essentialist view of these dynamics and instead present appropriationism and substitutionism as reactions to nature’s
resistance to capitalist modes of production. The ‘organic’ inherent to conventional food systems thus loses the passive role so often assigned to it in political-economic analyses; rather, in the authors’ words, agriculture is understood as ‘confronting’ capitalism “with a natural production process”, which has consequently required industrial interests to adapt to its biological, spatial and temporal specificities (Goodman et al 1987, 1).

The agency of nature in agri-food systems continues to shape debates and has led to (re)inforced calls for ‘hybrid’ understandings of agricultural processes (Whatmore 2002), with many promoting the use of actor-network theory (ANT) as a viable tool for such enquiries (Whatmore & Thorne 1997; Goodman 2001). Not only does this approach encourage greater symmetry in agri-food analyses, whereby (non)human actors are perceived as equal agents in shaping food system practices, but it also seeks to disturb the dualistic tendencies of earlier literatures that retained ‘nature’ and ‘society’, and ‘production’ and ‘consumption’ as largely disconnected spheres (for a useful overview see Winter 2005). According to Whatmore (2002, 123), the comprehension of agri-food systems through notions of ‘systems of provision’ (Fine & Leopold 1993; Fine 1994; Fine et al 1996) and ‘commodity chains’ (Friedland 2001) tends to ascribe greater importance to production, with food often treated as “little more than the terminus of the crop” (cited in Winter (2005, 610)). Goodman (2002, 271) presents a similar critique, declaring at the turn of the 21st century that “consumption is still very much a theoretical ‘black box’” in agri-food debates.

As with the treatment of nature, the theoretical neglect of consumption by political-economy approaches renders the post-production sphere in a similarly passive and apolitical state (Goodman & DuPuis 2002). The fears, desires, bodily materialities, cultural politics and geographies of consumers are thus left critically unanalysed, as are the ‘matter’, practices and conventions through which agri-food travels between field to plate, and beyond (Jackson 1999; Whatmore 2002; Cook 2004; Evans 2011a, 2011b). In response, cultural approaches have sought to populate debates with more corporeal ‘body-subjects’ (Lupton 1996; Probyn 2000; Murray 2008), while others have pointed to the ‘quality turn’ as a salient example of consumer resistance to the globalising forces of industrial agri-food capitals (Nygård & Storstad 1998; Murdoch & Miele 1999; Murdoch et al 2000).
In these latter literatures, commentators argue that anxiety and distrust over the safety, nutrition and socio-ecological impacts of food production has translated into greater consumer demand for higher quality products (Renting et al 2003) – with ‘quality’ understood in multiple and often interrelated ways as embodying the values of local, higher welfare, ‘slow’, organic and fair trade, to name a few (Goodman et al 2012). Such activities (amongst others) have led some to declare a new paradigm in agrarian systems, characterised as a transition from a previously ‘productivist’ model of agriculture to one of ‘post-productivism’. Paraphrasing Ilbery & Kneafsey (1997), Evans et al (2002, 316) describe the characteristics associated with post-productivism:

“...a shift in emphasis away from quantity to quality food production; the growth of alternative farm enterprises, conceptualized as ‘pluriactivity’; state efforts to encourage the development of more traditional, sustainable farming systems through agri-environmental policy; the growing environmental regulation of agriculture; and the progressive restructuring of government support for agriculture.”

These developments have been linked to recent spatial transformations of rural landscapes (Lowe et al 1993; Marsden 1998), as well as the rise in popularity of alternative food networks (AFNs) – with the latter conceptualised as “forms of food provisioning with characteristics deemed to be different from, and perhaps counteractive to, mainstream modes which dominate in developed countries” (Tregear 2011, 419). Examples include farmers’ markets, community-supported agriculture (CSA), vegetable box and organic schemes, and Fair Trade goods. AFNs have been heralded as a welcome challenge to the practices upon which the globalised agri-food system has expanded – from the lack of transparency, the ‘facelessness’ of its supply chains, and the now well-recorded impacts on (non)human welfare, to its aggressive regulatory and labour reforms that have undermined rural economies across the world (Ilbery & Kneafsey 1999; Renting et al 2003).

However, recent commentaries have warned of the challenges posed by the increased ‘mainstreaming’ of AFNs over recent years that risk “assimilation and dilution” of their original values within the corporate food complex (Goodman et al 2012, 5). Critics have pointed to the hypocrisies of the commoditisation and incorporation of AFNs into global food channels, arguing that in many instances the ‘alterity’ of these networks has become another victim to capitalist appropriation (Goodman & DuPuis 2002; Guthman 2003, 2014). Moreover, AFNs have been subject to criticism concerning their
(re)inforcement of ‘good eating’ as the activity of certain class-based, Northern-centric and racial demographics (Goodman M. 2004; Hayes-Conroy & Hayes-Conroy 2010), thereby perpetuating unequal access to safe, nutritious food and leading to many “missing guests at the table” of agri-food reform (Goodman D. 2004, 13).

3.1.1 APs as simulation of, and disruption to, current agri-food practices

While admittedly non-exhaustive, this review of recent agri-food debates is intended to illustrate some of the main themes that have occupied critical discussions on food production and consumption over recent decades, and which offer insights to the topic of this thesis. Taking heed of earlier critiques (Goodman & Watts 1994; Evans et al 2002; Goodman, D. 2004), the aim of this thesis is not to position APs as emblematic of a new paradigm in agri-food systems. This may seem contradictory given the title of the thesis and its argument of APs as the materialisation of ‘eating for the post-Anthropocene’ – a claim which appears to suggest the emergence of a new set of epoch-defining agri-food practices. Yet there is a subtle but important distinction to be made between the promise of APs and the means by which they are materialising. While their promise is to disrupt the ‘bad stuff’ of current livestock systems and ‘reinvent (protein) food’, they are also offering complete simulation of the visceral and eating practices of conventional animal foods. Moreover, despite the distinct shift in geographies (Silicon Valley) and expertise (Big Tech) of protein production, as will be shown APs are clearly operating under mainstream capitalist logics and are following the well-trodden path of using the market and consumer choice to drive sustainable reform.

So while they promise a new paradigm in protein production systems, closer inspection reveals a more complex picture of both disruption and continuance in different ways. To borrow Goodman & Watts’ (1994, 39) phrasing, the thesis thus examines APs as both “convergence and divergence” from current agri-food processes, and seeks to answer David Goodman’s (2004, 11) specific call of exploring “the ways in which the ‘old’ might shape the ‘new’”. In the context of APs, the influence of the ‘old’ is identified then as the continuation of market-led and productivist ‘solutions’ to food system crises, the persisting trend towards ‘responsible’ rather than reduced consumption, and the continued appeal to consumer tastes for, and visceral expectations of, animal-derived foods.
At the same time, as noted above, there are characteristics of the recent AP movement that represent distinct ‘divergences’ in current agri-food processes, and thus require equal attention. These include the shifting geographies, networks and materialities of protein production (namely to Silicon Valley) and consumption (i.e. middle-class eaters in the Global North), and the changing narratives and actors involved in the project of global food security.

The agri-food debates discussed above provide a useful starting ground for attending to these factors. For instance, the thesis adopts a similar approach to those set out by the ‘consumer turn’ in these literatures – that is, the recent AP movement is examined through a non-binary lens so that production and consumption are viewed as relational and co-constituting processes. The agency of nature and (non)human actors, as well as the importance of consumer practices and visceral understandings are also central to the thesis’ approach, as is the acknowledgement of both the usefulness and critical limitations of political-economic analyses of food systems.

Yet to more fully explore the ways in which APs represent both simulation and disruption to contemporary agri-food processes, and ultimately as a form of ‘eating for the post-Anthropocene’, requires an extension of these existing debates. First, it is necessary to further unpack the moral dimensions of agri-food networks – that is, how moral sentiments and anxieties have shaped the materialities, geographies and practices of food, and have given rise to ‘moral economies’ predicated on ideas of ‘good’ and responsible eating (Goodman M. 2004; Jackson 2010). Given the moral-laden nature of the AP sector through their promises of a ‘better’ future, it is necessary to understand how these novel products reinforce or differ from existing traditions of ethical and responsible food practices. Of particular interest to this project are the mechanisms used, why and whom by, to responsibilise consumers to become ‘better’ eaters, a subject that has received relatively little attention in traditional agri-food debates. To attend to these points, the chapter makes the case for engaging with the theoretical work of Michel Foucault, particularly his concept of ‘biopolitics’. This approach is also adopted to reveal the instances whereby consumers resist their responsibilisation by other social actors. In doing so, the thesis contributes to recent calls in agri-food studies for less passive and apolitical treatments of the post-production sphere (Goodman & DuPuis 2002).
The primary form of resistance in the context of APs that the thesis examines is the so-called ‘yuck factor’ that has largely characterised public reactions to date. This phenomenon invites engagement with a growing body of literature both within and beyond geography that has been concerned with the (bio)politics of taste and the ways in which ‘things become food’ (Roe 2006). A further consequence of the post-production realm being treated as passive and apolitical in previous scholarship has been to neglect the highly intimate and emotional nature of food and eating practices. This approach forgets that we both “sense and make sense” of the foods we eat through a variety of means (Evans & Miele 2012), from the discursive performance of labelling and promotional advertising, to the look, smell, feel, sound and taste of the material products. As Guthman (2015) notes, there are limits to the degree of agri-food appropriation or substitutionism that will be accepted by eaters, and that visceral understandings and expectations of food represent some of the most powerful barriers to these processes. As mentioned at the start of this thesis, AP developers must carefully manage the tension between the novelty of their products (disruption) and meeting the deeply entrenched visceral expectations and desires associated with protein foods (simulation). A review of literatures that have examined the (bio)politics of taste and edibility is thus necessary to inform the critical analysis of this balancing act in later chapters. In doing so, the theoretical groundwork will be established to examine how the visceral has shaped the development pathways of APs, acting both as a barrier and opportunity for gaining consumer acceptance, and ultimately creating a new form of food biopolitics.

A final line of enquiry is to consider the contemporary moment within which APs have emerged, and how this has shaped the ways in which APs have either reinforced or diverged from the materialities, narratives and geographies of existing agri-food practices. As the following section highlights, feelings of anxiety and fear – particularly at a societal level – have underpinned many previous and existing moral economies of food (Jackson 2010; 2015). It is argued that considering the role social anxieties have played in the emergence of the latest APs is key to addressing some of the central research questions addressed later in the thesis concerning the shared timing (‘why now?’), and the particular actors, methods, narratives and geographies that have characterised the sector to date.
3.2 Food and eating in the Anthropocene: A responsibilised era

3.2.1 Anxious eating

As the previous section highlights, agri-food debates have done much to reveal the shifts in spatialities, political economies and materialities that have characterised agricultural production – and to a growing extent, consumption – over the last century. Yet a tendency of such debates has been to overlook the moralising dynamics inherent to modern food systems. In response, recent work on the ‘moral economies’ of food has sought to more fully explore and make explicit the relationship between ethical sentiments and individual consumption behaviour (Jackson 2010). In particular, this scholarship has focussed on the dramatic rise in food products – largely documented in the retail contexts of Northern economies – that have seemingly thrown off the veil of commodity fetishism and instead “veritably shout to consumers about the socionatural relations under which they were produced through carefully wrought images and texts” (Bryant & Goodman 2004, 348). As discussed above, these ‘alternative’ products have emerged in response to rising consumer anxieties over the impersonal, disconnected and ambiguous natures of modern globalised food networks. Through images of smiling farmers and bucolic scenery (Goodman M. 2004), and descriptions of ‘happy’ animals (Miele 2011) and notions of ‘fairness’ and ‘justice’, we thus see the domain of everyday food consumption increasingly characterised by ‘boundary objects’ that work to (re)connect food consumers with the (non)human assemblages of production – or at least idealised versions of these assemblages – and ultimately encourage purchase (Eden 2011).

Such developments have inspired academic study of consumption not only as a mechanism of self-fulfilment but also of political action (Crewe 2001). This politicisation of self-making through food choice – both symbolically and physiologically – has been described as indicative of a new way of ‘doing’ politics (Barnett et al 2017), creating new opportunities whereby individuals – particularly the already politically-minded (Adugu 2014) – can exercise an ‘ethics of care’ through consumption (Goodman 2010). In this way, alternative food products and networks act to ‘mobilise the consumer’ (Miller & Rose 1997), encouraging them to become what some term ‘consumer-citizens’ (Mol 2009), ‘reflexive consumers’ (Guthman 2003), or ‘ethically competent consumers’
(Miele & Evans 2010) through the mediation of their food choices (Clarke et al 2007). As Michael K. Goodman (2004, 893) notes, through such processes the contemporary concerns of development, social justice, and environmental and animal welfare have increasingly become “the political and moral ‘business’ of consumers across much of Europe and the US”. Buying food is thus rendered as an everyday and convenient way – particularly for the relatively well-off in the Global North – of ‘making a difference’ (Adams & Raisborough 2010). As Eli et al (2016, 70) state: “With money as power and markets as political arenas, consumers are imagined as wielding both the means and the responsibility to bring about change” through the simple act of ‘voting with their wallets’.

Before unpacking the theme of responsibility further, I first want to turn to the role of anxiety as a catalyst of contemporary moral economies of food and eating. More specifically, of interest is the approach taken by social and cultural geographer Peter Jackson (2010, 152) to explore anxiety as a “social issue rather than a purely personal concern”. In a series of recent studies, Jackson has worked to situate anxiety – both performed and felt as a ‘social condition’ – as an added dimension to the political and moral economies of food (see also Jackson & Everts 2010; Jackson 2015). Drawing on Beck’s (1992) Risk Society and others who have traced evolutions of social anxiety in times of world conflict, nuclear threats, and more recently, terrorism (Ungar 2001), Jackson makes the case for viewing food-related anxieties as something similarly experienced and embodied by individuals, yet at the same time having the capacity to be connected to broader societal concerns and events. Recent ‘food scares’ such as BSE and salmonella (to which the more recent outbreaks of avian and swine flu may be added), are some of the more high-profile examples whereby consumer anxiety can be seen as extending across the complexities and multiplicities of globalised food networks. It is the ‘hidden’ materialities and relations of these networks that food scares expose, revealing – but only partly – the many opportunities within modern food systems whereby individual welfare may be compromised. The ‘scary’ or anxiety-causing part of food scares can thus be understood as not only the immediate threat of bodily harm (i.e. through ingestion of unsafe food), but also the loss of control they represent over a fundamental function of everyday life. As Freidberg (2004, 6) comments, “what alarms people is the evidence that the risks hidden in an increasingly industrialized and
internationalized food supply are neither well understood by science nor well regulated by government”.

The perception of ‘risky’ foods in the modern (Northern) zeitgeist, however, extends beyond those contaminated by pathogens or zoonotic disease alone. In similar ways to food scares, recent discourses proclaiming a global ‘obesity epidemic’ have likewise resulted in heightening social anxiety around eating. The ‘costs’ of obesity at the societal and planetary level are often quick to find in such discourses: for example, economic loss due to lower work productivity and overstretched health services, higher ecological impacts through greater resource use, and even threats to national security (Guthman 2007). The validity of the ‘facts’ that have driven recent obesity crisis narratives have drawn extensive critique, with many studies exposing the questionable entanglements of Big Pharma and weight loss industries in their propagation (Rich & Evans 2005; Oliver 2006; Guthman 2015), and challenging the persistent demonisation of the ‘abnormal’, ‘unproductive’, often gendered body in popular culture and public health discourses (Guthman & DuPuis 2006; Murray 2008). Through these narratives, we see personal food choice again embedded within a social field of anxiety, as the individual is burdened with ‘correctly’ managing one’s weight to ensure the prosperity of the greater social good.

The perceived threats of obesity and food scares serve as just two examples of food-related issues that have contributed to current social anxieties around eating. While they represent materially different ‘hot situations’ (Stassart & Whatmore 2003) in the world of food, they share in their capacity to add new and ever-changing concerns that individuals today are encouraged to manage through their everyday food practices. Of interest to Jackson (2010) is how these situations and their discourses of risk have given rise to particular psychological and industrial responses. For example, he notes the tendency for such discourses to “involve the scapegoating of innocent Others who society's moral guardians encourage us to think of as a convenient ‘folk devil’” (ibid, 152). In the food cases he examines, he finds recurring evidence of participants locating the sources of their anxiety in various gendered, racialised and geographically-defined Others, ranging from the ‘ignorant housewife’, the ‘foreign producer’, and the materialisation of these fears in the ‘risky’ bodies of food (particularly meat) itself.
The question of who takes on the role of ‘society’s moral guardians’ within social fields of anxiety also raises key points for concern. Elsewhere, Jackson and Everts (2010, 2804) have noted how the creation and perpetuation of objects of anxiety by certain social actors – both public and private – can create a type of “justified moralising” which may “invoke heroic action and serve a variety of political purposes, either to subdue public anxiety or to maintain it”. In other words, they highlight that in fostering a ‘culture of fear’ sufficient room is made for heroic counter-actions by state and/or industrial actors on behalf of the social good. In a time of ‘crisis’, democratic procedures and due diligence are often sacrificed in the name of urgency and the supposed need for a response ‘right now’ (Bauman 2006; Glassner 2009). Risk discourses of tipping points and the impending collapse of civil society thus provide an enabling backdrop to legitimise certain social actors to adopt the role of ‘society’s moral guardians’ and push their ‘solutions’ through to the public in the less critically-minded atmosphere of hype and anxiety. To illustrate the price paid for this culture of fear, Glassner (2009, xii) refers to a quote by former US National Security Advisor Zbigniew Brzezinski in the Washington Post:

“Fear obscures reason, intensifies emotions and makes it easier for demagogic politicians to mobilize the public on behalf of the policies they want to pursue.”

Recalling the literatures discussed earlier, it has been shown that a similar effect can be powerfully perpetuated by agri-food industries in their efforts to mobilise the public to keep buying food. Within an atmosphere of crisis there is great capacity for commercial as well as political opportunities to be furthered under the banner of societal good. We see this potentiality materialised through the rise in ‘higher welfare’ products amidst food scares (Miele & Lever 2013), and in diet foods as an antidote to the obesity ‘epidemic’ (Guthman & DuPuis 2006). It has also served to accelerate political and financial support for agri-tech ventures, such as GMOs, under the recent rhetorical claims of a ‘global food crisis’ (Davis Stone & Glover 2011).

Guthman and DuPuis (2006, 441) interpret this persistence of market-led and often technocentric responses to food-related crises as part of neoliberalism’s broader solution to “commodify everything” and to create “purchasable solutions to the problems it generates”. In order to overcome the limits to accumulation presented by food scares and obesity, the authors highlight the recurring strategy of markets to
simply commodify alternative forms of eating (such as ‘safer’ or lower calorie products). Such alternatives thus provide convenient fixes that purportedly remain kind to (non)human bodies, while simultaneously remaining kind to capitalism (Guthman 2015). A further convenience of this approach for commercial interests is the scapegoating of food system failures on to individual consumers. Rather than holding the system and certain actors within it accountable, it is individuals that are most often burdened with the responsibility to manage the associated risks through self-surveillance and mediation of their food choices (Mansfield 2012a). The mechanisms and implications often involved in this process of scapegoating will be discussed more in Section 1.3.

3.2.2 Turning to tech (again)

It is important to briefly comment here on the recurrently technocentric nature of these market-led responses to food-related social anxieties. Whether the crisis in question is food scares, obesity or global scarcity, a common feature of counter-actions in recent times has been the distinct turn towards technological fixes. As previous commentators have highlighted, we can understand the prevalence of food technofixes over socio-political reform as part of the broader ideological shift towards neoliberalist values. Again as Guthman (2015) argues, such approaches remain kind to markets by providing spatial and socioecological fixes in the forms of eating bodies and the techno-industrial appropriation and substitutionism of food production (Goodman et al 1987).

Central to the appeal of technofixes is what Giampietro (2016a, 52) describes as the “techno-fantasy generated by the Cartesian dream of prediction and control”. From the Green Revolution, to GMOs and now the latest APs, a shared and defining belief that runs at the heart of these food innovations is the promise of “benevolent technoutopias” and “biocapitalistic salvation” (Jönsson 2016, 739), predicated on the total conquest of the vagaries and inefficiencies of Nature through technoscience. With the stakes often set at the levels of planetary salvation and utopic futures, debates concerning the use of technofixes typically take on highly moralistic tones. For many, the promise of technology and our ability to use it to solve societal crises call on our ‘moral duty’ to pursue its development (Hopkins & Dacey 2008; Stuart 2013). For others, however, technofixes represent ‘moral cowardice’ by political and industrial leaders in their continual use of the markets as the primary arena for political change (Schneider 2013).
Other and related concerns regarding food technofixes have ranged from the increasing control and ownership of ‘life’ by corporations (Marris 2001; McAfee 2003); the neo-colonialist tendencies that often frame Northern-centric technoscience as ‘saving’ the South from impending crises and under-development (Escobar 1995); the recurring failure of previous technofixes to fully realise their promises, and their tendency to intensify existing or create new socioecological injustices (Shiva 1991); and, the uncertainty of long-term human health and environmental risks, particularly those related to harmful ‘leakages’ of modified genes and industrial ingredients into eating bodies and ecosystems (May 1999; Pence 2002; Augoustinos et al 2010). The fears of this perceived intermingling of materialities, particularly between eater and eaten, bring to mind existing literatures on the ‘vitality’ of food which will be explored later in this chapter (Bennett 2010), and will come to inform the project’s investigation into similar attitudes towards the latest APs.

Building on these literatures, the ways in which APs have been framed and materialised as the latest technofix salvation with respect to food will form a critical part of the thesis’ empirical analysis. Of particular interest will be the ways in which the ‘technological’ aspects of these innovations have served to reinforce and/or create new political economies, geographies and materialities within existing agri-food networks. Moreover, it will examine how AP developers manage the technological identity of their products – particularly in relation to techno-utopic visions – and the (bio)political work being done by this framing (or indeed its absence) within different, but also new, contexts. The analysis will also keep in mind the critiques that have been prompted by previous technofixes, examining the extent to which APs may raise similar concerns regarding biocapitalist control over Nature, the continued power imbalances between North and South, and their potential to exacerbate and/or provoke new socioecological issues.

3.2.3 A new (geological) age of anxiety

As noted above, social anxieties relating to food have in many instances instigated and legitimised the turn to technofixes as necessary responses. While issues such as food scares and obesity certainly remain amongst the prolific ‘folk devils’ of current food-related fears (Jackson 2010), I argue that contemporary social anxieties around food have taken on new meaning and scale over recent years with the emergence of the
Anthropocene diagnosis. Originally proposed by earth system scientists at the turn of the 21st century, this diagnosis proclaims that we are now living within a new geological epoch, one which is characterised by human activities reaching such a level as to have become a dominant and destructive force on the Earth System (Crutzen & Stoermer 2000). In the words of Steffen et al (2007), humans are now affecting the Earth System “outside the range of natural variability”, and consequently as a species we face stark and urgent decisions if we are to prevent a near-future of severe climate instability, resource scarcity and civil unrest on a planetary scale.

It is through the specific context of Anthropocenic tipping points – particularly relating to global food insecurity – that APs have emerged, and to which they promise pathways to realising a better future (i.e. the post-Anthropocene). In this way, the thesis views APs as a materialisation of Anthropocenic logics in that their existence is both owed to and legitimised by the particular crisis narratives and social anxieties of the Anthropocene. To develop this argument, it is necessary to briefly examine the logics inherent to the Anthropocene diagnosis, a task conducted in the following sections.

3.2.3.1 The Anthropocene: Diagnosis and debates

From its beginnings as an informal comment in Crutzen and Stoermer’s (2000) article for the International Geosphere-Biosphere Programme (IGBP), a growing and increasingly interdisciplinary network of intellectual, political and artistic activities has evolved around the Anthropocene diagnosis. Its proposal has inspired far-reaching debate across the Academy, and gained prolific engagement in both policy arenas and popular culture. It has prompted the recent genesis of several academic journals (e.g. Anthropocene, The Anthropocene Review), conferences, books, artistic endeavours, and global research networks. It has also provoked global media headlines that range from the concerned – “The age of Anthropocene: Should we worry?” (Foley et al 2011) – to the desolate – “Goodbye forever, friendly Holocene” (Rockström 2016) – and the more alarmist – “Humanity’s terrifying impact on Earth justifies new Anthropocene epoch” (Carrington 2014). The scale and speed of this uptake within the relatively short lifespan of the Anthropocene idea has been remarked upon by many, and has led some to talk of the ‘Anthropo-scene’ as a way of capturing the broad intellectual, creative and political space that has been catalysed through its diagnosis (Castree 2015; Lorimer 2017).
A number of recent overviews have served to make sense of the Anthropo-scene (Castree 2014, 2015; Lorimer 2017; Schulz 2017). A central theme identified in these studies is what Lorimer (2017) terms the “scientific question” of the Anthropocene phenomenon – that is, the intellectual enquiry led by earth system scientists that aims to build on Crutzen & Stoermer’s original concept by empirically demonstrating the end of the Holocene and the beginnings of a new geological age. Fundamental to such endeavours has been attempts to clarify and agree on the official start date of this epochal shift, a task that has wide-reaching political and ontological implications. Numerous start dates have been suggested: the earliest proposals have linked the catalyst of Anthropocenic effects to the faunal change caused by early human hunting (Barnosky et al 2014) and the rise in agriculture in 8,000 BC (Ruddiman 2003). Lewis & Maslin (2015) have proposed 1610 or 1964 based on the occurrence of ‘golden spikes’ in geological records.\(^{24}\) Some have linked the beginnings of the Anthropocene to the Industrial Revolution (e.g. Steffen et al 2011), while the onset of the Great Acceleration in the mid-twentieth century and, more specifically, the first nuclear bomb explosion at Alamogordo, New Mexico in 1945 have also been proposed (Steffen et al 2015; Zalasiewicz et al 2015). Alongside these debates, questions have been raised regarding the choice of metrics (e.g. CO\(_2\) levels, biodiversity depletion) and scientific methods upon which the Anthropocene start date should be based (Waters et al 2014; Hamilton 2015). Moreover, Hamilton (2015) queries to what degree Anthropocenic effects should be measurable across the entirety of the Earth System – i.e. beyond solely geological and/or meteorological evidence – to warrant the declaration of a new geological epoch, and also highlights that changes on such a scale require a considerable time period to become detectable, thus throwing doubt on more recent proposed start dates.

The political implications of the formalised Anthropocene start date are considerable (Dalby 2013). The argument for an early date serves to create a more spatially, culturally and thus politically neutral interpretation, in that it disallows more concrete finger-pointing to particular geographies and populations and instead assigns climatic shifts to an obscure category of ‘early humans’. This position has been critiqued as “exonerating modern humans from blame for environmental decline” (Hamilton 2013, \(^{24}\) A ‘golden spike’ represents global changes to the Earth System recorded in a number of stratigraphic deposits worldwide that correlate to provide a Global Stratotype Section & Point (GSSP) (see Lewis & Maslin 2015).
While a start date linked to the Industrial Revolution or Great Acceleration would assumedly evoke a more spatialised interpretation – i.e. pointing to industrialised economies in the North as the primary causal agents – some have challenged that the very term ‘Anthropocene’ continues to deny more geographically-nuanced readings through its maintenance of a species-level narrative (Malm & Hornborg 2014). As such, Anthropocenic debates continue to reproduce discourses of ‘mankind’ as causal agents rather than more explicitly questioning which categories of the Anthropos bear most responsibility for contributing to, and thus leading action against, contemporary planetary changes (De la Cadena 2015; Schulz 2017).

In reaction, alternative framings have since been suggested, including ‘Capitalocene’ (Moore 2017), ‘Anglocene’ (Bonneuil & Fressoz 2016), ‘Manthropocene’ (Raworth 2014), and ‘Plantationocene’ (Haraway et al 2016), all of which attempt in different ways to rebalance the lacunae inherent to the Anthropocene terminology, and more explicitly define causality and accountability (see Lorimer (2017) for useful overview). Indeed, Haraway (2015) argues that more than one name is needed to capture the multiplicities and (dis)continuities bound up in the Anthropocene diagnosis, and that part of its nomenclature should reflect the dynamic ‘ongoingness’ this era represents. Speaking to these points, she offers an additional name – the ‘Chthulucene’ – to account for the “sym-chthonic forces and powers” and the “myriad temporalities and spatialities and myriad intra-active entities-in-assemblages—including the more-than-human, other-than-human, inhuman, and human-as-humus” (Haraway 2015, 160).

3.2.3.2 ‘New’ ontologies: Humans as cause and solution to the age of anxiety

A further outcome of the Anthropocene diagnosis has been to make more explicit the links between humans and the ‘natural’ environment. While this worldview has of course been long advocated in the social sciences (Haraway 1991; Whatmore 2002; Latour 2004; Harrison et al 2004; Castree 2005), we see an encouraging uptake of this ‘new’ ontological outlook within the life sciences, as well as in international policy discourses. With the rise of Anthropocenic debates there has consequently been a surge in opportunity for bridging the division between the social and the natural that has long been held in intellectual thought (Lorimer 2017). It has inspired discussions of what the diagnosis could (and should) mean for issues such as conservation (Lorimer 2015), sustainable development (Knight 2015), and for academic fields and institutions more
broadly (Slaughter 2012; Castree 2014). Some have also examined its potential to stimulate new modes of planetary stewardship (Berkhout 2014), and an overall greater sense of humility and responsibility of care amongst the world’s population (Smythe 2014).

It is these latter two points in particular which have added further fuel to the moralising dynamics of everyday practices in the era of Anthropocenic anxiety. In other words, in accepting the connection between human activities and planetary degradation, our species has been reimagined by the Anthropocene diagnosis as both vulnerably intertwined with and powerful managers of the Earth System. This framing positions us not only as having the ability but also the responsibility to address our activities in the present to ensure a safer and more prosperous future. Recalling the words of Steffen et al (2011), the authors summarise this newly-assigned dual identity of humans in the Anthropocene as being “the first generation with widespread knowledge of how our activities influence the Earth System, and thus the first generation with the power and responsibility to change our relationship with the planet” [my emphasis].

As outlined earlier in this document, a key aim of the thesis is to understand what it is about the contemporary moment that has given rise to the latest AP movement. This brief overview has served to identify the particular social field of anxiety that has been provoked by the Anthropocene diagnosis as a key catalyst. Within this specific ‘culture of fear’, humans have been reimagined as both the problem and solution to Anthropocenic tipping points, thereby giving rise to calls for greater responsibility and action to avoid further planetary destruction. It has created a potent and global-reaching atmosphere of urgency, and declared the need for silver bullet solutions that can help us safely navigate the planet to a more climate stable, healthy and ethical post-Anthropocene. As recent commentators have put it, the Anthropocene is “a reckoning for our species” (Blasdel 2017) that demands immediate response in our new role as ‘planetary stewards’ (Steffen et al 2011).

Of interest to the thesis’ analysis then, will be the different ways this diagnosis and the broader social anxiety it has evoked has enabled APs to become a rationalised ‘solution’ at this contemporary moment. It will examine the Anthropocene’s crisis narratives, asking in what ways food-related anxieties have been reimagined under its diagnosis, whose voices are involved (and deemed legitimate), and how these discourses have
shaped the material, ideological and discursive development of the latest AP sector to date. In doing so, a case will be made for viewing APs as a materialisation of Anthropocenic logics and anxieties, through which we see the continued turn to market-led, technocentric and individualistic approaches to current global issues.

In sum, this brief review has sought to highlight the moralised arena of modern food consumption, and the specific role social anxieties – such as the Anthropocene diagnosis – play in fuelling the moral economies of eating. In particular, it has been shown how food-based cultures of fear can lead to certain social actors (such as agri-food industry), and particular approaches (e.g. technofixes) being legitimised as the necessary and most effective pathways to salvation amidst times of crisis. As many have observed (Guthman & DuPuis 2006; Eli et al 2016), such approaches serve to perpetuate neoliberal values in that the means of large-scale political change remain resolutely market-based and often technocentric, and the responsibility for realising such change is often the project of relatively wealthy, Northern consumers (Goodman M. 2004; Eli et al 2016).

But how exactly are individual consumers responsibilised towards such action? That is, through what mechanisms is this responsibilisation conducted, and is there potential for resistance? If the key to AP success is the mobilisation of ‘good’ eaters in the name of bringing about the post-Anthropocene, then it is necessary to understand exactly how this mobilisation is being conducted and the barriers it may have faced to date. As the next section outlines, it is argued that the work of Michel Foucault and those who have applied his thinking to the context of food offer promising theoretical tools to attend to these questions.

3.3 ‘Good eating’ and ‘good eaters’: The biopolitics of food

The review above has aimed to situate APs within established and systemic practices of personal food-eater relations being targeted as a site for managing societal welfare through the management of the self. This dynamic aligns closely with Foucault’s concept of ‘biopolitics’ and has been the subject of important recent work by Foucauldian geographers (e.g. Braun 2007) and other food scholars (Bobrow-Strain 2008; Paxson
In addition to this small but growing biopolitical turn in food-related studies, theoretical engagement with this concept has been widely applied across the Academy, from the fields of philosophy, political science, history, medicine, law and literature. The extent of this engagement has led Rutherford and Rutherford (2013a) to recently note, "biopolitics has fast become a most fashionable term in academia". Likewise, one can find thousands of academic publications that draw from other Foucauldian ideas such as governmentality and technologies of the self, revealing the far-reaching utility and continued exploration of Foucault's work. Indeed, this monumental turn to the Foucauldian over the last thirty years has led some academics to now argue that his thinking has “been done to death” and can be safely left behind (Cooter & Stein 2010, 109; Campbell 2011, vii), a view that is reflected in recent publications which claim to go ‘beyond Foucault’ (Clough & Willse 2011; Debrix & Barder 2012; Prozorov 2013).

While the turn to Foucauldian analyses across academia has been vast in its scope and scale, this thesis argues that his work still presents a valuable toolkit through which original and important observations can be made – particularly the application of Foucault’s ideas on power and the governance of different publics and individuals within the contexts of food-related anxieties, future food solutions and the associated political/moral economies of food production and consumption. It also offers useful insight through the concept of ‘biopolitics in reverse’ which calls attention to the potential for individuals to resist the mechanisms that act upon them, thereby allowing a less passive reading of the ‘governed’ that has often characterised previous literatures. The following sections first provide a brief overview of this theoretical grounding, before turning to examine how Foucauldian ideas have been applied within existing geography and other social science studies on food and eating.

### 3.3.1 The art of governing

Between the period 1978 to 1979 Foucault gave a series of lectures on ‘The Birth of Biopolitics’ at the Collège de France, during which he made explicit the primary focus that had occupied his academic interests to date: ‘the art of government’ (Foucault 2008, 2). His fascination lay in the radical shift in the practice of governing that occurred during the first half of the eighteenth century. Prior to this period, he argues, the art of governing had been exercised through the modality of sovereignty which used
the power to “take life and let live” as its mechanism of control over the population (Foucault 2003, 247). This power was legitimised through a system of right founded upon traditional virtues such as “wisdom, justice, liberality, respect for divine laws and human customs” (Rose et al 2006, 84), and materialised through military and judicial institutions (Foucault 1980, 95). Importantly, as much as this system of right enabled the monarch to exercise his power, it also established its limits; in other words, for royal power to remain ‘legitimate’ (and not stray into oppression) it was required to be exercised within the boundaries set by the laws and rules of the very system that verified and enforced it (Foucault 2008, 8).

In his analysis of governmental literature, Foucault reveals how this particular art of governing was displaced during the first half of the eighteenth century by a new mentality, or governmentality, which he refers to as raison d’Etat (reason of state). Rather than prioritising the ‘question of right’ and ensuring the sovereign was both enforcer of and liable to the laws of state, raison d’Etat instead concerned itself with ensuring the continued strengthening of the state and its power. In other words, the primary question of government changed from “Am I governing in proper conformity to moral, natural, or divine laws?” to “Am I governing with sufficient intensity, depth and attention to detail?” so as to enable the most effective, productive and stable functioning of the state (Foucault 2008, 18-19). This shift in priority from questioning the origin of acts of power to assessing their ability to ‘maximise’ the state was largely stimulated by the dramatic growth and industrialisation of populations around this time, a phenomenon which rendered the traditional modality of sovereignty an increasingly ineffective way of governing the people (Foucault 2008, 249). Both the micro (i.e. individual/local) and macro levels of the social body were by now escaping the reach of royal power; thus in order to realise the new ideals of raison d’Etat its principal task was to exercise a new form of ‘power over life’, or biopower.

The micro level of society was the first to be addressed (Foucault 2008, 250). Through the establishment of disciplinary institutions during the seventeenth century – the prison, the barracks, the asylum, the hospital, the school – the ‘individual body’ was...

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25 In his essay on governmentality, Foucault describes this concept as an “ensemble formed by the institutions, procedures analyses and reflections, the calculations and tactics, that allow the exercise of this very specific albeit complex form of power...” (see Miller & Rose 2006, 2).
brought under new systems of continuous surveillance and management in an attempt to ‘machine’ the individual and ‘tame’ the soul – an exercise Foucault terms anatamopolitics (Rutherford & Rutherford 2013a, 414). It was not until later in the eighteenth century, however, that attention turned to the macro level via another expression of biopower, often referred to by Foucault as biopolitics and later summarised by Gordon (1991, 8) as “the conduct of living and the living”.26 By this time the population had become a large and complex entity and as a consequence began to be seen as a ‘body’ in itself with its own characteristics distinct from “those that shape individual wills” (Rose et al 2006, 84). In order to shape these characteristics towards raison d’Etat, the task of biopolitics was to convert the population into a governable object which could be managed from a distance and consequently brought into line with the new ideals of the state (Legg 2005; Rutherford & Rutherford 2013a). As such there developed a need for gathering specific knowledges and exercising new techniques of governing which targeted the habits and activities of the population as a whole, as well as the individual wills within them. Power thus became capillary; it became a “power of regularisation” operating at all levels of the social body and no longer consisted in taking life and letting die, but rather in “foster[ing] life or disallow[ing] it to the point of death” (Foucault 2008, 247).

It was through the identification of these elements that Foucault shifted the lens of his enquiry on to the ‘how of power’, a shift that would become pioneering in academic research on social control and lead to new understandings of power, knowledge and the practice of governing populations in modern societies.

3.3.2 Techniques and technologies of power

Conceptualising power as ‘capillary’ is one of the ground-breaking features of Foucault’s work and is of critical importance to the research aims of this project. To elaborate on this idea, Foucault describes ‘power’ as neither possessed nor given, exchanged nor recovered, but rather exercised. It thus “only exists in action” (Foucault 1980, 89). What then, does this action involve? In one of his lectures given at the Collège de France during 1975-76 (part of the “Society Must be Defended” series), Foucault takes this

26 Foucault was inconsistent in his use of the term biopolitics and eventually dropped it as his academic interests developed (see Rutherford & Rutherford 2013a, 413).
question as his primary subject of discussion. Building upon the traditional understanding of power as “that which represses”, he constructs an argument for viewing power primarily in terms of “struggle, conflict and war” (Foucault 1980, 90). This is significant for two reasons: firstly, it asserts that relations of power are both the product and constituting factor of “a definite relation of forces that is established at a determinate, historically specifiable moment” – in other words, relations of power can and should be understood as historically embedded, with both their mechanisms and their goals created by and maintained through the specific cultural, social, economic, political, discursive and environmental make-up of a given time. Secondly, power for Foucault is “a war continued by other means”. The “means” to which he refers are those material sites and immaterial mechanisms through which power continues to be exercised in the everyday, the “unspoken warfare” which is installed into “social institutions, in economic inequalities, in language, in the bodies themselves of each and everyone of us” (Foucault 1980, 90). In assuming these points we begin to see how populations are never in fact liberated from the relations of power made explicit during times of conflict. Rather the ‘peace’ that follows conflict in civil society is merely a re-inscription of these forces by political systems – all that happens is a change in ‘means’ through which they are exercised.

This presents the question: what exactly are these ‘means’ through which power is re-inscribed? Foucault refers to them as technologies of government – that is, an array of techniques and apparatuses developed by the state to realise the goals of raison d’Etat. As mentioned above, these new technologies were required to a) make the population, and all those within it, visible to state power – in other words, to “centralise knowledge” (Foucault 2003, 183); and, b) to align the “desires” of the population with all that would strengthen the state and its power. With regards to the former, an arsenal of discursive technologies was developed so as to make the population ‘knowable’, and hence ‘intelligible’, to the state through language. Statistics, documents, lists, maps and tables were among many such apparatuses through which public health, education, security, sexuality and economy were made knowable to the state. In making these aspects ‘knowable’ they could thereby become ‘manageable’ and it was the new domains and corresponding institutions of government that became the sites of this management. As Miller and Rose (1990, 6) note, in order to manage domains such as the national economy or public health it is necessary to conceptualise such entities as “amenable to
management”. Thus in using discursive technologies to define the characteristics and limits of these domains, to establish their ways of reasoning and their appropriate apparatuses, to identify their problems and formulate solutions, and to legitimise their obligations and claims to power, knowledge about the social body became centralised and state power increasingly took “life under its care” (Foucault 2003, 253; Rose et al 2006).

Of critical importance to this new art of governing was the ability to produce norms from the collected data which were aligned to the ideals of raison d’Etat. This particular technology, Foucault argues, is something “that can be applied to both a body one wishes to discipline and a population one wishes to regularise” (Foucault 2003, 253). For example, through the collection and analysis of health data it is possible to make calculations on the ‘optimal state’ of health required for both an individual and the social body as a whole to carry out the efficient functioning and strengthening of the state. A norm of ‘good health’ can thus be established, one that is verified by ‘experts’ within the health-based domains of government and related external parties, and disseminated throughout the social body via discourses such as ‘official’ leaflets, presentations, educational programmes, policy documents and so on (a process which forms part of the second objective of aligning people’s desires; more on this to follow). Once established, the population can thus be divided into distinct categories: either an individual or group are seen to qualify under the standards of the norm, or they are ‘abnormal’ and therefore pose a threat to the security and wellbeing of the population. If the latter, raison d’Etat requires that the particular individual or group re-aligns themselves back to the norm, a process that may occur through the self-disciplining of the subject or, in more extreme cases, the physical removal of the subject from the wider social body.

This process exemplifies what Foucault meant by the capillary nature of power and what Miller & Rose later termed ‘governing at a distance’ (Rose et al 2006, 89) – that is, by establishing and disseminating a norm, the individual subject is responsibilised to adhere to its standards in full knowledge that, upon failure, they threaten the welfare of their fellow population and must therefore re-address their behaviour or risk being removed to an institution (either for rehabilitation or permanent separation). Empirical examples of this process are provided in Foucault’s earlier ground-breaking work on
hospitals, schools, military barracks and the penal system where the norm was entrenched in public imagination through specific technologies of government including discourse, infrastructure and public spectacle (Foucault 1995; Foucault 2003). Through these and other works, he demonstrated that the norm both disciplines the individual body into behaving and believing in a certain way (i.e. the way of raison d’État) and also regularises the behaviour of the social body towards similar goals. In a time of rapid population expansion, this technology of government became of increasing importance for the management of the social body and the subjects within it, and as we shall see still remains a key expression of biopolitics in modern society, particularly around food and eating.

3.3.3 Eating biopolitics: Mechanisms of responsibilisation

In contrast to the distinct biopolitical turn in the field of geography over recent decades (Rutherford & Rutherford 2013b), the application of biopolitics specifically to the study of food has been slightly later in emerging. It is only relatively recently that momentum has gathered in exploring the biopolitical dynamics of foodstuffs in a Foucauldian sense, and even now the literature remains relatively sparse. A notable example is Nally’s (2011) work on the biopolitics of food provisioning in the Global South. He demonstrates how the “discovery of ‘hunger’” in the Global South has led to the hungry poor becoming sites for aggressive biopolitical strategies by western agri-biotechnology companies. Framed as ‘backwards’ in their knowledge of agriculture and their unwillingness to ‘improve’, the hungry poor have subsequently been constructed as ‘threats’ to the development of agrarian capitalism and ultimately to the nutritional and economic welfare of the Global North (ibid, 43).

In order to mitigate these threats, Nally shows how agri-tech firms have framed their activities as ‘curative interventions’ that are justified as encouraging “better habits and purer morals” amongst the hungry poor. However, Nally highlights that such interventions subject them to the vulnerability of global market fluctuations and undermine their ability of self-provision. The hungry poor thus become a spatialised ‘Other’, kept in a perpetual state of scarcity so that consumers in the industrialised North may prosper. Such dynamics around the management of life appear to align with a more thanatopolitical reading of biopolitics (Agamben 1995; Mbembe 2003) and
indeed Nally draws upon this school of thought to demonstrate how the hungry poor are ‘let die’ to allow commercial interests to succeed.

Other biopolitical studies of foodstuffs follow a more affirmative tradition of enquiry, focussing instead upon how particular products and dietary regimes have encouraged the responsibilisation of the individual and positioned the state as the enabler of this process, rather than the perpetuator of eugenics-type regimes.27 These studies have shown how various actors become embroiled in complex discourses of morality, responsibility and ‘expert advice’ on foods which aim to instruct the individual on “how one should concern oneself with oneself, make oneself the subject of solicitude and attention, [and] conduct oneself in the world of one’s everyday existence” (Rose 1996).

One of the most prolific arenas for the production of these entrepreneurial subjects has been the dieting industry. In response to the rise of programmes such as Weight Watchers and the Atkins diets over the last sixty years there has been much academic attention on the mechanisms these regimes use to encourage their followers. For Foucault, dietary discourse represented another mode of ‘governing from a distance’ whereby individuals are given the tools to fashion their bodies into the types of productive and predictable subjects most suited for socioeconomic welfare (Lavin 2013).

A number of studies have built upon this understanding to show how the desires, expectations and abilities produced by dietary discourses over the last century have aligned with the wider economic developments and socio-political thinking of the time (Rabinbach 1990; Coveney 2000). For example, Lavin (2013) notes how the transition from an industrial to a service-based economy in the US during the mid-twentieth century was similarly reflected in the contemporary mainstream dietary rhetoric. Previous perceptions of the body as a machine which had proliferated during the Industrial Revolution were replaced by new thinking around the psychological aspects of diet and health. Rather than solely focussing on calorie input and metabolism, attention turned towards understanding the body’s desires and using collective emotional support and knowledge-seeking to create an empowered, more attractive self (Bordo 1993) – an ideal which was culturally and politically more acceptable as recent

27 See Rose (2001) for more affirmative reading of contemporary biopolitics.
memories of the World Wars and the Holocaust had entrenched a widespread fear of “the erasure of individual will” by totalitarian regimes (Lavin 2013).

Many have argued, however, that this promise of self-empowerment through dietary programmes produces the opposite effect; particularly within Foucauldian feminist literature, these programmes are instead seen as processes of normalisation whereby the ideals and surveillance mechanisms of the social body are internalised by the individual body (Bartky 1990; Bordo 1993; Heyes 2006). The ‘body’s hungers’ thus become an enemy to the ‘ideal self’, perceived as being outside of the norm and therefore requiring constant monitoring and discipline. Far from achieving self-mastery and autonomy, individuals instead become increasingly ‘docile’ as they physically and ideologically shape their bodies to align with the norms most conducive to the functioning of the social body.

Strategies of responsibilisation around food have also been shown to extend beyond the world of commercial dietary programmes. A number of works have been written on the biopolitical dynamics that have long surrounded child nutrition in Western countries, particularly within the school environment. Scholliers’ (2013) historical study of nutritional textbooks demonstrates how the diets and food education of children became prominent foci of state and academic attention in Belgium in the decades before and following WWI. Though Foucauldian terminology is not explicitly referenced, Scholliers’ work is notable for its identification of the Foucauldian-type technologies and expert discourses that were constructed around nutrition during this period, and how these elements responsibilised schools (particularly all-female institutions) to increase their nutritional knowledge and ultimately ensure the continued health of future generations.

In more recent times the nutritional education of children has similarly been targeted by UK and US governments in an effort to forestall the current global ‘obesity epidemic’ (Guthman & DuPuis 2006; Wright & Harwood 2009; Gibson & Dempsey 2013). Within many schools, children (and teachers) are now increasingly encouraged to monitor their diets, often through seeking expert knowledge around obesity-related risks, which in turn instructs them on how to eat healthily (Wright 2009, 1). In conjunction with this self-monitoring process, these particular individuals are additionally subjected to continuous surveillance by authority figures, most notably external health and
governmental professionals. As a result children’s lifestyle choices have become new sites for measuring compliance to or digression from what is ‘good’ for society. In the specific context of obesity discourse, state-led campaigns (inspired by Western medical thinking and promulgated by mass media) have largely influenced the public to equate weight with health and a person’s appearance with their relationship “to the good of the rest of their society and their cost to that society” (Wright 2009, 10; see also Bordo 1993; Heyes 2006).

Inferences about a person’s ‘good taste’ are also often made by the media on the basis of their weight, with a transgression in the latter often being equated to a transgression in the former (Phillipov 2013, 382). Through the production of truth claims around weight and diet and the dissemination of these truths within educational contexts, it is apparent how the food choices made by or on behalf of children in industrialised countries have increasingly become important sites of governing from a distance. Not only are individuals encouraged to ‘educate’ themselves and align their diets with expert-led conceptions of healthy nutrition, there is also a distinctly moral aspect to these dynamics whereby personal food choices have come to signify the individual’s status as moral and responsible members of the wider social body (Bordo 1993; Heyes 2006).

Our understanding of ‘good’ and ‘bad’ foods has, however, experienced a radical transformation over the last century and in turn created new foci for the discourses of morality and responsibility discussed above. The invention of new technologies and techniques in the early-twentieth century opened up the molecular level of life to scientific understanding (Rose 2001, 11-12), and resulted in our knowledge of the ‘bodies’ we ingest undergoing a significant transformation – namely, that the matter we eat contains constituent parts which can be isolated and linked to particular human health dynamics. Consequently, it is now the calcium in milk that is viewed as beneficial for bone development, the vitamin C in oranges that helps common cold prevention, and the good bacteria in dairy products that can aid digestive health. Likewise our understanding of food-borne diseases has now re-focussed to the molecular level, resulting in specific strains of bacteria and microbes being identified as the source of human health problems rather than the whole foods themselves.
Not only has this molecularisation of food opened our foodstuffs to new sites of commodification – much in the same way as has been documented with human and other non-human life (Rose 2001; Parry 2004) – but novel sites of biopolitical strategies have likewise emerged. As Scrinis (2012) demonstrates in his work on *nutritionism*, our understanding of the relationship between eater and eaten in the industrialised West has been characterised by three distinct trends over the last century: the first spanned from the late-nineteenth to mid-twentieth century and was dominated by concerns over the *quantity* of nutrients in the public diet. As others have similarly noted, the eating body was viewed in highly mechanistic input-output terms and health risks were very much defined in the language of deficiencies, particularly with regards to protein, vitamins and overall calories (Rabinbach 1990; Lavin 2013). In the decades that followed the ‘mechanical body’ became the ‘at-risk body’, giving rise to discourses around good and bad nutrients and the transition from fears of deficiency to those of over-consumption. Finally, from the mid-1990s to the present day, Scrinis notes a new emphasis on the ‘enhanced body’ whereby good nutrients can not only maintain health but also *improve* it. Notions of optimal combinations and ratios of particular nutrients now dominate nutritional advice in Western countries and as such have given rise to “nutricentric individuals” who are encouraged to optimise their bodies through the consumption of ‘good’ and avoidance of ‘bad’ nutrients (Scrinis 2012).

Parental-child nutrition is arguably one of the most significant contexts within which this nutritional biopolitics has been applied in recent times, and the perceptions of food as either *optimiser* or *risk* have become increasingly salient. As the immediate custodians of “future citizens” (Mansfield 2012a), the food choices of parents on behalf of their children are thus a critical site for ensuring the wellbeing of the social body, both in the present and in the future. As with teachers, it is clear that one technique to achieve this end has been to encourage parents to seek knowledge of the risks associated with particular foods and the ‘bodies’ they contain. This process is often bound up in implicit pressures of being a good parent while also fulfilling one’s

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28 Scrinis (2012, 271) defines nutritionism as “where the nutrient level becomes the *dominant* level and mode of understanding food, such that it does not merely inform and complement but instead tends to undermine, displace, and even contradict levels and ways of understanding and contextualising the relationship between food and the body” (original emphasis).
responsibility, as a “competent citizen”, to the optimisation and sustainability of the social body (Bobrow-Strain 2008).

Mothers in particular have been a target of these biopolitical strategies; in their respective studies of seafood and unpasteurised milk, Mansfield (2012a) and Paxson (2008) highlight the disciplining of mothers by state-led advice so that they self-manage the risk to their offspring by making the ‘right’ dietary choices. The emphasis of this advice is firmly placed on the internal components of seafood and raw milk which have been linked to both positive and adverse effects on foetuses and young children. As such, mothers are responsibilised to seek information about these foods before consuming them, a process which places the responsibility of navigating the ever-changing landscape of nutritional information predominantly on women, as well as “the burden of solving environmental health dilemmas” and other socio-political factors (Mansfield 2012a). Similarly, Bobrow-Strain (2008) illuminates comparable dynamics surrounding the responsibilisation of mothers and their choice of bread over the last sixty years, and highlights the emergence of new biopolitical discourses around risk which relate to food hygiene and purity. Thus, in addition to ensuring one’s children are eating good nutrients and avoiding the bad, the cleanliness of the foods they eat and the hygiene of the home environment have also become a “requirement of competent citizenship”, and the responsibility for maintaining these standards has again largely come to rest on mothers (Bobrow-Strain 2008).

These literatures reveal the array of material and discursive mechanisms – often propagated by industrial and/or state actors – by which consumers have been responsibilised to choose certain products over others. Such mechanisms have ranged from appeals to the cleaner and healthier materiality of foods, to notions of industrial production methods providing safer and technically superior alternatives to home cooking. The biopolitical implications of these processes include the surveillance (both self-led and from external actors) and the ultimate shaping of eating behaviours towards the macro goal of societal wellbeing, thereby encouraging individuals to connect their personal conduct to the moral, socioeconomic and physiological prosperity of society as a whole. Such analyses thus reveal eating as a central and everyday means by which people problematise “what they are, what they do, and the world in which they live” (Foucault 1992) – a view that speaks directly to the
scholarship on moral economies of food reviewed earlier in this chapter. The value of applying Foucauldian thought to food is that it unveils the how behind these modern trends towards responsibilised consumption. It helps to reveal the various mechanisms designed to intervene on individuals so that the everyday act of eating becomes a primary means “of forming oneself as a responsible, ethical subject in relation to a larger social formation” (Bobrow-Strain 2008, 23). Building on these theoretical directions, the ways in which similar and new biopolitical dynamics are materialising through APs will be examined in Chapters 7 and 8 of the thesis.

3.3.4 Biopolitics in reverse: More-than-docile bodies

One of the major criticisms of Foucault’s work is that the capillary forms of power he speaks of render any form of resistance impossible (Taylor 1986; Fraser 1989; Harper & Stein 2006; see also Butin (2001) for discussion of these critiques). Yet the concept of resistance was in fact central to his understanding of power. In his later works he identifies how resistance can exist in a similarly capillary-like nature, occurring at the localised level and even using the same techniques and technologies of the power it seeks to oppose (Pickett 1996). He demonstrates this in his study of reverse discourses on homosexuality that were made possible by the very narratives and truth regimes created to oppress it: “Homosexuality began to speak on its own behalf, to demand that its legitimacy or naturality be acknowledged, often in the same vocabulary, using the same categories by which it was medically disqualified” (Foucault 1990, 101).

Similar instances of this ‘biopolitics in reverse’ have been documented in food-based contexts. The highly controversial issue of GMOs and the attempted management of its controversy through discursive mechanisms provides a case in point. As previously discussed, pro-GMO discourses have ignited intense debates amongst expert and public communities in recent decades (Myskja 2006; Glover 2010a, 2010b). To allay public concerns, industrial framings of GMOs underwent key evolutions from being a ‘laboratory hazard’ in the 1970s to a ‘manageable risk’ during the following decades (Andrée 2002). As Andrée (2002) observes, this transition was instigated by the arrival of new actors in the field, namely politicians and the emerging American biotechnology industry which had employed many of the genetic engineers from the previous decade. Their agenda was to commercialise the products, both for domestic and international markets, and as such new policies were produced that were “predicated on the
manageability of GMO risks” and “allowed for movement of GMOs out of the lab and into the field” (ibid, 171; see also Wright 1994; Landecker 2007).

With the potential risks of GMOs supposedly of a manageable nature, a major focus of the industry’s pro-GM discourses turned to the advantages of their products. These namely centred on the opportunities for the various stakeholders involved: for food producers this meant increased productivity and reduced use of pesticides; for states the possibility of using GMOs for extreme weather protection, cheaper pharmaceuticals and improving food security; and for consumers, the promise for increased nutritional value and cheaper, more sustainable produce (Whitman 2000). Underlying all of these proposed benefits was a moral claim to our human ‘duty’ to utilise the latest expertise and technical capabilities in addressing the major issues that threaten the modern world (i.e. hunger, famine, malnutrition, climate change). This consequently projected a sense of responsibility on all stakeholders, particularly consumers, to accept GMOs and allow their development to continue for the benefits of social good (Nuffield Council on Bioethics 2003; Paterson 2013; Vidal 2013).

The controversy that has since surrounded these truth claims, however, reveals that these stakeholders have not become entirely passive or ‘docile bodies’. There has been mixed success in responsibilising the desired targets towards accepting GMOs, particularly within Europe: some have adopted the moral line (mostly politicians and industry stakeholders), claiming that GMOs offer the only viable solution to present-day food issues and so their development should be supported despite the unforeseen long-term risks (which, of course, they argue will be manageable) (see Glover 2010b; Clark 2014). Conversely, as mentioned earlier, many have instead raised concerns over potential health, environmental and socioeconomic impacts this appropriation of Nature by global agribusinesses might, and in many instances has already created (Monson 2006; Stewart 2013).

How then to account for these voices of resistance in Foucauldian terms and understand the dynamics of responsibilisation that are occurring? In the case of GMOs, Andrée (2002) argues that by conceptualising GM foods as a ‘manageable risk’ the discourse was framed by notions of certainty and prediction and thereby allowed contesters to

build counter-arguments using the same vocabulary as their pro-GM adversaries. These arguments primarily centred on the inability of Science to predict with absolute certainty that GMOs do not pose a significant threat to environmental and public welfare, and thus called for regulatory measures to adopt the precautionary principle (Gortari 2014). Moreover, one of the central technologies that served pro-GMO interests by identifying novel traits within products has subsequently been adopted by the opposition; this has since enabled a ‘unique identifier’ to be assigned to each GMO ‘event’ and allowed GMOs (and their creators) to be identified and traced throughout the whole production process, even after entering the field (Andrée 2002, 184).

The case of GMOs serves as just one example in highlighting that it is too simplistic to view the targets of food biopolitics as completely passive subjects. This is not to discount existing literatures that have demonstrated how the materialities, discourses and truth regimes around food and eating can produce increasingly docile bodies. However, many studies do not consider in detail the potential for these actors to resist these processes of responsibilisation and, in some instances, demand it back from those who have targeted them. In this vein, Heyes (2006) advocates for a more multi-faceted understanding of these dynamics: in her biopolitical analysis of Weight Watchers she shows how such regimes can at once cultivate docile bodies and enable agency by providing dieters with the capabilities to understand their health and re-assess their position within the social body. She thus calls for further exploration of these dualistic repressive and enabling facets of power and the potential for docile bodies to even “exceed the regime of normalisation that generated them” (Heyes 2006, 138).

The purpose of reviewing the potentiality for biopolitics-in-reverse is to set up the theoretical groundwork for the following section, and point to a central facet of this thesis’ enquiry. In conducting a biopolitical analysis of APs, the thesis intends to...

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30 In North America, assessment of the substantial equivalence of a GM food (i.e. posing no further risk than their non-GM counterparts) is focussed primarily at the genetic level. As such, instead of the whole organism being subjected to a risk assessment (as is the case in Europe), only the novel traits within a GM food are the object of regulatory measures (Gortari 2014). This has allowed governments and other pro-GMO stakeholders to not only narrow the focus of risk assessment and management to a much smaller scale, but also oppose the labelling of their products on the grounds that there is no way to differentiate between GM and non-GM foods ‘in the field’ (i.e. at the consumer level) (Andrée 2002; Myhr 2007). A ‘unique identifier’ is “a nine-digit alphanumeric code given to each transgenic (or genetically engineered) plant that is approved for commercial use, including planting and food/feed use” (OECD 2002). The unique identifier has been integrated into European Union legislation on the labelling and traceability of GMOs (Regulation (EC) No 1830/2003), and the Cartagena Protocol on Biosafety.
examine both the mechanisms of consumer responsibilisation that serve to create docile, ‘self-making’ bodies (de Solier 2013), as well as the instances of consumer resistance that have been instrumental in shaping and creating barriers to these mechanisms. Of central interest, the project considers the strong ‘yuck factor’ exhibited by many consumers in response to the latest APs as a materialisation of biopolitics-in-reverse. This argument, developed in the following section, looks to extend previous studies that have focused primarily on reverse discourses to also consider how resistance to responsibilisation can additionally manifest through more bodily, emotive and visceral forms.

3.4 The (bio)politics of taste and edibility: Food as more-than-consumption

So far it has been shown through previous case studies that appeals to ‘betterness’ have served to obtain consumer acceptance and adoption of certain food products. This approach follows the logic often promoted in mainstream free-market ideologies that given enough information, and with competitive pricing, the consumer will tend towards the most rational choice (Scott 2000). This thinking has however been extensively critiqued within critical food studies and geography debates. Evidence has shown that simply increasing consumer-facing information and product choice can result in feelings of confusion and suspicion amongst consumers, leading to personal food choices predicated on less rather than more information-seeking (Roe 2006; Eden 2011). Linked to this, it is vital to acknowledge that food choices are far from rational decisions. Like many consumption activities, the foods we eat are not chosen solely with ‘logical’ end goals in mind – such as, achieving optimised welfare for the self and planet. Instead food and eating are part of messier, more bodily and emotional relations, embedded within deep and longstanding traditions of cultural value, sensory pleasure and social conventions. As Goodman (2016) highlights, we are not merely ‘consumers’ that ‘consume’ but ‘eaters’ that ‘eat’, a subtle change in terminology that serves to emphasise the highly intimate and material connection inherent in food-eater relations (Goodman et al 2010). A unique quality of food as an act of consumption is that it involves the physical ingestion and merging of matter with our own materiality; it is consumption as both literal and figurative embodiment (Probyn 2000; Mol 2008).
As such, the task of the food researcher is to attend to the food-eater relations that are manifested and practiced through this embodiment. It is to understand how our position as fleshy ‘body-subjects’ (Lupton 1996; Probyn 2000; Murray 2008) shapes our perceptions and everyday practices of food, and how our visceral and emotional preferences can present both a barrier and opportunity to the food industry in shaping our food choices. Of particular interest to this research project is how the visceral and emotional dimensions of food-eater relations can be mobilised in order to re-draw the ontological categories of ‘edible’ and ‘inedible’ – that is, the divide between what counts as food and non-food in people’s perceptions. Such processes can be understood as an engagement in ‘ontological politics’ (Mol 1999) whereby personal taste and perceptions of what qualifies as edible go far beyond the individual, entangling eaters within broader networks of social and political-economic forces. This section reviews literatures that have examined such matters with the aim of providing a conceptual grounding for how this thesis will attend to the ‘more-than-consumption’ factors related to the latest AP sector.

3.4.1 The making of taste

The complexity of creating consumer tastes for foods has been a key subject of academia and corporate marketing strategies over the last century. As Hayes-Conroy and Hayes-Conroy (2008, 467) note, “developing a taste for something does not happen in a vacuum” and can be ‘strategic’ in maintaining, preventing or creating particular social behaviours and ideologies (Elias 2000). There is much evidence to show how the tastes which shape today’s food industry have been the result of intense and sustained efforts by particular actors, not only to convince consumers to enjoy certain products but to actively choose them over alternatives (Carolan 2011).

Sidney Mintz’s (1986) seminal text on the sugar industry was one of the earliest studies to attend to these forces: looking beyond the evolutionary reasons for humans desiring sweetness in their diets, his book highlights the vast assemblages of people, organisations and political and cultural influences that were involved in transforming sugar from a foreign luxury item into one of the staple ingredients of modern diets. This proliferation of sugar in global food cultures was by no means an accident. The global ‘tuning’ of consumer palates, to use Carolan’s (2011) terminology, was instead a much more vigorous and aggressive campaign, one that was at once the product and the
perpetuator of the global political, cultural and material landscape that existed from the seventeenth century.

Mintz’s work is important for demonstrating how sugar came to be such a dominating force within the global food system, but as to why Europeans developed such an avid and long-lasting taste for this foodstuff is not considered in the same depth. One of the reasons Mintz cites is how the establishment of free trade and improved production methods in the early-nineteenth century increased the supply of sugar to Europe and caused a dramatic drop in price. However, Smith (1992) has since argued that an economic analysis can only go so far in explaining the rise in sugar consumption, as regardless of price, if the product was not desirable to consumers in some way they would not have incorporated it so systemically into their eating habits. Like Mintz, Smith similarly acknowledges the important political-economic and material factors that increased the consumption of sugar during this time: namely, the fact that sugar had achieved a stable price by the mid-eighteenth century and through the efforts of tea companies such as Twinings, the consumption of tea with sugar became an affordable practice (Smith 1992, 271-75). Yet Smith points to specific cultural developments that also contributed to the proliferation of sugar consumption at this time. For example, sugar became a popular way of displaying wealth and membership to the social elite. When excessive sugar consumption came to be viewed as both morally and physically detrimental, the rise in popularity and associated health benefits of tea enabled an opportunity to indulge in sugar in a morally-acceptable and moderate way. The combination of tea and sugar thus moved from the sole context of “status and fashion [and] into a new practice that had meaning within the context of discourse on health” (Smith 1992, 270), and moreover, into the culture of respectability that was accessible to consumers of all classes.

The tuning of consumer tastes as a strategic tool for state and industry interests has been documented in the more recent evolution of industrial foods. Citing examples such as cereals and canned foods, Carolan (2011) documents how appeals to technical expertise and an emphasis on convenience and affordability have served to tune

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31 This, Smith (1992, 273-75) argues, explains why tea was initially favoured over coffee as at this time the latter was produced outside of European control and so was not as readily accessible to Western markets.
consumer tastes to these novel products. A common strategy shared by these products was to incorporate them into the diets of military and education systems (Carolan 2011; see also Cantarero 2007). Many food companies also added ‘a face’ to their products so as to emulate the familiarity once shared between local consumers and producers – well-known examples include the W. K. Kellogg’s signature on his cereal boxes and characters such as the Quaker Oats Man and Aunt Bessie (Carolan 2011, 26). Arguably a more recent incarnation of this strategy is the rise of celebrity endorsements of food products which have been shown to increase the sense of familiarity for consumers and, in some instances, act as important markers of product quality (Dixon et al 2011).

Other strategies for tuning consumer tastes to particular foods include the associations of a product with the lifestyle and physique of certain celebrities (Dixon et al 2011), with appearing progressive and ‘cool’ (Schor & Ford 2007), and with recent social justice movements (e.g. Slow Food) (Hayes-Conroy & Hayes-Conroy 2008). All of these cases support the view that has long been documented, particularly by anthropologists, that a person’s taste for food is much more than the product of satisfying biological needs, or indeed a failing in personal discipline and restraint (Mead 1943; 1964; Douglas 2009 [1966]; Cantarero 2007; Messer 2007). This view has been developed more recently in debates around obesity to dispel common assertions among public health and media literature that growing waistlines are the direct result of the misguided tastes and weak willpower of the individual. Guthman & DuPuis (2006) among others have made important contributions in showing that the tendency to choose and desire unhealthy foods is rather caught up in a larger “neoliberal shift in personhood from citizen to consumer” (see also Bennett 2010, 40). As a result, personal taste has become a vehicle by which people can be tuned towards particular socio-political and economic goals, to the point where the eater comes to literally ‘embody’ (and subsequently propagate) these forces (Guthman & DuPuis 2006), or as Probyn (2000, 2) describes, a process by which we “eat into culture, eat into identities, [and] indeed eat into ourselves”.

A similar strategy was identified by Dickens (cited by Wansink 2002, 93) in relation to offal and during the 1970s when the USDA authorised the inclusion of textured-vegetable proteins into school meal programmes (Carolan 2011, 37); the same reasoning continues to exist with current meat alternatives such as edible insects (Tranter 2013).
Understanding how consumer tastes are formed and tuned to particular foods is fundamental to examining the strategies being implemented by AP developers to create markets for their products. However, I feel there is another important dimension to the process of consumer attunement that must be considered in relation to APs. As discussed in earlier sections, the novelty of the latest APs – both in terms of their unfamiliar raw materials and production methods – has caused many people to either dismiss outright or at least question their status as food. As such, it is necessary to go beyond merely examining whether APs will be desirable to eaters by also focusing on their precarious status as ‘edible’ matter. Such enquiry, it is argued, will help in further understanding how and why APs have challenged the very ontological category of ‘food’ – and more specifically, of ‘meat’, ‘milk’ and ‘eggs’ – and, in many instances, have caused such emotive reactions amongst eaters.

3.4.2 Taste and edibility

In the same way as consumer tastes are shaped by wider societal forces, the perceived edibility of a substance can similarly be viewed as a co-constituted phenomenon. Both are inextricable from the experiences and ‘situatedness’ of an individual (i.e. the cultural, socio-political and environmental conditions they have been exposed to over their lifetimes), and both can act as ‘loaded’ concepts whereby an individual’s identity is judged in accordance with standards of ‘good taste’ or with acceptance of foods that are considered too ‘base’ or unhygienic for particular social classes (Wansink 2002). In some instances the acceptance of certain foods as ‘edible’ can even be viewed as a type of antisocial behaviour (see Black’s (2007) work on eating garbage).

There are, however, important distinctions to be made between the perception of a food as desirable and a food as ‘edible’. According to Messer (2007, 53) the latter can be defined as “all items recognised for their nutritive or additional dietary values, which are ingested via the mouth, swallowed and then digested”, whereas ‘inedible, non-foods’ are:

“organic or inorganic items that nutritionists or members of particular cultures do not recognise as food because of sensory unattractiveness, anticipated negative physiological effect, predominantly non-nutritive properties, or culturally determined dislike or disgust”.

As work on behaviours such as Pica demonstrates (Young 2007; Portalatín 2007), an individual may have a taste or desire for an inedible substance, and conversely many
people can find edible substances wholly undesirable. Though what of substances that are technically fit to eat but are not perceived as ‘edible’ by certain individuals? This arguably goes beyond a question of desirability for a substance; it is instead bound up in understandings of what ‘food’ is and therefore should be according to different individual, societal and trans-national expectations. Ultimately, it is a question of ontology (e.g. Mol 1999), a process of recognising a food as edible which is subtly different from recognising a food as desirable, despite both processes being constructed through similar socialisation forces.

3.4.3 Edibility formation

This argument builds on previous literatures which demonstrate how perceptions of edibility are shaped by specific assemblages of (non)human elements (Vialles 1994; Roe 2006; Probyn 2011). These elements can include specific individuals enacting particular practices such as the slaughtering methods of an abattoir worker, the preservation mechanisms of a transporter, or the promotional strategies of a retailer; these may in turn be informed by nonhuman elements including social, political economic and cultural factors, and are generally performed through the use of specific utensils and spaces.

The dependency of edibility formation on such assemblages is demonstrated clearly in Vialles’ (1994) book Animal to Edible, an anthropological study of abattoirs in the Dour region of south-west France. She documents the journey of a living organism becoming a substance which local, national and international consumers consider edible (‘cow’ to ‘beef’, for example). Completing this process involves a complex demarcation of space both within the abattoir itself as well as the separation of the abattoir (death) from the rest of society (life), a dissociation which has been increasingly enforced in the West from the early-nineteenth century (Vialles 1994, 17). It is through this organisation of space that edibility formation is managed. The animal, taken from the realm of the living, is transported out to the abattoir. Once there it is directed through the site, starting in the “dirty sector” within which the stunning and slaughtering are completed, and eventually arriving in its ‘modified’ form into the “clean sector” where “everything is inert, bloodless, trimmed, and stabilised by cold” (Vialles 1994, 35). Each space

33 Pica is the appetite for largely non-nutritive substances such as earth, clay, glass, metal etc.
requires a specific collection of individuals operating with specific skillsets and utensils, which are in turn informed by regulations of hygiene and ethical conduct, as well as current public tastes. It is thus the collection of these elements that transforms the ‘cow’ into ‘beef’, that distinguishes ‘slaughtering’ from ‘murdering’, and that allows a highly brutal, messy and sombre business to become an ethical, controlled and overall ‘acceptable’ means of food production.

Vialles’ case study highlights the accepted (non)human elements involved in the edibility formation of most meat-based products in Western countries. However, this assemblage is highly open to re-interpretation depending on geographical, temporal, economic and cultural specificities. As such the process described above may not in fact produce an ‘edible’ substance for certain individuals and cultures; for example, many religious consumers would not consider this method of meat production acceptable as it does not conform to the specificities of their religious dietary laws (e.g. halal; see Lever & Miele 2012). Through investigation of the intermediary steps of food production, and the specific (non)human elements involved, we can thus begin to understand why certain foodstuffs may be accepted as edible in one culture but not in the other, and how the presence or absence of a particular component may jeopardise the perception of edibleness at the consumer level.

Other elements that have been shown to affect perceptions of edibility include the promotional strategies of food retailers – from the design of the retail space to the positioning of products within the store (Probyn 2011) – and the written and visual information on food labelling. Through the latter medium, Evans and Miele (2012) have highlighted how specific aspects of a foodstuff can be made to matter (“presented”) or not matter (“absented”), a process which can have powerful influence over creating and maintaining particular cultural understandings of food. As such, edibleness in certain instances can become bound up with particular standards and discourses of ‘naturalness’, ‘care’, ‘safety’ and ‘sustainability’, whereby associations with intensive industry or highly technological methods can, as a result, assign a product to the category of inedible.

In addition to the discursive performance around food products, Evans and Miele (2012) also remind us that eaters both ‘sense and make sense’ of foods. As such, they invite us to acknowledge the critical role played by our visceral engagement with
foodstuffs, and how these can determine our perceptions of both desirability and edibility. In their own words, they state that “[w]e do not merely contemplate foods; rather, we taste them, we smell them, we feel their textures with our hands and our tongues—we enter into an embodied relationship with them” (ibid, 302). Such insights help in understanding examples of dissonance in public attitudes to certain food products that can be mediated by the ways in which we viscerally encounter food. The infamous feature on turkey twizzlers by celebrity chef Jamie Oliver in his TV series School Dinners is a case in point, and one Evans & Miele specifically refer to in their discussion. With the aim of improving the nutritional standards of school meals, Oliver engaged in a highly emotive demonstration of creating turkey twizzlers in the manner of industrial production methods in front of an audience of schoolchildren. This involved blending turkey offal and skin, mixing with chemical additives, and then shaping and deep-frying them in their distinctive ‘twizzled’ form (Pike & Kelly 2014, 44). This performance evoked the intended feelings of disgust – both by the schoolchildren and TV viewers around the UK – that eventually contributed to the removal of turkey twizzlers from school menus. Oliver’s display reveals how sensory perceptions of foods play a central role in our willingness to accept them into our eating habits. It demonstrated how a non-food (i.e. less desirable turkey off-cuts and chemical-derived ingredients) can traverse the conceptual divide of (in)edibility and become perceived as food given the ‘right’ material conditions – in this instance, by creating a fun and convenient meat-based snack, with its less appetising origins literally covered in a layer of taste-pleasing deep-fried breadcrumbs.

In a similar vein to discussions in the previous section of this review, it must not be assumed that consumers are entirely passive or ‘docile’ in such processes of edibility formation (Eden 2011). Conflicts in edibility perception between consumer and retailer have arisen as a result of cultural/personal taste preferences (ShortList 2013), the ineffective design of the retail environment (Probyn 2011), or the absence, mishandling and overuse of particular information (Roe 2006). Furthermore, the rise of consumer concerns regarding the link between nutritional quality and edibility have led to increasing pressure on producers and retailers to use particular production methods, to provide more transparent labelling, and to refrain from including certain ingredients in their products (Mol 2008; de Krom & Mol 2010; Gadema & Oglethorpe 2011; Scrinis 2012).
3.4.4 Food semiospheres

We can thus understand edibility as something that is co-constituted through the (non)human assemblages of food production and consumption. Yet it is by no means a fixed condition; rather the literatures above point to an understanding of edibility as a fluid state, one which can be (un)made so that a substance once perceived as inedible can in fact come to be accepted as edible (and vice versa).

To make the conceptualisation of this fluidity between (in)edibility clearer, Parasecoli (2011) has looked to the language of semiotics. He talks of edibility as a food semiosphere which “constitutes itself by marking its porous, ever-shifting boundary in relation to the extra-semiotic that surrounds it”. In other words, he views edibility as a particular realm, one that exists at the individual level and whose boundary is dictated by the context-specific factors described in the previous section – i.e. personal taste and quality expectations, food labelling and so on. Outside of this boundary substances are perceived by the individual as inedible – however, this status quo is by no means fixed as the ever-shifting nature of the boundary between the (in)edible realms enables an individual’s food semiosphere to be re-configured. Thus, a previously perceived inedible substance may come to be seen as edible if it can be made to appeal to the existing conditions of a person’s food semiosphere; or alternatively, if certain strategies are implemented to re-shape the boundaries of the individual’s food semiosphere that consequently allows the acceptance of a previously perceived inedible substance. In this way, “new extraneous substances [can] become part of the system” (Parasecoli 2011, 651).

3.4.5 Edibility as theoretical lens

This conceptual approach to edibility evokes a new set of questions regarding the current yuck factor associated with APs which go beyond those asked in existing consumer studies (e.g. Verbeke et al 2015). Analysis in these latter literatures tends towards questions such as ‘would you eat X?’, with the AP in question inserted as the object of the query. There are a number of problems associated with this research approach. A primary critique is that asking people whether they would hypothetically eat something has very low ecological validity – that is, it fails to account for the significant difference in a person talking about what they might or might not eat in a hypothetical context, compared to the embodied everyday practices of eating. For
example, an individual may respond affirmatively to eating insects in a survey, particularly after hearing the socioecological benefits they promise. They may therefore conclude that insects appear as a *rational* food choice and as such they would choose to eat them. Yet if confronted with an insect and asked to eat it, the individual may have very different reactions. If they are personally unfamiliar with insects as a foodstuff it may evoke commonly held associations (particularly in the West) with creepiness, dirtiness and being viscerally unpleasant. They may be unsatisfied that a cricket, for instance, does not provide the same sensory experience as a steak, nor carry with it the same cultural value (e.g. masculinity, conquest of Nature, virility). They may also disregard the insect for failing to meet already familiar and established food practices and conventions – for example, cooking a large meat joint on celebratory occasions. Regardless of the ‘rational’ arguments in favour of eating insects then, the individual in this instance may in fact choose not to eat them, guided more by viscerally and culturally-informed factors. Returning to Goodman’s (2016) point, this example serves to again highlight that we are not merely consumers who consume, but *eaters* who *eat*.

The novelty of APs thus represents both opportunities and challenges for their developers in gaining consumer acceptance. On the one hand the claimed benefits of APs compared with conventional animal foods may potentially serve to render the former as more edible due to overcoming the lower (non)human welfare, health risks and ecological damage associated with the latter. Yet on the other hand, the raw materials and production processes APs entail challenge those currently accepted in contemporary (Western) food practices. The purpose of examining the edibility formation literatures above has been to demonstrate how critical these intermediary stages of food production are in the likelihood of a substance being perceived as edible by different publics. Thus in addition to the materiality of the final product, the steps by which it has been produced are also of significant importance in a food being accepted into an eater’s food semiosphere. Insects, tissue culture and plants made through Big Tech are not yet typical and accepted components of mainstream (Western) food semiospheres. There is consequently much work to be done by AP developers to normalise their products as food, a task that must attend to a careful presenting and absenting of the (non)human elements entailed within the production-consumption network, as well as the consumer-facing aspects of visceral expectations, and familiarity and convenience of established consumption practices (e.g. purchasing, preparing and
eating). Examination of the strategies of normalisation being used by AP developers will thus form a central theme of the thesis’ analysis. This will be done first through the Foucauldian lens of biopolitics (Ch. 7) and then via a visceral autoethnography through which I recount first-hand experiences of the normalisation mechanisms of an AP product during fieldwork (Ch. 8).

3.5 The eater and eaten: The ‘vital materiality’ of food

Another important component of taste and edibility formation to consider in the context of APs is the complex relationship many eaters experience between themselves as eaters and the things they eat. Not only can this relationship shape the socio-political and cultural identity of an individual – as demonstrated earlier in this section – but it can also have substantial influence over the way in which an individual understands and perceives their bodily make-up. Annemarie Mol (2008) provides excellent insights into this blurring of subjectivities: in contemplating the phrase ‘I eat an apple’, she reflects upon the situatedness of the apple – that is, the many locations and (non)human actors involved in its production, transportation, retail, as well as the social, political economic, cultural and spatial factors that brought the apple to the ‘I’ as eater. In much the same way as Cook (2004) has argued in his ‘Follow the Thing’ studies, Mol postulates that we as eaters not only consume the material form of that apple, but also its (non)human situatedness which brought it into being and on to our plates. But what does it mean to consume such aspects and relations? Do they become a part of the eater, or does the eater become a part of them? Or indeed, is there not a difference to distinguish here and instead eater and eaten can be seen as creating a newly formed assemblage? In Mol’s (2008, 30) own words on this complexity and confusion of boundaries, she states:

"The eating self is not an agent in even a remotely similar way. It does not control 'its' body at all. Take: I eat an apple. Is the agency in the I or in the apple? I eat, for sure, but without apples before long there would be no 'I' left. And it is even more complicated. For how to separate us out to begin with, the apple and me? One moment this may be possible: here is the apple, there am I. But a little later (bite, chew, swallow) I have become (made out of) apple; while the apple is (a part of) me."

This levelling of the subjectivities of eater and eaten has been similarly promoted by Jane Bennett (2010) in her work on ‘vital materiality’, which itself builds upon an extensive literature seeking to revalorise the agency of nonhuman ‘things’ (see Bennett
2000, viii for extended list). As Gibson-Graham (2011, 3) state in their description of Bennett’s concept:

"We are all just different collections of the same stuff – bacteria, heavy metals, atoms, matter-energy – not separate kinds of being susceptible to ranking. Bennett’s vital materiality captures the alien quality of our own flesh – we are not fully or exclusively human but an array of substances of different types, we are made up of ‘its’ more than ‘mes’. Her vibrant materiality depersonalizes agency, shifting its locus onto the behavior of assemblages rather than discrete beings”.

In the act of eating, therefore, we can be seen to add to the collection of ‘its’ that constitutes our bodily material.

Our understanding of the exact nature and affective ability of these food-based ‘its’ has undergone a dramatic shift over the last century as knowledge of the molecular materiality of foods has increased (Scrinis 2012). This has, in Bennett’s (2010) words, brought attention to new ‘actants’ within the assemblages of eating, such as vitamins, bacteria, minerals, fats and so on. The ability to now associate these actants with particular effects on the human body has in turn re-imagined food as possessing a kind of positive or detrimental ‘vitality’ which can be transferred to the eater’s body through ingestion. As such the intermingling of eater and eaten has taken on new meanings, whereby consumers seek particular positive ‘vital matter’ within foods that may be assimilated into their own bodily materiality, and avoid those which may have detrimental effects.

This understanding of food has been noted to have a significant influence on perceptions of desirable and edible foods. A number of studies have shown how people believe if a food possesses higher levels of positive vitality – that is, has undergone minimal processing and has been freshly harvested – their bodily matter will benefit more from the food’s internal vital actants (Magnusson et al 2003; Hughner et al 2007; Lahlou 2011). Conversely, if a food possesses detrimental vitality – i.e. pathogens, artificial substances – it is feared that these actants will adversely affect the materiality of the eater through sickness, modification or even death (Hammit 1990; Saba & Messina 2003).

These debates provide further depth to understanding the negative consumer response to innovative foods such as APs. Not only must the discursive, ontological and material elements that create a foodstuff be considered in the process of taste and edibility
formation, but also the vital materiality of the food itself. This awareness can help in understanding how an eater may fear the assimilation of techno-industrial foods – the ‘Frankenstein’ or ‘mutant’ matter as some describe (Pence 2002) – into their own materiality, as they perceive their body would subsequently become part mutant or modified in the process. Thus, attending to the presence of similar beliefs around the latest APs – whereby it’s perceived unnatural, Frankenstein, or modified materiality could somehow negatively affect that of the eater – will be an important focus in examining the edibility formation process of these novel foods.

Yet it is not only the materiality of industrial foods that evoke concern for eaters. Animal foods have a long and precarious place within human diets. While high cultural value has and continues to be assigned to meat and other animal-derived matter across cultures – with examples including associations with notions of masculinity, virility, power and socioeconomic status (e.g. Adams 1990; Fiddes 1991) – the physiological closeness between our own and animal bodily matter renders animal foods as highly ambiguous and risky substances (Chiles 2013). Without the ‘proper’ conventions, such as the social and material assemblages of (non)human actants and practices described in the sections above, animal foods risk becoming ‘matter out of place’ (Douglas 1966), and as such threaten physiological and moral defilement. APs thus face the negotiation of this precarious relationship between humans and animal foods that positions meat, milk and eggs as both highly desirable and highly risky substances. A vital part of examining their edibility formation will thus attend to the ways in which this negotiation is conducted, focussing in particular on the decision-making behind the processes by which they are becoming (simulating) and not becoming (disrupting) ‘meat’, ‘milk’ and ‘eggs’.

3.6 Conclusion

The purpose of this chapter has been to outline the theoretical concepts that underpin the thesis’ investigation of APs. To understand how APs represent simulation and/or disruption to existing agri-food processes requires a review of how these processes have been conceptualised and articulated within existing critical debates. In conducting this task, it has been shown that APs join a long line of previous cases whereby
capitalism has endeavoured to penetrate agricultural processes through techno-industrial means, and under the banner of planetary salvation. Speaking to this latter point, it also revealed the moral as well as political economies of contemporary food practices, and the central role anxiety – both at the individual and societal level – plays in facilitating these dynamics. In particular, recent research has shown how social anxieties around food have served to create new market opportunities for agri-food capitalism, facilitated by the accompanying atmosphere of crisis that invites ‘heroic actions’ and gives little time for critical reflection on their potential outcomes or efficacy (Bauman 2006; Glassner 2009; Jackson & Everts 2010).

To further elucidate this theme on morality and food, the chapter argued that valuable insights can be gained from the recent turn in food scholarship to the Foucauldian concept of biopolitics. This theoretical approach allows for a deeper analysis of the how behind the moralising dynamics of modern food consumption, revealing the mechanisms by which individuals are responsibilised to manage societal welfare through their own personal behaviours. A further value of this approach is that it makes theoretical room for acknowledging the potential for consumers to resist responsibilisation. Previous cases of this biopolitics-in-reverse have contributed more active readings of the post-production sphere, acknowledging that consumers are not always and completely rendered ‘docile’ by the biopolitical mechanisms enacted upon them.

Finally, recent scholarship on the (bio)politics of taste and edibility was reviewed to highlight that food and eating must be understood as ‘more-than-consumption’. Understanding the ways in which ‘things become food’, and how the visceral represents an integral part of our alimentary sense-making, allows for a more critical investigation into the decision-making behind the materialities and consumer-facing discourses of APs. It also contributes new insights on the strong yuck factor that has so far characterised consumer reactions to APs – namely, by highlighting that consumer acceptance of foods very often goes beyond the ‘rational’ logic so often ascribed by conventional economic theory, given that food-eater relations are inherently more bodily, emotive and intimate than other forms of consumption.

These debates reveal a number of critical insights that will be advanced in the empirical chapters of this thesis. First it will seek to build on recent thinking around food
anxieties by examining the relationship between food-related social anxieties and the development of APs at this contemporary moment. Drawing further on the theoretical repertoire of Foucault, this ‘history of the present’ (conducted in Chapter 5) aims to understand how different cultures of fear regarding global food security over the last century have (in)directly enabled APs to emerge as a necessary solution to today’s many tipping points. While the thesis posits that APs represent the materialisation of specifically Anthropogenic anxieties, it is shown that the very existence and nature of this sector owes much to the logics and politics that have long characterised how food security has been conceptualised, rationalised and acted upon in global policy discourses and agendas. This enquiry thus begins the task of mapping the temporalities (i.e. ‘why now?’) of the latest APs, as well as the particular geographies (i.e. Silicon Valley), materialities (i.e. technofixes) and political economies they have mobilised.

While recent studies in food geography have done much to reveal how the moral economies of food entangle Northern consumers and Southern producers through spatialised networks of care, less attention has been given to the processes by which certain places become the hubs in which the ‘objects of care’ (i.e. ‘alternative’ food products) in these networks are produced. In the context of APs, an example of such a hub is Silicon Valley, California. With the majority of recent AP activity concentrating within the geographical locale of the Valley, we see a distinct spatial shift of food security activity to this region. Such a shift requires closer examination of the implications of this new reality, a task that invites engagement with recent thinking from economic geography on the relationship between place, culture and innovation. Chapter 6 conducts this analysis by interrogating what it means to solve food insecurity ‘Silicon Valley-style’, and exploring the ways in which the Valley’s institutional, spatial and cultural landscape influence the type of solutions deemed most legitimate and effective.

The remaining empirical chapters build on the biopolitical literatures reviewed in this chapter. Exploring the strategies deployed by AP developers for ‘normalising’ their products so as to situate them within existing mainstream food semiospheres will form a key component of their analysis. Attention will focus on the ways in which culturally-accepted food forms, cooking and eating practices, as well as discourses around APs, are being utilised by AP developers to appeal to the norms and practices that already exist.
within the boundaries of many eaters’ food semiospheres. By examining the normalisation processes by which APs are ‘becoming food’ (Roe 2006), the thesis argues that a new site of food biopolitics – introduced in Chapter 7 as the ‘biopolitics of edibility’ – can be identified. In doing so, the thesis looks to extend current agri-food debates by bringing together discussions from geography and other social science studies on food biopolitics and ‘things becoming food’. Through this theoretical work, it is posited that new insights can be gained in examining how the mechanisms by which APs become food have opened both the visceral realm and the conceptual divide between (in)edibility to new biopolitical potentialities, which ultimately serve to responsibilise eaters towards accepting APs as edible in the name of bringing about the post-Anthropocene.
The aim of this chapter is to outline the methodological approach and research design of the thesis. As revealed in the Literature Review, research on food requires an approach that can account for and be flexible to its many multiplicities, tensions and contradictions (Goodman et al. 2010). This multiplicity is apparent in the diverse themes of the thesis’ research questions that range from mapping the political economies and discursive landscapes of APs, to examining their material and (bio)political relationship with the visceral realm. To be able to better address this diversity, the project adopts a mixture of qualitative methods, including semi-structured interviews, policy analysis, and visceral autoethnography. Some of these methods are used more fully in different chapters, but all have served to collectively inform the data collection and analysis over the course of the project. In this way, the thesis can be seen as intellectually linked while drawing on different combinations of methods at different times so as to better ‘get at’ the various research themes and questions set out in the previous chapters.

What follows is a discussion of the rationale for choosing these approaches, and their benefits and limitations to the research process. I begin first with discussion of the research design, outlining the process by which participants were chosen and the main methodological approach used to engage with them (i.e. semi-structured interviews). The second section reflects on issues of positionality and the particular challenges raised by conducting elite interviews. The third section outlines the design and motivations for developing a visceral auto-based methodology, an approach that draws on important precedents elsewhere in food-based research (Mol 2008; Hayes-Conroy 2010; Longhurst 2012; Abbots 2015; Miele 2017). The primary reason for using this research method was to put into practice the theoretical framework developed in the Literature Review – i.e. that eating should be considered as ‘more-than-consumption’ (Goodman 2016) – and thereby use my haptic knowledges (Crang 2003) as another lens through which to examine the tensions, decision-making and (bio)political implications materialised through APs. Following a short reflection on the limitations of this research

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34 The term 'elite' is used in line with Mikecz's (2012, 485) definition: “Elites are dynamic and heterogeneous, as people can gain and lose elite status over time...What distinguishes elites from non-elites is not job titles and powerful positions but the 'ability to exert influence' through 'social networks, social capital and strategic position within social structures'”.

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method, the fourth section discusses the thesis’ final methodological approach – policy analysis – that is used in Chapter 5. This approach was chosen to further unpack the historical and political contexts of APs and, in doing so, explore how these products have come to be seen as the necessary and ‘logical’ solutions to contemporary food security crises. The chapter then concludes with a short summary of the methods reviewed.

4.1 Research design

4.1.1 A production-consumption approach

The project’s primary data sources have focussed on those involved in the production and promotion of APs, rather than consumer responses to them. At the outset of the project I had planned to conduct consumer-based research, but due to the richness of fieldwork data collected with AP producers and advocates – and given the relative time and word count constraints of a doctoral thesis – I decided to re-orient the project around the themes and questions provoked by this part of the research instead.35

Such an approach may be interpreted as reinforcing the separation between production and consumption that recent agri-food scholars have critiqued (Goodman 2002; Goodman & DuPuis 2002); however, it is the relations, spaces and materialities between these two ‘realms’ that very much form the core of this project’s interests. In examining how the AP sector has evolved over recent years, consumers appear in this story through the ways AP actors – particularly companies – are thinking about them and attempting to mobilise them towards AP eating (see Clarke et al 2007). As stated in Chapter 1, the success of APs – both as an economic venture and as potential planetary salvation – depends upon people accepting, buying and ultimately eating them in place of conventional animal foods. Much of the AP activity to date has thus been driven by imaginaries of what consumers will either accept or reject in terms of the materialities, visceral experience, and socioecological impacts of food products. Many AP companies have based their material and discursive strategies on these imaginaries – that is, on

35 This focus was also motivated by advice given by my Upgrade panel: it was suggested that my original thesis structure and plans were potentially too broad, and that there would be more value in narrowing the scope – and hence deepening the analysis – of the project.
projected notions of the behaviours, visceral reactions, and what many AP developers see as the inherent desire within people to make the ‘right’ choice for both self and planet through their everyday food consumption. As such, while I did not engage in direct consumer-facing research (e.g. via interviews or focus groups), the consumer remains a fundamental part of the story told in this thesis through analysis of the imaginaries, generated largely by AP producers, of the ‘responsible eaters’ they seek to appeal to and mobilise through their products. Moreover, the consumer is also made explicit through the reflections recounted in Chapter 8 on my own first-hand experiences as a consumer/eater of an AP product during fieldwork.

4.1.2 Choosing participants and interviews

4.1.2.1 US-based fieldwork

Early in the project I identified AP start-ups as a primary category of key informants for understanding the decision-making, values and visions of the AP space. My reason for this focus was that start-ups have and continue to dominate the recent AP movement – it is through these particular ventures, rather than larger agribusinesses or public-funded research, that most of the hype, financial backing and material products have been generated to date. At the beginning of this project there was a relatively small number of early-stage companies in operation, all of which I initially identified as potential interview participants (see Figure 2).

<table>
<thead>
<tr>
<th>AP start-up</th>
<th>Type of AP</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect Day (formerly Muufri)</td>
<td>Cellular agriculture (milk)</td>
<td>SF* Bay Area, CA</td>
</tr>
<tr>
<td>Clara Foods</td>
<td>Cellular agriculture (egg whites)</td>
<td>SF Bay Area, CA</td>
</tr>
<tr>
<td>Modern Meadow</td>
<td>Cellular agriculture (meat, leather)</td>
<td>New York, NY</td>
</tr>
<tr>
<td>Hampton Creek</td>
<td>Plant-based (egg proteins)</td>
<td>SF Bay Area, CA</td>
</tr>
<tr>
<td>Beyond Meat</td>
<td>Plant-based (meat analogues)</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Ambronite</td>
<td>Plant-based (food replacement drink)</td>
<td>Espoo, Finland</td>
</tr>
<tr>
<td>Soylent</td>
<td>Food replacement drink</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Big Cricket Farms</td>
<td>Insects</td>
<td>Youngstown, OH</td>
</tr>
<tr>
<td>Ento</td>
<td>Insects</td>
<td>London, UK</td>
</tr>
<tr>
<td>Six Foods</td>
<td>Insects</td>
<td>SF Bay Area, CA</td>
</tr>
<tr>
<td>Exo</td>
<td>Insects</td>
<td>New York, NY</td>
</tr>
</tbody>
</table>

*SF = San Francisco
However, this list was subsequently revised for a number of reasons. First, not all of the companies responded to my interview requests, and second, some of the ventures ceased operation over the course of my project (e.g. Ento). Within the first few months of the project I had also decided to concentrate my fieldwork on AP activity occurring within the US, with a specific focus on California. This decision was motivated in large part due to the US-based AP scene representing the largest geographical concentration of AP activity, as well as its general absence as a case study in contemporary AP scholarship. Time and budgetary constraints of fieldwork were also a contributing factor to focussing my research interests primarily on one geographical region. A number of ventures based outside California were thus removed from the list (except one), while others within this region were added over the course of project as I encountered them during fieldwork and through at-desk research. The final list of US-based AP companies I interviewed during the project thus ultimately expanded to 12; these are listed in Figure 3 which gives the name and location of the company, the position of my informant within the company, and further details on my rationale for speaking with them.

In total my US fieldwork consisted of three separate trips to California totalling just under three months and spread out over a period of 15 months during 2015-16. The majority of this time was spent in the three main regional hubs of AP companies (San Francisco, Palo Alto and Los Angeles), although a connecting flight through New York during one of these trips gave me a 24-hour stopover in Manhattan, during which time I was able to conduct an interview with one of the East Coast AP companies. While I had originally planned a longer fieldwork period in the US, the cost of living and travel was ultimately too prohibitive. However, through careful planning and often conducting multiple interviews per day during my research trips, I feel I was able to secure a sufficient number of quality, in-depth interviews that have provided an insightful representation of the leading corporate influencers and voices in the recent AP sector.

4.1.2.2 Following ‘the field’ beyond AP companies and the US

While AP start-ups have arguably represented the largest data source of the project, I wanted to broaden my engagement to also include other key influencers in the sector,

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36 The three US fieldwork trips were conducted in April 2015, September-October 2015, and July 2016.
both within and beyond the US. A primary aim of the project has been to understand why so much AP activity has concentrated within California (and specifically Silicon Valley), and what role this particular geography has played in shaping the trajectories of AP development. A fundamental part of the research design, then, has been to examine the spatial and institutional landscapes through which the majority of US-based AP start-ups have emerged. Thus in addition to interviewing founders and employees of AP companies, I have also met with and interviewed a number of key non-profit organisations within the AP sector, ranging from the leading AP advocacy group New Harvest, to a number of animal rights and food ethics charities that have advocated for and/or conducted research on APs. I also spoke with a number of key informants within the Valley start-up scene, including the main biotech accelerator IndieBio and a selection of private investors and venture capital funds with direct investments and/or interests in AP development. In addition, to gain both an academic and non-US perspective on the AP sector, I also interviewed a PhD student working on the only academic project on cultured meat production in the UK (see Figure 4 for full list). This interview was enabled primarily by the fact the researcher was also based in London. I have also attended multiple AP-related events over the last four years, many of which have represented formative moments in both the European and US-based AP scenes. These include the first International Cultured Beef Conference in Maastricht, Netherlands (October 2015), New Harvest’s first international cellular agriculture conference in San Francisco (July 2016), the BonAppétech Conference in San Francisco (October 2015), and an Indiebio Demo Day which showcased the start-ups graduating from their third biotech accelerator programme in San Francisco (July 2016). During these events I was able to meet and talk with a number of key informants working within the AP sector (from which a large number of my interviews were arranged), and also gain a sense of the latest news, debates and challenges that were at the forefront of AP activity worldwide.

4.1.2.3 Semi-structured interviews

In-depth, semi-structured interviews were chosen as the primary method by which to learn the views, values and decision-making by the key AP players identified above for a number of reasons. As Saldana (2011, 32) notes, this method is “an effective way of soliciting and documenting, in their own words, an individual's or group’s perspectives,
feelings, opinions, values, attitudes, and beliefs about their personal experiences and social world, in addition to factual information about their lives”. This choice also builds on the methods used in previous social science scholarship on APs (e.g. Stephens 2013), and elsewhere in critical food geography (Ilbery & Maye 2005; Jackson et al. 2009; Lever & Miele 2012).

A total of 25 semi-structured interviews were conducted during the project, with the shortest lasting 20 minutes and the longest 2.5 hours. Four US-based informants were interviewed twice, with the first meetings occurring during my initial research trip in April 2015, and follow-up interviews conducted during my second trip in September-October 2015. The majority of the interviews were conducted face-to-face either at the informant’s offices/workplace or in nearby cafés suggested by the interviewee. A small number were conducted over Skype when it was not possible to meet in person, either due to the limited availability of the informant or logistical barriers (e.g. being based in the UK between fieldwork trips). Subject to the permission of the informant – gained through completion of the project’s consent form before the interview commenced (see Appendix 3) – all of the interviews were audio recorded with a Dictaphone. Following the interviews the audio files were stored under anonymised file names on a password-encrypted storage device in preparation for transcription. While a number of participants granted permission to be named, it was decided that all data would be anonymised in the analysis and write-up of the research. As such the thesis refers to them only by nature of their affiliation to an AP organisation (e.g. ‘plant-based protein co-founder’) or related activity (‘AP investor’).

Care was taken during each interview to ensure my frame of reference was not imposed on the participants’ viewpoints through leading questions (Flick 2009), and all interviews were designed so as to remain as flexible and adaptive to the informants’ responses as possible, and allow them the majority of the time to speak (Delaney 2007). As Malkki (1995) notes, providing this space rescinds any claim to a “scientific detective’s urge to know ‘everything’” and opens up opportunity to “gain access to those very partial vistas that our informants may desire or think to share with us”.

In this way, the interviews were designed to allow informants the space to introduce topics and themes to the discussion that I may not have thought of or previously been aware. It also aided in gaining more insight not only into what my interviewees knew
about a certain topic, but how they thought about and situated that knowledge within
the wider context of the research area (Delaney 2007). An example of this process
occurred during an interview with two co-founders of an AP company when I asked
them what other AP ventures they were aware of. They referenced a few and through
this list they went on to highlight the difference between the ventures affiliated with
academics and those without. This then led to a long, ‘thick’ (i.e. in-depth) reflection and
debate between the informants on the different tensions they saw regarding academic
perspectives mixing with for-profit business. Prior to this interview, which was one of
the first conducted in the field, I had not considered these particular tensions, nor how
they might be viewed by different actors working in the AP sector and were potentially
contributing to how it has emerged (i.e. largely through for-profit ventures over public-
funded academic research). Reading back the transcript after the interview, this part of
the conversation struck me as highly important and in subsequent interviews I made a
point of asking participants about their views on the business models that have
characterised the AP sector to date, and why they think this is. What thus began as an
unexpected comment ultimately went on to form a central theme of the thesis, and
directly inspired the analysis of Chapter 6. This is just one example of how the research
process, particularly during the interview stages, attempted to be as reflexive and open
to being shaped by the data as possible (Hesse-Biber 2010). Moreover, in addition to
allowing further questions and themes to be added to future interviews, this approach
also enabled any lines of enquiry that proved ambiguous or unhelpful to be removed or
reformulated.

Through this interview design I was able to gather rich, in-depth insights from some of
the leading influencers and voices working in the recent AP movement. It has allowed
me to gain detailed accounts of the motivations of founders to start AP companies, why
many of them chose to do so in Silicon Valley, the values and visions that have driven
them, and the external factors and imaginaries of their target customers that have
shaped their decision-making. It has also enabled me to gain a sense of the motivations
of those that make up the wider institutional landscape around AP start-ups, and the
impacts their support (whether in the form of advocacy, venture capital or technical
research) has had on the development trajectories of APs. These insights have been
crucial for attending to the overarching aim of this thesis: that is, to examine what the
latest APs ‘mean’ in (bio)political, socioeconomic, spatial and material terms for the
<table>
<thead>
<tr>
<th>AP start-up</th>
<th>Interviewee</th>
<th>Type of AP</th>
<th>Location (at time of interview)</th>
<th>Rationale for interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect Day (formerly Muufri)</td>
<td>Co-founders x2</td>
<td>Cellular agriculture (milk)</td>
<td>SF Bay Area, CA</td>
<td>First cultured milk venture</td>
</tr>
<tr>
<td>Clara Foods</td>
<td>Co-founder</td>
<td>Cellular agriculture (egg whites)</td>
<td>SF Bay Area, CA</td>
<td>First cultured egg white venture</td>
</tr>
<tr>
<td>Hampton Creek</td>
<td>Employee (retail team)</td>
<td>Plant-based (egg proteins)</td>
<td>SF Bay Area, CA</td>
<td>One of the first companies to emerge in recent AP movement; identified by many other interviewees as pioneer in AP space; one of the few AP companies to reach over $100 million valuation; prominent investors (incl. Bill Gates, Khosla Ventures)</td>
</tr>
<tr>
<td>Tiny Farms</td>
<td>Co-founder</td>
<td>Insects</td>
<td>SF Bay Area, CA</td>
<td>One of the first US-based ventures to develop ‘data-driven’ insect farming systems</td>
</tr>
<tr>
<td>Calysta</td>
<td>Employee (management team)</td>
<td>Methane-produced fish feed</td>
<td>SF Bay Area, CA</td>
<td>Pioneer in alternative animal feeds (however, the thesis subsequently focussed only on APs as human food rather than animal feed)</td>
</tr>
<tr>
<td>Geltor (formerly Gelzen)</td>
<td>Co-founders x2</td>
<td>Cellular agriculture (gelatine)</td>
<td>SF Bay Area, CA</td>
<td>First AP gelatine venture; participant at IndieBio during fieldwork</td>
</tr>
<tr>
<td>New Wave Foods</td>
<td>Co-founders x3</td>
<td>Algae &amp; plant-based seafood</td>
<td>SF Bay Area, CA</td>
<td>First AP seafood venture; participant at IndieBio during fieldwork</td>
</tr>
<tr>
<td>Memphis Meats</td>
<td>Co-founder</td>
<td>Cellular agriculture (meat)</td>
<td>SF Bay Area, CA</td>
<td>Only California-based cultured meat company; participant at IndieBio during fieldwork</td>
</tr>
<tr>
<td>Impossible Foods</td>
<td>Employee (analyst)</td>
<td>Plant-based (meat and cheese)</td>
<td>SF Bay Area, CA</td>
<td>Pioneer in plant-based space, largely due to development of ‘plant blood’; one of the few AP companies to reach over $100 million valuation; prominent investors (incl. Bill Gates); connected through another interviewee</td>
</tr>
<tr>
<td>Beyond Meat</td>
<td>Employee (marketing team)</td>
<td>Plant-based (meat)</td>
<td>Los Angeles, CA</td>
<td>One of the first companies to emerge in recent AP movement; prominent investors (incl. Khosla Ventures)</td>
</tr>
<tr>
<td>Soylent</td>
<td>Co-founder</td>
<td>Food replacement drink</td>
<td>Los Angeles, CA</td>
<td>While not intended as a replacement specifically for conventional animal foods, Soylent has been a pioneer venture in the recent US food tech scene and received considerable hype and financial backing. The company also shares well-known investors with a number of the AP companies in this table.</td>
</tr>
<tr>
<td>Exo</td>
<td>Co-founder</td>
<td>Insects</td>
<td>New York, NY</td>
<td>One of the first US-based edible insect companies</td>
</tr>
</tbody>
</table>

*Figure 3: List of US-based AP companies interviewed*
<table>
<thead>
<tr>
<th>Organisation/Individual</th>
<th>Location (at time of interview)</th>
<th>Rationale for interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private investor†</td>
<td>SF Bay Area, CA</td>
<td>Conference discussant on future of food tech; personal interest in investing in APs</td>
</tr>
<tr>
<td>Private investor</td>
<td>SF Bay Area, CA</td>
<td>Conference discussant on food tech investment in Silicon Valley</td>
</tr>
<tr>
<td>Future Institute</td>
<td>SF Bay Area, CA</td>
<td>Recommended by a US-based colleague researching APs; have engaged in future-casting work and published reports on the future of meat and food</td>
</tr>
<tr>
<td>PETA†</td>
<td>Los Angeles, CA</td>
<td>Non-profit animal rights organisation; sponsored a $1million prize in 2014 to first scientist to create and bring to market cultured chicken product (prize was never received); has maintained support and interest in cellular agriculture and plant-based APs</td>
</tr>
<tr>
<td>Mercy for Animals†</td>
<td>Washington, DC</td>
<td>Non-profit animal rights organisation; has maintained support and interest in cellular agriculture and plant-based APs; launched sister organisation Good Food Institute (GFI) in 2016 which provides business, legal, financial and media support to early-stage cellular agriculture and plant-based companies (incl. Memphis Meats)</td>
</tr>
<tr>
<td>Humane Society US (HSUS)†</td>
<td>Washington, DC</td>
<td>Non-profit animal rights organisation; has maintained support and interest in cellular agriculture and plant-based APs; direct connections with key AP institutions (e.g. Josh Balk (Senior Director for food policy) is a co-founder of Hampton Creek, and both he and Paul Shapiro (Vice President of Policy) are on the GFI advisory council</td>
</tr>
<tr>
<td>Venture capital fund</td>
<td>London, UK</td>
<td>Prominent investor in APs</td>
</tr>
<tr>
<td>Food Ethics Council</td>
<td>London, UK</td>
<td>Leading UK charity on the ethics of food and farming; conducted research project on cultured meat during 2014-15; held one of their regular Business Forums and published a report in 2015 on the topic of ‘A steak in the future’ which considered the viability and ethical considerations of cultured meat</td>
</tr>
<tr>
<td>PhD researcher</td>
<td>London, UK</td>
<td>Only UK-based academic working on the production of cultured meat</td>
</tr>
</tbody>
</table>

Figure 4: List of other interviewees working in AP sector (US and Europe)

† Interviews conducted via Skype from London, UK
global agri-food system, and to contextualise APs as both a product and reinforcement of contemporary logics of the Anthropocene era.

4.1.2.4 **Limitations and the data as representative of ‘the field’**

While a number of interview requests to AP companies were met with non-responses early on in the project, these were generally limited to informants based outside of California and so were largely beyond what became the primary geographical focus of the project. All of the California-based companies I contacted agreed to interview, and four were willing to participate in follow-up meetings. Within this selection I was able to gain interviews with a diverse variety of companies currently working in the AP sector, including those who are seen as pioneers in the space (often due to factors such as technological advancement, multi-million dollar valuations, or simply being the first venture to attempt production of a specific AP (see Figure 3)). As such, the data provides insights from many of the ventures that have become synonymous with the recent AP movement – both in the US and globally – and have played considerable roles in terms of shaping the direction, strategies and visions of the sector.

Overall, I have found gaining access to AP companies generally unproblematic, an experience which is not always forthcoming in research based on elite interviewing (Ostrander 1993; Delaney 2007; Rice 2010; Thuesen 2011; Mikecz 2012). Specific challenges to gaining access to elites can range from their limited availability to meet for sufficient periods of time, or at all; their tendency to remain in the role of ‘spokesperson’ for their organisation rather than sharing their personal views (Delaney 2007); the material being discussed being highly sensitive due to, for example, commercial interests (e.g. intellectual property); and, difficulties navigating the institutional architecture around elites, such as numerous levels of corporate gatekeepers to access them. As Mickecz (2012, 483) states, “elites are visible but not necessarily accessible”.

While I did experience all of the challenges listed above at various stages during the research project, I believe my general success in gaining access not only to a wide range of US-based AP companies, but also to a number of the top-ranking employees within these ventures, has a lot to do with the timing of my research project – that is, my research began at a time when a lot of my informants had only recently started their
companies, and as such had not yet developed an extensive institutional architecture (e.g. personal assistants, public relations (PR) teams), nor fully adopted the role of ‘spokesperson’ for their companies during interviews (Delaney 2007). Over the course of the project, I was told by some of my participants that as their companies had grown in size, fame and wealth they had become more cautious in accepting interviews with external researchers (e.g. press, researchers). I also noticed during one follow-up interview that my informant spoke much less candidly than in our first meeting, instead remaining largely within the confines of what appeared to be their newly defined PR messaging. These observations suggest that if I had started my project a few years later, I may have found it more challenging to gain access to as wide a variety of AP companies and specifically to their top-ranking employees, and possibly encountered less candid reflections from these informants.

While I typically found accessing AP companies to be relatively unproblematic, accessing investors was significantly more challenging. An example of this issue involved an interview request during fieldwork to a high-profile investor in Silicon Valley. My initial contact was with his personal assistant who suggested that to meet with the investor I should ‘offer something’ from my research that might prove useful to him. It was made clear that the investor’s time was highly valuable and to gain access would require information in return to make it worth his time. I was not comfortable with ‘auctioning’ the findings of my research in this way, and so ultimately abandoned this line of enquiry with this particular individual. The majority of my interactions with investors – or at least their employees – culminated in similar dead ends, often due to their unavailability or unwillingness to speak with me, or in some instances the lack of publicly-available contact details to even initiate contact. These challenges are reflected in the considerably lower number of interviews conducted with this community compared with start-ups and other members of the AP space.

Despite acknowledging these limitations, it is felt that the data collected still provides useful and important insights from many of the leading actors within the recent AP sector, both in the US and globally. As such the interviews can be viewed as representative of many of the values, visions and decision-making that have been fundamental to shaping the development of AP activity over recent years. At the same time, however, ‘the field’ presented and analysed in this thesis is understood only as a
snapshot of this recent AP activity. As described above, a number of key voices were not able to be included, either due to time and budgetary constraints of fieldwork or to difficulties in gaining access to certain informants (e.g. investors). It is also understood that the interpretation of the data in later chapters is one of many stories that could have been told (Longhurst 2012). Furthermore, the project’s attempts to ‘map’ the field of research was done not as a literal exercise, but rather with awareness that ‘the field’ cannot be viewed as a discernible and separate space/time that is ‘over there’ or ‘then’.

In line with Hyndman (2001) and others (e.g. Katz 1994), the thesis adopts the view of the field as ‘here and now’ – that is, to view fieldwork not as a process whereby the researcher moves into a physically designated ‘place’ (e.g. California) within which she may find a ‘people’ (e.g. AP companies) or ‘things’ (e.g. APs) to study (Nast 1994), but instead to see herself as “becom[ing] part of the field” (Hyndman 2001, 265). While the data collected through my interviews with key informants in the AP sector is taken as reflective of their attitudes and decision-making, it is understood that the information gathered is a product of my own and the project’s particular ‘situatedness’ (Haraway 1991; Kobayashi 2009). As such, the interviews are not viewed as a mechanism through which I, as an objective and separate observer, have uncovered ‘truths’ about the AP sector; rather, they are taken as contextually-embedded within the specific researcher-researched relations and situations through which the research process was conducted. These issues of situatedness and positionality are discussed in further detail in the next section.

4.2 Positionality and power in the research process

Much has been written in feminist, post-Marxist and postcolonial studies on the importance of acknowledging positionality and the ‘situatedness’ of knowledge within the research process (Katz 1992; McDowell 1992; Gibson-Graham 1994; Radcliffe 1994; Rose 1997; Nightingale 2003). The concept of situated knowledges stems from Donna Haraway’s influential work in the late 1980s and early 90s which sought to dispel the notion that academic research of any discipline could claim a detached, objective, god-like perspective in its enquiry. As Nightingale (2003, 77) elaborates:
“Central to the concept of situated knowledges is the idea that there is no one truth out there to be uncovered and, as a result, all knowledge is partial and linked to the contexts in which it is created.”

By this argument, there is consequently no view that can claim to be ‘from nowhere’ (Haraway 1991). Rather, Haraway (1988, 589) states that research must always be understood as a ‘view from a body’, a body that is always “complex, contradictory, structuring, and structured”. In understanding that “all knowledge is a product of the context in which it is developed” (Kobayashi 2009), many feminist and geography scholars have since used Haraway's concept to explore the role of researcher in the act of researching, asking important questions about how knowledge is produced, by whom, and for what reasons, and which subjects and discourses within this process may be privileged over others (e.g. Rose 1997).

Such postmodernist readings have spurred fervent debate on the politics of positionality within geography in recent times, particularly in the context of research on peripheral and subaltern populations. Both Nagar (2002) and Raju (2002) have referenced the impasse that has resulted from these debates, where on the one hand the fear of lacking an ‘authentic voice’ to comment on ‘the Other’ has led many to avoid fieldwork; and on the other hand, the turn to self-reflexive approaches has been criticised as “mere ‘navel gazing’ intended to gain legitimacy as ‘authentic researchers’” (Raju 2002, 174). For Raju (2002), this impasse highlights the important contributions postmodernist theory has made to the research process – namely, that speaking for and representing others in academic work is an inherently power-laden and imbalanced endeavour, and that appeals to universalising theories and reductionist categories should be critiqued and rejected. However, her argument tends towards a view that the stalemate such debates have created in certain scholarly domains is ultimately unproductive. This is expressed in the question she puts to the reader midway through her text: “Is the positionality of a researcher so irreconcilably privileged that there can be no bond of commonality between the researcher and the researched?”

In line with these literatures, this project similarly understands knowledge as being situated, and that the researcher unavoidably adopts a privileged position through the process of conducting research. It also adopts the belief that great care must be taken to acknowledge and, where possible, manage this privilege. With regards to this particular project, privilege has manifested through my position as a white, Western academic
working within an institution that during my fieldwork I found to carry with it the prestige of its geography (i.e. London) and its reputation (i.e. it was ‘known’ by many of my interviewees), which likely helped in gaining access to a number of informants (see Herod (1999, 321) and Kobayashi (2009) for interesting discussions of these points). My privilege has also manifested through my position as ‘representor’ of the voices of others through the research, and that despite efforts to remain adaptive and flexible during the research process, ultimately a large part of the control over whose voices to analyse and the interpretation of the ‘data’ has been exercised by myself. Acknowledging points such as these serves to make my position as researcher “explicit and ‘locatable’” (Samers 2006). It is to point to the particular power dynamics inherent in the research process of this project, and recognise myself not as a detached, impartial, disembodied and neutral observer, but rather as situated within my existing knowledges, experiences, values and privileges, as well as those that have been (re)shaped over the course of the project (DeLyser et al 2010).

4.2.1 Power struggles

4.2.1.1 Who’s in control?

While not dismissing the power-laden effects of my positionality described above, there were particularities to this project – i.e. engagement with elites – that require further reflection. As many have observed, research with elites raises the potential for power dynamics that may be qualitatively different from those produced by interviewer-interviewee relations with marginal and subaltern populations (Ostrander 1993; Delaney 2007; Rice 2010; Thuesen 2011; Mikecz 2012). Despite the ‘high regard’ organisational elites can often express for academic researchers, many accounts on elite interviewing highlight how the researcher can often become, to use Delaney’s (2007, 215) term, the “status subordinate”. Delaney explains that this positioning can be both direct – i.e. explicit reference to seniority by elite – or indirect – i.e. the elite’s political/economic status, or the institutional architecture around them (for example, having a personal assistant). I would also add age difference and gender as key contributors to the potentiality for becoming ‘status subordinate’. Almost all of the elite interviews I conducted during this project involved male informants, and some involved informants more senior in age than me. In addition to class, Manderson et al (2006, 1331) note that gender and age in interviewer-interviewee relations can shape “the
interactions of the interview participants” and influence “the style of conversation, the territory of discourse, and the use and meanings of vernacular speech”. Moreover, Neal (1995) discusses how being a young female researcher can also result in not being taken as seriously as male counterparts, thus leading to the potentiality of being seen by the informant as subordinate in status (see also Kenyon & Hawker 1999, 318; Arendell 1997).

Having said this, the Silicon Valley start-up scene is notorious for its proclivity for twenty-something (predominantly male) entrepreneurs looking to disrupt the world. As such, while my focus on this sector certainly raised issues of gender within interviews (more on this below), a high proportion of my informants were of a similar age to me. So while there were a number of interviews where I was conscious of the potential for becoming ‘status subordinate’ due to age difference, this was not as much of a universal concern across the project as perhaps would have been in other corporate/elite sectors that are occupied more with older professionals.

A consequence of becoming status subordinate in elite interviews is that the informant may end up controlling the direction and tone of the exchange. In her experience of elite interviewing, Ostrander (1993, 22) notes “the tendency of elites to ‘just talk’” which she ascribes to “their being used to having others interested in what they have to say and in having what they say make a difference in the lives of others”. She continues with a clarification: “This is an accurate reading on their part of their social status and power, not simply a personal sense of self-centredness or a distorted self-importance”, a distinction which she states “is useful for researchers to understand” (ibid, 22). Delaney (2007, 215) also notes that given their professional and/or social backgrounds, elites are often comfortable seizing control and dominating exchanges, and may even challenge the perspectives of the researcher (Mikecz 2012). Both Rice (2010) and Raco (1999) have discussed instances during interviews where elites have refused to answer questions, often due to the requested information being commercially or politically sensitive. Somewhat related to this, others have noted the challenge of elites staying ‘on-script’ with regards to the views of their organisation – that is, they may remain in their role of ‘spokesperson’ rather than sharing their own views and experiences (Delaney 2007; Ostrander 1993). These points again highlight that “researchers do not automatically establish the agenda” (Rice 2010, 72) in interviews, and that significant
preparation including strategies for dealing with such challenges are essential for getting the most out of elite interviewing (Mikecz 2012).

4.2.1.2 Strategies adopted for this project

A number of strategies to account for these challenges were employed during this project, with many informed by the experiences and advice discussed in the literatures above. For each elite interview, in-depth research was conducted on the informant’s organisation and involvement in AP activity, and efforts were made to find out the norms and culture of their working contexts (Mikecz 2012). One example of this was establishing their preferred form of professional contact, and using their language in correspondence and the interviews themselves. Informality, high technological literacy, and prevalent use of social media and other communication platforms beyond the more conventional ‘work email’ are common features of the working culture in Silicon Valley. To remain flexible to these factors, on a number of occasions I made use of platforms such as Twitter and LinkedIn as well as email, phone and in-person meetings at industry events to make initial contact with informants.

The suggestion by other researchers that elites are generally comfortable with ‘just talking’ during interviews was generally supported by my own research experience. While Ostrander (1993) describes instances where her informants began talking as soon as introductions were completed, I did find that most of my interviews started with a request by the informant to recap my research interests and motivations for speaking with them. This consequently gave me the chance to set up loose parameters of my expectations for the interview, and I would also make a point of placing my open notebook in front of me so the list of questions were visible to the informant – this was not with the intention of them necessarily reading the list, but simply to act as a reminder that I had clear questions/themes I had prepared and wanted to talk about.

Regarding instances of informants ‘seizing control’ during interviews, I generally adopted Delaney’s (2007, 215) suggested tactic (inspired by jiu-jitsu!) of “using your opponent’s momentum to your own advantage”. In this way I sought to use any tangential topics the interviewee raised as connecters to those I wanted them to reflect more on. I also adopted the role of ‘inquisitive learner’ as a way of encouraging this further reflection. This strategy, Delaney states, allows the researcher to turn their
position as ‘status subordinate’ to their advantage, enabling them to probe an interviewee’s thoughts on a topic in a non-threatening way (e.g. ‘Could you explain further as I don’t fully understand…’) (ibid, 215). This approach was also useful in the instances I genuinely did not understand the more technical details of the AP sector, often relating to specific language or scientific procedures used in AP production.

There was only one occurrence during my interviews where I was consciously aware of an informant refusing to answer my question. This did not involve an outright refusal, but rather I noticed a very rapid change in tone in the informant’s answer which was obviously intended to quickly shut down that particular line of enquiry. The topic in question was regarding the origins of the scientific research that underpinned the particular company’s production of APs. The exchange proceeded as follows, with italics used to denote the change in tone by the informant (the specific protein source is removed for purposes of anonymity):

\begin{quote}
**AS:** I’m interested in how you came to decide on [specific protein source]. Was it just, you know, plucked out of the air?

**HC:** Yeah, it was literally what’s next on the list…like going down a line of [sources] we wanted to test…Then we brought in new people and we said ok what varietal did you test, and how many because there’s over 230 varietals of [specific protein source], so it literally was just like on a list we wanted to test.

**AS:** So did that come from a particular scientist’s work beforehand? Or just a list from somewhere else?

**I:** You know, I’m not sure. I’d imagine it did. It’s a good question though.

**AS:** Yeah, it just seems, it’s incredible that you’ve been able to do so much with just one [protein source] variety.

**I:** Yeah, I agree.
\end{quote}

Going into this exchange I was aware from previous research that this particular topic was a sensitive issue: questions have been raised in Valley media cycles about where the ‘science’ behind this company’s activities has come from, and the issue was also commented on during a panel at a food tech conference I attended in San Francisco. While the informant’s answers had been much longer and more detailed in the rest of the interview, the two penultimate responses in the transcript section above were noticeable in their short and curt nature.

Upon reflection, I feel I could have used additional strategies to probe further on this line of enquiry. Admittedly a mixture of relative interview inexperience (this was quite
early on in the project’s fieldwork), and uncomfortableness with navigating confrontation and more ‘threatening’ questions led me to topic-shift too quickly away from the subject. I highlight this exchange in the spirit of Rose’s (1997) confessionary account of research ‘failures’, and as an example of a common obstacle to data collection discussed in elite interview literatures: that is, the refusal of an informant to fully answer a question due to the information being deemed sensitive. This was the only refusal I was conscious of during my interviews. In other cases of discussing sensitive material, a couple of informants asked for their answers to be off-record. In these cases I would turn off the Dictaphone and resume recording after the topic had been discussed, and no reference to their comments during this time was made in the thesis. This only happened on two occasions and was not felt to have impeded the data collection of the project.

4.2.1.3 Considering gender and ‘Otherness’ in the research process

As mentioned above, being a young female researcher opened up the potential of becoming ‘status subordinate’ or a “low status stranger” (Daniels 1967) in the eyes of my (largely male) informants. While I cannot recall explicit feelings of this eventuality, critical studies suggest that the answers and conduct of informants differ according to gender, both of the interviewer and interviewee (Arendell 1997; Horn 1997; Pini 2005; Manderson et al 2006). This does not mean that the data I collected is ‘incorrect’; rather, it should simply be viewed as different on account of its situatedness within the particular gendered relations (and other social, cultural and historical ‘baggage’) of the interviewer-interviewee encounters of this project (Arendell 1997).

While elite interviewing can give rise to these potentialities, it has also been suggested that factors such as gender, age and other types of ‘Otherness’ can in fact work to the researcher’s advantage in accessing and building rapport with elites. Commentators have noted how young female researchers can be viewed as ‘non-threatening’ and ‘harmless’ particularly to male informants (Gewirtz & Ozga 1994), while being an ‘outsider’ both in terms of nationality and profession can position academics as a “friendly foreigner” (Colloredo-Mansfeld 1998) rather than a more “threatening ‘domestic’ investigator” (Herod 1999) or “spy” (Horn 1997; see also Mikecz 2012). As such, my gender, age, nationality and professional position outside the AP sector may have to certain degrees helped to facilitate access and trust with my interviewees.
4.2.1.4  *A turn to the visceral...*

As mentioned above, the use of semi-structured interviews has allowed me to gain rich insights into the perspectives and decision-making that have significantly shaped AP development to date. However, as outlined in the Literature Review, the thesis understands eating to be significantly ‘more-than-consumption’ (Probyn 2000; Goodman 2016), and as such its methodology requires an approach that can ‘get at’ the more bodily, messy and emotional aspects of AP production and consumption. Having spent a lot of time shopping for, cooking and eating a number of AP products during my fieldwork, I saw an opportunity to use these personal experiences as a mechanism for exploring one of the primary aims of the thesis: i.e. understanding the role the visceral realm has played in AP development. Drawing on previous literatures that have used their bodies as a ‘research instrument’ (Mol 2008; Hayes-Conroy 2010; Longhurst 2012; Abbots 2015; Miele 2017), my aim was to examine how my visceral interactions with APs exposed the tensions and opportunities this realm presents to the successful adoption of APs into everyday eating practices. In this way, I was able to explore how the various material and discursive mechanisms used by AP developers worked to responsibilise me to accept APs, and conversely how my visceral reactions helped to facilitate and formed a resistance to this responsibilisation. The design and motivations for adopting this visceral-based methodology are discussed further in the next section.

4.3  **Visceral autoethnography**

4.3.1  *The body as an ‘instrument of research’*

As the debates above show, there has been growing interest in acknowledging and understanding both the presence and ‘situatedness’ of bodies in social science research. However, the ways these bodies ‘sense and make sense’ of the world (Evans & Miele 2012) within the research process has remained relatively under-theorised. The human body is still viewed by many as a text that can be read and analysed, an approach that discounts the importance of other bodily senses through which it may interact with and be affected by other (non)human bodies (Stoller 1997). Within geography there have been increasing calls over recent years for addressing this lack of methodological incorporation of all senses into geographical research (e.g. Crang 2003). Amongst these debates, the tendency to use the visual as the primary lens of accessing ‘the researched’
has been challenged (Johnston & Lorimer 2013), as has the disproportionate emphasis on ‘talk’ (Latham 2003; Hayes-Conroy 2010). In response, appeals have been made for methods and methodologies that overcome this “sensual ‘blindness’” (Johnston & Lorimer 2013, 679) by instead acknowledging and being sensitive to what Crang (2003, 499) terms ‘haptic knowledges’, described as the “processes of learning through our bodies’ responses and situations”.

Elsewhere in feminist and cultural geography there have been similar calls for greater acknowledgement of the connection between bodily senses, emotions and (bio)political subjectivities, and important explorations have begun into new ways of re-valorising ‘the visceral’ within research practices – both relating to the bodily experiences and subjectivities of participants but also, and of particular interest to this project, those of researchers (Probyn 2000; Little & Leyshon 2003; Roe 2006; Longhurst et al 2008, 2009; Hayes-Conroy & Martin 2010; Hayes-Conroy & Hayes-Conroy 2010; Johnston & Lorimer 2013). Such approaches thus “take the body seriously” (Dewsbury 2010, 326), treating it as “an instrument of research” (Longhurst et al 2008) that can be used for “allowing deeper inquiry and unearthing additional ways of gathering information” on the feelings, practices and geographies of different bodies (Sweet & Ortiz Escalante 2014, 1827). Building then on earlier theorisings of situated knowledges, these debates serve to remind us that the body “is the location from which one experiences and speaks – and researches” (Pile 2010, 11), a view that prompts methodological questions regarding how the ‘felt worlds’ (Johnston & Lorimer 2013) of the researcher (and researched) may be incorporated and represented in the research process.

Food and eating particularly lend themselves as research topics for ‘getting at’ these felt worlds. Food is something we not only think about but also engage with on a bodily level as we come to ‘know’ it through a multiplicity of senses, and through which (sub)conscious decisions are made whether to ingest and thus incorporate its matter with our own (Mol 2008; Bennett 2010; Evans & Miele 2012). A rich literature has developed that has sought to make use of haptic knowledges to explore food and eating. In her study of the Slow Food social movement, Hayes-Conroy (2010, 736) engages in a number of food-related activities in her aim to ‘access the visceral realm’, including

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37 As Longhurst et al (2008, 208) note, however, it is important to remember that the ‘embodied subjectivities’ of participants and researchers are “not always mutually exclusive categories”.
“meals at homes or restaurants...cooking, gardening, food shopping, farm stays, interning as a restaurant cook, neighbourhood tours, wine tasting, helping to host dinner parties, and attending formal events held by local SF chapters”. Cooking, sharing and eating meals, both with participants and with fellow researchers, have been central to other key studies (Longhurst et al 2008, 2009; Mann et al 2011; Piper 2013; Miele 2017), as has growing (Sandover 2013) and composting food (Abrahamsson & Bertoni 2014). Beyond food-related contexts and focussing more on the ‘felt worlds’ of participants, others have worked with body-mapping (Sweet & Ortiz Escalante 2014), walking tours in urban settings (Johnston & Lorimer 2013), and accompanying specialist visually-impaired walking groups in the Lake District, UK (Macpherson 2008).

Building on these existing debates, I wanted to similarly use innovative methods that allowed me to incorporate my haptic knowledges of APs and thus explore the messier, emotional and more bodily relations that make eating considerably ‘more-than-consumption’ (Goodman 2016). This approach provides a key contribution to the thesis’ analysis of APs as it seeks to understand how their development is entangled with and shaped by emotions and other sensuous, bodily experiences. The ways in which I viscerally interacted with APs during fieldwork were through shopping, cooking and eating, practices that speak to the particular methods in the food research reviewed above (Mol 2008; Hayes-Conroy 2010; Longhurst 2012; Abbots 2015; Miele 2017). Yet while many of these studies have sought to examine the felt worlds of others, in my case I was the sole ‘participant’ in the visceral exercises and as such the research design was centred more around the methods of auto-biography/ethnography. This approach to visceral work brings with it a set of benefits and challenges which are discussed in the following sections.

4.3.2 Visceral autoethnography

Ellis et al (2011, 273) define autoethnography as “an approach to research and writing that seeks to describe and systematically analyze (graphy) personal experience (auto) in order to understand cultural experience (ethno).” The authors describe it as a convergence of autobiograpy and ethnography, a view similarly expressed by Purcell who states autobiography “shares much with biography, ethnography, and autoethnography in that they all aim to provide a rich account of human experience”.

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The use of auto-based methods is not new to geographical research (Moss 2001; Spry 2001; Besio & Butz 2004; Butz 2010), nor to studies of food (Mol 2008; Longhurst 2012; Abbots 2015). Such approaches have proven effective at getting at the less ‘visible’ and more felt aspects of their respective research contexts, and how these are situated within broader social, cultural and political-economic relations. Goodman (2016, 241) has recently called for food researchers to engage more with auto-based methods, stating that “for too long, we as scholars and eaters have been asked to step out of the way in describing the contemporary social life of eating and food” [original emphasis]. The value of auto-based approaches, he argues, is the ability to “get at the complexities and complications of food itself, but also as a way of ‘doing’ and ‘enacting’ more and better food scholarship and food politics” (ibid, 241). In the spirit, then, of stepping ‘back into’ food research, auto-based methods offer a way for the researcher to incorporate herself as ‘a source of information’ into her work, and, like the data collected from other participants, use that information to “elaborate empirical links with concepts” and “to contribute to critically informed uses of the individual” in food/geography research (and in other fields) (Moss 2001, 3). Longhurst (2012, 875) describes similar motivations for her autobiographical account of her personal relationship with weight gain and loss, stating that “autobiography can combine cultural analysis with stories of the self, resulting in thick description that helps to further understanding of individuals’ and groups’ lives.”

The visceral autoethnography developed for this project works to combine these auto-based approaches with the practices of shopping, cooking and eating that have been used elsewhere in food research (Mol 2008; Hayes-Conroy 2010; Longhurst 2012; Abbots 2015; Miele 2017). This combination was seen as an effective way of getting at and providing a ‘rich account’ of my ‘human experiences’ of the more-than-consumption aspects of APs. While eating APs comprised a recurring part of my fieldwork (e.g. tasting sample products at food tech conferences and during interviews), I wanted to focus on visceral experiences that ‘mirrored’ as closely as possible the everyday ways consumers would typically encounter AP products. To eating, I thus added shopping and cooking. I felt that by ‘designing’ the exercise as such provided a more meaningful and effective way for experiencing first-hand the mechanisms of responsibilisation – and any resistance I expressed against them – within the ‘real life’ contexts of AP consumption.
As such, the exercise documented in Chapter 8 relates to a particular sequence of shopping, cooking and eating that occurred in the same day during fieldwork, and involved one AP product – Beyond Meat’s grilled ‘chicken’ strips. This choice of product was largely due to its availability within a local Whole Foods shop in the neighbourhood that I was staying during one of my fieldwork trips to San Francisco. My reasons for the specific flavour choice of ‘grilled’ over the other two available (‘southwest style’ and ‘seasoned’) are reflected on further in Chapter 8, but in short, they were motivated by my feelings that the grilled strips represented less ‘processing’ and would allow me to better assess their ‘chicken’-like taste due to the absence of additional flavouring. There were other Beyond Meat products in the Whole Foods shop (e.g., their ‘beef’ crumble), as well as a selection of Hampton Creek’s eggless mayonnaise products. A further reason for picking Beyond Meat’s grilled ‘chicken’ strips over these other items was motivated by what I felt like cooking at the time I was standing in the aisle debating the different options. It was also influenced by the ingredients I already had in my rented accommodation, as well as the limited number of pans and cooking utensils that were in its kitchen. So, while this visceral exercise could have been conducted on any of the APs available in Whole Foods that day – or indeed another day and in another AP stockist I visited during my fieldwork – it was through an assemblage of emotions, geographies, temporalities and non-human actors particular to that encounter that I came to choose the grilled ‘chicken’ strips for this visceral research exercise.

As Hayes-Conroy & Martin (2010) have done, I recorded these experiences in a diary-like format, writing thick descriptions of my reactions and the environment within which they happened. Care was taken to document as fully as possible the ‘gut feelings’ (Probyn 2000) and emotions I experienced during my different encounters with the AP product. It is now increasingly established within geographical debates that emotions ‘matter’ to how we interact with and give meaning to the world (Davidson & Milligan 2004; Longhurst et al 2008) – particularly in the realm of food and eating (Miele 2011) – and are entangled with and can be manipulated for political and commercial purposes (Meštirović 1997; Bondi 2005; Glassner 2009; Jackson & Everts 2010). Acknowledging and reflecting on emotions and feelings is thus a fundamental part of using the body as a research instrument; it is through these descriptions that the felt world(s) of both researcher and researched may be articulated and thus made ‘visible’. I also used photography to document various stages in this visceral exercise. This was done both
for my own research use as visual records, but also to extend my ‘thick description’ beyond the sole use of written word. This latter motivation points to one of the main challenges, and to some limitations, of conducting visceral-based research which is discussed in the following section.

Overall I found visceral autoethnography a useful and effective method for attending to the research questions that were concerned with the more-than-consumption aspects of APs. It served to complement the other empirical chapters, particularly Chapter 7, by providing a first-hand account of the ways in which I felt, as a consumer, I was mobilised as a ‘responsible eater’ through the materialities and discourses of APs, and conversely how my visceral responses acted to both facilitate and resist this mobilisation. Finally, like Moss (2001), Longhurst (2012) and other researchers document (e.g. Mol 2008), using an auto-based technique enabled me to situate my own experiences within – and consequently shed light on – the broader social, spatial and political-economic networks that shape how we come to ‘know’ and interact with food. To borrow Rose’s (1997, 309) framing, it was a method that allowed me to engage in a dualistic form of reflexivity so that I could look “both ‘inward’ to [my] identity...and ‘outward’ to [my] relation to [my] research and what is described as ‘the wider world’”. As such, and as others have similarly observed (e.g. Longhurst 2012), it provided an effective method through which I could not only think through my ‘situatedness’ within the research process, but also practice it in fuller and more conscious ways.

4.3.3 Limitations: Representation, universality and who’s body?

There are, however, certain issues to consider regarding visceral autoethnography as method. The first relates to which ‘self’ is being evoked and used as research instrument in this ethnographic process, or as Butz (2010, 138) states: “what ‘auto’ is being driven by autoethnography”. The second concerns how, and indeed if, the insights collected through an auto-based methodology can contribute to broader generalisations beyond the particular subject and case study (i.e. my personal interactions) being analysed.

The use of case-specific, context-dependent knowledge has been challenged by many as lacking scientific rigour, namely due to its perceived inability to contribute to more generalised theories and understandings of the wider world (e.g. Dogan & Pelassy 1990). However, the value of case-specific research continues to be upheld as a valid
method for the social sciences. For Flyvberg (2006) it provides a means to ground macro-level theories of social life. The value of the single case-study is thus to intervene on the propensity of social science research to generate theories, but not test them within ‘real life’, embodied contexts (Gerring 2007). In doing so, there is opportunity for generalised theories to be informed and reworked through the lived experiences of the contexts, bodies and relations they seek to describe. Case-specific research thus offers a reflexive, but importantly not causal, connection between the ‘part’ and the ‘whole’ (Becker 2000). While rejecting claims of causality, to avoid the other extreme that has been attributed to the specific use of auto-based case studies – i.e. ‘navel-gazing’ or “self absorbed digression” (Anderson 2006, 385) – I draw on the approaches of Moss (2001), Longhurst (2012) and others in taking care to situate my personal experiences within wider theoretical debates, namely those concerned with the (bio)politics of food and eating, visceral knowing, and how bodies are made as eaters and things as food (Probyn 2000; Hayes-Conroy 2010; Evans & Miele 2012).

In line with this thinking, it is acknowledged that the ‘data’ produced through my autoethnographic account in Chapter 8 is not intended as a “whole picture” (Hayes-Conroy 2010, 736) of how others necessarily engage with and conceptualise Beyond Meat’s grilled ‘chicken’ strips, nor as a ‘whole picture’ of myself as a singular, static and knowable self. It is conducted then with full awareness of the “partial-ness” and “moment-ness” of the experiences I felt and represent in my analysis (Latham cited by Hayes-Conroy 2010, 736). As Longhurst (2012, 877) states in her autobiographical account, it is “of course just one story of many I could have relayed”, and indeed, one of the infinite number of stories other (non)researchers could have told. Moreover, it is understood that there was “no prior reality or unified identity to gain access to or be created by research” (Gibson-Graham 1994, 214) – that is, there was no ‘true self’ to uncover during the research process, and that in treating my body as a research instrument was not to claim it constituted a separate and thus objective lens of enquiry, but rather was situated within – and thus (re)configured by – the research context.

Finally, with any attempt to incorporate the visceral into academic work, the researcher is typically faced with the conflict, even hypocrisy, of using text to represent bodily experiences. This concern has been raised by non-representational theorists (NRT) who argue that emotions are performative (Anderson & Harrison 2006), and are thereby
understood as always ‘potential’ and ‘almost’ (Thien 2005), which in turn makes them ultimately unknowable and ungraspable (Pile 2010). Yet despite these arguments, the use of text to represent bodily experience is a contradiction shared by many NRT literatures as they continue to be largely bound by the written word to describe what they claim to be un-representable (Pile 2010). This can in large part be attributed to the generally ‘wordy worlds’ that academia generates and demands (Crang 2003), and this is identified as the main reason for the use of written description in Chapter 8 of this thesis (as well as the more specific requirements of the doctoral thesis as a word-based document). To attend to this conflict in part, efforts have been made to provide thick descriptions that aim to capture as rich a sense as possible of the visceral and emotional dynamics experienced during the exercise. Attempts were also made to extend beyond a complete reliance on text by the addition of photographs taken during the autoethnographic process.

4.4 Policy analysis

Finally, my use of policy analysis in Chapter 5 was motivated by my interests to understand a fundamental part of the discursive arena through which APs have been catalysed and legitimised as the ‘logical’ and ‘necessary’ solutions to contemporary Anthropocenic crises. Moreover, I also wanted to understand the processes by which these ‘crises’ have been constructed within policy discourse, both in the present through the recent Anthropocene diagnosis but also looking back over the last century at previous problematisations of global food security in international policy texts. In short then, and largely inspired by the poststructuralist thinking advanced by Foucault’s work (see Scheurich 1994), my interests have been to understand how both the ‘problems’ related to global food security and their recommended ‘solutions’ have come to be ‘known’, interpreted and ultimately established as the dominant ways of thinking, and how this has contributed to the development trajectories of the latest APs. My focus is thus concentrated not so much on the intentions of policy discourses, but rather examining the meaning and consequent effects that are materialised through them (Taylor 1997, 24). Such an approach serves to challenge the view that policymakers – and indeed those who act on their discourses – are “responding to ‘problems’ that exist
‘out there’ in the community”, but rather such problems are constructed in and through the discourses that are offered in response (Bacchi 2000, 48).

Drawing heavily on Foucault’s work, Scheurich (1994, 300) provides a useful description of his methodological approach to policy discourse analysis – referred to as ‘policy archaeology’ – which speaks closely to that adopted in this project:

“Policy archaeology, refusing the acceptance of social problems as natural occurrences, examines closely and sceptically the emergence of the particular problem. By what process did a particular problem emerge, or, better, how did a particular problem come to be seen as a problem? What makes the emergence of a particular problem possible? Why do some ‘problems’ become identified as social problems while other ‘problems’ do not achieve that level of identification? By what process does a social problem gain the ‘gaze’ of the state, of the society and, thus, emerge from a kind of social invisibility into visibility?”

In contemplating the social construction of societal problems, such an approach invites consideration of how power is exercised through policy discourses – namely, through the creation of ‘knowledge’ and ‘truth’, and how possibilities for thinking ‘otherwise’ are constrained as a result (Ball 1993). Moreover, policy discourses can have the effect of concealing the power relations inherent in their construction (Bacchi 2000), and of “redistributing ‘voice’” so that “only certain voices can be heard as meaningful or authoritative” (Ball 1993, 15).

In adopting this methodological approach, it is important to consider exactly what is meant by policy ‘discourse’. In reviewing what she terms ‘policy-as-discourse analysis’, Bacchi (2000, 55) states that “there is no single or correct definition of discourse” but that a generally accepted characteristic amongst these literatures is that “discourses are powerful” and that “they provide meanings that assist particular groups to maintain positions of influence; but they are not an overarching structure operating outside of history”. Adopting a materialist interpretation, Codd (1988) views discourse both in terms of spoken and written words as well as the social effects that are produced and governed by such symbols. He states:

“In this sense, discourse refers not only to the meaning of language but also to the real effects of language-use, to the materiality of language. A discourse is a domain of language-use and therefore a domain of lived experience.” (Codd 1988, 242) [original emphasis]

The primary ‘material’ forms of policy discourse examined in this project include official reports published by some of the leading global agencies working on food security
issues – including the FAO, World Health Organisation (WHO), and World Bank. This approach builds directly on established critical analyses of food security policy discourses (e.g. Maxwell 1996; Jarosz 2011; Margulis 2014) and, like these studies, the agencies selected for analysis were chosen due to their considerable influence in shaping and legitimising how global food security is problematised and what actions are deemed necessary in response. A further motivation for selecting these publications is that many of the reports have been directly referenced by key actors working in the recent AP sector, both in my fieldwork interviews and in the promotional materials and media coverage of AP producers and advocacy groups. By focussing on policy reports, the project primarily interacts with policies in the form of written word, and seeks to unpack their power as a form of “textual interventions into practice” (Ball 1993, 12). Yet, as Codd (1988) emphasises, it is essential to recognise that this material form is embedded within and (re)constituted by the domain of ‘lived experience’ which shapes and limits what is said and/or written in the materialised form of discourse.

To analyse the policy discourses selected for this project, then, is to examine both the written words of the reports and the historical, social and political contexts which have shaped their formation. These interests are reflected in the use of the phrases ‘archaeology of knowledge’ or ‘history of the present’ that Foucault often used to describe his approach, and which have inspired the terminology of subsequent policy analyses (e.g. Scheurich 1994; Gale 2001). The examination of contextual factors works to ‘determine the conditions of possibility’ for both language-use and their social effects in policy discourses. It thus acknowledges that policy discourses are not created in political or institutional vacuums, nor do they enter such vacuums once disseminated in their material forms (e.g. as reports) (Ball 1993). By unpacking the historical, political and social networks through which policy discourses emerge, it is possible to reveal the ‘hidden’ power relations that their truth regimes, and the sense of ‘inevitaleness’ these produce, often conceal. It uncovers the political motivations, negotiations and compromises that have shaped the construction of policy ‘truths’ – what Ball (1993) refers to as the ‘ad hocercy’ of policy discourses – as well as the social, material and cultural conditions that have resulted in their construction at specific times and in specific places. Moreover, this approach also reveals that policy discourses are constantly in a state of ‘becoming’ (Ball 1993; Bacchi 2000), and that the ‘problems’ they
identify are “rarely solved, except in the sense they are occasionally purged from common discourse or discussed in changed legal, social or political terms as though they were different problems” (Edelman cited by Bacchi 2000, 48).

Building on the work of Foucault and other poststructuralist analyses of food security policy discourses (e.g. Jarosz 2011), this dissertation (i.e. Chapter 5) conducts a ‘history of the present’ to consider how the problematisation of food security over the last century has played a role in enabling APs to materialise as logical solutions to Anthropocenic tipping points at this contemporary moment. It is important to note here that, in adopting this approach, the chapter does not claim to uncover a unidirectional and singular line through the events it examines, and present APs as the end product of a neat and sequential story. As Kendall & Wickham (1999, 14) state, of interest to this Foucauldian method is not a search for ‘causes’ but ‘contingencies’, so that APs are considered not as a necessary conclusion to the events examined but as “one possible result of a whole series of complex relations between other events”.

4.5 Conclusion

This chapter has outlined the design and rationale for the project’s methodology and considered the various benefits and challenges associated with its different approaches. As set out at the beginning of the chapter, I wanted a methodology that was at once cohesive yet also flexible and adaptive to the multiplicity of themes in my research questions that the study of food necessarily demands. As such, I decided to adopt a mixture of methods that includes semi-structured interviews, visceral autoethnography and policy analysis. In line with the benefits they each present as research tools, these approaches are deployed to different extents within different chapters. For example, building on previous AP scholarship and critical food studies, semi-structured interviews were seen as the most effective method for gaining insights on the perspectives, practices and values that have driven many of the key influencers within the AP sector. Interviews thus form the primary method used in Chapters 6 and 7 which attend to questions concerning who and what products are involved in AP development; what logics, imaginaries, materialities and geographies have driven the decision-making by these actors; and, what are the biopolitical implications arising from these processes.
Yet it is strongly advocated in this project that food research must extend its focus beyond solely ‘talk’ and discourses to also engage with the visceral realm, the latter of which constitutes a fundamental part of everyday eating practices (Probyn 2000; Hayes-Conroy 2010; Goodman 2016). To conduct this task, I have drawn on important precedents set in previous food scholarship that have endeavoured to incorporate haptic knowledges into the study of eater-eaten relations (Mol 2008; Longhurst et al 2008; Hayes-Conroy 2010; Miele 2017). The visceral autoethnography developed and used in Chapter 8 was designed to mirror as closely as possible the everyday practices through which consumers typically encounter APs – i.e. shopping, cooking and eating. Using my body as an ‘instrument of research’ through these practices allowed me to explore the claims of AP developers and their mechanisms of responsibilisation from the perspective of a consumer (yet as emphasised, without claiming to speak for all consumers). This approach thus serves to complement the other empirical chapters by providing reflections on my own experiences of feeling mobilised as a ‘responsible eater’ through the materialities and discourses of an AP product, and also how my visceral responses acted as both facilitator and barrier to this mobilisation.

Finally, the thesis draws on the Foucauldian-inspired traditions of policy analysis to further unpack the historical, political and spatial situatedness of the recent AP movement. Such an approach is used to address the questions of ‘why Silicon Valley?’ regarding the geographical concentration of recent AP activity, and ‘why now?’ regarding their shared timing and ascendency over recent years. This serves to reveal the relationship between APs and the logics and anxieties of global food security that have evolved over the last century, culminating in the most recent problematisations under the Anthropocenic diagnosis. Conducting a ‘history of the present’ thus helps to expose the broader contextual factors that have enabled APs to become viewed as necessary and ‘logical’ solutions to contemporary crises – factors that have been concerningly overlooked in current AP scholarship.

It is at this macro-level of analysis that the empirical section of the thesis begins in the following chapter. The dissertation then takes this contextual understanding forward as discussion moves first to the geographies of Silicon Valley, then to the biopolitical strategies of APs, and finally into a Whole Foods and my kitchen through a visceral exercise.
CHAPTER 5 | The Nerd's Burden: Alternative proteins as the ‘new’ problematisation of food security

5.1 Introduction

"With the latest tech, UN seeks to end world hunger Silicon-Valley style"

Mis (2016)

“[Food's] ripe for reinvention. We need to look for new ways to raise nutrition in the poor world while shifting some of our choices in the wealthy world"

Bill Gates, founder of Microsoft (2013b)

Approximately two hundred different definitions of food security are estimated to exist (Smith et al 1992). The evolution of the term since its first appearance in a World Food Conference report published in 1975 – defined as “availability at all times of adequate world supplies of basic food-stuffs..., to sustain a steady expansion of food consumption..., and to offset fluctuations in production and prices” (quoted in Maxwell 1996) – has been well documented (Maxwell 1996; Shaw 2007; Jarosz 2011, 2014). This scholarship has shown how world events and key shifts in political-economic and development ideologies have played central roles in both the conceptualisation of and response to food security over the last century – in other words, they reveal the historical conditions through which ‘regimes of truth’ (Foucault 1995) have been established and – particularly through discourse – have served to legitimise certain problematisations and solutions to the issue of food security. Amongst their findings, they document the entanglement of this issue with neoliberal agendas which have served to replace the state with the individual, and self-sufficiency with purchasing power as the mechanisms of food security action at the global policy level (Jarosz 2011). They also reveal the persistent framing of food system failings as the result of under-productivity (and thus scarcity), and technical rather than structural problems (Maxwell 1996; Sommerville et al 2014; Nally 2015). In framing the issue in these ways, we see how the pathways towards technical solutions and industry actors have been repeatedly legitimised as the logical and necessary responses.
Yet missing from this scholarship is the examination of a more recent evolution in food security discourses, one that is characterised by an expansion of how the problem is constructed to include new ‘crises’, and a distinct turn towards new solutions (i.e. APs) and a new cohort of problem-solvers (the actors and practices of Silicon Valley) as the most effective responses. As the quotations above demonstrate, such directions are being rationalised by leading global agencies and thinkers as the necessary means by which to create a food-secure planet. We thus find the UN launching ‘innovation hubs’ and partnering with Valley institutions in its fight against world hunger (Mis 2016), and Big Tech royalty such as Bill Gates declaring the technological ‘disruption’ of food as a necessary pathway to this goal, with specific reference to Valley-based APs including Hampton Creek’s eggless mayonnaise and Beyond Meat’s plant-based meats as promising examples.

The aim of this chapter is to explore how this latest evolution in food security thinking has come to be, and how this has enabled APs and Valley actors to be legitimised as leaders in global food security strategies. Drawing on Foucauldian methodology, it conducts a ‘history of the present’ to consider the historical conditions over the last century through which the issue of food security has been (re)imagined, and unpacks the processes of legitimation that act through its related discourses. It is in tracing the power/knowledge dynamic (Foucault 1972) applied through these discourses that we may contextualise the current moment of food security sensibilities, whereby we find APs and Valley actors legitimised into the project of feeding the world. These shifts represent the emergence of a distinct phase in food security imaginings: what I term the ‘Nerd’s Burden’. This framing builds directly on William Easterly’s (2006) ‘White Man’s Burden’ in his critical study on the West’s economic and ideological dominance in global development agendas. The ‘Nerd’s Burden’ is thus intended to signify the longstanding Western-led enterprise of global civilisation and ‘development’ being passed to the hands of a specific geographical hub of largely male, Valley-based elite, armed with technofixes that promise a better world for all.

This research builds directly on the important work of Jarosz (2011) and other leading critical thinkers on the evolution of food security discourses (e.g. Maxwell 1996; 38 'The White Man's Burden' is itself referenced by Easterly from Rudyard Kipling's 1899 poem of the same title.)
Margulis 2014). Drawing on this scholarship, I trace how food security has previously been constructed as a problem and, in turn, how certain actions have come to be legitimised as the necessary solutions. The chapter then extends the scope of these literatures in two ways: first, by revisiting a largely overlooked period of food security discourse whereby protein became a central concern to political and corporate agendas during the mid-20th century; and second, by considering the contemporary moment of food security discourses today. Regarding the latter point, the chapter documents how food security has been reimagined as a problem not only of scarcity but also overconsumption and Anthropocenic tipping points. A further feature of this re-problematisation has been the rise again of protein – this time, animal protein – as a central issue of food security discourses today. By tracing these evolutions in food security thinking, the ground is established to examine how APs and Silicon Valley are now being legitimised through contemporary ‘truth discourses’ of food security agencies and thinkers as the necessary solutions for feeding the world.

The chapter proceeds as follows: after a brief note on its methodological approach, discussion turns to an overview of existing critical thinking on food security discourses over the last century. This is done to reveal the conceptual evolutions in food security theory and policy that have involved distinct phases of re-problematisation at the international policy level. The chapter then extends this scholarship by considering the changing discourses of food security in the Anthropocene, before then turning to consider the particular role protein has played over the last century: first during the particular episode of the ‘world protein gap’ in the mid-20th century, and now with the rise of what I refer to as the ‘animal protein problem’ over recent years. The events leading to these diagnoses are examined, as well as the shared but differentiated turn towards industrial actors (e.g. multinational oil companies vs. Valley entrepreneurs) and technofixes (e.g. single-cell proteins vs. APs) as the recommended and legitimised solutions. In doing so, the chapter follows Carolan’s (2013, 11) assessment of food security discourses as a “process of cumulative continuity”, while at the same time seeking to highlight key changes in the truth discourses of the current ‘Nerd’s Burden’ phase, and the new geographies, expertise and solutions that have been mobilised as a result.
The chapter closes with discussion of the implications materialised through this latest evolution in food security thinking. In particular, it builds directly on Jarosz’s (2011) work which explores the relationship between the changing definitions and scale of food security discourses, and how these have served to entrench neoliberal ideologies in the project of feeding the world. The chapter extends Jarosz’s observations by showing how the recent evolutions in food security discourses represent further scalar as well as spatial and material shifts in the modern neoliberal project of food security, the consequences of which extend across the political economies of both food and global development. These shifts reveal the reproblematisation of food insecurity in the following ways: a) as a problem not only of the hungry poor in the South but also the overfed rich (and poor) in the North; b) an issue extended across the global scale through its complicity in and vulnerability to Anthropocenic tipping points; c) the rationalisation of Silicon Valley as a leading geographical and ideological hub of food security strategies; and, d) the material evolution from emergency relief products to burgers, meatballs and mayonnaise as the future of food security solutions. As well as these conceptual and material changes brought about by this turn to APs and Valley actors, the continuance of certain themes through this trend are also examined.

5.2 Methodological approach

To conduct this analysis, the chapter adopts a methodological approach developed by Foucault, but one that is distinct from those used elsewhere in the thesis. In The Birth of the Clinic, Foucault (2013, xxi-xxii) outlines the aim of his research as follows:

“The research I am undertaking here therefore involves a project that is deliberately both historical and critical, in that it is concerned – outside all prescriptive intent – with determining the conditions of possibility of medical experience in modern times.”

The chapter takes inspiration from this methodology, often referred to as a ‘history of the present’ (Kendall & Wickham 1999). It engages in a historical and critical analysis that works to ‘determine the conditions of possibility’ of APs and Valley actors developing at this contemporary moment as rationalised solutions to global food security. It approaches as an object the truth discourses of food security over the last century – with ‘truth’ understood in Foucauldian terms as “a system of ordered
procedures for the production, regulation, distribution, circulation, and operation of statements”, and to which “specific effects of power are attached” (Foucault & Rabinow 1984, 74). The chapter analyses these discourses to examine how the issue of food security has undergone key conceptual shifts; evolutions that tell a story of the changing rationalisations of political and scientific thinking during this period, and the entanglement of food and nutrition in such agendas. Adopting this methodology is not to suggest that ‘facts’ in a pure, ahistorical form are there simply to be recovered, lying in wait untouched by the “historical reason that has already subjected them to an order without appeal” (Rose 1990, based on Gordon 1989). Instead, the chapter’s focus is historical reason itself in the context of food security; that is, how this global issue has both been problematised, and solutions and their executors rationalised into the project of creating a more food-secure world. Moreover, it is important to note that the chapter does not intend to draw a unidirectional and singular line through the events it discusses and present APs as the end product of a neat and sequential story. As Kendall & Wickham (1999, 14) state, of interest to this Foucauldian method is not a search for ‘causes’ but ‘contingencies’, so that APs are considered not as a necessary conclusion to the events examined but as “one possible result of a whole series of complex relations between other events” (see also Deleuze & Guattari 1988).

This approach requires examination of what Foucault termed the ‘historical ensemble’ which encompasses such things as notions, institutions and scientific concepts, amongst many others (see Rose 1990, 373). Amidst this milieu, a central focus of this chapter is on the truth discourses of leading global institutions of food security, such as the FAO, WHO and World Bank, materialised through their official publications. This approach builds directly on established critical analyses of food security policy (e.g. Maxwell 1996; Jarosz 2011; Margulis 2014) and, like these studies, the institutions selected for analysis were chosen due to their significant influence in shaping and legitimising (inter)national public and private action on food security. A further motivation for this focus is that many of the reports published by these institutions were directly referenced by key actors working in the recent AP sector, both in interviews conducted by the author and those published in the media and the promotional materials of AP companies. In addition to policy discourses, the chapter also draws on narratives sourced from 25 interviews conducted with key personnel in the AP space (e.g. start-up co-founders, advocacy groups, investors), and from key secondary materials related to
the sector (e.g. conference presentations, advocacy and PR materials, AP advocacy and company websites, media articles).

5.3 Food security: A changing problem

5.3.1 Global markets, the spectre of scarcity and Anthropocenic tipping points

“A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”

FAO’s current definition of food security

The term food security has undergone key conceptual shifts over the 20th century. Following food shortages in the post-World War years and the global food crisis of the 1970s, food security in the mid-20th century was problematised primarily as an issue of scarcity. As Jarosz (2011, 117) notes, the term food security has and continues to be “used interchangeably with ‘hunger’”. During this period, the association between scarcity and food insecurity has also possessed a distinct spatial characterisation whereby it has largely been deemed a problem of the hungry poor in the Global South.

This concern over scarcity has led to what many refer to as the ‘productionist paradigm’, meaning the belief that food production must continue increasing to sufficiently meet the needs of the global population. The continuance of ‘Malthusian pessimism’ (Sen 1982) during the 20th century which warns of population growth outstripping food supply has given this paradigm added legitimacy and urgency. For example, it contributed to the rationalisation of the Green Revolution, where the primary objective was to increase calories in the developing world. Through this paradigm, food insecurity was primarily understood as the consequence of under-productivity, a problem that could be addressed through intensifying production both by scaling up agricultural systems and adopting the high-yielding crop varieties (wheat, corn, rice) and technological inputs (e.g. synthetic fertiliser) of Northern agribusiness (Carolan 2013). During the period between 1960 and 1985, food production in developing countries doubled (ibid, 18), leading many to herald the Green Revolution as a great success. However, critics have since highlighted that the gains in productivity

have been vastly undermined by the ecological footprint of the Green Revolution’s intensive model, the privilege afforded to technological and market-led solutions over socio-political reforms, and the consequent role this has played in deepening social and economic inequalities for the world’s most vulnerable populations (Shiva 1991).

While the productionist paradigm persists in food security discourses, the ground-breaking work of Amartya Sen (1981) signalled a conceptual evolution that added a further concern to the problem of food security: the issue of access. Sen demonstrated that supply of food did not guarantee a reduction in hunger; rather, he argued, food security needed to account for social and economic access by different individuals to food. A consequence of this shift was a reimagining of food security as not only the absence of hunger, but also the ability by individuals to purchase food (Maxwell 1996; Jarosz 2011). The continuance of this framing is evident in the Foreword of a recent FAO report:

“One of the hardest challenges for food security is ensuring that all who need food have the means to buy it”

(FAO 2011, ix [my emphasis])

This change marks a key moment in the re-scaling of food security thinking whereby earlier strategies of building national self-sufficiency were replaced by calls for increased globalisation and trade liberalisation, and the reimagining of individuals as economic agents in the global food system (Jarosz 2011). Carolan (2013) refers to this phase in food security discourses as the ‘neoliberalisation of food security’. In practice, these conceptual shifts from the national to individual level, and from self-sufficiency to purchasing power, had the material consequences of opening food security to the “institutional architectures” favoured by the World Bank and other neoliberal bodies (Margulis 2014). These included interventions such as the insertion of agriculture into the General Agreement on Trade and Tariffs (GATT) (Farsund et al 2015), and structural adjustment policies that encouraged nations to sell their food reserves, guided by the World Bank’s reasoning that “it was more cost-effective to buy grain on the international market using revenues from exports” (Jarosz 2011, 126). Such developments have served to maintain the geographical and political-economic asymmetries of power across the global food system, and prioritise economic growth over the eradication of hunger (Sommerville et al 2014). They have also further
entrenched "food's status as a commodity" rather than a human right (Jarosz 2011, 126), thereby privileging and legitimising economic interventions as the central means to achieving food security.

A resurgence of Malthusian pessimism has occurred in recent years in light of predictions that global population numbers will increase to 9.5 billion by 2050. As such, there have been renewed calls for increased food production (Tomlinson 2013; Candel et al 2014), with some experts claiming rates will need to double to meet projected population demands (e.g. FAO 2009, 2013). Yet at the same time, food security discourses have undergone a further evolution that has received less analysis by existing scholarship. This has involved the broadening of definitions beyond the sole issue of scarcity (whether through absence of supply or access) to also consider overconsumption of calories, particularly unhealthy or 'empty' calories (Carolan 2013), as an additional threat to food security. While it is apparent that total availability of food has in fact continued rising over recent decades, it is now increasingly recognised that this trend does not adequately capture where and by whom these calories are being consumed. As a recent FAO report summarised:

"World average per capita availability of food for direct human consumption, after allowing for waste, animal-feed and non-food uses, improved to 2,770 kcal/person/day in 2005/2007. Thus, in principle, there is sufficient global aggregate food consumption for nearly everyone to be well-fed. Yet this has not happened: some 2.3 billion people live in countries with under 2,500 kcal, and some 0.5 billion in countries with less than 2,000 kcal, while at the other extreme some 1.9 billion are in countries consuming more than 3,000 kcal."

(Alexandratos & Bruinsma 2012, 1)

This pattern of 'stuffed and starved' populations is an inherently geographical phenomenon (Patel 2007), with calorie abundance largely concentrating in the Global North and undernourishment remaining a persistent reality in developing countries, particularly in Africa (Baro & Deubel 2006; Devereux 2009).\(^{40}\)

The recent Anthropocene diagnosis has also further expanded the problematisation of food security. These discourses have served to highlight the urgent and systemic vulnerability of global food production to the array of planetary tipping points that

\(^{40}\) However, recent studies have noted the rising trends of obesity and malnutrition from overconsumption of calories in developing and rising-income countries, with particularly dramatic increases in China and Latin America (Uauy et al 2001).
characterise the Anthropocene era – from climate change to decreasing natural resources. Such trends are predicted to have severe and global-reaching impacts on food systems (Schmidhuber & Tubiello 2007), with the most vulnerable populations worldwide already suffering the consequences of reduced availability and access to safe, nutritious food. Achieving food security in the context of climate change has been declared by the FAO (2016) as one of the most “daunting challenges facing humankind”. Added to the ecological crises facing the food system, further concerns have been raised regarding the welfare of livestock animals (Miele et al. 2005; CIWF 2009) and the safety of global food supplies. As will be shown below, links are now being made between the intensification of food production – particularly livestock – and the growing prevalence of zoonotic diseases in food supply chains and antibiotic resistance in human populations worldwide. In an era of Anthropocenic tipping points we thus find the project of global food security problematised across a multitude of new fronts: from ecological instability and rising (non)human welfare risks, to the threats of uncontrollable population numbers and the persistent spatialised polarities of scarcity and abundance (Patel 2007; Nally 2011).

5.4 The protein problem

While the history of food security narratives has undergone extensive and important scholarly analysis, the specific role of protein in shaping these discourses has received less attention. Over the timescale examined in this chapter, there are two distinct periods in the problematisation of food security whereby protein has been elevated as a central concern and diagnosed as a crisis of global-scale. The first relates to a time during the early to mid-20th century and the declaration of the ‘world protein gap’, a diagnosis which saw the dominant message of scarcity being reimagined through the lens of protein deficiency. The second period relates to contemporary trends in which today’s food security concerns – i.e. under- and overconsumption, Anthropocenic tipping points, and growing demand – have undergone a similar protein-centric gaze, although this time specifically animal protein. This section provides an overview of these respective problematisations and considers the continued turn to the industrial technofix as the ‘rational’ and ‘necessary’ response.
5.4.1  *A nutricentric crisis in the mid-20th century*

"Certainly, throughout most of history and prehistory, and among the less developed countries today, the problem has always been that of too little, rather than too much, protein. Individuals and populations are therefore well advised to pursue a production strategy aimed at maximizing protein intake and at resisting any lowering of per capita norms."

*Harris cited in Diener et al 1980, 172*

In the early 1930s, Dr Cicely Williams, a paediatrician working in the Gold Coast (now Ghana), published findings on a disease locally referred to as *kwashiorkor*. Williams noted that the illness usually affected children between six months and four years old who had been weaned early due to the arrival of new-born siblings. With a high mortality rate, Williams sought to distinguish cases of kwashiorkor from the common diagnoses of *pellagra*, a vitamin deficiency disease, and *marasmus*, a form of severe calorie deficiency, both of which were perceived as the prevalent causes of infant and child undernutrition (Sathyamala 2016). Williams instead pointed to “amino acid or protein deficiency” (cited in McClaren 1974, 93) as a probable cause, an argument supported by the reduction in symptoms through administering “sweetened condensed milk with cod-liver oil and malt” (Williams 1935, 1151).

Her findings were, however, met with contestation by the Western medical community, an outcome which Stanton (2001, 149) attributes to Williams’ openness to local traditional knowledge (a stance in direct opposition to medical thinking at the time) and the strong gender biases that existed in the medical profession. Yet in just over a decade, the recently formed FAO and WHO had declared kwashiorkor as “the most serious and widespread nutritional disorder known to medical and nutritional science” (Brock & Autret 1952, 72). With such statements, the localised findings of Williams’ research in Africa had been extrapolated into a crisis of global scale, soon referred to as the ‘world protein gap’. Undernutrition was thereby recast as *malnutrition*, a distinction that led to significant changes to the institutional arrangements and official framings of food security, as well as the recommended courses of action. For example, Sathyamala (2016, 824) notes the distinction made by the FAO in 1955 between energy and protein requirements, with greater emphasis and urgency given to the latter in tackling food...

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41 Williams borrowed the word kwashiorkor from the local Ga dialect, translated as ‘the disease of the deposed child’ (Stanton 2001).
security issues. Later the FAO would pronounce that “the No. 1 problem of the F.A.O.
and for national agricultural departments is the production of protein foods of good
quality” (cited in McClaren 1974, 94). Dedicated advisory groups were established –
such as the US National Research Council’s Committee on Protein Malnutrition and the
WHO/FAO/UNICEF Protein Advisory Group (PAG) – to examine cases of protein
deficiency and recommend solutions (Marstrand & Rush 1979). In a 1968 report
*International Action to Avert the Impending Protein Crisis*, presented by an expert panel
to the UN, it was stated that: “The protein gap in the nutrition of the population of our
planet is becoming a most important scientific, technological and public health problem
and a national and international issue” (cited in Carpenter 1994, 162).

### 5.4.2 The technofix turn: A lesson from history

Initial responses to the protein gap diagnosis by the international community included
the exportation of dry skim milk from the US, a foodstuff which the nation happened to
have in major surplus at the time. The alignment of a pronounced global deficit in
protein foods with the availability of excess milk in the US has since been described as
the “fortunate by-product of a domestic surplus-disposal problem” (Berg, cited in
McClaren 1974, 94). By the mid-1960s however, US milk stocks were considerably
lower than had been projected.

Around this time, recommendations at the global policy level were shifting towards
solutions from unconventional sources (Carpenter 1994). Encouraged by these
discourses, industrial players in the Global North began directing vast sums of funding
to the development of novel protein-rich foods, ranging from single-cell proteins (SCPs)
grown on crude oil to the fortification of wheat with lysine (a synthetic amino acid and
by-product of the nylon industry) (McClaren 1974; Carpenter 1994). As the next section
documents, a major consequence of these developments was to bring the unlikely actors
of multinational oil companies into the arena of food security, and in doing so set up a
precedent to the recent AP movement whereby a protein-based technofix became the
logical solution to a food-secure planet.
5.4.2.1  A new problem, a new market: Making proteins from oil

One of the first major industry players to attend to the protein gap was multinational oil company British Petroleum (BP). In the early 1960s an employee of a BP French affiliate laboratory, Alfred Champagnat, began experimenting with growing yeast on oil as a potential human food source (Bud 1994). He found that not only could cheap petroleum or organic waste-based hydrocarbon feed stocks be used to grow the yeast, but the final product also contained the full range of amino acids and thereby presented both a nutritionally viable and cheap protein alternative. Moreover, the infrastructure for its production was already available on a multinational scale, meaning the major oil companies were in a position to mass-produce these fermented products, or single-cell proteins (SCPs) as they later came to be known (Mateles & Tannenbaum 1968; Scrimshaw 1968). In Champagnat’s mind, this protein-rich product was the ideal solution for the world-hunger problem.

BP quickly adopted Champagnat’s vision and heralded SCPs as the dawn of a ‘third age’ in the history of man where food would, through biotechnologies, be “entirely under [man’s] control” and involve “no soil, sunlight, or even assistance from human labour” (Scott-Smith 2014). Elsewhere similar ventures had begun at Shell, Hoescht and ICI in Europe, in the Soviet Union and Japan, and in a joint research partnership between Standard Oil and Nestlé in the US (Carter 1981; Bud 1994; Bamberg 2000). By mid-1965, BP was arguably the frontrunner having established three research laboratories and two pilot plants in France and the UK, in addition to a product-testing facility in the Netherlands.

However, despite initial ambitions of developing SCPs as a solution to world hunger, it was quickly decided by BP management and in many of the other oil companies that animal feed would be a more practical and lucrative option (Bud 1994). This change in direction was in part due to their products containing higher levels of unprocessed yeasts and nucleic acid (a major cause of human gout) than permitted in human food products, and the promise of higher economic returns. It also removed the challenge of

42 The industrial production of microbial biomass has its origins in the late 1900s with baker’s yeast, yet it was during World War I and II that yeast biomass began to be grown specifically as a human food due to its high levels of proteins and essential minerals and vitamins (Halász & Lásztity 1990, 193-94); the authors also include a history of pre-industrial uses of microbial biomass as human food).
the ‘yuck factor’ associated with consumer-facing products (Anupama & Ravindra 2000; Bamberg 2000).43

The ambitions to develop SCPs as animal feed were, however, unable to be realised. This was due to a multitude of factors, ranging from the spike in oil prices following the oil embargo in 1973 (Senez 1986), to the shift towards high-yield crop production as the priority food security strategy, driven by advances in Green Revolution technologies and the rapidly growing soya-bean industry (Goldberg 1988; Bud 1994). As a consequence, the drive to develop SCPs as a food security solution began to experience severe casualties amongst the major oil companies, with most folding their operations by the end of the 1960s (Ellingham 1980; Bud 1994, 136). BP attempted to ride the wave of setbacks but eventually ceased all SCP operations in 1978 (Bamberg 2000, 443). ICI were by then the only player left in the SCP race; over the next decade they also terminated their operations but the company would return to the SCP world again with the development of Quorn.

5.4.2.2 From feeding the many to feeding the few: The case of Quorn

At the same time Champagnat’s work was inspiring the turn to SCPs within the oil and chemical industries, explorations had begun at British bread-making company Rank Hovis MacDougall (RHM) on the potential of growing protein-rich food on the company’s surplus starch (Bud 1994; Trinci 1994). This was largely due to the personal interests of the company’s director Lord Rank, a devout Methodist and philanthropist, in addressing the world-hunger problem.

By 1970 a mycoprotein had been identified (Fusarium graminearum A3/5) which possessed the ‘natural consistency’ and nutritional profile they were looking for (Sadler 1988; Bud 1994).44 The next decade was spent fine-tuning this mycoprotein, or Quorn as it would later be named, and addressing quality issues so as to ensure it met with human food safety regulations. In 1984 Quorn was given unconditional approval by the

43 A contributing factor to this negative response was the framings used by SCP producers to describe their products: prior to ‘single-cell protein’ becoming the official terminology, the oil companies had given their products the uninspiring names ‘proteins-from-oil’, ‘microbial protein’ and ‘petroprotein’ (Anupama & Ravindra 2000, 460; Bamberg 2000). It was soon acknowledged that ‘single-cell protein’ was a more favourable term and the brand names Toprina and Pruteen were developed to increase their appeal as consumer products.

44 The mycoprotein the RHM team discovered is derived from the naturally-occurring plant Fusarium graminearum (see Davies & Lightowler 1998, 92).
UK’s Ministry of Agriculture, Fisheries and Food (MAFF) to be sold for human consumption. In the same year RHM formed Marlow Foods – a joint venture between RHM and ICI – with the aim of scaling-up production through the use of ICI’s fermenters that had originally been built for their own SCP production a decade earlier (Bud 1994). The first Quorn consumer product, Sainsbury’s savoury pie, made its retail debut in 1985 in the UK supermarket chain Sainsbury’s, and by 1988 Quorn was being served in the restaurants of British Home Stores to high reviews (Trinci 1994; Sadler 1988). The product range has since grown to a variety of ready-meals and uncooked forms that aim to simulate conventional animal protein products (e.g. ‘beef’ mince, ‘chicken’ pieces), and is now available in food retailers throughout the UK, Europe and the US.

As with many of the earlier SCPs, the original vision for Quorn similarly failed to materialise with the final product. Rank had envisaged that his product would feed the world’s poor yet the cultural and economic challenges that had occurred during Quorn’s long development ended up steering its trajectory in a completely different direction. By the time of its commercial launch, Marlow Foods had decided to target the growing vegetarian market in the UK by promoting Quorn as a healthier alternative to meat due to its lower calories, saturated fats and cholesterol (Trinci 1994). The other major factor in this change of direction had been the challenges posed by the materialities and economics of production: over the course of testing it had been found that using RHM’s waste starch as the growth medium was not economically viable and so the company began importing American maize as an alternative (Bud 1994, 137). What had thus begun as a philanthropic and sustainably-minded project had instead produced a specialist food product for middle-class, Western consumers with a higher carbon footprint than initially intended.

This brief history of the protein gap era and SCP response reveals three key findings that are instructive for analysing the recent AP movement: first, the re-problematisation of food security through a nutricentric lens, elevating protein to the centre of political agendas; second, the result of this diagnosis leading to calls at the international policy level for technical and industry-led solutions; and third, the tensions between initial techno-utopian visions and the material, economic and visceral obstacles that ultimately prevented earlier AP ventures from ending world hunger. While world events and changing food security theorisations resulted in the abandonment of this protein-centric gaze by the early 1980s, a resurgence of this framing has occurred in more
recent years. However as will be shown, while a number of characteristics remain the same – such as the continued turn to technofixes – the contemporary ‘protein problem’ represents key evolutions in the truth discourses of food security: namely, a shift to the specific problem of animal protein, a move from concerns of scarcity to abundance and other Anthropocenic tipping points, and the legitimation of new food security experts in the form of Silicon Valley actors. As the next section documents, through the truth discourses of the contemporary ‘protein problem’ we can trace the enabling conditions through which the latest APs have become established as the legitimate and rational means for solving global food security.

5.4.3 The problem becomes animal

While protein deficiency remains a significant food security concern in many developing nations today, further concerns related to protein – specifically animal protein (e.g. meat, dairy, eggs) – have surfaced in recent years. In line with broader evolutions in current food security thinking, the ‘animal protein problem’ is similarly seen to extend beyond the sole issue of scarcity to also encompass that of overconsumption and the systemic unsustainability and (non)human welfare risks of modern livestock production. As such, the last decade has seen increasing warnings from academic and policy communities that a stable, safe and sustainable food system cannot be achieved if business-as-usual continues in the livestock sector. It is useful here to examine these discourses to see how animal protein has been re-problematised as an issue of food security, as it is amidst their diagnoses that the latest APs have arisen and, in some cases, taken direct inspiration in their own problematisation of the current protein problem.

5.4.3.1 Ecological crisis

Almost a decade before the IARC press release, concerns were raised at the international policy level regarding the direct links between animal protein and environmental degradation. The FAO’s 2006 report Livestock’s Long Shadow was a significant moment in bringing global attention to the diverse and planetary-scale impacts of the livestock industry (Steinfeld et al 2006). It stressed the risks of continuing with business-as-usual in the face of growing demand for animal proteins in
the emerging economies of the Global South, and rising natural resource constraints worldwide. The authors make stark connections between livestock production and land degradation, atmosphere pollution, water stress, and biodiversity loss, and point to the structural changes in the sector over recent decades – namely intensification, vertical integration, geographic concentration and up-scaling of production units – as accelerating these impacts (Steinfeld et al 2006, 20).

Perhaps the most controversial and headline-grabbing diagnosis of the report, however, was the link made between the livestock industry and climate change:

“Livestock production is a major player, responsible for 18 percent of greenhouse gas emissions measured in CO₂ equivalent. This is a higher share than transport.”

(Steinfeld et al 2006, xxi)

Both this figure and the measurements used to compare livestock with the transport sector have since been challenged (Jamieson 2010), and were later revised by the FAO (2013, xii) to “14.5 percent of human-induced GHG emissions”. However, this link made by the 2006 report signalled a major shift in connecting livestock production to climate change, one of the biggest crises of the contemporary era.45

5.4.3.2 Overconsumption

In October 2015, the International Agency for Research on Cancer (IARC), the cancer research group of the WHO, published press release No. 240 (IARC 2015) for a forthcoming monograph in which direct links were made between the high consumption of red and processed meats with greater risks of developing cancer (white meat and fish were not evaluated). The report classified processed meat as ‘carcinogenic to humans’ – putting it in the same category (Group 1) as smoking and plutonium – and red meat as ‘probably carcinogenic to humans’.46 The findings were said to “support current public health recommendations to limit intake of meat” (IARC 2015), while at the same time recognising that red meat in particular does hold

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45 Debates surrounding this figure have continued, with a WorldWatch report published in 2009 claiming the original FAO figure had underestimated livestock’s contribution to CO₂-equivalent emissions, instead stating the figure rests at “55% of annual worldwide GHG emissions” (Goodland & Anhang 2009, 11).

46 The IARC report takes the category of red meat to include beef, veal, pork, lamb, horse, goat and mutton, and processed meat to include products that have undergone curing, smoking or salting, or contain high levels of fatty tissues (e.g. sausages) (Domingo & Nadal 2017).
nutritional value. It concludes that reduction of red and processed meat is advised rather than complete removal from diets.

The press release was met with considerable response across the world, particularly in the media. Numerous headlines focussed particularly on the grouping of processed meat with smoking, with many stating direct equivalence in cancer-causing properties.\(^{47}\) The WHO later published a Q&A document (WHO 2015b) clarifying that the Group 1 classification was not meant to infer that processed meat was equally dangerous to tobacco smoking, stating that “IARC classifications describe the strength of the scientific evidence about an agent being a cause of cancer, rather than assessing the level of risk”.

During the period of the initial press release and the anticipated monograph, a number of reviews of new epidemiological studies have been conducted to test the classifications made by the IARC (De Smet & Vossen 2016; Lippi et al 2016; Domingo & Nadal 2017). Whereas some challenge the original conclusions, the majority have been found to support the carcinogenicity levels determined by the IARC (although knowledge gaps are highlighted) (Domingo & Nadal 2017). The prevailing message of these studies, and the original findings of the IARC, remains one of improved health benefits through reducing intake of processed and red meat. At the same time, the nutritional value of red meat is acknowledged and as such it is advised by the IARC that governments and the WHO determine appropriate nutritional guidelines that strike a balance between the risks and benefits of red meat consumption (WHO 2015a).

5.4.3.3 Antibiotic resistance

In addition to the WHO’s findings on the carcinogenicity of red and processed meats, the organisation has previously raised concerns of the widespread antibiotic use in the modern livestock industry. As part of a major project to create a Global Strategy for Containment of Antimicrobial Resistance, the WHO highlights the need for interventions to address the “inappropriate antimicrobial use” which they claim “poses an emerging public health risk” (WHO 2001, 37). The growth in intensive industrialised systems is identified as a main driver for the increased usage of antibiotics, both as growth promoters and as a preventative for animal illness. In North America and Europe it has

\(^{47}\) Headline examples include the Daily Mail’s (UK) “Processed meats as big a cancer threat as cigarettes, health experts to say”, and Italian newspaper Il Mattino claimed that one burnt steak could be equivalent to smoking 600 cigarettes (cited in Domingo & Nadal 2017, 257).
been estimated that “50% in tonnage of antimicrobial productions is used in food-producing animals and poultry” (WHO 2001, 38).48

Though the exact figure is subject to debate, there is general consensus across the WHO and other expert groups that antimicrobial resistance constitutes “a global problem that needs urgent action” (WHO 2001, 11). The US Food and Drug Administration (FDA) has reiterated this urgency, stating that in the US “[m]ore than 70 percent of the bacteria that cause infections are resistant to at least one of the antibiotics commonly used to treat them”. A primary strategy proposed in the WHO’s Global Strategy is the reduction in use of antibiotics beyond the field of human medicine, such as in food production. Both policy and academic communities across the world have thus called for a systematic phasing-out of antimicrobial growth promoters in livestock production, and for therapeutic antimicrobial agents to only be available for animal use through prescription (Gilchrist et al 2007).

5.4.3.4 Food safety

In addition to promoting faster growth times, the increased use of antibiotics in livestock farming has been both a contributing factor and response to the rise in zoonotic diseases in global livestock populations over recent decades. Of the most recent outbreaks, bovine spongiform encephalopathy (BSE) and its associated variant of the human disease Creutzfeldt–Jakob (vCJD), foot and mouth disease (FMD), and avian and swine flu have been amongst the most high-profile and fatal to both human and particularly non-human life.49 The effect of these respective food scares has been to trigger repeated spotlights on the ‘black box’ of modern livestock production, revealing the vast complexity and disturbing lack of transparency, accountability and regulation of practices throughout many of its networks (Nygård & Storstad 2002; Stassart & Whatmore 2003). While precise causes vary between the different crises, the

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48 See Gilchrist et al (2007) for discussion on different proposed estimates (both higher and lower) of antibiotic usage in modern livestock production.

49 BSE/vCJD was first detected in the UK in 1985 and subsequently spread to other European countries; by 2000 it was reported that over 4.7 million cattle had been slaughtered (Oosterveer 2002). The UK has also experienced two major outbreaks of FMD over the last century: one in 1967 which lasted 222 days and resulted in the slaughter of 434,000 cattle, sheep and pigs; and more recently in 2001 with more than 6 million animals slaughtered (Bickerstaff & Simmons 2004). An outbreak of a strain of avian flu in poultry was reported in 1997 in Hong Kong SAR, China; by 2013 the disease had spread to both poultry and human populations across Asia, Europe and Africa leading to hundreds of human infections and numerous human deaths, and remains an ongoing global concern (WHO 2016).
proliferation of livestock-related zoonotic disease has been attributed to a number of interrelated social, political and ecological factors, ranging from increased globalisation of trade and travel, higher concentrations of human populations through urbanisation (which, in certain countries, brings with it increased contact between (non)humans through backyard animal rearing (Sundström et al 2014), and the growth in intensification of animal farming (Wu et al 2017).

The outbreak and subsequent handling of these recent crises by various agri-food experts have led to decreased consumer trust in governments, food producers and retailers, and the general ‘science’ and industrial practices of livestock systems (Wales et al 2006). They have also resulted in lasting tensions throughout supply chains due to fierce debates amongst public, private and scientific communities over the causes of and accountability for the controversies. Each scare has resulted in substantial financial losses – for example, the total cost of the UK BSE/vCJD crisis alone is estimated at £5 billion sterling (Oosterveer 2002) – due to factors such as the rollout of state-funded inoculation programmes, the large-scale testing and destruction of animals, and the loss of livelihoods and consumer sales due to safety fears. With the projected increases in world population growth and demand for animal-sourced foods over the coming decades, the risks to global food security posed by livestock-related zoonotic disease – particularly in (non)human populations of lower-income countries – remain at a critical level (Sundström et al 2014; Wu et al 2017). As such, continued calls have been made to decrease the probability of these threats, ranging from measures to improve biosecurity monitoring (Tomley & Shirley 2009), to more political and welfare-motivated reforms away from current (intensive) systems of production (CIWF 2009).

5.4.3.5 Animal welfare

The food scares and antibiotics crisis discussed above represent just some of the “hot situations” (Callon 1998; Stassart & Whatmore 2003, 450) that have generated greater public scrutiny of animal welfare in modern farming. Amongst current livestock practices, the factory farm has arguably become a central node of these controversies through which the “multi-dimensional concept” of animal welfare (Miele et al 2011) has been fiercely contested and defended by different actors. As Miele et al (2011, 104) highlight, to some the factory farm is seen as enhancing certain contributing factors to animal welfare – e.g. health, absence of stress and pain, ability to express particular
behaviours – while for others the system represents a barbaric constraint of these aspects. Recurring critiques lambast factory farming as the ultimate triumph of economic interest over humanity and compassion, whereby efforts to maximise production have reimagined animals merely as machines (Harrison 1964) and, in a Marxian sense, as ‘alienated labourers’ enslaved within a system that denies freedom or quality of life (Leder 2012).

In reaction to this systemic commodification of animal life, commentators have demanded equal moral consideration for all (non)humans (Regan & Singer 1989), and have sought to abolish the ‘asymmetry’ of human-animal relations which have ascribed different categories of animals – companion, farm and wild – with different ‘rules’ of living (Miele et al 2005). Some have argued for the inclusion of livestock welfare in the conceptualisation and measures of sustainability (Buller & Morris 2009), while others explicitly frame the inhumane treatment of farm animals as a direct threat to global food security (CIWF 2009).

As a consequence there have been calls for major reforms that account for and include the moral value of animal life in assessing the acceptability of farming practices (Thompson 2004). A number of state-led interventions and certification schemes have been initiated over recent decades (e.g. the Welfare Quality® protocol in Europe (Miele et al 2011)) and an entire market share of animal products has evolved based on guarantees of higher welfare. Such measures have had the effect of constructing new systems of calculating, scoring and ultimately selling the ‘happiness’ of farm animals (Miele 2011). For many consumers, the perception of animals living happy lives before their eventual slaughter represents the “best compromise between the ideal life for animals (the wild) and the need to rear animals for human consumption” (Miele 2010, 4). However, others argue that the ‘new welfarist approach’ does not go far enough in fully overcoming the asymmetry of (non)human relations, claiming that it sustains the status of farm animals as human property (Francione 2012) whereby their treatment remains subject to economic benefits rather than interests in their wellbeing. Proponents of this position instead state that sufficient welfare reform requires the total cessation of rearing and consuming animals as human commodities, and the establishment of “veganism as a clear and unequivocal moral baseline” (ibid, 175) and/or a transition to alternatives such as APs (Pluhar 2010).
5.4.4 The ‘new’ technofix: The turn to APs and the Valley

5.4.4.1 AP framings of the current food security ‘problem’

All of the themes discussed above represent the central pillars of how animal protein has been problematised by the recent AP sector – namely, that it represents a system deeply complicit in, and vulnerable to, the many global tipping points which characterise our current era: from ecological instability, and (non)human welfare risks, to a system unable to cope with expected population growth. Moreover, in addition to rising population numbers the growing demand for animal products – particularly meat – is also commonly cited. This particular challenge was raised by an employee of a plant-based AP company:

“[P]eople's appetites for meat, for that chew and the part of the satisfaction that comes with that - it’s really strong. And it’s growing unfortunately. The problem we’re trying to address is growing. If you look at places like China as it becomes more affluent the consumption of meat has dramatically increased. They’re adopting more and more of a western diet and the taste for meat, and we simply don’t have the land or resources to do that the old way.”

*Plant-based company, California (2015)*

Direct reference to the policy discourses discussed above has been a frequent occurrence in the public interviews and presentations of the AP sector, as well as a recurring feature of my fieldwork interviews. The most commonly cited publications included the FAO’s *Livestock’s Long Shadow* report, the 2009 Worldwatch publication on livestock and climate change, and, within the edible insect space, the FAO’s 2013 report advocating for insects as a food and feed security strategy (van Huis *et al* 2013; more on this below). Such discourses have consequently played a direct and influential role in leading many AP proponents to declare current livestock production methods as ‘absurd’. This characterisation has featured in numerous AP discourses, from media interviews with AP founders to presentations given by advocates at industry conferences. It is a theme that has long been featured in the discourses of one advocacy group in particular: New Harvest. Taking inspiration from an essay entitled *Fifty Years Hence* written by British Prime Minister Winston Churchill (1931), New Harvest have frequently cited the following quotation in their promotional materials:
“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.”\textsuperscript{50}

Through such framings we see animal protein problematised as a crisis of systemic inefficiencies and harm to (non)human life. It is also presented as an issue facing the combined challenges of rapidly rising demand within emerging economies, and an estimated 2 billion extra people to feed by 2050. Such claims have served to legitimise the argument amongst the AP movement for a total “reinvention” of protein foods (Gates 2013b) by looking for solutions beyond conventional livestock systems. As the following section shows, the mechanisms that have characterised this process to date have largely centred on technological innovation and the adoption of, and in many cases physical relocation to, the start-up culture of Silicon Valley.

\textit{5.4.4.2  Beyond conventional animals}

“If you were starting from scratch figuring out a way to deliver protein to human beings you wouldn’t use an animal; science would tell you to do something different.”

\textit{Amol Deshpande, cultured meat investor}\textsuperscript{51}

In the new era of the ‘animal protein problem’ we find momentum again being directed towards a search for protein sources and production methods beyond the conventional livestock industry. Some of the most recent AP ventures share parallels with the earlier cases discussed above: for example, although precise inputs and techniques differ from SCPs, a number of cellular agriculture companies are also based on the use of fermentation methods to grow protein from non-animal materials. Cultured meat, edible insects and the latest plant-based products, however, mark a distinct departure from the methods taken by the SCP race in the mid-twentieth century.

The turn towards these specific products has been supported in the broader arena of contemporary food security discourses. A notable example of this turn to alternative protein sources at the global policy level – and one that is recurrently cited by recent edible insect advocates – is the FAO’s 2013 report entitled \textit{Edible Insects: Future Prospects for Food and Feed Security} (van Huis \textit{et al} 2013). In many respects this

\textsuperscript{50} For example, the quotation appears in the footer of the organisation’s website (www.newharvest.com) and has been repeatedly referenced in their public presentations.

\textsuperscript{51} Quotation sourced from Gates Notes video shown during Josh Tetrick’s 2013 TED Talk (available at: https://www.youtube.com/watch?v=QVTkdpeb8A). Gates Notes is the self-titled blog of Microsoft-founder Bill Gates (www.gatesnotes.com).
publication echoes the framings and proposed strategies of earlier FAO and other policy discourses. It begins with the familiar productionist paradigm that global population trends will require current food production to double, and that ‘innovative solutions’ are needed to meet this demand (van Huis et al 2013, ix).

Yet the type of protein – i.e. insects – the report advocates marks a distinct departure from earlier discourses that remain focussed on conventional livestock. The report’s main argument is instead for a global shift from conventional livestock towards ‘new’ systems of production based on alternative protein sources. While insects are the primary case study, the authors also promote other unconventional alternatives, stating that “[f]eeding future populations will require the development of alternative sources of protein, such as cultured meat, seaweed, beans, fungi and insects” (ibid, 59). Direct reference to APs has similarly been made in other influential documents: for example, the 2009 Worldwatch report on livestock and climate change and a FAIRR report on factory farming both advocate the development of cell-cultured and plant-based analogues, with the latter document including profiles of recently-founded California-based AP companies Hampton Creek and Impossible Foods (Goodland & Anhang 2009; FAIRR 2016). Beyond policy discourses, Bill Gates (2013a) has endorsed a number of AP companies – in which he has personally invested – on his Gates Notes blog which has proved highly influential in terms of the sector gaining media attention, attracting investment and generally being considered as legitimate pathways to a better model of protein production.

The promotion of APs in these discourses marks a key shift in the solutions deemed appropriate by expert groups to the modern protein problem. Where some have argued for improving practices within conventional livestock systems through the mechanisms of sustainable intensification (Godfray et al 2010), here we see arguments for expanding these systems to unconventional, largely technology-led sources such as cellular agriculture, plant-based analogues and insects. Moreover, to bring about these changes the private rather than public sector has once again been positioned as the more effective trajectory:

52 While considered ‘novel’ and ‘unconventional’ in the West, the practice of insect rearing and consumption have long histories in many non-Western countries (DeFoliart 1995; van Huis et al 2013).
“Because of the urgency of slowing climate change, we believe that recommending change directly to industry will be more effective than recommending policy changes to governments, which may or may not eventually lead to change in industry.”

(Goodland & Anhang 2009, 15-16)

As discussed earlier, this call by the policy world for industrial actors to take on the problem of food security is not a new phenomenon. However, there is a characteristic of this most recent iteration that marks a distinct evolution in the problematisation of food security: it concerns specifically who amongst the industrial community is being legitimised as the most effective problem-solvers. Rather than the multinational corporations that were encouraged to take on the ‘protein problem’ of the 1950s, the contemporary turn has instead been directed at entrepreneurs and the start-up scene. Not only this, it is the start-up culture of Silicon Valley in particular that is being legitimised into the project of food security in contemporary discourses, a trend we see being materialised through the emergence of the recent AP sector.

5.4.4.3 The Valley approach

The turn to technology, and particularly the high-tech models of Silicon Valley, is a defining feature shared by the recent AP movement. In much the same way as Bobrow-Strain (2008) documents in the shift towards industrial bread production in the early 20th century, the use of technology has been rationalised by AP proponents as a means by which to bring protein production into the controlled, clean and expert realms of Science. This view is demonstrated in a section on the New Harvest (2017) website entitled ‘The benefits of cellular agriculture’:

“Compared to their conventional counterparts, cellular agriculture products have fewer environmental impacts, a safer, purer product, and a more consistent supply. This is because the product is being produced in safe, sterile, controlled conditions.”

Yet there is also a deeper reasoning underpinning this turn to technology. The first suggestion of this during my research was made in an interview with an employee of a plant-based AP company when I asked whether the business thinks of itself as a ‘food tech’ company:

“I think we do think of ourselves in that way, and we do get labelled that way too partly because of our investors like Bill Gates and Biz Stone, one of the co-founders of Twitter. And their expectations and our ambition are to really
transform the food system and how people are getting protein. So, in that sense we really are [in the categorisation of ‘tech’].”

*Plant-based company, California (2015)*

When asked why there seemed to be such a buzz around the label of food tech at the time of our interview, the same informant continued:

“For us it represents and reflects the magnitude of the challenge that we collectively as Earth’s population face, and Bill Gates and others recognise that challenge and the pressures related to it in terms of resource depletion and environmental degradation. Those demands need some big holistic thinking... So yeah in a way I think it’s a positive thing to be angled like that, because both they and we are literally invested in trying to change the world because we can’t keep going on the path we’re going.”

*Plant-based company, California (2015)*

The turn to technology by AP developers is thus significant not only because of its perceived benefits (i.e. more controlled, safe and humane methods), but also because it is the approach believed most capable of meeting the magnitude of the current protein problem due to its associations with ‘big holistic thinking’ and the ability to ‘change the world’. And it is these characteristics that have become most famously associated with the high-tech culture of one place in particular – Silicon Valley – a region which has seen a distinct concentration of recent AP activity. In Weiner’s (2016, 297) study of the region, he relays how a local resident describes the culture as one of “brutal optimism”:

“Anywhere else in the country, he explains, your new idea is met with an avalanche of reasons why it won’t work; in Silicon Valley, it’s met with a challenge: Why don’t you do it? What are you waiting for?” [original emphasis]

We see a similar reflection of this culture in the unofficial slogan of Facebook, one of the biggest and most successful firms that for many embodies the ideology of the high-tech region: ‘move fast and break things’. Yet Morozov (2013, x) notes how a key shift has occurred in the way Valley investors and entrepreneurs are now increasingly ‘breaking things’, an evolution that has taken the notion of disruption from one of mere invention (“invent or die!”) to one of making the world a better place (“ameliorate or die!”). This attitudinal shift was reflected in a comment by a co-founder of a cultured AP company based in the Silicon Valley area:

“[Investors] are hungry for really creating this disruptive change that could really impact the way that we live our lives, the way that we live and operate in, and ultimately have huge impacts on the environment, on animals and on
people’s health. And I think that’s something that’s very compelling for a lot of investors and if companies can rationalise that as also a lucrative business opportunity then I think it’s a really great place to be in as a company; not only can you tout the compelling business case but also, you know, appeal to the mission-driven desires to really want to make a difference, make a legacy and do it in a way that they will also be able to have great returns.”

Co-founder, cellular agriculture company, SF Bay Area (2015)

The use of market-led technologies to disrupt the world for the better has become a powerful and pervading ideology of the Valley, a techno-utopian vision with deep historical roots dating in part back to the counterculture movement of the 1960s (Turner 2006). Today it increasingly shapes the language of how business is conducted, the criteria for acquiring venture capital, and ultimately what is considered as ‘innovation’ both within and increasingly beyond the region. As discussed at the beginning of the chapter, within the specific context of food security discourses there has been a marked increase in calls for collaborations between public agencies and Valley partners. An example of this is the recent launch of the Global Impact Challenge in January 2017 by the UN’s World Food Programme (WFP) in partnership with Singularity University (SU), an initiative that inspired the headline quoted at the start of the chapter: “With the latest tech, UN seeks to end hunger Silicon Valley-style” (Mis 2016). Under the banner “Moonshot solutions sought to end world hunger” (WFP 2017), the initiative was a public call to entrepreneurs, students and others amongst the global innovation community to apply with technology-based ideas designed to end hunger by 2030. Beyond the UN, the United States Agency for International Development (USAID) has also recently looked to Valley entrepreneurs to aid in the fight against food security (Cheney 2016). These examples reveal a distinct shift in contemporary discourses at the (inter)national level that have resulted in Valley actors and practices becoming increasingly legitimised as the most desirable and effective methods for tackling the contemporary problem of food security.

53 Founded in 2008 by author and futurist Ray Kurzweil and entrepreneur Peter Diamandis, SU describes itself as “a global learning and innovation community using exponential technologies to tackle the world’s biggest challenges and build an abundant future for all” (Singularity University 2017). Throughout the Global Impact Challenge, applicants are promised the opportunity to develop their ideas using “lean-startup and human-centred design” and the chance to “transition their solution into a viable company within SU Labs” (WFP 2017).
These characteristics, and the implications for the AP sector and the food system more broadly, are considered in more detail in Chapter 6. What is important to note here is that in contemporary problematisations of animal protein, the turn to technology – and more specifically the technological models of Silicon Valley – have become legitimised by many within and beyond the AP movement as the logical and most viable approach to the contemporary ‘protein problem’. As the CEO of one of the most successful Valley-based AP companies was recently described, “[he] appears to be committed to moving fast and breaking things” (Garfield 2017) – a characterisation that arguably reflects the dominant approach of many working in the recent AP sector.54

5.5 What does this mean for the modern project of food security?

5.5.1 New spatial, scalar and material dimensions of food security

Through this analysis we see the processes by which the issue of food security has and continues to be re-problematised in modern times, both in terms of how it is defined and the solutions deemed necessary in response. While an extensive scholarship has documented these trajectories over the last century, more recent evolutions have yet to receive critical attention. By turning a lens on this recent history, two key findings have been highlighted: first, the expansion of the food security problem beyond the sole issue of scarcity; now we find this issue extended across the spatialised extremes of under and overconsumption, in addition to a variety of planetary tipping points. Furthermore, in certain discourses a nutricentric gaze has been adopted – an evolution with an important historic precedent – so that the issue of animal protein has been presented as a central concern of food security agendas today.

Second, in tandem with these changing conceptualisations there has also been a shift in the suggested responses at the international policy level. As the chapter shows, the legitimation of industrial technofixes has a long history in food security discourses; however, where historic cases show a turn to multinational corporations, more recently we find a shift towards entrepreneurs and the business models of the start-up scene. More specifically, it is to the start-up models of the high-tech culture of Silicon Valley

54 Referring to the CEO of Hampton Creek, Josh Tetrick, this comment was made in a recent media article by Bruce Friedrich, director of the prominent AP advocacy group the Good Food Institute (GFI).
that food security discourses are now pointing, and through which a large concentration of AP activity has emerged to date.

As a result of these two changes, we can trace key shifts in terms of the geographies and scales of the food security problem and its recommended solutions. Regarding the former, the problem of food security has been extended from the hungry South to also include the overfed North, thereby reframing it as an issue not only of the developing but also developed world. At the same time, in an era increasingly characterised by Anthropocenic debates, we find food security problematised across the global scale, both as a product and producer of unfolding planetary crises.

With these changes, recommended solutions have undergone similar spatial and scalar shifts. For example, the increasing role of Valley actors in food security agendas represents a distinct geographical shift that once again privileges Northern industry and expertise in global development matters (Escobar 1995), and maintains the power imbalance of food producers in the North and food receivers in the South. Yet despite this relation remaining a cornerstone of current agendas, the recent re-problematisation of food security is also marked by a turn to Northern, predominantly middle-class consumers as primary agents in solving global food security. This is exemplified by the markets currently being served by the recent AP movement, the majority of which have to date been characterised by higher-end retailers, restaurants and health/fitness outlets in North America and Europe. This is perhaps most salient with regards to recent edible insect products: almost exclusively these have ranged from protein bars, snack foods and baking ingredients largely sold in specialist health food stores and gym locations, and at relatively high price points (e.g. $42.00 for a box of 12 Exo Cocoa Nut bars at 60g each, working out as $3.50/bar; or, $19.99 for a 2oz bag of Bitty Food’s cricket flour). Admittedly these costs are predicted to reduce with improved economies of scale and regulatory reforms, and the chosen product ranges have been rationalised by many edible insect companies as a ‘gateway’ strategy – that is, a way to familiarise Western consumers to the practice of eating insects before transitioning to other products. However, it is unclear how long this transition is

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55 Notable exceptions to this trend have been a number of plant-based protein ventures such as Hampton Creek and Beyond Meat, both of which originally launched in Whole Foods but have since expanded to lower-priced retailers such as Target and Walmart. However, when considered on a global scale the price points of these latter retailers still remain unaffordable to many populations around the world.
expected to take, and if/how product ranges will be launched beyond North America and Europe. When enquiring with a US-based edible insect company on their expected timeframe for this transition, it appeared that the company was not planning to expand beyond protein bars in the foreseeable future:

"Just bars for sure at the moment. We’re going to do a few different lines of bars at first and then we’ll start looking into other products eventually, but we want to stay focused because there’s still such an educational challenge that we’re so far from having, like, really infiltrated even the bar market that it doesn’t really make sense yet to expand up."


While the author acknowledges that many of these companies are still relatively ‘young’ in their development, it is important to note that to date many insect products – as well as other AP ventures – remain highly niche, North American and Europe-centric, and affordable only to more affluent consumers, raising critical questions on their efficacy as global food security solutions. Moreover, like previous studies have shown in Southern contexts (Jarosz 2011; Margulis 2014), these dynamics reveal a similar trend – now extended to the Global North – by which solutions to food security are sought through individual purchasing power rather than self-sufficiency.

Building on the observations of Jarosz (2011) and others, we thus find new scalar as well as spatial shifts occurring through the latest evolutions in food security discourses, as new definitions, geographies, actors and solutions are being folded into the problematisations of this issue. We also see new materialities being legitimised into this arena, particularly regarding the type of end products being developed. Where previously food security solutions have ranged from emergency relief powders to the unappetising and gout-inducing forms of SCPs, now we see efforts to solve global food problems through protein bars, burgers, and mayonnaise. Such developments represent a further dimension of the changing cultural geographies of the food security problem: namely, the adoption of Western-centric food cultures as the material means through which to create a food-secure world. This trend arguably represents the further colonisation of Western – largely American – food tastes both within and beyond the US, contributing to the ‘McDonaldization’ effect (Ritzer 2011) whereby such tastes become increasingly entrenched as global symbols of progress and the free world (Parker Talwar 2003). Moreover, it also highlights a key feature of the recent AP sector that distinguishes it from many of its predecessors – that is, the recognition of visceral
enjoyment and familiar food products as essential components in food-eater relations, and thus in turn for gaining consumer acceptance and adoption. This particular theme will be examined further in Chapters 7 and 8.

5.5.2 APs as continuance as well as disruption

While these observations signify key changes, at the same time the recent developments in food security thinking represent a continuance of the overarching “green neoliberalism” (Goldman, cited by Jarosz 2011, 133) model that has come to define global development agendas. Constructed as a problem of animal protein, we see food security again being treated as a technical and nutricentric problem in which the rational and legitimate response is not to reduce consumption rates nor conduct structural reforms, but rather create new markets for ‘better’ alternatives and rely on ‘better’ consumption at the individual level. In line with the patterns observed by Jarosz (2011, 127) in previous discourses, and those examined in this chapter during the world protein gap era, such an approach neglects the “capitalist political economy and the unequal relations of production and consumption” that have led to the very crises of ‘stuffed and starved’ populations, of planetary tipping points, of welfare concerns, and of growing desires for animal foods that APs seek to address. Instead, through these latest ‘solutions’ we see the resurgence of food security problematised again through a nutricentric gaze which has enabled, amongst other factors, the industrial technofix to once again become the legitimate response. In doing so, we see “adequate personal income, markets and…the workings of the globalized food system” (ibid, 126) remaining the central means of global food security agendas.

Following this trend, we find industrial technofixers once again being called upon to deliver these solutions, this time through the ‘moonshot’ thinking and ‘disruptive’ power of Valley entrepreneurs. While the business models and geographies of these new problem-solvers have changed from those advocated in earlier discourses, APs represent just one case of the continued legitimation of both Western industry – particularly the American elite – and technological salvation as the means to a food-secure world. In doing so, APs signify the further entrenchment of the economic and political power of the (Western) private sector both within development agendas and
the global food system. They also represent the continued reliance on “over-production in some places and under-production in others” (Nally 2011, 49) as the Global South are maintained in their role as food *receivers* from Northern producers. Moreover, the specific turn to Silicon Valley points to a future food system where production is increasingly under the ownership and control of Big Tech. Such predictions raise political-economic concerns that mirror those of previous agricultural technofix movements – such as the respective Green and Gene Revolutions – which saw the increasing disempowerment of the landless and smaller-scale producers, the depoliticisation of food system failings, and the supremacy of Western Science and capitalism over local expertise, low-tech methods and alternative economic models (Shiva 1991; Glover 2010a). Added to these concerns, the Valley’s move into food production represents another frontier in Big Tech’s increasing centralisation across multiple realms of modern life, from communication, transport, commerce, and now, food.

### 5.6 Conclusion

Reflecting on the emergence of the recent AP space, an employee of a plant-based AP company told me: “This is such a narrative industry that has these very grandiose claims about our potential tangible impacts”. Through conducting a ‘history of the present’, the aim of this chapter has been to take seriously these narratives and “disentangle the conditions of [their] history from the density of discourse” (Foucault 2013, xxii). This work has sought to understand APs amidst the historical contingencies that have shaped how food security has been conceptualised, rationalised and acted upon. Moreover, it has made the case for viewing the recent AP sector as a manifestation of a new phase in this problematisation – the Nerd’s Burden – one that is defined by a turn towards new nutricentric, technofix solutions and to Silicon Valley as the new problem-solvers of feeding the world. As with earlier evolutions in food security discourse, these recent changes have similarly been shown to have “political, economic and material outcomes in particular places” (Jarosz 2011, 118), whereby we see the problem of food security extended across new spatial, scalar and material

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56 Fieldwork interview, plant-based company, SF Bay Area (July 2016).
dimensions that represent both novel and continued problematics for the political economies of food and development. While the chapter has begun initial explorations of the implications associated with these trends, there is much scope (and indeed urgency) for further critical analysis on this subject.

The chapter has also sought to situate the latest APs amidst the specific heritage of food security framings as a 'protein problem', and the subsequent response by industry to feed the world on unconventional sources. In doing so, key parallels and differences have been revealed that are often neglected in academic and media coverage of this emerging sector. In many cases, particularly in the media, the latest APs are largely treated as a completely novel phenomenon in the history of food production. Examining earlier examples of industrial AP development reveals key insights into the factors that shape the ideological and material trajectories of AP production, both past and present. Given the highly promissory nature of the current AP sector, important lessons can be gained from considering the evolution of previous cases – such as, how world-saving claims by SCP producers eventually succumbed (either by choice or due to external obstacles) to the requirements and goals of for-profit business. It is instructive to keep these histories in mind as the latest AP companies develop and face the challenges of balancing their original visions with the obligations of private business.

A primary aim of this chapter has been to begin the task of situating APs amidst the historical and contemporary conditions that have (in)directly enabled their emergence at this current moment. Key to the chapter's findings have been the influencing factors that have contributed to the shared timing ('why now?') and specific geographies of recent AP activity ('why Silicon Valley?'). In light of these observations, this latter characteristic invites further consideration. It prompts important and arguably urgent questions concerning what it means for Silicon Valley to have become the new problem-solvers of global food security – and indeed, other global development issues – and how the specific culture and ideologies of this place have additionally contributed to the development trajectories of APs. It is to these questions that the following chapter now turns.
Amidst the current global drive across public and private sectors to innovate more, better and faster than ever before, there is one place in particular that has become a central beacon to such endeavours: Silicon Valley. The high-tech industry of this region – largely concentrated in San Francisco and the southern Bay Area in California – has long been established as a hub, if not “world-leader” of innovation (Perry Piscione 2013). Recent decades have seen increasing attempts to replicate its model in locations around the world, including Silicon Roundabout (London, UK), Silicon Wadi (Tel Aviv, Israel), and Silicon Taiga (Novosibirsk, Russia). There has also been an increasing turn by international agencies and national governments towards Silicon Valley for solutions to global problems. The headline above refers to the United Nations’ (UN) new strategy to tackle world hunger through the launch of a tech accelerator programme in partnership with Valley-based institution, Singularity University. The United States Agency for International Development (USAID) also recently announced that their global food security initiative, Feed the Future, was looking to Silicon Valley entrepreneurs for “food security partners” (Cheney 2016). In the same year, President Obama wrote a ‘to-do list’ for Silicon Valley, challenging the high-tech industry to develop solutions to issues ranging from climate change to terrorism (WIRED 2016), a challenge which mirrors the similar call of former UN Secretary-General Kofi Annan in 2002 (Annan 2002).

The aim of this chapter is to examine what it means to tackle global issues such as food security ‘Silicon Valley-style’. I argue that in the eagerness of scholarship and policy interventions to stress the need for innovation in the urgent times we currently live, the concept of innovation has been ‘black-boxed’ – that is, it has reached a degree of stability in public thinking (Hinchliffe 1996), so much so that it is largely treated as a

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57 This chapter is based on a paper submitted to Economic Geography; the paper has been through one round of peer-review and, subject to revisions, has been invited for resubmission.
singular, apolitical and always-positive end goal (Moro 2013). While recent scholarship, notably economic geography, has done much to demonstrate how the practices of innovation (and in turn regional economic growth) are very much embedded within spatial, scalar and cultural contexts, there has been a distinct neglect of interrogating the ways in which this embeddedness produces particular varieties of innovation. To date, distinctions have typically been made along the metric of ‘successfulness’, so that most studies have analysed firms, regions or inter-regional networks as examples of successful or unsuccessful innovation (e.g. Sturgeon 2003).

The aim of this chapter is to go beyond this metric and interrogate what it means to ‘do’ innovation in Silicon Valley, and how the embeddedness of its practices has significant implications for the variety of innovation that is produced within this region. Understanding what this variety entails is of critical importance at a time when the Valley is increasingly being looked to as a pioneer for solving the world’s most pressing challenges, from climate change to hunger.

To examine the Silicon Valley-style of innovation, this chapter draws on empirical research conducted within the region’s alternative protein (AP) sector. In response to many of the environmental, health and ethical ‘crises’ mentioned above, a number of ventures have recently emerged that aim to develop more sustainable, ethical and healthy alternatives to current meat, dairy and egg production. In Silicon Valley these have included new varieties of plant-based products, edible insects and cellular agriculture, the latter of which utilises cellular and acellular techniques to grow animal proteins outside (in-vitro) animal bodies. Valley-based products so far have included cultured meat (Memphis Meats), milk (Perfect Day), eggs (Clara Foods), and gelatine (Geltor). APs form part of the Valley’s recent turn to food production and thus provide a valuable case to examine how the region’s particular variety of innovation is shaping a sector that has little precedent in its high-tech ecosystem. The findings are drawn from 25 interviews with founders and employees of the AP companies, as well as investors, advocacy groups and other actors in the AP space. The chapter also draws from visits to company headquarters, production sites and key events that occurred during three separate research trips to the Silicon Valley area (including San Francisco, Palo Alto, Menlo Park, Redwood City and Sunnyvale).
The chapter proceeds as follows: first, I review existing literatures, with a focus on economic geography, which have theorised the practices of innovation and identify how innovation as a concept has become black-boxed. A critical part of this process has been the under-studied role of place in the conceptualisations and practices of innovation – specifically the role of place-specific culture in shaping not only how innovation is enabled, but also in producing a particular variety of innovation. I introduce and develop this concept of ‘varieties of innovation’ in the second section, outlining how it builds on and problematises certain aspects of existing innovation literatures. I make the case for viewing Silicon Valley as possessing a distinct culture of innovation that is entangled in the historical, relational and material contexts of its regional geographical territory, as well as those extending across extra-local spaces and scales. To do so, I draw specifically on Longhurst’s (2015) study of the alternative milieu of Totnes in Devon. Through his concept of ‘socio-cognitive space’ – which constitutes the three dimensions of spatial imaginaries, ontological and epistemological multiplicity, and ontological security – Longhurst shows the power of place-based cultural systems within particular geographies to produce particular ways of conceptualising and practicing innovation, as well as cultivating dominant tropes of what is valued and qualifies as ‘innovation’. This chapter proceeds by adapting and applying Longhurst’s categories of socio-cognitive space to the emerging sector of APs in Silicon Valley. I begin by examining the spatial imaginary of Silicon Valley as an ‘innovative place’, before turning to explore the region’s ‘ontological and epistemological singularity’ to demonstrate the dominant variety of innovation that characterises its high-tech culture. The chapter concludes by discussing the wider implications of global organisations such as the UN looking to Silicon Valley for solutions to food security and other global challenges.

6.1 Innovation: Space/scale/relations/culture

While Innovation Studies as a distinct academic tradition remains a relatively young field (Godin 2012), writings on the subject of innovation have a long and multidisciplinary history. In examining this history, we can observe key shifts in the treatment of innovation, both as a concept in intellectual thinking and as a catalyst for real-world material, political and socio-economic practices. Approaches to innovation in recent scholarship owe much to a heritage of ideas over the last century that have
developed through the fields of economics, sociology, history, STS, management studies and geography (Gopalakrishnan 1997). Three central themes that have characterised this scholarship have been the association of innovation with economic growth; its synonymous treatment with science and technology; and, its relationship to space. Economic geographers in particular have contributed important work on developing these themes. They follow in the footsteps of earlier economists, such as Joseph Schumpeter and other economic theorists (Godin 2010), by conceptualising innovation as a function of economic production. Schumpeterian theory posits that innovation is the conversion of ‘invention’ (viewed as a creative process “without importance to economic analysis” (Schumpeter 1939, 85) to commercial application. Schumpeter also famously attributed the origins of innovation to the solo ‘engineer-entrepreneur’, and later the ‘large firm’ (Godin 2008) – a mythology we shall see still dominates the high-tech culture of Silicon Valley. In economic geography, innovation has similarly been theorised as an activity of industry, with examples of innovative practice largely attributed to changes in organisational processes (e.g. flexible working, knowledge exchange) or, perhaps more commonly, the development of technological products. Moreover, innovation is invariably presented as the necessary mechanism for economic growth, whether at the level of individual firms, regions or (inter)national economies (see MacKinnon et al 2002).

A major contribution of economic geography to the study of innovation has been the development of a spatialised, and later relational approach to further unpack its origins (i.e. how innovation is created) and the conditions that facilitate it. During the 1980s and 90s, debates in the field concentrated on the causal links between geographical proximity and the propensity for innovation. Spatial proximity, it was argued, was critical for increasing innovation by facilitating social relations (e.g. trust), knowledge spillover (Howells 2002), lowering transaction costs, and enabling access to specialised inputs such as machinery, services and infrastructure (Porter 1998). A distinct pantheon of spatial-centred concepts characterised economic geography scholarship on innovation and inspired influential changes to business and policy practices. ‘Industrial districts’, ‘clusters’, ‘spatial agglomeration’ and ‘regional systems of innovation’ (Howells 1999) are some of the theoretical lenses through which innovation has and continues to be conceptualised, mapped and implemented in economic geography thinking.
In the early 2000s, geographical theorisations of space and place underwent a relational turn, and interests in innovation shifted from ‘spatial proximity’ to ‘relational proximity’ (Boggs & Rantisi 2003). Rather than think of innovation as contained within particular spaces as previous studies had done, relational geographers began to conceptualise it as happening between spaces (and scales) (Jones 2009, 490, Bunnell & Coe 2001). To think of innovation practices as relational, Fløysand & Jakobsen (2010, 329) write, involves “focussing on networks of actors, the flow of knowledge and assets within these networks, and the interconnectivity of various networks. It also involves acknowledging hegemonic positions of certain actors within these networks.” This focus represents a further evolution away from the generalised, quantifiable models of regional growth that characterised earlier neoclassical-economic geography, and the view of innovation as a product of “input-output relations and material linkages” (MacKinnon et al 2002). Instead it follows the work of radical geographers in exposing the differences between and connectivity of spatial contexts, and their role in producing varied and uneven development (Harvey 1982; Massey 1984). It also takes its roots from the sociologically-based arguments of Polanyi (1944) and Granovetter (1985) whose work, amongst others, sought to address the undersocialised views of neoclassical economics and highlight the institutional and cultural embeddedness of economic relations within systems of norms, rules of conduct and shared knowledge (see Fløysand & Jakobsen 2010).

While the relational turn has offered important insights into these contextual specificities, some have criticised the frameworks of early relational economic geography studies for retaining overtly localised perspectives in their analyses, calling into question their focus on institutional and cultural relations at the regional level without sufficient acknowledgement of their extra-local interconnectedness (MacKinnon et al 2002; James 2007). Moreover, concerns have been raised regarding the tendency of this ‘new regionalism’ (Lovering 1999) to suggest the existence of generalisable ingredients for economic growth that can be exported and implanted in other regions (Bunnell & Coe 2001; Yeung 2005). Such approaches, MacKinnon et al (2002, 297) argue, carry “the implicit claim that regions can somehow be regarded as distinct objects with causal powers of their own”, a view which “can be seen as a form of spatial fetishism that tends to elide intraregional divisions and tensions” (cited in Yeung 2005). Spigel (2017) lends further critique by challenging the treatment of culture by
many relational perspectives. He contends that while institutional and embeddedness approaches have revealed the importance of cultural factors in shaping innovation trajectories, the notion of culture remains under-theorised and can often be treated in “homogenizing ways” (ibid, 291). In agreement with James (2007), he states that “accounts of the role of regional, national, or ethnic culture in economic processes have largely relied on vague and ill-defined mechanisms to connect culture and action, and these mechanisms crowd out the role of agency and experimentation” (Spigel 2017, 292). As such, the practices of individual actors such as entrepreneurs are understood as causally linked to the macro-culture of the organisations and regions within which they are situated, with little room allowed for the possibility of individual experimentation or cultural multiplicity at the micro scale, nor for connections with cultural fields beyond the local region.

The evolution of perspectives on innovation in economic geography appears thus to be travelling in ever more concentrated critical circles, with each stage providing important, if sometimes conflicting, contributions. By privileging spatial proximity and material linkages as in the early literatures, the concept of culture has been shown to remain under-theorised and the relational connectivity of regions across different spaces, scales and networks is lost. Relational perspectives that remain overly localised have fallen prey to similar critiques, while those which reject the region as the primary unit of analysis can (and have) been criticised for overstating the heterogeneousness of regional constructs and for disallowing any sense of “specificity to particular regions” (Yeung 2005). And for those seeking to open the black box of culture (Spigel 2017), I contend that a similar refusal of regional specificity is exerted, and the ability for individuals to counter and adapt the macro cultures of institutions and regions is in part overstated; more on this below.

In setting out my approach then, I draw on elements from these previous critiques but also seek to problematise some of their assumptions. First, to overcome the “analytical bias towards localized relations within regions”, I look to Yeung’s (2005, 47) framing which views the region “not as a closed system or a container of intangible assets and structures, but as a relational construct through which heterogeneous flows of actors, assets and structures coalesce and take place” (ibid, 47). In doing so, Yeung makes conceptual room for recognising regions as objects of analysis, while simultaneously
acknowledging their relational interdependency both across time (i.e. their historical context), and with other regions via “relations of control and dependency, market competition and extra-local forces”. As such, Yeung’s relational approach moves us beyond understanding regional economic growth (and innovation) as the sole product of its localised relational practices. Instead it works to situate the causal links of regional growth and innovation within extra-local networks, while also remaining aware of the “complementarity and specificity to particular regions in question” (ibid, 48 [original emphasis]). The recognition of regions as distinct objects of analysis is of particular importance here; for while the boundaries of places such as Silicon Valley continue to be contested in academic thinking, it is clear that the idea of the Valley as an ‘innovative region’ currently exists in the imaginaries of multiple actors today, both within and beyond its local milieu. As such, there is a need to acknowledge these boundaries and understand how they have been drawn and are conceptualised by those who shape and are shaped by their construction.

Second, building on Spigel’s (2017) work I similarly seek to redress the under-theorisation of culture in existing studies of innovation and make the case for the instrumental role culture plays in shaping the innovation practices of Silicon Valley. While acknowledging Spigel’s legitimate critique of previous relational frameworks for often privileging cultural structures at the regional level – which, he argues, gives “quasi-causal power to space, robbing individual actors of the agency to experiment with new approaches, perspectives, and practices and minimizing the role of other influences such as the organizational cultures of industries” (ibid, 291) – I contend this counter view is similarly problematic due to its over-privileging of individual agency within certain regional innovation cultures. In particular, I call into question Spigel’s statement in his paper that follows the quote above: “This is particularly troubling when studying entrepreneurs, who by definition must transgress existing norms and structures in order to succeed” (ibid, 291). In this chapter I show that the culture of innovation in Silicon Valley does in fact restrict the agency of individuals in many ways – it shapes and limits the spaces, scales, mechanisms and materialities through which innovation is ‘done’, and considerably reduces the scope for ‘transgressing existing norms and structures’. Indeed, I argue that such transgressions are actively discouraged by the regional culture, and that ‘success’ is in fact predicated on their absence. Where transgression is seen to occur (frequently referred to and celebrated as ‘disruption’ in
Valley parlance), I demonstrate that it typically, and often resolutely, remains loyal to the overarching norms and structures of the region’s dominant innovation culture: namely, capital-friendly practices and high-tech products.

It is important to note here that the chapter does not argue for the existence of just one culture of innovation in Silicon Valley; rather, it introduces the concept of ‘varieties of innovation’ and posits that a dominant variety exists in the Valley that has come to represent and be synonymous with the region’s identity as an innovative place. The next section develops this concept of varieties of innovation before applying it to examine the recent emergence of alternative proteins in Silicon Valley.

6.2 A ‘varieties’ approach: The specificities and multiplicities of innovation

In developing the concept of varieties of innovation, I aim to do two things. First, to unsettle the concept of innovation which I argue has become black boxed in the majority of economic geography literatures to date. This is not to undermine the contributions that the discipline has made to debates on the origins, practices and conditions entangled in the processes of innovation. Rather it is to call attention to the neglect of sufficiently critical interrogations of the motivations behind, and impacts of, innovative practices, as well as how these practices come to be valued by particular actors in particular contexts. Innovation has largely been treated in these literatures (and also in policy and business circles) as an unquestioningly singular and always-beneficial endeavour, stripped of its political content and repackaged as a symbol of revolutionary change and ‘progress’ (Morozov 2013, 168). This perspective is exemplified in Bunnell & Coe's (2001, 569) recent paper:

"Whatever disagreement and dispute surrounds the conceptualization of contemporary economies, there appears to be broad consensus on the desirability, even necessity, of innovation. Innovation and related concepts – entrepreneurship, creativity, enterprise – are held up as an essential component of any recipe for individual or collective success in a world speeded-up and increasingly interconnected."

This stabilisation of innovation as a ‘desirable’ and ‘necessary’ practice has deflected analysis away from understanding how the very concept has come to be established within the spatial, relational and cultural contexts of particular regions. Enquiries into what is valued and qualifies as ‘innovative’ in these different contexts, and what
political, material and social impacts this has in shaping the trajectories of innovation have been less scrutinised. It is not enough, in my opinion, to ask the question that has occupied much of existing economic geography literatures to date – i.e. how do spatial, cultural and relational factors *enable* innovation, with innovation taken here as an essential and always positive end-goal. Instead we must ask: How do these factors *produce* particular varieties of innovation, and what are the implications of these different varieties? With this latter question, we can begin to unsettle and challenge the black box of innovation that has characterised many studies on Silicon Valley specifically, and across economic geography more broadly. It recasts innovation as something that is *enacted* rather than simply enabled to occur. Furthermore, it works to make visible the factors that construct the value systems of innovation in particular contexts, and how these in turn shape the way innovation is both practised and understood by actors within and beyond those contexts.

The second aim of my varieties of innovation approach, is to redress the over-simplified treatment of culture in geography studies of innovation (James 2007; Spigel 2017), and also make the case for conceptualising cultures of innovation existing and intersecting across the regional level. This is not to imply such regional cultures exhibit permanence or isolation from ‘outside’ networks and contexts; instead it posits the ability for interconnected yet distinct, fluid yet (temporarily) stabilised cultures to exist at the regional level, and through which innovation practices and their understandings can be shaped.

To expand upon this position, I look to Longhurst’s (2015) recent study of innovation in the alternative milieu of Totnes in Devon, UK, where he draws on the concept of the ‘protective niche’. With its conceptual tradition in STS, a niche is understood as the “micro-level where radical novelties emerge” (Geels & Schot 2007, 400) and are protected from extra-local pressures, such as mainstream market competition. In this way, niches act as ‘incubation rooms’ for emerging technologies (Furlong 2010), and have been shown to span across (extra)local networks (e.g. Law & Callon 1992). However despite acknowledgement of niches as multi-scalar and relational, Longhurst (2015) argues that the significance of geography in their operations has been overlooked. In his study of Totnes, he shows how space is an integral component in the region’s ability to act as a protective niche for a particular variety of innovation – what
he refers to as ‘alternative innovation’\textsuperscript{58}. As well as the importance of physical space (i.e. geographical proximity), Longhurst points to the role of ‘socio-cognitive space’ in fostering experimentation in Totnes. He outlines how this particular type of space is created in three ways: first, by producing ‘ontological and epistemological multiplicity’; second, by producing ‘spatial imaginaries’; and third, by providing ‘ontological security’ (ibid, 189).

The first dimension reflects a distinct “culture of ‘credulousness’” within the Totnes milieu that produces “the socio-cognitive space for experiments to emerge by stretching the socially accepted (and constructed) boundaries of possibility” (ibid, 190). This stretching of possibility, Longhurst argues, is a consequence of the region’s history as a place of diverse, alternative epistemologies and ontologies: for example, new age beliefs and radical politics. The historico-geographical embeddedness of Totnes is thus conceptualised by its inhabitants as providing a socio-cognitive space where multiple radical ideas can co-exist and are not hindered in their development by more typical perceptions of possibility.

The second dimension relates to how the physical landscape of Totnes plays a role in the area being viewed as a ‘good place’ for innovation. Inhabitants described the utopian nature of Totnes, both in its aesthetic natural beauty and the many visible successes of experimentation throughout the area. For these reasons, Longhurst found a similar value attached to ‘being there’ (Gertler 2003) – i.e. physically present within the milieu – that is often expressed by Silicon Valley actors.

Underpinning both of these dimensions, the third describes the ‘like-mindedness’ of the Totnes milieu, and a common goal of seeing and creating the world differently. Key here is the practical and moral support for innovative ideas amongst its inhabitants, where people help each other to think, create and even live in ways beyond dominant social and cognitive norms (e.g. illegally living on their land). The normalisation of these non-mainstream practices within the locale was identified as a fundamental component in shaping the ‘alternative’ variety of innovation enacted in the area.

Examining the socio-cognitive spaces that concentrate within particular geographies reveals the power of place-based cultural systems to shape and cultivate particular

\textsuperscript{58} i.e. defined as innovation beyond mainstream political, economic and sociocultural models.
ways of thinking about and doing innovation, as well as instil a sense of normativity around these practices (i.e. what counts as innovation). How then, can we think of innovation practices in Silicon Valley through this lens? To address this question, the following sections apply Longhurst’s categories to the emerging sector of alternative proteins, while making some key amendments. I begin by examining the spatial imaginary of Silicon Valley as an innovative place, making the case for a regional perspective in the analysis of its innovation practices, as well as exploring the sub-regional scale. I then turn to Longhurst’s concept of ontological and epistemological multiplicities – however, here I amend this to ‘ontological and epistemological singularity’ to demonstrate the dominant variety of innovation that characterises the high-tech culture of Silicon Valley. Observations regarding Longhurst’s third category of ontological security will be discussed throughout these sections.

6.3 Spatial imaginaries of Silicon Valley: From regions to micro-spaces

“[Spatial imaginary] relates to how individuals believe that the area is a good place for experimentation. The argument here, is that the way a place is conceived can effect [sic] the actions of the inhabitants.”

(Longhurst 2015, 191)

Since the rapid ascent of the semiconductor industry during the 1970’s and 80’s, Silicon Valley has been upheld as the shining example of a successful innovative region; of how to ‘do’ innovation and in turn accelerate economic growth. The ingredients to the region’s success have been attributed across economic geography, business studies and popular science literatures to a multitude of factors: its flexibility and adaptability in the face of global market change (Sturgeon 2003); its connections across (extra)local spaces and scales (Saxenian & Hsu 2001); its ability to attract new talent and tap into existing pools of specialist expertise (Porter 1998; Christensen et al 2011); and, its culture of high interfirm mobility (Benner 2002; Fallick et al 2006). The beginning of Silicon Valley’s reign as “the innovation capital of the world” (Perry Piscione 2013) is often linked to its recent computing history. However, others have shown the need to push its origin story as far back as the Californian gold rush (Matthews 2003) and the development of radio technologies in the San Francisco Bay Area in the late-nineteenth century (Sturgeon 2000). There has also been a tendency for the region’s successes to
be linked to its local ecosystem of high-risk venture capital firms. While these firms undeniably constitute a key ingredient of the region’s current innovation culture (and will be returned to in this chapter), Leslie (2000) reminds us that one of the largest investors in the region’s history has been the US military. These factors plus others – e.g. the influential part played by Stanford University and its Dean of Engineering, Fred Terman (Saxenian 1983, Adams 2005) – are critical in piecing together the innovation culture of Silicon Valley today. They reveal the historical as well as geographical embeddedness of the region’s mechanisms, institutional processes and working culture, as well as their connections across multiple spatial and scalar fronts.

In my conversations with AP company founders and employees based in the Bay Area, all expressed a similar belief in Silicon Valley as a place where successful innovation happens. Like many others who have travelled to the Valley to chase the promise of innovation and economic prosperity (Matthews 2003; Shankar 2008), most of the AP founders I interviewed told me they had made the move to the area specifically to start their ventures. When asked why, all made reference to the region’s unique niche (Geels & Schot 2007) of institutions, expertise and relations that made it considerably easier to begin a start-up compared with other parts of the US. During a conversation with an employee of a San Francisco plant-based company, I asked whether he thought the firm could have grown as fast as it had done if it had started in another place:

“...There might be a few places we could have started in, like Austin, maybe Boston possibly, but the beautiful thing about San Francisco is we have such access to VCs [venture capitalists] - they’re everywhere and they come here and feel our energy and see what we’re doing. It’s been big with the press, it’s also been big with recruiting so there’s three levels - that’s why San Francisco is such a hotbed of innovation because those three things are everywhere.”

Despite the recent growth in technology niches elsewhere in the US, such as Austin and Boston, the AP founders I spoke with deemed Silicon Valley as the most desirable due to possessing the necessary and more established conditions for successful innovation: from the types of funding opportunities (high-risk, early-stage VCs) and knowledge networks (e.g. Stanford, Berkeley), to the general atmosphere of alternative thinking and living that Valley inhabitants, and California more broadly, are attributed with. As

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59 Fieldwork interview, SF Bay Area (October 2015).
one co-founder of an edible insect company described, this latter point was of particular importance for choosing the Bay Area:

"It’s a forward thinking, high-tech, early adopter, food conscious-type of place, and food trends in the US do start on the West Coast and make their way east...they really do, they start in LA and San Francisco and they sort of spread out from there. Also we were in Maine and we told a few people what we were getting into and they were like, crickets? That’s fish bait! No interest at the time. So ok, it was a no brainer [to move to the Bay Area]. Plus it was starting to be winter [in Maine] and it was getting really cold!"\(^{60}\)

All of these factors combined appear to have created a powerful spatial imaginary in the minds of AP actors that Silicon Valley is a ‘good place’ to do innovation. This imaginary extends beyond the material, social and institutional relations of the region’s industrial context (i.e. the components that facilitate the business of ‘doing’ innovation), to also include the area’s distinct cultural openness to alternative ideas – what Longhurst (2015) refers to as ontological and epistemological multiplicity. Silicon Valley specifically, but also California more generally, has long been associated with an enthusiasm for experimentation and entrepreneurialism, a characteristic that has strong ties to the region’s counterculture history and the use of technology as a mechanism to oppose mainstream economics, politics and culture (Turner 2006). Much like Longhurst (2015) observed in Totnes, the pleasant weather, natural beauty, open-mindedness and world-famous examples of existing Valley-borne ventures (e.g. Apple, Google) have all served to fuel its spatial imaginary as a place where innovation happens, and, importantly, where it succeeds – both in economic terms and in radically shifting paradigms of practice. Thus the importance of ‘being there’ (Gertler 2003) was stressed by all of the AP employees I spoke with: not only on a practical level as a means of accessing the region’s resources and working within the ontological security of its networks; but also on a less tangible level, as if by being physically present in the area would ignite their ‘entrepreneur-spirit’ (Schumpeter 1947) and transform them into successful, paradigm-shifting disruptors in the same mould as the Big Tech companies that have gone before. Indeed, this latter point was made explicit when the employee of the San Francisco plant-based AP company stated that the firm aspired to be the ‘Uber’

\(^{60}\) Fieldwork interview, SF Bay Area (October 2015).
or ‘Airbnb’ of the food system: “as Uber is a leader in transportation, as Airbnb is leading disruption in hotels, we want to create that with food”.\textsuperscript{61}

It became clear through these conversations that a shared and powerful “place myth” (Longhurst 2015) exists amongst the AP founders connecting the place of Silicon Valley with notions of innovation. The Valley is conceptualised by these actors, like many others beyond the AP sector, as a region defined by its ability to facilitate and produce innovation. And a fundamental way in which the ‘edges’ of this innovative region are discerned is the geographical territories of the Bay Area. These are specific, physical places where many AP founders have purposefully migrated to, motivated by a shared spatial imaginary that it matters to be physically situated ‘there’, for ‘there’ is where innovation happens and succeeds (Matthews 2003). The notion of Silicon Valley as an innovative place can thus be understood as a socio-cognitive construct situated within and shaped by a specific geographical territory. Recognising that a fundamental dimension of people’s perceptions of the Valley-innovation relationship is in part grounded in a particular geographical region is thus a crucial factor in unpacking its practices of innovation.

6.3.1 \textit{Micro-spaces of innovation}

At this point it bears teasing out exactly what ‘being there’ in Silicon Valley entails for the aspiring innovator. According to the popular spatial imaginary of the area, it \textit{matters} to be physically present in the Valley, to situate yourself within its spatial and relational contexts. But how to access its coveted resources? How to transition from simply being present in a place to becoming embedded within its practices and, ultimately, an embodiment of innovation itself? How does the individual arriving with just a suitcase and a big idea (a popular mythology of the region, and something which features in a number of AP origin stories) come to be the next Mark Zuckerberg or Steve Jobs?\textsuperscript{62}

This question of \textit{how} has been notably under-studied in economic geography (Ettlinger 2003), with most literatures instead focussing on the ingredients deemed necessary for

\textsuperscript{61} Fieldwork interview, SF Bay Area (October 2015).

\textsuperscript{62} E.g. In an interview with New Harvest (2015), Clara Foods co-founder Arturo Elizondo described his move to the Bay Area: “I was so into food tech, and I knew DC wasn’t the place for that, so I figured I should probably be in San Francisco to pursue my passion. A week later, I booked a one-way ticket, no job, no place to stay.”
innovation rather than exactly how people come to engage with them. While an exhaustive list of how recent AP founders have come to be embedded within the innovation niche of the Valley is beyond the scope of this chapter, there is one institution in particular – IndieBio – which has featured in many of their origin stories. Started in 2014 by VC firm SOSVentures, IndieBio is the first tech accelerator in Silicon Valley (and purportedly the world) to focus exclusively on the life sciences. Each year individuals and teams can apply to IndieBio’s bi-annual four-month programme based in San Francisco, during which they receive seed funding, lab space, mentoring and networking opportunities – in exchange for a percentage of company equity – that all aim to transform biotech-based ideas into viable businesses. Each programme ends with a Demo Day where the start-ups pitch their ventures to a room of carefully selected VCs, media and other members of the high-tech locale. This format was inspired by other highly successful IT-based accelerators in the region (e.g. Y-Combinator) which have spawned some of the high-tech industry’s most famous companies, such as Dropbox and Airbnb. The mission of IndieBio is twofold: to promote biology as an ‘applicable technology’ and to create a pathway whereby biotechnology start-ups can develop as quickly as IT-based ventures; or as one media article has put it, to “accelerate synthetic biology to tech startup speed” (Forbes 2015). At the time of writing, IndieBio had completed four programmes in San Francisco, with five edible AP ventures amongst their alumni.

(Bio)tech accelerators such as IndieBio and Y-Combinator have become renowned and highly coveted mechanisms through which innovators can access the networks and resources of the Valley (Hallen et al 2014; Cohen & Hochberg 2014). They constitute fundamental parts of the contemporary high-tech niche of the region, where big ideas, money, hype and expertise coalesce within local physical spaces (e.g. the shared labs/offices used by programme cohorts, or the venues for Demo Days) and extend across powerful networks within and beyond the local milieu. The speed is rapid, the networks highly coveted, the investments vast, and the desire to discover and create ‘disruptive’ innovation is voracious. In this way these accelerators can be seen as microcosms of the region’s ideologies, relations, materialities and actors: ‘micro-Valleys’

63 SOSV also runs programmes in Cork, Ireland, now under the name RebelBio.
64 For specific company and programme details, see below.
within ‘the Valley’. They have been shaped by and now themselves increasingly fuel the popular spatial imaginary of the region. In other words, they have become core nodes within the region where innovation is perceived to concentrate and emerge. Their significance is apparent in their ever-growing magnetism to innovators, VCs and tech media, all of whom continually flock to engage in the ‘next big thing’ in disruptive high-tech. Y-Combinator in particular has been described as “the world’s most powerful startup incubator” (FastCompany 2016) and has an estimated multi-billion dollar valuation. The power of its influence was commented on in a recent media article: “YC’s reputation for manufacturing success is now so deeply ingrained in the Valley zeitgeist that the legendary angel investor Ron Conway calls it ‘a one-stop shop for the best-quality Internet companies’” (Chafkin 2015). Inspired by Y-Combinator’s model, IndieBio is en-route to establishing itself as the ‘one-stop shop’ for finding and developing the ‘best-quality’ biotech companies.

As mentioned, at the time of writing five AP companies have passed through the IndieBio programme – one in Cork, Ireland (Perfect Day, formerly Muufri) and four in San Francisco (Clara Foods; Geltor, formerly Gelzen; Memphis Meats; New Wave Foods). Apart from New Wave Foods, all belong to the category of cellular agriculture with products including milk, egg whites, gelatine, and beef and chicken. New Wave Foods is developing algae-based seafood, with shrimp as their initial product. Perfect Day and Clara Foods were enrolled on programmes in the same year (2014) although in different countries and cohorts, while Geltor, Memphis Meats and New Wave Foods were part of the same autumn cohort in 2015 in San Francisco. For those enrolled on the San Francisco programmes, IndieBio represented the first major step in becoming linked to the innovation networks and practices of the Valley. Furthermore it worked to make these AP ventures visible to the Valley milieu and promote them as credible ventures for others to get excited about and, ultimately, invest in. These particular benefits of IndieBio were described by one of the recently enrolled AP founders:

“It’s the number one biotech accelerator in the world so it definitely lends – you know, whenever someone can validate that this is an investment that somebody else they believe in [i.e. IndieBio] has made, that adds credibility, just instantly.”

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66 Fieldwork interview, SF Bay Area (October 2015).
Many of these AP founders moved specifically to San Francisco to participate in the IndieBio programmes, some quitting jobs and academic positions to do so. All have now graduated from their respective programmes and have remained in the Bay Area.

The benefit, then, of ‘being there’ in the geographical region of Silicon Valley appears to operate at multiple levels. As observed earlier in the chapter, there was a shared sense amongst AP founders that it was vital to be physically located in the general Valley area to increase their chances of success and immerse themselves in the perceived atmosphere of innovation associated with that place. Yet within this geographical area there are particular places at the sub-regional level, like IndieBio, where innovation is seen to concentrate and emerge. In addition to tech accelerators, these micro-spaces take many forms – from garages and basements, to specific restaurant tables where famous high-tech deals have been struck (Audia & Rider 2005) – and are a prevalent feature of the AP sector in the Valley. I attended Demo Days and conferences in old industrial buildings, and visited makeshift labs in warehouses, office blocks, and unremarkable industrial parks on the ‘wrong’ side of the freeway. With space at a premium, often these labs existed in the same room as the admin areas which typically consisted of tables and sofas with people on laptops (and sometimes the CEO’s dog). Cupboards of test samples, boxes of merchandise, and white boards with calculations and business strategies blurred the boundaries between ‘lab’ (product creation) and ‘business’ (product promotion).

There is a distinct quasi-religious nature to these types of micro-spaces within the Valley (Audia & Rider 2005). They have become part of a pilgrimage for tourists and Valley inhabitants alike, with numerous people journeying to them “to partake in something techno-scientifically sacred” (Shapin 2014). There is a perceived significance in physically being in these spaces, and of starting ventures in their vicinity and likeness. Their unconventional nature also lends further support to the broader spatial imaginary of Silicon Valley as a place for disruptive innovation. Dining tables in inexpensive restaurants, garages in suburban streets, and labs in converted offices all feed into the region’s sense of “business without a template” (Shapin 2014) and of success without the more conventional trajectories of “higher education, job experience, and gradual upward mobility” (Shankar 2008, 48). In short, they work to redefine how
innovation is ‘done’, and moreover, entrench a sense that the Silicon Valley way is the way of innovating.

Place, then, plays a fundamental role in the Valley’s cultures, practices and perceptions of innovation. The geographical territory of the Bay Area is at once produced as an ‘innovative place’, at the same time as this spatial imaginary produces actions and micro-spaces of innovation within the region. And with the considerable notoriety and economic success that have evolved from such actions and spaces, this in turn reinforces the perception of the Valley as a place where innovation happens. A consequence of this relationship between place and innovation is that the Valley as a region has become synonymous with what counts and is valued as innovation – both in the perceptions of those within and external to the milieu. Hence, for example, we see the UN claiming that they intend to end hunger Silicon Valley-style, and a core part of this strategy is to physically send personnel to the region in order to ‘do’ innovation.

What requires further scrutiny, however, is how the place of Silicon Valley shapes the doing of innovation. The next section examines the Valley not simply as an innovative place, but as a place where a dominant variety of innovation reigns – one which is entangled in the historical, political and material specificities of the region, and is considerably more bound in its trajectories than the Valley zeitgeist typically presents.

6.4 Ontological and epistemological singularity: Not all ideas welcome

According to Longhurst (2015, 190), another notable characteristic of the Totnes milieu is how it provides socio-cognitive space “for radical ideas to be enacted”. A crucial factor in facilitating this process is the region’s distinct “culture of ‘credulousness’” – that is, a culture where multiple beliefs and understandings of the world coexist. In the case of Totnes, Longhurst posits that geographical place plays a critical role in producing and shaping this culture. He points to the area’s long history of encouraging diverse perspectives, beliefs and practices. This openness to multiple epistemologies and ontologies is, he argues, a fundamental underpinning of experimentation in the region – it serves to create a protective socio-cognitive environment for new ideas and extends what is deemed possible, acceptable and valued as ‘innovation’.
We have seen in the previous section that Silicon Valley possesses a similar spatial imaginary of being an innovative place, and that an important part of ‘being there’ is to be present within the atmosphere (or socio-cognitive space) where radical ideas are seen to be protected and allowed to thrive. To use Longhurst’s terminology, the Valley’s ‘culture of credulousness’ is one of its defining and much-celebrated attributes – it is a place renowned for its ontological and epistemological multiplicity, where anyone can come with a big idea (the bigger and more disruptive the better) and realise their American Dream (Pellow & Park 2002).

Yet during my time engaging with the AP sector in the Valley, I observed a fundamentally different picture. First, the sector exhibits a distinct homogeneity in terms of its models of practice. For example, the overwhelming majority of AP ventures in the Valley have, to date, evolved as private companies. Most were founded as such, and many of those that began in academic contexts have since evolved into commercial enterprises. Many AP founders I spoke with attributed this trend to the common perception of the Valley milieu (which many of them also personally shared) that the private sector is where innovation ‘happens’. As one co-founder of a cultured milk company stated:

“...I'm sorry but it's over – academia is not doing it [innovation], government's not doing it. It's companies.”

A similar sentiment was shared by Joshua Tetrick, CEO of plant-based company Hampton Creek, in a recent interview with WIRED magazine: “The more I drilled into food, the more I thought capitalism could be used to reorient the system” (Solon 2016).

Despite recent studies revealing the instrumental role US government funding has played in the Valley’s history (Leslie 2000; Matthews 2003), there is an extant aversion today amongst the region’s milieu towards state-led intervention in innovation processes. Notable Valley figures have been publicly vocal against such interventions: for example, in his renowned essay entitled ‘The Education of a Libertarian’, Paypal co-founder (and prominent AP funder) Peter Thiel (2009) declared that “a deadly race between politics and technology” currently exists, and that we must look to the latter as a means to “escape beyond” the former. Recent battles between Big Tech firms and the

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67 Fieldwork interview, SF Bay Area (April 2015).
NSA over data surveillance have further exasperated tensions between the Valley milieu and US government (Holpuch 2014), and reforms proposed by recently-elected President Trump that will have direct impacts on Valley practices – e.g. revoking the H-1B visa scheme for skilled tech workers from overseas – have done little to temper these relations (Shieber 2016). With direct reference to Schumpeterian theory, Thiel (2009) concludes his essay by stating that world prosperity will not be realised by government, but rather by the lone technofixer crusading for the advancement of capitalism:

"The fate of our world may depend on the effort of a single person who builds or propagates the machinery of freedom that makes the world safe for capitalism."

This animosity towards state involvement in innovation can be linked to the regional context of Silicon Valley, as well as its extra-local relations. For example, Mikler & Harrison (2012) examine the historic tension between private and public sector in the US as a product of the nation’s particular variety of capitalism (i.e. liberal market economy) which, they argue, has largely limited the state to the role of ‘consumer’ and decentralised ‘funder’ of private-led innovation, rather than ‘coordinator’ or valued ‘collaborator’. At the regional level, Turner (2006) describes how strong individualist sentiments during the Cold War established a powerful counterculture movement amongst Valley inhabitants that sought to protect individual liberty and creativity from the perceived ‘grey mass’ of American bureaucracy and the looming Soviet Union. Moreover, he notes the central role the counterculture movement played in connecting technology with notions of what qualifies as innovation in the Valley, a point to which I will return.

In the AP sector, the private model of business has become a necessary condition for accessing funding and the many other influential resources of the region, such as the tech accelerators discussed above. IndieBio programmes are explicitly designed for applicants to go from “bench to market” within four months. At a recent Demo Day, Program Director Ryan Bethencourt explained how this mission starts from Day 1 of the programmes when each team is asked “how long until you have a product that makes money?”.68 The necessity to adopt for-profit models to gain Valley interest was further

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68 Fieldwork, SF Bay Area (July 2016).
exemplified by an AP company co-founder and IndieBio alumnus. We were discussing a recent award the company had received, and specifically the venture that had beaten them to first place:

“[H]e’s inventing this cocoon that allows you to plant trees in the desert and they’ll grow happily and productively. But the problem with that is that even though it’s a cool idea and he’s already done pilot testing and all of that, no VC is going to fund his company. They’re not going to get the returns they need. I mean this is more like a non-profit, maybe they’ll make a few million but no VC is going to invest in them.”

We see here a limit to the ideas that are taken seriously and are given support by the Valley milieu: where ‘cool ideas’ with tested proofs of concept, yet lacking the promise of financial returns, are overlooked by the dominant innovation culture of the region. The Real Vegan Cheese (RVC) project is a notable case in point of this dynamic, providing a striking comparison of the different trajectories that for-profit versus non-profit AP ventures have experienced in the Valley to date. Similar to private companies such as Perfect Day, RVC is seeking to remove animals from milk production by genetically modifying yeast cells to produce milk proteins. RVC’s model of practice however is entirely based on open-source and community-led science, and the project uses crowdfunding campaigns to support its activities. By choosing the open, non-profit model, RVC is a distinct minority in the Valley’s AP sector. It has resulted in precluding (by choice) the project’s access to venture capital. As an employee of a for-profit cellular agriculture venture explained:

“They refuse to take venture capital because it comes with a set of strings attached. You need to have IP, you need to have an actual company, you need to be a little bit greedy. It is capitalism. They don’t like that. They hate the Man, they call us the Man - they consider us the big, bad evil company.”

A consequence of RVC’s chosen model has been that since the project’s inception their total capital raised has remained in the tens of thousands of dollars. In comparison, the first round of seed funding Perfect Day received from private investors was $2 million.

69 Fieldwork interview, SF Bay Area (October 2015).
70 https://realvegancheese.org/.
71 Fieldwork interview, SF Bay Area (October 2015).
As mentioned in the quote above, the specific requirement of IP constitutes a fundamental ‘string’ attached to the for-profit model of innovation, and was a requisite condition explicitly stressed by a number of investors I spoke with in the Valley:

“What I would be looking for is something that isn’t completely futuristic, had a pretty good IP position because I think that’s going to play a big deal here, and I think patents are going to play into valuations when people buy you out.”

VC, SF Bay Area (December 2015)

“The framework I have usually when we’re making, or I’m making an investment personally, is ‘what is unique about this product?’ Or ‘the company itself, what is defensible?’”

VC panel, Bon Appétech Conference, San Francisco (October 2015)

Patents have played an important historic role in shaping the Valley’s practices of innovation, particularly following the establishment of the Court of Appeals for the Federal Circuit (CAFC) in the 1980s. As a “centralized appellate court”, Hall and Ziedonis (2001, 105) note that the CAFC “not only unified the judicial treatment of patent rights in the United States, but transformed the legal environment from one that was generally sceptical of patents to one that promoted the broad, exclusive rights of patent owners”. The authors note the culture of aggressive patenting that evolved in the Valley around this time, describing an environment of high-stakes “patent portfolio races” as rapid technological development forced firms to protect as many pieces of the innovation-scape as possible, particularly as most computing products relied on technologies from across the semiconductor industry (Hall & Ziedonis 2001, 104).

The weight afforded to patents in the current AP sector can thus be seen as an artefact of the high-tech culture of innovation that evolved during the semiconductor boom. A number of founders described the challenges of bringing the world of food in line with these established high-tech funding models, the mechanisms and expectations of which are founded on IT-based products and services. While the Valley currently has an extensive ecosystem of software-based ventures related to food (e.g. recipe apps, delivery services), the AP sector presents a much ‘messier’ crossover of tech and food: their products are not based in software and data alone but rather encompass the materialities of food itself, along with its associated regulations, politics, cultures and economics of production. Attempts to simply transfer the IT-based VC model of ‘doing’ innovation to APs has presented certain challenges – such as, the need to establish
forms of defensible assets that can be protected under patent law, the need to prove the scalability of production, and the intense time pressures to create material products – all of which AP founders told me are relatively easier and quicker to achieve when working in the IT-based realms of algorithms and products not intended for bodily consumption.

According to a Valley-based VC, the defensible asset for food companies and products has historically been the brand. Yet despite a brand being very difficult to replicate, he highlighted that at the start-up stage “there isn’t much of a brand, so how do you put a huge valuation on that?” In recognition of this, many AP ventures have made conscious adaptations to their innovation trajectories, both materially and discursively, to ensure they meet investor requirements of scalability and patentability. An employee of a plant-based AP venture explained these decisions:

“When we’re talking to an investor the focus shifts to technology, to what we’re doing in a lab here. Because the investor sees a ‘food company’ - that’s not scalable, that’s not huge, it’s not going to be a unicorn. You know, ‘is it worth my time?’ But when you talk about building databases, computational biology like predictive models of screening plants, then they think wait, that’s something that’s scalable - like 400,000 plants in the world, you guys could licence this out. That is what gets them excited more than just [food] as a product.”

These adaptations are fundamental in bringing the world of food into the institutional language and models of the Silicon Valley-style of doing innovation. The Valley’s high-tech culture recognises ‘technology’ and understands that it ticks its required boxes of IP and scalability. Reframing food as technology thus works to align these AP ventures to the way the Valley does innovation – it fits in with the ontological and epistemological singularity of the region which privileges for-profit models as the model of innovating. The emphasis on technology also reflects its historical connection with innovation that became prevalent during the region’s counterculture movement in the 1960s and 70s. While the movement has often been mythologised as a staunch opposition to conventional forms of government and business, scholars have shown that many members in fact actively turned to the tools and systems-thinking of the

72 Bon Appétech Conference, San Francisco (October 2015).
73 A ‘unicorn’ in Silicon Valley parlance refers to a company that has reached a valuation exceeding US$1 billion. This is perceived as the ultimate goal of the Valley start-up scene, with only a small percentage of companies ever reaching this target (examples include Google, Facebook, Airbnb, Uber).
74 Fieldwork interview, SF Bay Area (October 2015).
military-industrial complex, and even collaborated in their development (Markoff 2005; Turner 2006). Many counterculture icons were passionate technophiles, advocating for what Kaiser & McCray (2016) term ‘groovy science’ which sought to connect counter-with cyber-culture and encourage commune dwellers and technologists alike to imagine technology as a tool “for the transformation of individual and collective consciousness” (Turner 2006, 7). Technology was thereby appropriated as a mechanism of innovation and a means of facilitating personal liberty, unbounded creativity and global harmony, and remains a central component in the innovation-capitalism-freedom ideology that is at once a product and producer of the Valley’s high-tech culture today (e.g. Diamandis & Kotler 2012).

6.5 Conclusion: What does it mean to feed the world ‘Silicon-Valley style’?

This chapter has sought to apply a critical lens to examine what can be hiding under the banner of ‘innovation’, and to situate it as a place-based activity. These lines of enquiry were catalysed both by my field observations of the AP/food tech sector in Silicon Valley, as well as the broader trend that has increasingly brought the Valley milieu into the realms of global development over recent years. As mentioned at the start of this chapter, such partnerships have in many cases been encouraged by world leaders and global agencies, and framed as necessary strategies for solving a range of planetary crises, from climate change to food security. This turn has materialised through the development of innovation practices and micro-spaces in the likeness of the Valley, as well as the physical movement of innovators to its geographical region (Mis 2016). In much the same way as I observed in the Valley’s AP/food tech sector, we see here the pervasiveness of the spatial imaginary in contemporary thinking that has established Silicon Valley as the place for innovative solutions – so much so that the UN has now turned to it as an ideological and geographical partner in the fight against world hunger.

But what does it mean to feed the world Silicon-Valley style? The varieties of innovation approach I develop in this chapter has sought to address this question through the lenses of place and culture and their relationship to how innovation is enacted rather than simply enabled. I have argued for the need to acknowledge the stickiness of place and culture in determining the practices and conceptualisations of innovation – i.e.,
what qualifies and is valued as ‘innovative’ within particular place-based cultures. In doing so, my aim has been to reverse the tide of previous literatures and policy mechanisms that have stripped the material and political situatedness of innovation as a concept (Morozov 2013), and positioned it as a singular and always-beneficial goal. By acknowledging the contexts of place and culture we can instead interrogate the multiplicities and specificities of innovation, and thereby acknowledge that to look to a place such as Silicon Valley for innovative solutions is to be met with a particular variety of innovation that dominates that place – one that privileges for-profit and techno-centric models. The UN’s quest to end hunger Silicon Valley-style is thus not simply an endeavour of innovation, but is to ascribe to a particular regional culture and value system of innovation that produces solutions in the mould of private companies and high-tech products. It is to venture into the heart of the ‘disruptive’ technofix model, where capitalism remains resolutely undisrupted and food security becomes another frontier for the private, rather than public, sector to solve.

The ‘varieties’ approach developed in this chapter thereby seeks to disrupt the concept of innovation itself, and in doing so makes contributions to existing literatures in various ways. To studies of innovation, it attends to the under-theorisation of place and culture (Spigel 2017) and demonstrates the power of regional culture to shape and constrain the practices of innovation enacted within a particular geographical region. To studies of food, technology and hunger, it contributes another lens through which to interrogate endeavours that claim to act under the untouchable banners of ‘innovation’, ‘progress’ and ‘development’ (Escobar 1995), and reveal the instances in which these are used as a “harmless euphemism” for techno-centric capitalism (Morozov 2016). In my study of the Valley-based AP sector, I was admittedly thrown many times by my own interrogations into the activities of people who repeatedly cited the creation of a sustainable and ethical food system as their primary motivation. For, who can question this as a positive end-goal? Who would want to oppose the notion of innovation as a ‘desirable’ and ‘necessary’ means of improving the status quo (Bunnell & Coe 2001)?

Yet the ‘varieties’ approach enables us to not oppose innovation outright, but rather problematise certain varieties that are chosen and valued over others as the mechanisms for improving the status quo. Thus in addition to the atmosphere of social anxieties and legitimising forces of policy discourses discussed in Chapter 5, APs can
also be understood as a product of a particular place, whereby their materialities and discourses have been shaped by the Valley’s dominant variety of innovation so that the solutions they present to the issues of protein production are revealed as yet more capitalist-friendly, high-tech products and undisturbed rates of consumption. As such, disrupting the banner of ‘innovation’ under which APs and other food technologies are emerging allows us to ask whether these ‘solutions’ are indeed the most desirable and necessary to the cause of achieving global food security, and more broadly invites closer analysis of the role Silicon Valley’s style of innovation can and should play in addressing current planetary challenges.
CHAPTER 7 | Eating for the post-Anthropocene: Alternative proteins and the biopolitics of edibility

7.1 Introduction

Against the backdrop of climate change, antibiotic resistance, animal welfare concerns and rising food-related health problems, the livestock industry faces mounting limits to business-as-usual. Recent years have seen recurring policy and public interventions from a broad range of actors, each of which has added to the sense of urgency that change must happen, and happen fast, if we are to realise a future of lowered global emissions (Chatham House 2015), reduced chronic illnesses (WHO 2015a), mitigated antimicrobial resistance (FAIRR 2016), and a more just food system (CIWF 2009).

In response to this context of impending tipping points – now commonly referred to in epochal terms as the Anthropocene (Steffen et al 2007) – there has been growing interest in finding alternatives to conventional animal-derived products (e.g. chicken, beef, pork). To date this activity has largely concentrated within distinctly Western geographies – particularly North America and Europe – and has been characterised by three main categories of alternative proteins (APs): edible insects, plant-based proteins, and a movement commonly referred to as ‘cellular agriculture’. This latter group involves ‘acellular’ methods such as the genetic modification of yeast cells to produce milk and egg proteins, and ‘cellular’ methods including tissue engineering to cultivate meat from animal-derived stem cells; both approaches are conducted outside (in-vitro) animal bodies. A shared motivation behind these new AP ventures is to create protein products that offer fewer environmental impacts, reduce or negate animal welfare concerns, and offer nutritionally superior alternatives to their conventional counterparts (Post 2012; van Huis et al 2013). Moreover, these claims are made in combination with the promise of visceral equivalence to the widely familiar and much-loved array of conventional animal-derived foods – that is, they build on the model of

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75 This chapter is based on a paper submitted to Transactions of the Institute of British Geographers; I am currently working on a second round of very minor revisions, following which the editor has suggested the paper will likely be ready for publication without need for peer-review again.

76 With 'conventional' interpreted in this thesis as that pertaining to typical, mainstream animal-derived foods in Europe and North America (henceforth ‘the West’).

77 http://www.new-harvest.org/what_is_cellular_agriculture.
previous protein analogue companies (e.g. Quorn) by promising to be indistinguishable in their taste, feel, appearance, sound and smell, as well as their functionality in terms of preparation, cooking and eating. While a range of edible insect and plant-based products have already reached the market at the time of writing, cellular agriculture ventures remain in earlier stages of R&D.

Given the relationship between APs and the context of Anthropocenic crises within which they have emerged, and to which they promise radical solutions, these novel foods can be situated amidst existing traditions of ethical consumption. Like the products of initiatives that have gone before (e.g. Fairtrade), APs represent another example whereby individuals are connected to a globalised sense of responsibility through the repertoires of everyday consumption (Barnett et al. 2005), and are encouraged to ‘care at a distance’ through their food choices (Bryant & Goodman 2004). They share characteristics with previous campaigns that have sought to ‘mobilise the consumer’ (Miller & Rose 1997) and offer ways to extend individuals’ concerns and “existing dispositions into new areas of practice”, such as choosing to buy locally-sourced or higher-welfare foods (Clarke et al. 2007, 246). In doing so, we can understand APs as part of the established tradition of personal food-eater relations being targeted as a site for managing societal welfare through the management of the self – a dynamic which aligns closely with Michel Foucault’s concept of ‘biopolitics’ and has been the subject of important recent work by geographers and other food scholars (Bobrow-Strain 2008; Paxson 2008; Mansfield 2012a). This chapter builds directly on the recent geographical and social science interest in the biopolitical relationship between food and individual-societal welfare. However, to date these literatures have largely focussed on already-familiar products such as bread, seafood, cheese and staple crops. By examining APs, this chapter in contrast seeks to extend a biopolitical analysis to novel foods – i.e. substances that either have no history of human consumption (cellular agriculture), or are unfamiliar to particular cultural contexts (edible insects, plant-based proteins). To undertake this project the chapter brings existing food biopolitics literatures into dialogue with studies in critical food geography that have explored the processes of ‘things becoming food’ (e.g. Roe 2006; Evans & Miele 2012).

My focus on these latter studies is to draw on their insights into the material and discursive mechanisms that work to traverse the physiological and perceptual divide between inedible (non-food) and edible (food). For as I show in this chapter, AP
developers are heavily engaged in strategies that aim to materially and discursively construct the edibility of their products – in other words, to convince consumers that their products are in fact ‘food’. And it is in these mechanisms of edibility formation that I identify a new site of food biopolitics: introduced here as the ‘biopolitics of edibility’.

To develop this concept the chapter proceeds as follows: first, it reviews recent literatures that have applied a biopolitical lens to food. This is done to examine previous cases where decisions by those involved in food production and promotion have worked to responsibilise eaters into actively choosing certain products, and to do so as a means of managing societal welfare through an individualised ‘politics of choice’ (Barnett et al 2005). I then extend these literatures by applying a biopolitical analysis to novel foods, using APs as a case study. To attend to their novelty in terms of their uncertain status between food and non-food, I draw on recent scholarship in critical food geography and other social sciences that has examined the material and discursive mechanisms involved in transforming substances into food. I focus in particular on studies of animal-derived products, exploring first the ‘ambiguous’ nature (Chiles 2013) of conventional meat, dairy and eggs that necessitates the processes of their edibility formation to overcome strong associations with taboo and defilement (Douglas 2003 [1966]), and the perceived riskiness of their ‘lively’ matter (Bennett 2010). I then address the ambiguity of APs and briefly examine how, to date, these novel foods have been perceived as ‘matter out of place’ (Douglas 2003 [1966]). This sets up the final sections of the chapter which explore the material and discursive strategies used by AP developers to address current perceptions of their products as non-food. The material strategies I examine are designed to intervene at three levels of APs: their molecular matter; their visceral attributes; and, the practices of their production and consumption – by which I mean the methods used by developers to create APs, and the contexts within which consumers engage with them. The discursive strategies analysed encompass the textual and visual language used to describe and promote APs, ranging from commercial advertising to the promissory narratives of advocacy groups, start-up ventures and promotional events.⁷⁸

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⁷⁸ It is important to highlight here that the categories of ‘material’ and ‘discursive’ are made distinct in this chapter for analytical purposes, but are seen as ultimately inextricable and collectively involved in how eaters come to make sense of things as ‘food’.

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In examining these strategies, the chapter concludes by reflecting on the edibility formation of APs as a site of biopolitics in two ways: first, by going ‘beyond the consumer’ (Evans et al 2017) in its analysis to examine how the material and discursive construction of APs themselves is itself a manifestation of biopolitics. This is shown through the ways in which AP developers seek to physically and discursively materialise normative notions of what meat, dairy and eggs ‘are’ by working to simulate the molecular, visceral and practice-based nature of conventional animal products. Yet these mechanisms also work to position APs as better than conventional products, thereby opening up a dynamic of responsibilisation directed at consumers to choose APs in the name of improved individual and societal welfare. Second, the chapter examines how these material and discursive mechanisms work on consumers by responsibilising them to quite radically reconfigure their perceptions of what counts as ‘food’, again motivated by a message that to do so will help realise the more climate-secure, healthy and ethical era of the post-Anthropocene.

7.1.1 Methods

The chapter’s analysis draws directly on empirical findings collected through field-based research in two main geographical hubs of AP development across Europe and the US. Field research was conducted over several trips to key areas of AP activity including Los Angeles, San Francisco, Silicon Valley and New York City in the US, and Maastricht, NL in Europe. Empirical data was collected from 25 semi-structured interviews and site visits conducted with key informants in the AP sectors of these locations. Given the chapter’s focus on industry-level strategies, founders and employees of private companies working across the AP spectrum (i.e. cellular agriculture, edible insects and plant-based proteins) constituted the largest percentage of informants, ranging from start-ups to more established firms. Interviews were also conducted with researchers involved in the non-commercial development of APs, and

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79 All interview quotations in this chapter that are not cited from secondary sources are taken from the author’s field research. Distinctions are made between specific key informants in the AP sector (e.g. company founders) so that citations follow this format: [role of individual], [type of AP company], [location], [date of interview]; quotations by general employees are cited with reference to the type of AP company only. The locations are cited as either ‘United States’ or ‘Europe’ – this decision was made to retain informant anonymity given the relatively small number of stakeholders involved in the recent AP activity.
those working to finance and support APs through venture capital streams and tech accelerator programmes. In addition, the chapter examines secondary source material from the corporate marketing campaigns of APs and from other commentators working within the AP space (e.g. non-profit advocacy groups), as well as media reports that have followed the sector’s emergence.

7.2 Biopolitics of food: Interventions on and through food

The expansion of what is considered edible in the name of Anthropocenic crises raises important parallels that speak to, and arguably extend, existing debates on the biopolitics of food which geographers have been heavily engaged with (Bobrow-Strain 2008; Nally 2011; Guthman 2012; Mansfield 2012a; Gibson & Dempsey 2015). APs can be situated in the long history of food products that have encouraged personal consumption as a means to optimise societal well-being. Drawing on Foucauldian thought, there has been recent interest by geographers to examine this history and draw attention to the technologies of governance that exist around food consumption, including the power of food materialities and narratives in shaping perceptions of what is considered ‘good food’ and, by extension, what it means to be a ‘good consumer’ (Lupton 1996; Goodman et al 2010). This in turn has been linked to wider normative notions of how humans ought to live in relation to other (non)humans (Lorimer & Driessen 2013; Whatmore 2006), as well as intensifying racial, gender and societal norms (Bobrow-Strain 2008; Mansfield 2012a). The distinct “moral charge” (Mintz 1996) that has long been associated with personal food choice (Trentmann 2007) thus reveals eating as a central and everyday means by which people problematise “what they are, what they do, and the world in which they live” (Foucault 1992). The value of applying Foucauldian thought to food, therefore, is that it reveals the mechanisms which intervene on individuals so that personal diet becomes a principal means “of forming oneself as a responsible, ethical subject in relation to a larger social formation” (Bobrow-Strain 2008, 23).

A biopolitical lens also enables us to consider how the materialities and discourses of food itself are intervened upon by actors beyond the consumer (e.g. government, business) in the name of public good, thereby revealing “how the management of food...
maps onto strategies for managing life” (Nally 2011, 38). Building on the relatively under-studied subject of food by Foucault, Nally draws parallels between state-level food provisioning and the security mechanisms Foucault (2007) identifies as working to bring populations under regimes of discipline and optimisation. With the shift of governmental concern towards hygiene, health and economic security at the population level, the quantity, safety and nutritional quality of food have in turn been revealed as key objects of political power (Bobrow-Strain 2008). This has led state, and later corporate, actors to intervene on populations via discourses designed to responsibilise individuals for their own diet-related conduct, legitimised by appeals to the welfare of the population as a whole (Gibson & Dempsey 2015). More recently through the application of genetic technologies and other technoscientific practices (e.g. pasteurisation) to the ‘stuff’ of food (Bennett 2007; Abbots 2016), we see these interventions extended to material means and their rationalisations expanded to include planetary as well as human welfare (Andrée 2002; Paxson 2008). Through a biopolitical lens then, we can understand food as intimately connected with personal conduct and broader prosperity, acting both as an intervention on individual consumers as well as itself being intervened on by actors beyond the consumer – a dual dynamic which this chapter shows is similarly materialised through APs.

Of the interventions discussed in previous biopolitics of food literatures, many have operated across the molecular scale of foods and in doing so have brought new imaginaries and techniques into food practices. Distinct parallels can be drawn here with studies on the ‘molecularisation of life’ (Rose 2001) which document how recent advances in the biosciences have opened up and resituated the human body within new landscapes of opportunity and risk (Braun 2007). The molecularisation of agricultural life through techniques such as genetic engineering has brought about similar outcomes: it has unveiled a new scale through which we come to ‘know’ and act upon the foods we eat. Nally (2011) describes a significant consequence of this shift as ‘accumulation by molecularisation’. Building on Harvey’s (2003) concept of ‘accumulation by dispossession’, he shows how the influx of biotechnology into food production has instigated profound changes to global food provision by taking control of “production itself” (Cooper 2008) at the genetic scale. In doing so, the materialities of food have been opened to new frontiers of capital accumulation, and in turn new “biopolitical struggles” (Andrée 2002). Notions of ‘good’ and ‘safe’ eating, of poverty and
nutritional salvation, of planetary well-being, and of progress and innovation have consequently played out across the genetic scale of foods (Bouis 2007). Such framings have been used to disparage – often on moral and emotive grounds – critics of genetically-modified foods, as well as to legitimise the (bio)corporatisation of food production and the use of market mechanisms “as a better protection against scarcity” (Nally 2011, 37).

With the reimagining of human and agricultural life through a molecularised lens, further interventions on the materialities of food have been legitimised under the banner of public health: namely, the establishment of new production and processing practices designed to control the risks posed by the ‘liveliness’ (Bennett 2010) of food’s molecular matter. Examples include the use of pasteurisation techniques in cheese-making (Paxson 2008) and the introduction of wrapped bread (Bobrow-Strain 2008), both of which have been used to reimagine industrialised food products as the safer, cleaner, and hence more responsible choice. Such case studies show how the microbial makeup of foods has acted as battlegrounds for a moralised market share, as industrial producers have pitted ideas of expertise and “control for sale” (Bobrow-Strain 2008, 26) against the ‘risky’ practices of smaller-scale businesses and domestic cooking. They also reveal how broader political concerns of contagion beyond health (e.g. race) have materialised through the physical matter of food and its practices of production and regulation (Slocum 2011; Guthman 2012; Mansfield 2012b).

Regarding interventions on consumers, the molecularisation of food has had considerable impact in shaping how eaters engage with food in everyday practices. In his work on ‘nutritionism’, Scrinis (2012) documents the attachment of ‘good’ and ‘bad’ qualities to specific nutrients, resulting in the molecular scale of foods becoming another site for managing the self as a responsible eater. Mansfield (2012a) observes in her study of seafood that the presence of pathogens and toxins such as heavy metals have likewise become bound up in ideas of responsible eating. As mentioned above, this biopolitics of contagion often extends beyond the materialities of the products themselves so that food contamination is problematised as a broader issue of race, gender or socioeconomic status rather than of the systems of production (Bobrow-Strain 2008; Guthman 2012). In this way, particular members of society (e.g. women, ethnic minorities, low-income) often become the target of food safety campaigns and
other state interventions, and are responsibilised to make better food choices to safeguard societal health (Mansfield 2012a). There is a distinct temporal aspect to this responsibilisation too, as Mansfield (2012a, 589) describes how these interventions “not only make individual women scapegoats for broader socioenvironmental problems but also intensify a highly gendered biopolitics of lifestyle and responsibility for securing the future”.

Through these biopolitical analyses, much is revealed concerning how food is bound up in processes of responsibilisation, processes that act upon the end consumer through material and discursive means but also intervene on the materialities (i.e. the physical matter and practices) of foods themselves. The molecularisation of food as a biopolitical mechanism is highlighted here for its centrality to many existing studies on food biopolitics, and is a theme which this chapter directly builds on. Yet where this chapter differs from these literatures is its focus on novel foods, taken here to represent substances that have no previous history of human consumption (cellular agriculture) or are unfamiliar to certain cultural contexts (edible insects, plant-based proteins). While existing food biopolitics literatures have examined the introduction of new technoscientific practices that can be viewed as producing ‘novel foods’ (e.g. genetic engineering), all have focussed on already-familiar end products (bread, seafood, cheese, staple crops). In applying a biopolitical lens to APs, I extend these literatures by examining products that are largely perceived as non-food and thus require radical mechanisms of responsibilisation to convince eaters not only to choose them over conventional animal products, but to also perceive them as food. To explore how these mechanisms work to reconfigure the boundaries of (in)edibility – thereby producing a biopolitics of edibility – the next section examines recent thinking on ‘things becoming food’ (Roe 2006), both within and beyond geography.

7.3 Making ‘food’: Animal products and the mechanisms of edibility formation

“She looked down at her own half-eaten steak and suddenly saw it as a hunk of muscle. Blood red. Part of a real cow that once moved and ate and was killed”

*The Edible Woman*, Margaret Atwood (2009 [1980], 185)

While animal products have long been perceived as a means of embodying positive qualities – e.g. physical strength, virility, courage and socioeconomic status (Fiddes
they also occupy an uneasy position within human consumption practices. Commenting on the “anxiety and ambiguity” associated with meat in particular, Chiles (2013, 473) attributes this status to its existence “concurrently as both animal flesh and de-animalized commodity”. He points to the lively origins of meat, i.e. having once been part of a living being with bodily matter very similar to ours (muscle, bones, skin), as well as its journey through the violent means of slaughter as significantly contributing to its precariousness as an acceptable foodstuff (see also Kubberød et al 2002a). Meat and milk feature frequently in Mary Douglas’ (2003 [1966]) ground-breaking work *Purity and Danger* in which she documents an array of intricate and morally-charged rituals designed to avoid the threat of spiritual and physical defilement from the bodily matter of animals, both living and deceased. Under the ‘wrong’ circumstances then, animal products very easily pass into the category of ‘matter out of place’, representing disorder and an affront to the proper and natural organisation of the environment (Douglas 2003 [1966], 2). Such cases contravene specific cultural and material conditions which prevent the appropriate transition from animal to edible (Vialles 1994), thereby rendering the ambiguous substance as too lively, risky and ultimately too ‘animal’ to be considered acceptable and safe food.

While notions of what is ‘appropriate’ have differed across space and time, the longstanding cultures of taboo that have evolved around animal consumption reveal a systemic project by humans to manage the boundaries between animal and food – a project that works across a variety of fronts, from moral and physical cleanliness to the intricate ordering of (non)human relations. Unpacking the mechanisms involved in this management has been the task of recent writings across the social sciences, notably in geography and anthropology. In developing her concept of ‘things becoming food’, Roe (2006, 109) seeks to “open up space for a close examination of how a thing (an animal or plant) passes through a set of human practices and material processes that do the translating from food production to food consumption”. Taking a relationist approach, she traces the journey of things over time and space and comments on the points at which they are affected, and thus transformed, by (non)human processes into edible foods. Roe documents a live sushi performance to exemplify these processes, observing how the practices and equipment of the chef, the smells, textures and tastes of the fish, and the presentation of the end product all contributed to the animal-to-food
conversion. Parallel observations are made by Vialles (1994) who, in her book *Animal to Edible*, documents the use of particular spaces, personnel, expertise and material inputs within abattoirs to facilitate the process of turning a living being into ‘food’ rather than simply producing a dead corpse.

Having transitioned through the stages of production and processing, a critical part of a foodstuff’s edibility formation occurs at the consumer level through aspects such as labelling, advertising and retail presentation. As Evans & Miele (2012) and others have shown, the modern (Western) consumer is typically met with a careful performance of ‘absented’ and ‘presented’ imaginaries and materialities of animal foods so that the end products are disconnected from their messier, brutal and lively origins (see also Probyn 2011). This is exemplified by the frequent descriptions of ‘happy animals’ on product labelling (Miele 2011) and the common absence of blood, skin and other visceral features from their material appearance. Indeed, consumer studies have shown that for certain demographics (e.g. young, female, urban) the presence of these visceral features, particularly in red meat, can render it “a disgusting entity” (Kubberød *et al* 2002b, 57), with participants expressing negative feelings about the mouth-feel (fibrous, bloody) and the ‘heavy’ body-feel experienced when eating meat. For others however, often males, these features contribute to the pleasurable experience of meat-eating and are directly linked to the cultural value of animal products as sources of strength and power (Adams 1990). The importance of viscerality in our engagement with and conceptualisation of food-body relations (Longhurst *et al* 2008; Hayes-Conroy & Hayes-Conroy 2010) is largely absent from existing food biopolitics literatures, and as will be shown is a central mechanism through which the biopolitics of edibility has emerged in the case of APs.

The material and discursive mechanisms used to overcome the precarious status of animal products as (in)edible substances speak closely to Parasecoli’s (2011) concept of ‘food semiospheres’. In his words, a food semiosphere “constitutes itself by marking its porous, ever-shifting boundary in relation to the extra-semiotic that surrounds it”. He views edibility as a realm that exists for every eater and is bound by context-specific factors relating to their personal experiences of food. An individual’s perception of edibility is thus tied to their exposure to particular material, visceral, discursive and sociocultural assemblages. It is reinforced through the appearance and sensory aspects
of an end product, the textual and visual language used to describe it, the performance of the retail/eating environment, and the cultural associations it draws upon and reinforces (Evans & Miele 2012; Probyn 2011). Other material conditions concerning the presence of harmful entities within a food (i.e. pathogens) and nutritional content can also be seen as contributing to the boundaries of an individual’s semiosphere. Yet this status quo is by no means permanent. Parasecoli (2011) notes that the “ever-shifting” nature of the boundary between the (in)edible realms enables an individual’s food semiosphere to be re-configured, thereby allowing the possibility of “new extraneous substances [to] become part of the system” (ibid, 651). When presented with a novel food, he states, an individual will immediately place it in “the basic opposition edible/inedible”, yet this binary is then dissolved through the following negotiation:

“Depending on the cultural resources and on the personal attitudes of the eaters, foods newly admitted in the semiosphere can be considered more or less familiar and more or less palatable, which places them on two continuums going from ‘totally exotic’ to ‘totally familiar’, and from ‘totally palatable’ to ‘totally unpalatable’” (ibid, 654).

The strategies I document later in this chapter can be seen as actively working to make APs appear more ‘familiar’ and ‘palatable’ to eaters; to more readily be accepted into their food semiospheres. This work has in large part been in response to the distinct ‘yuck factor’ associated with the latest APs to date which threatens their acceptability as food. Media headlines have frequently referred to cultured meat as ‘Frankenfood’ (Santa Maria 2012), and allusions to cultural notions of creepiness and dirtiness often characterise reports on insects (Gates, S. 2013). Academic studies conducted in Western countries have observed corresponding feelings of disgust amongst participants towards these APs, particularly regarding their initial gut reactions (Megido et al 2014; Verbeke et al 2015). However, some studies found that while a degree of uncertainty remained, through further reflection participants’ openness to APs increased as they began to situate APs amidst the practices and notions of acceptability in current animal-food production (Weele & Driessen 2013).

As Parasecoli’s (2011) work and the other literatures reviewed in this section show, the negotiation of the boundaries of (in)edibility is at once a material and discursive project – from the practices, visceral qualities and physical matter of food, to the performance of textual and visual language in its final consumer-facing form. In the case of animal products, these material and discursive mechanisms are essential to overcoming the
ambiguity and anxiety that comes with transforming a living being into a consumable substance; a necessity made even more profound by the existence, and thus familiarity, of animal consumption in human diets stretching back millennia.

Turning to APs then, these novel foods add further uncertainty to an already precarious landscape: as Chiles (2013, 479) describes, they represent “an ambiguous solution to an ambiguous problem”. To prevent APs being perceived as ‘matter out of place’ and remaining outside people’s food semiospheres, their developers have implemented strategies that work on APs themselves (both materially and discursively), which in turn work both to appeal to and ultimately reconfigure notions of what counts as ‘edible’ in consumer thinking. It is in these strategies of edibility formation that I identify new sites of biopolitics, a dimension which has been under-studied in previous scholarship on things becoming food. The value of bringing these two bodies of literatures together is thus threefold: first, it builds upon recent studies in critical geography/food studies by unpacking the biopolitical dynamics that act across the boundaries of (in)edibility; second, it facilitates the extension of a biopolitical analysis to the case of novel foods, and also brings forth the importance of viscerality in food-eater relations that has largely been absent from food biopolitics studies; and third, it contributes to conversations across critical food studies regarding the central (and politicised) role of material and discursive mechanisms in the construction of food-eater relations.

The next section proceeds by examining how APs are ‘becoming food’ through interventions on their discourses and materialities, with the latter focussed at three levels: molecular, visceral, and the practices of production and consumption. This serves to reveal a biopolitics of edibility which simultaneously entangles the stuff of APs and their target consumers in notions of ‘good’ and ‘normal’ eating, set within the broader context of responsibility for bringing about a more stable and ethical post-Anthropocene.
7.4 The edibility formation of APs

7.4.1 Molecular mechanisms: A reductionist approach

It has frequently been stated across the AP sector, both in the US and beyond, that there is a need to redefine our understandings of animal products and to do so through a molecularised lens of food. When viewed through this lens, they argue, animal products can be understood as a collection of nutrients and chemicals. This approach is exemplified by cultured milk-company Perfect Day (formerly Muufri) when describing their production methods in a recent media interview:

“Our solution is to make real milk from the bottom up. It’s a fairly simple mixture: six key proteins for structure and function, eight key fatty acids for flavour and richness. In different ratios, these components give us cow’s milk, goat’s milk, or even buffalo milk – all suitable to become countless products, from toppings to cheeses to desserts.”

This shift towards a molecularised understanding of animal proteins can be linked with wider developments in the biomedical sciences. All of the cultured and plant-based protein companies I spoke with during my fieldwork had at least one co-founder from a biomedical or life science background, or had drawn directly from research conducted in these fields to launch their first products. A co-founder of a cultured milk company stated it was his previous job at a medical company “teach[ing] cells what proteins to make” that inspired him to translate his understandings of proteins to food production. He recounted an experience during this period of eating a bagel with vegan cream cheese, which he described as “runny, flat, watery and tasteless”, and led him to the following thinking:

“I could literally picture there being interlocking proteins that were just not in there. In real cream cheese there’s firmness and it’s like there’s protein in this, but there’s not protein in what I’m eating right now. So if only someone could go make this protein, you know. And then I’m back at work making proteins – it was like two and two together.”

Co-founder, cultured milk company, US (April 2015)

A similar perspective was shared by an employee of an AP company creating plant-based ‘meat’ products:

“You know meat really isn’t that complicated in terms of the composition of amino acids, lipids, water, minerals and fats. All of that is available in the plant

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80 http://www.biobasedpress.eu/2015/03/synthetic-food/.
In adopting a molecularised understanding of animal products, foods such as meat, milk and eggs are divorced from the bodies of conventional livestock. The dependency of their status as food is disconnected from the bodily processes and materialities of animals, thereby opening production to alternative technologies and expertise such as plant science or tissue engineering. Current perceptions of ‘meat’, ‘milk’ and ‘eggs’ are thus extended to new scales, raw materials, production methods and end products, moving us beyond the definitions determined by Nature and what many in the AP space view as the limits of and to Nature. The other co-founder of the same cultured milk company commented: “Nature made what it made through accidents; we can make what we want based on target properties”. As Braun (2007) notes with the molecularised body, this molecularisation of food breaks down the ‘somatic’ boundary of animal-derived products and situates them within a body-/borderless molecularised world. By identifying which molecular components are needed to technically construct ‘meat’, ‘milk’ and ‘eggs’, we can understand the edibility of APs as being materially constructed through a high-tech, bottom-up approach.

In the case of recent insect companies, a related but slightly different approach to edibility construction has been adopted: related in that it operates at the molecular scale, but instead of literally building edibility through a bottom-up approach a dominant strategy has been to highlight the nutritional equivalence that already exists within insect species (FAO 2013). Insects are frequently advertised as containing the same if not higher quantities of nutrients that are valued in conventional meat: for example, in one of Exo’s rationale statements entitled ‘Why Crickets?’, the New York-based company emphasises that their protein bars provide “a complete protein source, containing all essential amino acids”. Speaking to one of the company’s co-founders, he described how this emphasis on molecular composition has helped customers to situate their products in relation to both conventional and other AP options:

“What we’ve found so far is that people treat it [insects] almost as an animal meat product, because compositionally they are essentially an animal in terms of their protein to fat to carb ratio, and the amino acid ratio that their protein has. It’s much more comparable to a steak than it is to a soy bean.”

Co-founder, insect company, US (October 2015)
Through such framings, consumers are thus encouraged to align APs with existing animal products on the molecular scale. This approach contributes to overcoming negative (Western) cultural associations and helps shift perceptions of insects from ‘pest’ to ‘food animal’ (Stock et al. 2016), a point to which I return later.

7.4.2 Familiar products and practices

When discussing their methods, a co-founder of the same cultured milk company highlighted that some people “don’t believe in the reductionist approach, they believe that there is too much in there”. This view of food as being ‘more-than-consumption’ (Goodman 2016), and that consumer understandings go beyond the purely biological makeup of foods and are instead shaped by less ‘rational’ and more visceral, emotive, cultural and often contradictory factors, was shared across the majority of AP professionals I engaged with. As discussed earlier, this speaks to perceptions of edibility going ‘beyond biology’ – i.e. extending further than a substance’s molecular materiality. For if APs such as cultured milk or insects are technically edible and contain the same molecular makeup as conventional animal products, why does the ‘yuck factor’ exist? In her study of ‘substitutionism’, Guthman (2015) states that “[t]oo much substitutionism tests the boundaries of food” and can make “certain food inventions unacceptable”. Likewise, reducing food to its molecular components and building it from the bottom-up tests the boundaries of acceptability. It introduces novel and unfamiliar actors, materials and practices into the intimate relationship between eater and eaten, asking the eater to accept these and ultimately embody them – both ideologically and materially – through ingestion (Mol 2008). It also treats eaters as a homogenous, ‘rational’ group, failing to account for different bodies with different bodily experiences and relationships with food (Hayes-Conroy & Hayes-Conroy 2010).

To attend to these factors, AP developers have also looked ‘beyond biology’ in the edibility formation of their products. These strategies have sought to balance the novelty factor of APs by appealing to existing expectations of what ‘food’ is and how it becomes so, particularly regarding the categories of meat, dairy and eggs. Indeed, all APs reviewed in this chapter have been designed to simulate already-familiar foods,

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thus diffusing their difference from established animal products. Perhaps the most widely-publicised example of this was the globally-broadcast event in London in August 2013 which saw the unveiling and first public tasting of cultured meat in the form of a burger. The burger was cooked by celebrity chef Richard McGeown in front of a live audience and tasted by two independent food researchers, Hanni Rutzler and Josh Schonwald, as well as the lead scientist behind the burger’s creation, Professor Mark Post. The main motivations for the event, Post states, were to present a proof of concept to attract investment and make the case for cultured meat as a better alternative to current livestock production (O’Riordan et al 2016). Yet it also provided, I argue, an opportunity to conduct important work on cultured meat’s edibility formation. Several aspects of the materialities of the event can be seen as working to situate cultured meat as food in public thinking: first, the choice of end product used to introduce cultured meat to the world. Reflecting on this decision, a UK-based academic connected to Post’s work at the time of writing commented:

"Why a burger? It’s something that’s very familiar, something that’s very on trend in a way...We love burgers, we love processed foods; it’s something we can relate to."

Cellular agriculture researcher, Europe (October 2016)

The familiarity of burgers as a foodstuff, particularly in the West but also as an exported food culture worldwide, immediately works to align cultured meat with the food semiospheres of a global audience. It is a food that is recognisable and loved by millions of people around the world. It is also widely associated with Western lifestyles and ideas of personal and economic freedom, so much so that eating burgers is seen by many as a step towards realising the American Dream (Parker Talwar 2002). Along with these positively-held associations, the global popularity of this food for its enjoyable taste, low cost and convenience also work towards increasing public acceptance of cultured meat as not only edible but a desirable food (Stephens & Ruivenkamp 2016). The power of simulating burgers and other popular animal products is also evident in the strategies of the latest plant-based AP companies: continuing in the model of other companies in the plant-based sector (e.g. Quorn), AP ventures such as Beyond Meat, Impossible Foods and Hampton Creek are also materially mimicking conventional animal foods, offering plant-based alternatives to popular types and cuts of meat (e.g. Beyond Meat’s ‘chicken’ strips; Impossible Foods’ ‘beef’ burger), and acting as
replacements to conventional animal ingredients in familiar products (e.g. Hampton Creek's pea-based mayonnaise).

Beyond the cultured burger itself, the materialities of the tasting event also contributed to the normalisation of cultured meat. The burger was cooked and served with ingredients, methods and accompaniments that will be familiar practices for many meat-eaters. The layout and format of the event shared similarities with popular television cooking shows, and the presence of a chef and food researchers, as opposed to a panel of biomedical scientists, also helped to bring cultured meat into the ‘world’ of food. This was further reinforced by Hossain repeatedly situating the burger within the expertise of McGeown, asking him in his capacity as a chef to help the audience ‘make sense’ of the burger as food (Evans & Miele 2012). The smaller details of the tasting event – such as the eating equipment and meal format – also appeal to food norms and practices that are recognisable to many eaters, and play a critical part in people's food acceptance (Schösler et al 2012; Wansink 2002). All of these material performances can be seen as reorienting the boundaries between ‘edible’ and ‘inedible’, and collectively worked to convince the audience – specifically venture capitalists and the media – that cultured meat is indeed food.

The developers of edible insects have been similarly attentive to the materialities of their products. Given that insects are already a popular foodstuff in many parts of the world (DeFoliart 1995; van Huis et al 2013), the strategies of recent insect companies have worked specifically “to get edible insects on the Western plate”. Most ventures targeting Western markets have focused on the materiality of their merchandise to realise this cultural shift: for example, the majority of end products simulate already familiar and convenient food items such as protein/confectionery bars, sushi boxes and crackers, within which insects are typically used as ground-up powder. While the molecularised lens of insects has drawn parallels with animal products at the biological level, the choice to grind them up represents a distinct effort to de-animalise insects by ‘absenting’ their bodily matter (Evans & Miele 2012), an approach which has in large part been in response to consumer reactions:

“I think the whole point is not looking at the insect...Legs are bad, eyes are bad, antenna, wings, all those things.”

Fieldwork interview, co-founder, insect company, US (October 2015).
Co-founder, insect company, US (October 2015)

To absent the bodily parts of insects is thus an attempt to absent their negative cultural associations – that is, to background those material reminders of insects as creepy, unclean and viscerally unpleasant (Megido et al 2014) – and thereby increase consumer acceptance of them as edible (Ruby et al 2015). To further support this goal, efforts have been made to assimilate insect consumption within existing food practices. Launching products through pop-up restaurants, utilising the expertise and traditions of established cuisines (e.g. sushi), and selling them through familiar, albeit largely high-end food retailers are just some of the practices through which insects are being made into food. Similar approaches are evident with plant-based APs with many coming to market in the US through mainstream retailers and popular restaurants. A key moment in the evolution of the AP sector was the recent decision by Whole Foods to include Beyond Meat’s plant-based burger in their meat counters, rather than the typical positioning within the alternatives/specialist diet section (Heath 2016). By simulating both the appearance of animal products, as well as the familiar and everyday practices of where these (and food in general) are bought and eaten, we can thus identify further material interventions through which these APs aim to become food in consumer thinking.

7.4.3 Sensory simulation

As discussed earlier, the sensory characteristics of animal proteins, particularly meat, are important for determining both acceptance and importantly pleasure, as well as rejection. High levels of juiciness, a fibrous texture, strong aromas and colours all contribute to establishing the category of ‘meat’, and it is these characteristics that are often used as “quality cues” in terms of a meat product’s taste, freshness and quality (Font-i-Furnols & Guerrero 2014). Higher intensity of these characteristics in meat products have been shown to add positively to some consumers’ experience, while for others they can lead to strong feelings of disgust (Kubberød et al 2002a, 2002b).

The ability for APs to be viscerally-equivalent to conventional animal products has been identified as one of the major challenges for gaining greater consumer acceptance, particularly amongst meat-eaters (Hoek et al 2011). It is this barrier which plant-based
protein companies such as Beyond Meat and Impossible Foods are seeking to overcome by not only simulating the appearance of animal meat, but also its full sensory experience:

"People love meat and our approach is to go with that and say 'well why can’t we provide people with meat made from plants that provides the taste, chew and satisfaction, and of course the nutrition that people are craving?'".

*Plant-based company, US (October 2015)*

To viscerally deliver ‘meat’, both companies have sought to understand the building blocks of what makes animal proteins behave the way they do when cooked and eaten. Using a similarly reductionist approach to those developing cultured proteins, they have examined the plant world to find the best sources for replicating these characteristics at the molecular scale. Impossible Foods have taken this approach as far as developing ‘plant blood’ – derived from plant-based heme molecules – so as to more fully mimic the taste, smell and juicy appearance of blood in red meat, as well as the red-to-brown colour transformation during cooking. The company attributes this unique feature as enabling the creation of their first product, the ‘Impossible Burger’, with the “look, feel, smell, sizzle, and most importantly, the taste of ground beef – but made entirely from plants” (Impossible Foods 2016). It is these characteristics that are actively displayed in their marketing campaigns, such as videos of the Impossible Burger being cooked and eaten in the same ways as a conventional burger.83 Parallels can be drawn with the cultured burger event which was centred on cooking and eating, a performance that offered not only confirmation of the burger’s visual and auditory likeness to conventional meat, but also confirmation of the smells as it cooked and reviews from the tasting panel of its taste and texture.

### 7.4.4 Normalising narratives

“Informational cues” (Fonti-i-Furnols & Guerrero 2014, 363) about food products are another key mechanism of edibility formation, particularly when used to ‘present’ or ‘absent’ certain aspects of a product (Evans & Miele 2012). The careful negotiation of the animal-ness of APs has thus been a discursive project as well as a material one. With

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insects, there have been conscious efforts to absent visual and realistic depictions of whole insects on packaging, instead opting for cartoon-like and ‘clean’-looking designs with textual descriptions that focus on taste, healthiness and high-quality ingredients. The names of recent insect companies can also be seen as a mechanism of edibility formation, with a large majority drawing on semantic similarities and word-play that associate insects with food (e.g. ‘Grub’). In contrast, when describing their production methods it was common for the insect companies I spoke with to use terms such as ‘livestock’, ‘farms’ and ‘rearing’, and to associate their methods with the long traditions of insect farming in non-Western contexts (DeFoliart 1995; van Huis et al. 2013). As seen with the material interventions then, a key part of the discursive transformation of animal-to-edible involves the careful framing of AP materialities and practices, which works to background their identities as pests and realigns them with those of food animals.

Discursive interventions play a similarly central role in the edibility formation of cellular agriculture and plant-based products. Of the companies I spoke with, all stressed the importance of using the labels ‘meat’, ‘milk’ and ‘eggs’ in helping to counter-balance the technological aspects of their products, and thereby position them as more food-like to consumers. This discursive simulation also extends to descriptions of their production methods:

“We make the yeast that’s going to give us our milk proteins. From there we go to our small-scale fermenters which is just like, have you ever been to a beer brewery by any chance? [Author: Yes]. So in small-scale that’s what we have in our lab right now.”

Co-founder, cultured milk company, US (April 2015)

“[Our] chefs previously worked at restaurants - they’re not engineers, they’re not computer coders, they’re chefs from Michelin-star restaurants who just love food.”

Plant-based company, US (October 2015)

In my interviews with cellular agriculture personnel, the longstanding traditions of culturing dairy products to create cheese and yogurt were frequently referenced. The synonymous nature of the word ‘culture’, with meanings applicable to food, tissue engineering and societal practices and values, has also played into the edibility formation of these APs: for example, the evolution from more clinical-sounding terms such as ‘in-vitro’ to ‘cultured meat’. In these ways, cellular agriculture – a term which
itself includes a combination of ‘new’ (cellular) and familiar (agriculture) – implies an extension of well-known food practices rather than representing a complete shift to novel processes. These strategies help to further stabilise APs as food by emphasising the use of the same raw materials (animal muscle) or familiar alternatives (yeast), as well as processes (fermenting) and personnel (chefs) that are firmly established and globally recognised in food production.

7.5 Eating for the post-Anthropocene: The biopolitics of edibility

“What we want to do is empower consumers so they have that choice to make: ‘Look, you don’t have to choose this, you can choose this other product that is the same if not better.’”

Co-founder, cellular agriculture company, US (June 2015)

The idea of APs being ‘the same if not better’ is at the heart of the biopolitics of their edibility formation. We have seen how, through a series of material and discursive mechanisms, AP developers are investing considerable effort and capital in creating products that simulate the visceral expectations, molecular compositions, practices and discursive characteristics of their conventional counterparts. Through such mechanisms, these APs appeal to the (largely Anglo-American) norms and expectations that have come to define the particular categories of meat, dairy and egg, as well as the boundaries of (in)edibility. The popularity of animal food consumption is thus not the target of disruption here; rather, it is to deliver products that are indistinguishable in enjoyment, cultural value and familiarity, and by doing so reconfigure what qualifies as meat, dairy and egg in consumer thinking. Providing ‘the same’ as conventional products thus involves material and discursive interventions on two successive targets: first, the APs themselves to normalise them as ‘food’; and second, through this normalisation the APs target consumers by appealing to but ultimately re-drawing their food semiospheres so as to become accepted as food.

The first form of biopolitics made manifest through edibility formation concerns the cultural politics bound up in the normalising strategies of APs: namely, which norms do such strategies draw upon, and consequently reinforce, as these APs become ‘food’? While numerous studies have documented how consumers are encouraged through eating to symbolically and literally embody social norms into their bodily matter (Bordo 1993), the normalisation strategies of APs demonstrate an ‘embodiment’ within their
own materialities of the ideals of what animal products ‘are’ and should be. As Stephens (2010, 400) notes, cultured meat (and other APs) exist for many consumers as “undefined ontological object[s]”. As such, a key part of AP edibility formation has been an exercise in “ontological politics” (Mol 1999), whereby notions of what constitutes ‘normal’ animal foods and production methods have literally been materialised within AP supply chains and their final market-ready forms, as well as their associated narratives. To date, this material and discursive performance of APs being made into food has centred on Western notions of conventional animal products: from their association with masculinity and power to the types of products they have emerged as, and their cultural and historical links with Western ideas of freedom and socioeconomic opportunity (Adams 1990; Fiddes 1991; Parker Talwar 2003; Calvert 2014). In exploring the biopolitics of edibility in the context of APs, important questions are raised regarding not only how their edibility formation acts to responsibilise eaters to adopt them, but also how this process reinforces Western-centric ideals of what ‘normal’ eating looks and feels like, as well as the continued cultural and political value attached to existing practices around conventional animal foods (see Sexton 2016).

Yet as the quote above shows, the aim of AP developers is to not only produce ‘the same’ but to provide better alternatives to conventional animal products. This notion of better-ness has been a key part of APs ‘becoming food’ and is likewise materially and discursively bound to their edibility formation. In becoming food, APs have become cleaner, safer, higher-functioning (e.g. fluffier egg whites, creamier milk), and more nutritious, ethical and sustainable alternatives to their conventional counterparts, and these traits are an important part of how developers promote them:

“I think being able to tout those benefits and have them be so that we’re not just comparing: i.e. these are [our products] and these are regular versions and they’re the same thing, but saying [our products] are better. And not just better because of the process, so the fact that they’re far more sustainable, there’s no risk of disease and they’re far safer for people to consume; but the fact that they also have these performance capabilities to them.”

Co-founder, cellular agriculture company, US (June 2015)

The emphasis on the cleanliness of APs, both morally and physically (i.e. ‘there’s no risk of disease’), is best exemplified in the recent evolution in terminology used to describe cultured meat. Through the particular efforts of the Good Food Institute (GFI) – a US-based non-profit founded in 2016 to promote and fund AP development – cultured meat
is now increasingly referred to as ‘clean meat’.\textsuperscript{84} Explaining the reasoning behind this descriptive shift in a recent blog, GFI’s director Bruce Friedrich commented:

“First, ‘clean meat’ is a more accurate way of describing real meat grown without animal slaughter. Second, ‘clean meat’ is similar to ‘clean energy’ in that it immediately communicates important aspects of the technology—both the environmental benefits and the decrease in food-borne pathogens and drug residues.”\textsuperscript{85}

Distinct parallels can be observed here with themes raised in previous food biopolitics literatures which document how other food products have been associated with notions of purity, both in terms of bodily hygiene and food safety, as well as ethical ‘cleanliness’. In the context of APs, this framing serves two key purposes: first, to promote the benefits of the ‘post-animal’ approach of APs, and second to legitimise the shift in practices and expertise to the realms of technoscience that such an approach has instigated.\textsuperscript{86} By removing animal bodies from protein production – bodies which we have seen instil ambiguity and risk to the creation of food – APs are positioned as mitigating these concerns by offering a range of methods that are cleaner materially (e.g. antibiotic and pathogen-free) and ethically (no slaughter, better for the environment).\textsuperscript{87} Conventional animal foods thereby become the ‘matter out of place’, a risk of physical and moral defilement. Recent events in conventional livestock farming have played heavily into this latter framing: outbreaks of avian flu and the increased exposure of intensive farming practices have pushed livestock-related issues up political and public agendas, and were all repeatedly cited by AP developers as factors helping to position their products as the less risky alternative – both physically and morally, as well as financially for food retailers:

"In the US we have the largest avian flu outbreak in US history and they’ve had to have recalls all over the country because a lot of major restaurants and companies have been cutting back on items that have eggs in them because of the price increase, and because they’re not comfortable with feeding eggs to consumers and risk them having eggs that were laid by chickens who had the flu.

\textsuperscript{84} Similar terminology has been used by actors in the emerging space of cultured meat R&D in Tel Aviv, Israel – e.g. SuperMeat (http://supermeat.com/meat.html).
\textsuperscript{85} http://www.gfi.org/clean-meat-the-clean-energy-of-food.
\textsuperscript{86} For discussion on the ‘post-animal’ approach, including the idea of a ‘post-animal bioeconomy’, see http://www.new-harvest.org/about.
\textsuperscript{87} There is still uncertainty concerning the feasibility of removing all animal inputs from certain AP methods (e.g. finding a cost- and performance-effective replacement for foetal bovine serum in cultured meat production). Also, a degree of ambiguity remains regarding the value and sentience of insect life and the ethical soundness of replacing the slaughter of certain animals with that of others.
Where Bobrow-Strain (2008) notes the ‘professionalisation’ of food production during the 20th century as domestic cooking was increasingly replaced by industrial methods, the recent AP sector represents a ‘biotechnification’ of protein production – an evolution that is practice/knowledge-based and geographical (i.e. the shifting of production on the microscale to laboratories and on the macro-scale to technoscience hubs such as Silicon Valley). It is these shifts that AP developers associate with the cleanliness, safety and other superior characteristics they attribute to their products: by bringing protein production into the controlled and sterile environments of the laboratory, APs represent another case of “control for sale” (Bobrow-Strain 2008).

To create a safer and more ethical post-Anthropocene, the consumer is thus responsibilised through the morally-charged materialities and discourses of APs to practice their sustainable and ethical competence (Miele & Evans 2010) and accept APs over conventional animal products. It is a choice that follows directly in the biopolitical footsteps of previous cases, whereby consumers are burdened with the task of materialising themselves as better eaters so as to materialise a better food system that safeguards societal and wider planetary welfare (Mansfield 2012a), and in doing so bring about the post-Anthropocene.

7.6 Conclusion

In this chapter I have explored the status and formation of edibility as a site for biopolitics. Bringing a biopolitical lens into dialogue with geography literatures that have studied the politics and materialities of ‘things becoming food’, I have turned these insights to the topic of novel foods and examined the biopolitics present in the negotiation of (in)edibility. I use the examples of APs to explore how this negotiation manifests in certain material interventions – molecular, visceral and practices – and discursive strategies that work to simulate conventional animal products but also position APs as the better choice for the self and planet. In this way, I highlight how the broader politics of the Anthropocene and the continued turn towards planet-saving technofixes are intertwined with the biopolitics of AP edibility formation, a biopolitics
which ultimately works to bring about the post-Anthropocene through the mechanism of personal food choice. By manipulating the materialities and discourses of APs to bring them into the food semiospheres of eating publics, AP developers have sought to position their products as not only societally and ethically better but also as easy, pleasurable and familiar choices for eaters to integrate into their diets. These strategies are inherently biopolitical in that they encourage eaters to want to want APs because of their enjoyable taste, familiarity and, importantly, world-saving promises. The general thinking amongst AP developers is that if a product looks, tastes and performs equivalently to conventional animal proteins, and also addresses Anthropocenic crises, then why wouldn’t consumers choose it? Consequently a new moral dimension to food consumption is created – one which requires further consideration by critical food scholarship – whereby consumers who do not choose APs over conventional animal products are implicitly positioned as ‘unclean’, inhumane and even cruel. They become the unproductive subject who, through their ‘bad’ and ‘inflexible’ tastes (Mol 2009), threatens the moral and material project of realising the post-Anthropocene. Ultimately APs also offer the perfect capital fix whereby production and consumption – and accumulation – may continue, if not increase, while at the same time claiming to combat the current ‘crises’ of the Anthropocene (Guthman 2015).

In developing the concept of ‘biopolitics of edibility’, new insights have been gained in the areas of the biopolitics of food production and consumption, as well as theoretical studies of edibility. The concept attends to the well-documented moral charge around eating by examining mechanisms directed at consumers, but also goes ‘beyond the consumer’ (Evans et al 2017) to explore those conducted on the materialities and discourses of food products themselves. In doing so, we see instances of how the bodies of both eater and eaten are materialised through a politics of responsibilisation which entangles the burdens of the Anthropocene into the practices of everyday food consumption and production. To theorisations of edibility, the chapter contributes to ongoing debates regarding the increasingly blurred boundaries between food and technoscience that novel foods present. The case studies of APs highlight how notions of what counts as edible are being reconfigured through the molecularised lens of the biosciences, opening foods to new scales of moral and material potentialities. Yet APs also provide a striking example of the limits posed by food-technology interactions. A key part of their biopolitics of edibility has required them to materially and discursively
embody established norms and expectations of conventional animal products to overcome the yuck factor of their technological origins. Of particular importance has been achieving indistinguishable visceral characteristics, a strategy which speaks directly to recent debates in feminist geography regarding the centrality of visceral factors in food-eater relations and how things become food (Roe 2006; Longhurst et al 2008; Hayes-Conroy & Hayes-Conroy 2010). Through the case of APs then, we not only see the molecular scale being opened to biopolitical dynamics but also the *visceral* realm, thereby rendering our sensory understandings of food as a new site through which the post-Anthropocene is being managed.

In an era marked by repeated and urgent calls for rethinking business-as-usual, from the energy we use to the foods we eat, APs represent a clear example of this trend. Yet in light of the observations above, we might ask: to what extent do APs *actually* re-think the status quo? Clearly they present distinct changes to some of the existing materialities of protein supply chains, such as the shift from agricultural to biotechnological contexts and the emergence of new geographies of food production (e.g. Silicon Valley). Such changes have already started to rethink, or rather redraw, the political economies of the food system, yet notably without disturbing existing economic and power structures (cf. Chapter 6). Appeals to Anthropocenic urgency have worked to legitimise these shifts towards the biotechnification of food production. Yet looking beyond these changes as symbolic of a complete ‘rethinking’ of protein production, I have shown that APs have also materialised biopolitical consequences that have long been documented in food and eating practices. The sites through which these consequences operate may be new, but the biopolitical outputs are largely the same: namely, APs represent the latest manifestation of the politics of ‘good’ versus ‘bad’ eating, and in turn ‘good’ versus ‘bad’ eaters. And despite offering some new materialities, these APs are emerging through the same economic and political mechanisms of power – specifically capitalist-friendly, Western-centric – that have been attributed to the very crises they claim to solve (Smith 2011). It is thus of critical importance that as this sector develops we continue to interrogate how APs are becoming ‘food’, and remain aware of the biopolitics they materialise as they attempt to bring about the post-Anthropocene.
8.1 Introduction

The previous chapter revealed the various material and discursive mechanisms that have been used by AP developers to encourage the acceptance of their products into people’s everyday eating practices. To gain this acceptance has required strategies that convince people not only of the desirability of APs, but also that they qualify as ‘food’. To facilitate this edibility formation, AP developers have had to strike a careful balance between familiarity with and divergence from conventional animal foods, an exercise conducted through the materialities, discourses and associated food practices of APs. I have argued that it is through this balancing act of providing the ‘same but better’ that a new moral dimension – i.e. biopolitics of edibility – has emerged for contemporary eaters to manage through their food choices. Underpinning these strategies has been a logic of making the ‘right choice’ the ‘easy choice’, where easy has been interpreted by AP developers as providing products that do not disturb the visceral enjoyment, familiarity, cultural value and convenience of conventional animal foods, while at the same time being better for the self and planet. Through this logic, eaters who do not accept APs are positioned as compromising the project of the post-Anthropocene through their ‘inflexible’ and thus irresponsible tastes (Mol 2009).

What follows in this chapter is a visceral exercise that seeks to examine these morally-charged aspects of APs further. Having spent time analysing the decision-making of AP developers and arguing that their strategies (re)create biopolitical dynamics around food and eating, I wanted to take my analysis ‘into the field’ in another way by examining these dynamics from the perspective of the actors they seek to work upon – i.e. eaters. My goal was to explore, as an eater, how the different material and discursive strategies of APs encouraged me to accept these products as ‘food’, and to see them as ‘better’ than conventional animal foods. I examine these processes through a particular

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88 This chapter has been adapted from a published paper: Sexton, A. (2016) Alternative proteins and the (non)stuff of ‘meat’, Gastronomica: The Journal of Critical Food Studies, 16(3), 66-78. The paper forms part a Special Issue entitled ‘Food stuffs: Materialities, meanings and embodied encounters’, and the published version is included in Appendix 1 of the thesis.
sequence of everyday food practices – shopping, cooking and eating – that I conducted during fieldwork involving a specific AP product: Beyond Meat’s grilled ‘chicken’ strips. I chose this sequence of practices to mirror as closely as possible the ways in which people (including myself during fieldwork) typically encounter these AP products in everyday contexts.

This exercise makes use of and builds upon the theoretical concept of food ‘stuffs’ which has been advanced in recent critical food scholarship to explore both “food’s material components and the objects through which food is transacted and mediated” (Abbots 2016, 1) see also Roe 2006; Evans & Miele 2012; Lavis 2016). Through this conceptual lens – to which I add the idea of the ‘non-stuff’ of food – I consider what was “made to (not) matter” to me (Evans & Miele 2012) through the materialities and discourses of the Beyond Meat product, and how this ultimately worked towards my acceptance of it as food, and more specifically, as meat. In this way, I draw on recent thinking (e.g. House forthcoming) that has extended literatures on ‘things becoming food’ by considering the act of eating as a critical and even essential part of this process. For as House and others remind us, it is through food’s relational engagement with eating bodies that “food is only really ‘food’” (Goodman 2016, 242). This chapter thus complements and extends the analysis conducted in Chapter 7 by examining how I came to perceive and accept Beyond Meat’s product as food through different eating practices, and how this process was entangled in moralising dynamics of betterness.

Critical to this exercise, however, is not only to reflect on the success of these strategies in convincing me to accept the AP product as food, but also to examine how and why they failed in certain instances. These occurrences serve to highlight the potential for individuals to resist biopolitical mechanisms and not always, or at least fully, be made ‘docile’ (Heyes 2006). The most notable form of resistance in this exercise manifested through my visceral engagement with the AP product. This serves as a reminder of the importance of the visceral realm in how we understand and interact with food (Probyn 2000; Hayes-Conroy 2010; Evans & Miele 2012). It also further supports the argument made in Chapter 7 on how APs have opened the visceral as a site of biopolitics, through which the fate of the post-Anthropocene is being managed.

89The reasons for this choice of product are discussed later in the chapter.
The chapter proceeds as follows: first, I begin by outlining the conceptual lens of ‘(non)stuff’ that I use to unpack how I both “sensed and made sense” (Evans & Miele 2012) of the Beyond Meat product during this visceral exercise. As I show, it is through a carefully curated selection of included (good) and excluded (bad) stuffs associated with conventional meat production that the company encourages its customers to accept their products as ‘better meat’. Using this conceptual lens thus provides further insight on how production and consumption come together in food-eater relations, particularly through the ways eaters come to ‘know’ the foods they consume (Roe 2006). After a brief overview of the visceral auto-based method used for the exercise, I then turn to consider the different (non)stuffs of Beyond Meat’s product that were made to (not) matter to me during my shopping, cooking and eating encounters. The chapter then concludes with reflections on these encounters, highlighting the different processes and contexts within which I either accepted or rejected Beyond Meat’s product as better meat. Such findings build directly on the biopolitical analysis conducted in Chapter 7, and further emphasise the fundamental and highly political role played by the visceral in AP development specifically, and eating practices more broadly.

8.2 The (non)stuff of ‘meat’: Mattering and not mattering

Adopting the conceptual lens of food ‘stuffs’ builds upon the studies reviewed in earlier chapters that have examined how things become food (Roe 2006; Probyn 2011; Evans & Miele 2012). As Abbots (2016, 236-7) argues, this lens further encourages “a greater level of assemblage thinking” that takes into account not only the end product that is ingested, but “the other ‘stuff’ that enables a food to be eaten in a particular way”. In the case of meat, this other stuff was found in studies by Roe (2006) and Vialles (1994) to consist of particular spaces, practices, objects and people that enabled the transition of a living animal into an edible substance. Through this collection of material and relational stuffs, these authors show how it was ‘meat’ that came to be produced as the final product, rather than the dead flesh of an animal corpse.

90 It is important to note the Western-focused contexts of these studies, and that the assemblages they identify are not intended to represent universal processes by which animals become edible substances.
Interrogating the assemblage of stuffs involved in the process of things becoming food allows for a better connection between production and consumption that have often remained separated in agri-food research (see Goodman 2002; Goodman & DuPuis 2002). Yet the goal of this approach is not to simply consider a product – e.g. meat – as the culmination of a commodity chain; that is, to 'follow it' through the networks of objects, relations and geographies that brought it to the supermarket shelves and ultimately to the plates of those who ingest it. Rather, as Roe (2006, 105) highlights, this approach helps to interrogate the relationship between these stuffs and the “meaning-making” – or what Evans & Miele (2012) refer to as ‘foodsensing’ – conducted by an eater during their engagements with a food product.

Beyond Meat’s products provide an interesting case for considering this relationship between the stuff of food and the sense-making of eaters, as it is through this particular lens that the company is encouraging people to view and accept its products as meat. In interviews discussing his company’s work, CEO Ethan Brown specifically describes and promotes his products as meat. For him, the raw materials may be different but the end products remain the same:

“Meat is really made up of five constituent parts: the amino acids, lipids, carbohydrates, minerals and water. They're all actually present in plants. What we’re doing is building a piece of meat directly from those plants, and so the compositions are basically the same. And in that case we are delivering meat.”

Yet in seeking to ‘deliver meat’ from plants, Beyond Meat – like other AP companies – has conducted a careful balancing act in presenting their products as meat-like in some respects, and not meat-like in others. As such, their products do not simulate all of the stuffs associated with and materialised through conventional animal products; rather, their products are the materialisation of a conscious choice between what the company claims to be the good and bad stuff of conventional meat. This is reflected in the following statement published on the company’s website:

“At Beyond Meat, we want all of the good and none of the bad. We want to eat delicious meat but we don’t want any of the bad stuff that goes along with it...Together we can build a world that’s zero downside and all delicious upside.”

“Our Vision,” Beyond Meat website

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91 Ethan Brown, interviewed on PBS NewsHour (see PBS Newshour 2015).
Beyond Meat’s ‘chicken’ strips can thus be viewed as a food materialised through a curation of (non)stuffs that claim to retain all of the good things about conventional meat, but have absented all of the bad. This process of selection speaks to the work by Evans & Miele (2012) on the ‘presenting’ and ‘absenting’ that similarly occurs with conventional animal products. The authors show that the curation of an animal food’s labelling and materiality often serves to foreground the desirable and forget the undesirable stuffs of livestock production, and through this process makes animals (not) matter to eaters in certain ways. In the case of Beyond Meat, we find a similar exercise of absenting and presenting certain stuffs that encourages eaters to view their products as a desirable meat product. However, added to this are explicitly moral-laden overtones – that is, through references to good and bad stuff, eaters are encouraged to view the company’s products not only as meat, but as better meat compared with conventional animal foods.

Building on these observations, the chapter first aims to explore exactly which stuffs of conventional meat have been deemed good and bad by Beyond Meat, and have consequently been made either present or absent in their products. The second aim is to reflect on how these (non)stuffs worked to facilitate my sense-making of the company’s products as better meat – with non-stuff referring to the things made purposefully absent from the materiality and/or discourses of the company’s products. To conduct this analysis I use a visceral-based autoethnography, a method that has proven highly effective in previous food scholarship for accessing and articulating the embodied relationships through which we, as eaters, “sense and make sense of foods” (Evans & Miele 2012, 306; Mol 2008; Longhurst 2012; Goodman 2016).

A further aim is to use this visceral exercise to think through the instances whereby I resisted the trajectory of sense-making that Beyond Meat attempts to facilitate through its products. Adopting the argument that eaters make sense of food through entering into embodied relationships with it is to simultaneously recognise the agency of the eater in this process (Roe 2006; Evans & Miele 2012). As much as the mechanisms of Beyond Meat’s ‘chicken’ strips worked to shape my perception of them as the ‘good stuff’ of ‘better meat’, I found that I was not in fact made completely docile during these encounters, but instead through certain visceral interactions I came to make sense of the product in ways that challenged those promoted by the company. As I discuss later in
the chapter, these occurrences build on literatures that argue for the potentiality of biopolitics-in-reverse in the contexts of food and eating (Heyes 2006), and highlight the visceral realm as a powerful site through which this resistance can materialise.

8.3 A note on methods

To unpack my fieldwork encounters with Beyond Meat’s products I draw upon autoethnographic methods (Anderson 2006; Ellis et al 2011) and previous work that has used the body as a visceral “instrument of research” (Crang 2003; Longhurst et al 2008). This is done to explore how, through sensing and eating, I came to personally situate and make sense of these products, both as ‘food’ and in relation to conventional meat. Ellis et al (2011, 273) describe autoethnography as “an approach to research and writing that seeks to describe and systematically analyze (graphy) personal experience (auto) in order to understand cultural experience (ethno).” They view it as combining elements of autobiography and ethnography, and stress that “as a method, autoethnography is both process and product” (ibid, 273). In line with this model, I used autoethnography as a method for exploring the products of Beyond Meat as a consumer and eater during my fieldwork (process), and I use it now in this chapter as a method for narrating, reflecting, and analysing these encounters through my written descriptions (product).

I draw on the work of other food scholars who have called for (Goodman 2016) and used similar methodological approaches, and which have proven to be a highly effective method for getting at less “visible” aspects of food/body research (Mol 2008; Longhurst 2012; Abbots 2015). Like these writers, I use autoethnography with awareness that my experiences and reflections have a “partial-ness” and “moment-ness” to them (Latham cited by Hayes-Conroy 2010, 736). As such, they are not intended to present a “whole picture” (Hayes-Conroy 2010, 736) of how others necessarily interact with and understand the products of Beyond Meat. Rather I use autoethnography, in combination with the visceral methods of shopping, cooking, and eating, to reflect upon my bodily encounters with the (non)stuff of Beyond Meat’s products and how these experiences formed an integral part of the ways in which I personally “sensed and made sense” (Evans & Miele 2012) of the APs as food. And to avoid “self-absorbed digression,” as
Anderson (2006, 385) cautions in his discussion of autoethnographic approaches, I take care to situate and consider my personal experiences in connection with wider theoretical debates around eating practices, visceral knowing (Hayes-Conroy 2010), and how bodies are made as eaters and things as food (Probyn 2000; Roe 2006). Building on Evans & Miele’s (2012, 303) observation that language can function as an “additional sense”, the chapter also draws on analysis of the labelling of Beyond Meat’s products, and information published on their website.

8.4 Free from the bad stuff: Health problems and Big Food

During fieldwork I visited a Whole Foods Market in an affluent, residential area of San Francisco to purchase some Beyond Meat products to cook and eat for the first time. The store’s layout steered me first through bountiful displays of fresh produce, then via a row of self-service salad bars, and on to a series of aisles that stretched across the width of the building. The first one happened to be a specialist diet aisle and it was there I found the Beyond Chicken strips among other plant-based meat, dairy, and egg alternatives. On the front of the packaging was a chicken-shaped image covered with vegetables (Image 1). To the right of this a caption read “REAL MEAT” in large capital letters, and underneath “100% plant protein; as much protein as chicken.” What struck me most, however, was on the back of the packaging: running the width of the reverse sleeve was a series of icons listing the many things the strips did and did not contain (Image 2). They were labelled as being “100% vegan”, “kosher”, and containing “20g of protein per serving”. They were also “cholesterol-free”, “hormone-free”, “non-GMO”, “antibiotics-free”, and “certified gluten-free” (with the latter three also displayed on the front of the packaging).

It is perhaps not surprising from a commercial perspective that Beyond Meat has displayed these labels on their products. Over recent years the vegan market has experienced significant growth in the US as consumers are increasingly adopting more plant-based diets (Crawford 2015). Similarly, protein has become the latest star of the functional food trend and as such is now advertised as a desirable selling point on a wide range of products, from breakfast cereals to beer (Daniels 2014). The ‘free from’ trend has also experienced a dramatic upward trajectory over recent years; the gluten-free market in the United States was valued at $2.6 billion in 2014 (Llewellyn Smith
and a recent Mintel report revealed similar growth in wheat- and dairy-free markets elsewhere in the Americas and in Europe (Brockman 2014). Its market share within the United Kingdom is expected to exceed £500 million by 2018 (Philipson 2014), and over half of the national population – 55.2 percent – now reportedly buy free-from products (McGowan 2016).

Prior to these developments, plant-based and free-from products were largely limited to specialist health stores. Today, however, it is common to find entire plant-based and free-from sections in major supermarkets, as well as numerous options on the menus of high-street restaurants and public institutions. An increasing number of everyday foods has since been reformulated under the plant-based and free-from model which has enabled eaters to continue enjoying the taste, convenience, and familiarity of these items (albeit often for higher prices). A factor that has been attributed to this increased demand has been the rise in awareness and medical diagnoses of ingredient-based sensitivities (Copelton & Valle 2009). However, recent studies reveal that consumer adoption of these foods extends far beyond reasons of medical necessity (Brockman 2014). For many, these consumption practices have instead been motivated by plant-based and free-from products becoming synonymous with “healthier” and “cleaner” foods (Crawford 2015), despite many of these foods containing high quantities of sugar as well as often being highly processed and industrially manufactured (Llewellyn Smith 2014). Such attitudes fall into the pattern Scrinis (2012) terms ‘nutritionism’, a phenomenon that involves the narrowing of industry and public focus onto specific nutrients and recasting them as either good or bad. As a result, foods that contain or are devoid of these nutrients are viewed (and often marketed) as the better option, regardless of the other ingredients and inputs within them. A well-known example of this process is margarine (Scrinis 2012; see also Hocknell 2016).

Plant-based and free-from products have thus become viewed by many eaters as devoid of the ‘undesirables’ of the modern food system (Brockman 2014). They are perceived as offering equivalent versions of everyday foods – i.e. comparable in taste, convenience, and familiarity – without the ethical misgivings, harmful ingredients, and seemingly high prices that are present in traditional products. However, despite becoming more mainstream, many plant-based and free-from products remain higher in price than their “regular” counterparts and as such present significant economic barriers to many eaters following these diets (Stevens and Rashid 2008; Singh & Whelan 2011).
‘dirty’ political economies of industrialised food. To allude back to the words of Beyond Meat at the beginning of the chapter, free-from products are perceived as providing the good stuff without the bad.

For many consumers, then, these products enable them to continue eating their favourite foods without feeling like they are eating the stuff of bad health and Big Food. The labels on the packaging of the Beyond Chicken strips can thus be considered as more than simply signifying an absence of particular ingredients. By calling attention to the non-stuff of these strips the consumer is invited to position this food as free from the undesirable stuff of modern (industrial) meat production. As mentioned in previous chapters, conventional meat has increasingly become associated with negative health consequences and many of these have been linked with the inputs commonly used in industrial production, such as growth hormones and antibiotics. The free-from labels on the Beyond Chicken strips actively call attention to the bad stuff of intensively-reared animal meat and invite the consumer to understand the strips as being devoid of such things, both in terms of their material inputs and the less care-full political economies associated with them. Thus, as I stood considering the packaging of the ‘chicken’ strips, I came to understand their materiality through their non-stuff (i.e. the stuff that had been made absent), and perceive this absenting as a materialisation of a more healthful, care-full, and thus better product. Moreover, by extension I felt that by eating this product I would come to embody these benefits and engage in a better form of eating. This was further supported by the product’s placement within the specialist-diets aisle, in addition to the overall environs of the Whole Foods Market; both added to my sense-making of these foods as distinct from the ‘normal’ fare and less desirable stuff of modern food production. Their presence within Whole Foods itself also added to my perception of these products as being selected by a care-full and “feel-good business” (Johnston 2008, 248) that promotes itself as mindful of farmer livelihoods, animal welfare, the environment, and ultimately, the well-being and culinary enjoyment of its consumers.

8.5 The cultural stuff of meat

The non-stuff of the Beyond Chicken strips – or more specifically, the non-stuff that distinguishes this product from conventional meat – was “made to matter” (Evans &
Image 1: Front of packaging of Beyond Meat 'chicken' strips
Photo by Alexandra Sexton © 2016

Image 2: Section of labelling on the back of packaging for Beyond Meat 'chicken' strips
Photo by Alexandra Sexton © 2016
Miele 2012) through the free-from labels on the packaging. In this moment, the strips were not meatlike in terms of their health impacts, production methods, and political economies. Yet elsewhere on the packaging other stuffs were made to matter, and attempted to position the strips as very much like conventional meat. This was most salient in the description of the product as “real meat” and the promise of containing “as much protein as chicken”. This latter claim was also repeated on the back of the packaging where one of the labels stated “20g protein per serving” underneath an illustration of a muscular arm. At the same time as being framed as devoid of the harm-inducing ingredients of conventional meat, these labels reassure the eater that the health benefits of the latter are still present. When I read these statements, the strips became meatlike through their equivalent nutritional properties, and also by offering the same culturally desirable benefits associated with these properties.

Of these benefits, bodily strength was particularly emphasised and made visible. It is also inferred through the product endorsements of elite US athletes on the company's website (Beyond Meat 2016a). The association between eating conventional meat and acquiring muscular strength has a long history in many food cultures, and has come to define meat-based corporate advertising, public health discourses, and claims to the naturalness of eating meat (Fiddes 1991; Joy 2010). The strength-giving abilities of animal protein are clearly viewed by Beyond Meat as an example of the good stuff of meat. As such, in this context they position their Beyond Chicken strips as very much like meat by offering these equivalent abilities, and by aligning with and reinforcing the cultural association between meat-eating and building strength. The eater is invited to see the strips as a means by which they can acquire the health benefits of conventional meat and in turn come to embody all of the desirable cultural associations that are attached to this particular physique (e.g. attractiveness, masculinity, power, virility, and self-confidence) (Adams 1990; Fiddes 1991; Bordo 1997; Calvert 2014).

Here I have shown how the plant-based products of Beyond Meat are navigating the realities, imaginaries, and expectations of conventional meat in terms of the latter's health impacts and the methods of its production. As animal meat has become an increasingly “ambiguous good” (Chiles 2013, 473), due to its existence as a desirable yet problematic, healthful yet risky substance, a careful balance is required by APs seeking
to become ‘meat’ in consumer thinking. In Beyond Meat’s vision, they must be meatlike enough to satisfy expectations regarding health properties and cultural associations, but not meatlike in the production methods and ethical dilemmas of modern protein production. As seen with other free-from foods, a consequence of this balance has been a distinct emphasis on the non-stuff of these AP products, an absence that is materialised through their packaging, their positioning within specialist aisles, and within the end products themselves. In so doing, this non-stuff is often seen as a signifier of a more healthful and care-full product, and another means by which the ‘ethically competent consumer’ (Miele & Evans 2010) may come to embody these properties through eating.

8.6 Free-from guilt: Animals, farmers, earth

The term ‘free from’ has largely come to represent food products where particular ingredients and/or industrial inputs have been excluded. However, a separate trend has emerged within the modern food system that represents another form of free-from eating. At the same time as ingredients and inputs have been removed from food products in response to the industrialisation of food production, a similar exorcism has occurred regarding their environmental and ethical footprints. In recent years consumer awareness of the animal welfare and planetary impacts associated with the modern food system has grown, as well as the often unjust political economies that exist particularly between producers in the Global South and consumers in the North. A number of schemes have evolved in response to these concerns, with Fairtrade arguably being the most notable (Goodman, M. 2004). Through providing fairer prices, transparency, and claims of sustainable and ethical practices, the products of these schemes have come to represent more care-full, place-full, and meaningful options, and as such they are often perceived as impact-free – and thus guilt-free – consumption choices (Goodman, M. 2004; Lewis & Potter 2011; Peloza et al. 2013). Like the free-from examples discussed above, these are products that claim all of the good stuff and none of the bad, where in this instance the bad represents harm to the “distant others” (Smith 1994) of Southern farmers, animals, and the environment.

Similar mechanisms exist around the products of Beyond Meat, yet notably the cardboard sleeve of the Beyond Chicken strips did not possess any visual or textual
references to the environment or animals, but instead focused on the health-related aspects of the product. However, the company’s “quest for better meat” is not limited to its health benefits. The page entitled “Our Vision” on the company’s website sets out the other components of this quest as follows:

“We believe there is a better way to feed the planet. Our mission is to create mass-market solutions that perfectly replace animal protein with plant protein. We are dedicated to improving human health, positively impacting climate change, conserving natural resources and respecting animal welfare. At Beyond Meat, we want to make the world a better place and we’re starting one delicious meal at a time.”

Further down the page another passage makes more explicit the connection between adopting plant-based proteins and creating a better world – it states that “replacing animal protein with meat made from plants would do wonders for human health, for the environment, for conservation of natural resources and for animals,” and goes on to claim “it’s worth a fight.” These messages are commonly reiterated by the company’s CEO in media interviews and public talks, particularly the call for swapping animal with plant-based meat as a solution to mitigating climate change. Indeed, a recent media interview states that it was a report on climate change in particular that provided the catalyst for Brown to begin developing plant-based alternatives to conventional meat:

“Brown’s aha moment came in 2009, when the Worldwatch Institute published “Livestock and Climate Change”, which carefully assessed the full contribution to greenhouse-gas emissions (GHGs) of the world’s cattle, buffalo, sheep, goats, camels, horses, pigs, and poultry…That was all Brown needed to hear to put the plant-based McDonald’s back at the top of his agenda. Forget fuel cells. Forget Priuses. If he could topple Meatworld, he thought, he could stop climate change cold.”

(Jacobsen 2014)

Not only, then, are the products of Beyond Meat framed as better in terms of their health benefits, but also in terms of their environmental footprint. By eliminating the animal, these APs are presented as removing the concerning levels of water usage, deforestation, GHG emissions, and other pollutants associated with large-scale meat production. Moreover, they also claim to remove the potential for animal suffering that has become associated with this type of livestock farming (Beyond Meat 2016b). The products of Beyond Meat thereby claim to offer the non-stuff (i.e. the absence) of environmental degradation and ethical concerns that have come to define modern meat production; instead they offer the good stuff of health but eliminate harm done to the distant others of animals and the planet. The emphasis on these particular non-stuffs
thus acts as further encouragement for eaters to view the Beyond Meat strips as a more care-full, sustainable, and overall better alternative to conventional meat.

Up until now I have engaged with the textual and visual sense-making mechanisms that appeared to me as a consumer when making my food choices in the supermarket. Yet these are not the only ways in which eaters come to 'know' food. As highlighted earlier, this is a process that involves both "sensing and making sense" (Evans & Miele 2012 [my emphasis]), and it is to these more visceral and embodied encounters with the Beyond Meat products that I now turn.

8.7 Sensing stuff

Standing in the specialist diet aisle in the Whole Foods Market, my choice of Beyond Chicken strips was between three different flavours: southwest style, lightly seasoned, and grilled (Image 3). I ended up choosing grilled. My decision was both personally and research-motivated: the former because I often try not to pick pre-flavoured foods, preferring instead to season things myself and avoid any extra levels of processing and additional (often ambiguous) ingredients. To me, the grilled strips offered the absence (or non-stuff) of this extra processing and instead enabled me to decide how to flavour them. I also picked this variety because, for research purposes, I wanted to see how chicken-like they tasted in their simplest form without any additional flavourings.

I moved from the specialist diet aisle and carried out the rest of my shopping. After examining the shape of the strips I had decided to use them to make a curry for dinner and, if they tasted good, as an ingredient for a quick lunchtime wrap the following day. I picked up some coconut milk, spices, and vegetables for the former, and some salad for the latter. I also collected a couple of cans of tuna as a backup for the wraps. Later that evening I set about making the curry. My first action was to open the packet of strips and feel them in my hands. They were rather chunky and uniform in shape, but quite soft; not too dissimilar in fact from chicken found in pre-made sandwiches. They did not have much of an odour and the little they had was not unpleasant, though perhaps ever so slightly 'processed' in some way. Their appearance was a chicken-like pale cream and running diagonally across the pieces were dark brown lines to simulate the grilled effect.
Image 3: Beyond Meat products in a Whole Foods Market, San Francisco, CA
Photo by Alexandra Sexton © 2015

Image 4: Cooking with Beyond Meat 'chicken' strips during fieldwork
Photo by Alexandra Sexton © 2015
These lines triggered a taste of charcoal as I looked at them, inspired by a visceral memory of grilled meat. The main surprise, however, came when I broke the strip in half – they shredded, as promised, pretty much equivalently to conventional chicken. As a frequent eater of other plant-based proteins this struck me as a significant advancement over other products; nowhere was the crumbly or rubbery texture of many meat substitutes I had previously tried. This was fibrous. This was, indeed, meat-like.

Then came the tasting: one half first. Again, like its odour it was neither pleasant nor unpleasant. It had a subtle savoury flavour mixed with a slightly charcoal taste and the same ‘processed’ quality I associate with pre-made foods. It was just pleasant enough to consider eating on its own, although I concluded it would probably be more enjoyable with other complementary flavours. I would rarely eat conventional chicken on its own so this was by no means a break in my usual eating habits.

I proceeded to make the curry in the same way as with conventional meat: I browned the strips, onions, and spices in oil before adding the coconut milk and vegetables to simmer until cooked (Image 4). The sounds and smells of the dish as it cooked were also largely comparable. The only notable differences to this whole process were the slightly reduced length in cooking time and the convenience of not needing to keep any raw meat separate from the other ingredients as I prepared the meal. I served the curry in a bowl with a naan bread on the side. The overall verdict was a tasty and enjoyable meal.

Whereas the strips did not add distinctly to the flavour of the dish, they offered a satisfying meat-like texture. If I had not known they were plant-based I would have quite likely passed them off as pre-cooked conventional chicken pieces. During my visceral sensing of the strips I found the ideologies that had been constructed in the supermarket (via the packaging and aisle positioning) were both reinforced and challenged by my bodily experiences of the product (Hayes-Conroy & Hayes-Conroy 2008). Perhaps most guiltily given my research area, my decision to buy tuna as a backup in case the strips did not live up to my visceral expectations is a salient example of the attitude-behaviour gap that shapes many consumers’ food purchases (Aschemann-Witzel & Aagaard 2014). Despite buying into the claims of a more sustainable, healthy, and ethical alternative, as I stood making my choice in the
supermarket aisle the visceral imaginings of my planned meals were still a powerful influence over my final decision, if not in fact a priority.

Also, I knew the strips did not contain any animal products and were thereby devoid of the ‘undesirables’ of industrially-produced chicken, yet aspects of the texture, smell, appearance, and taste called upon memories of exactly this type of foodstuff. This led to a slightly diminished enjoyment. Yet the familiarity of the strips in terms of how I was able to handle and eat them, the ingredients I could pair them with, and the shredded texture they provided all supported my perception of them as meat-like, and collectively encouraged me to enjoy them not as plant protein but rather as meat. They were thus not simply another vegetable added to the curry. This was, to my “minded-body” (Hayes-Conroy & Hayes-Conroy 2008), ‘chicken’ curry.

8.8 Thinking through (non)stuff

8.8.1 Becoming a ‘good’ eater through ‘better meat’

Of interest to this chapter is how, and to what extent, I came to make sense of Beyond Meat’s product as ‘better meat’. Regarding the question of how, I found that I made sense of the ‘chicken’ strips through a curated selection of (non)stuff that presented the product as meat-like in certain respects, and not meat-like in others. I was encouraged through various material and semiotic markers to view the strips as embodying the good stuff of conventional meat – that is, they claimed to offer the same, if not more, in terms of nutritional properties and cultural value. In addition, the aspects that made them different from, or more specifically, better than conventional meat were claimed to be materialised through the absence (or non-stuff) of comparable negative impacts on human health, animal welfare, and the environment.

Through this exercise, it became clear which aspects of conventional animal foods Beyond Meat considers to be good and bad, and how they make these aspects matter to the eater through the materiality and discourses of their products (Evans & Miele 2012). In their category of good stuff we find the sensory pleasure and cultural value of conventional meat, two aspects that are actively promoted and encouraged by the company through their products. As I found during my fieldwork, the materialities and imaginaries of their products do not ask their (largely middle-class, urban-based)
customers to modify where they shop for meat, how they culturally situate it, and the ways in which they prepare, eat, and enjoy it. The products may be plant-based, but the taste for and familiar practices around animal meat are deliberately not disturbed. Moreover, these products also leave intact – and arguably reinforce – the common imaginaries that contribute to the persistent dominance of animal meat in global diets. Instead of cultivating more positive notions around eating plant-based foods in their unprocessed forms, these products are instead adopting and aligning themselves with the same, largely Western-centric ideas of hypermasculinity, power, and physical attractiveness that are commonly associated with animal meat (Adams 1990; Fiddes 1991; Calvert 2014). The implications of making plants meat-like, then, is that the current and at-times problematic ideals of meat-eating are reinforced, and plant-based foods in their original forms continue to be treated as lower in visceral and cultural value in comparison with animal products. Some have questioned whether the approach taken by AP companies will in fact provide a sustainable solution in the long-term, arguing that plant-based products will never fully provide the same experience as animal meat and so eaters will continue to turn to the latter (Nosowitz 2014, Kummer 2015). We might ask then whether the energy and resources being used to make plants meat-like should instead be directed towards divorcing (or at least reducing) our tastes from animal foods and improving the visceral and cultural value of plants in their original forms.

Parallels can be drawn between my sense-making of the ‘chicken’ strips through their (non)stuff and the problematic trend observed by Scrinis (2012) towards highly selective ‘nutricentric’ understandings of food. As documented above, through these claims I was encouraged to view the product as more healthful and care-full than conventional meat. However, as Scrinis (2012) shows in his work on nutritionism, the performance of making certain (non)stuff matter and not matter is often inherently misleading. For example, the emphasis on the stuff made absent from the Beyond Meat strips draws attention away from the potentially problematic ingredients and political economies they do involve. Upon closer inspection, the ingredients listed on the packaging puncture the imaginary of the strips as free from the stuff of industrially produced food – these include “chicken flavor”, dipotassium phosphate, titanium
dioxide, and potassium chloride.\textsuperscript{93} Issues have also been raised regarding the level of salt in the southwest style and lightly seasoned-flavoured strips (Tepper 2013), and Kummer (2015) notes similarly high levels of seasoning, including sugar, in the company's Beast Burger. He attributes this decision as an attempt to mask the added nutrient powder, suggesting that by prioritising nutritional equivalency with conventional meat the company has compromised other health-related aspects of their products. Moreover, the focus on the environmental and ethical non-stuff of these products appears to leave little room for information on exactly how the company is contributing to the planetary ideals it highlights on their website and in promotional material; nor indeed did I come across any information during my encounters regarding the traceability, ecological footprint, or labour conditions of their commodity chains.

As discussed throughout the thesis, a further consequence of making sense of food as either good or bad is that eaters tend to then make sense of themselves through this moral binary. I found this to be a very powerful dynamic during my own encounters with the Beyond Meat product. When first picking it up in the supermarket my eyes were quickly drawn to the prominent messaging on the packaging that worked immediately to situate the product in relation to conventional animal meat, and to quickly present it as delivering a win-win solution by offering the same (i.e. the good stuff) but better (without the bad). This claim of betterness was a powerful factor in my desire to try the product, and was something that shaped my eating practices throughout the exercise. Certain moments stand out to exemplify this: for example, my feeling that the environmental footprint of the strips helped (incorrectly) to cancel out the footprint of the other ingredients I bought for the meal (e.g. coconut milk). In this way I felt justified in choosing non-local ingredients due to the good effects I was enacting through my choice of Beyond Meat's product. Such logics have been shown to highly influence eating and other consumption habits: for example, Barr et al (2011) found that people who engage in sustainably-conscious behaviours at home – such as buying organic products – are more likely to engage in less sustainable leisure and tourism activities, often due to their domestic practices being seen as a trade-off for lower commitments in other contexts. Goodman (2016) also reflects on a similar trade-

\textsuperscript{93} For clarification, the “chicken flavor” is listed as vegan and the dipotassium phosphate, titanium dioxide, and potassium chloride are stated as comprising “0.5% or less” of the product.
off in the context of healthy eating: in a short autobiographical account, he describes a particular decision he made to prepare a healthier evening meal to counteract the effects of indulging in a less healthy snack earlier that day, despite knowing this to be an ultimately flawed logic.

I also felt a sense of goodness when sharing the leftovers of the curry with a friend – I felt I was serving them a more care-full and healthful meal, through which we were both made ‘better’ in terms of our own welfare and also our broader societal and environmental impacts. These dynamics speak to literatures that highlight both the desires and pressures commonly experienced by eaters – particularly mothers – to protect the welfare and even purity of their family through providing good food (e.g. Mansfield 2012a; Cairns et al 2013).

Conversely, however, my decision to buy tuna as a backup meal plan was tinged with a sense of duplicity: that is, I felt like my desire for a tasty and familiar meal undermined the good act I had conducted by choosing the Beyond Meat product. Through my sense-making of the latter, I found that I positioned the tuna as a ‘bad’ choice due to the stuff it embodied (i.e. animal slaughter, less sustainable practices), and as such I became a bad eater for adding it to my shopping basket simply in case the Beyond Meat strips did not produce an enjoyable meal. This serves as an example of the tensions, and subsequent moralising dynamics that can arise between wanting good food to eat and good food for societal and planetary welfare (Hayes-Conroy & Hayes-Conroy 2008; Mol 2009; Goodman et al 2010; Beagan et al 2015).

8.8.2 Biopolitics-in-reverse: Sensing as resistance

Over the course of this visceral auto-based exercise I feel that Beyond Meat’s overall goal was largely effectuated during my engagement with their product – that is, both the materiality and discursive markers of the ‘chicken’ strips facilitated my sense-making of them not only as meat, but as better meat. However, there were two important instances to note whereby I resisted total acceptance of this perspective, both of which manifested through my visceral relations with the product. The first relates back to my decision to buy tuna as a contingency ingredient. This act reveals that I had not fully accepted the strips as meat when contemplating them in the supermarket, despite their claims of providing the same enjoyable stuff of animal meat and their visual appearance seeming to support these claims. At this point I had not yet fully sensed the strips
through cooking and, most importantly, through eating. As many food scholars have persuasively argued, we cannot fully ‘know’ food until the act of ingestion (Roe 2006; Evans & Miele 2012; Goodman 2016; House forthcoming). I wanted a type of meat for the lunchtime meal I had planned, and with this wish came a set of visceral criteria. From previous encounters I knew that the tuna I selected fulfilled these criteria, whereas having not tried the Beyond Chicken strips before I was unsure if they could perform as ‘meat’ in this particular meal. Thus, despite the sense-making I engaged in via the packaging that encouraged me to see the strips as meat, it was not until my visceral encounter with them that they became (more) so. In short, I could not accept the strips as meat until the point of eating them.

The second example of visceral resistance occurred during both the cooking and eating stages of the exercise. While the labels stating “100% plant proteins” and “100% vegan” indicated that the product did not contain any animal-based ingredients, the fact that it was so meat-like in its sensory properties led to an unexpected conflict when I was preparing them for the meal. The conflict arose due to the strips being meat-like enough to recall my visceral memories of conventional chicken, but their texture, smell and appearance was such that it reminded me of highly processed animal products (e.g. chicken nuggets). Consequently, as I made sense of the strips as meat through my visceral encounters, I in fact came to sense them as the very type of meat – i.e. processed – that is promoted as bad by Beyond Meat.

This arguably represents a case of biopolitics-in-reverse, yet in this instance manifested through the visceral realm rather than through the reverse discourses that Foucault and others have discussed (e.g. Pickett 1996). As Foucault shows in the case of homosexuality, the very vocabulary and truth regimes used to oppress this social category have subsequently been used by those oppressed to “demand that its legitimacy or naturality be acknowledged” (Foucault 1990, 101). This demonstrates the potential for bodies to not always be made completely docile through biopolitical

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94 This is not to claim, however, that the process of sense-making is somehow complete through the act of ingestion. As Mol (2008) and others (e.g. Hayes-Conroy 2014) point out, eating brings with it continued and new ambiguities that can never be fully knowable due to the haptic processes involved. The point I want to make here is that eating forms a fundamental part in how people make sense of food, and as such, how I made sense of the ‘chicken’ strips.
mechanisms, and as Heyes (2006, 138) notes in the context of dieting, in certain instances people may even “exceed the regime of normalisation that generated them”.

Rather than reverse discourses as Foucault and others have discussed, I argue that the experience I describe above represents a kind of ‘visceral biopolitics-in-reverse’, through which my sense-making of the strips can be read as a case whereby I exceeded the regime of responsibilisation promoted by Beyond Meat. In other words, while promoting their products as devoid of the bad stuff of conventional animal meat – defined largely as industrially-produced meat – this was precisely the type of meat that was evoked to me through the sensory properties of the ‘chicken’ strips. The way in which I sensed the product thus challenged the truth claims I encountered through its packaging, and ultimately led me to align the strips more closely with the same bad stuff of conventional animal foods that the company highlights to distinguish their products as better. This led me to re-evaluate whether I would actively choose them again, or if I would instead opt for ‘real’ chicken which I knew could offer an overall more enjoyable visceral experience. This serves as an example whereby the responsibilisation mechanisms exercised through the materiality and discourses of Beyond Meat’s products did not render me completely docile, and that it was through my visceral sense-making that such resistance was enacted.

8.9 Conclusion

The aim of this chapter has been to build on the observations discussed in Chapter 7 by analysing the biopolitical mechanisms of APs from the perspective of those they attempt to govern – i.e. eaters. This account is not intended to speak for all eaters; rather these reflections are provided with awareness of their ‘partial-ness’ and ‘moment-ness’ (see Hayes-Conroy 2010, 736), and their specificity to my personal experiences during the research process. While not making claims of universality, like other food researchers who have used auto-based methods I argue that the findings discussed in this chapter offer useful insights for thinking through APs specifically, and for conducting research on food-eater relations more broadly.

One such contribution of this approach is that it enables an empirical exploration of how meaning-making occurs between eater and eaten, and how the presentation and
imaginaries of different food stuffs play an important role in this process. Moreover, the findings reveal the considerable influence of food companies within this process of meaning-making – as I found with Beyond Meat’s products, it is often the producers who have the power to curate which stuffs are made to (not) matter through the material and semiotic markers of food products. This can have important implications regarding the potential reinforcement of problematic tastes for and cultural imaginaries around foods. In the context of the latest APs, their approach to not disturb these aspects of meat-eating, and indeed more than this, to actively encourage these associations as the good stuff worth retaining in their products, serves to reinforce the centrality of meat in modern diets, as well as the cultural associations between this food and notions of hypermasculinity, power and success (Adams 1990; Fiddes 1991). Choosing to simulate these aspects and make plants meat-like thus serves to retain their lower cultural status in contemporary (Westernised) diets, and treats the dominance of animal foods as both inevitable and irreversible.

Finally, the chapter demonstrates how fundamental the visceral realm is to the ways in which we make sense of food, and how it has become a particularly powerful site through which AP companies are encouraging eaters to accept their products. This follows a concerning trend highlighted by Hayes-Conroy (2014, 21; citing Thrift) who warns that “knowledge about the creation and mobilization of bodily affect is being deployed knowingly and politically, and ‘mainly...by the rich and powerful’”. Yet at the same time, this chapter has demonstrated that as much as the visceral realm can be co-opted towards agri-capitalist interests, it can also act as a powerful barrier against it. This aims to provide a more hopeful reading than can sometimes be offered in biopolitical analyses, as it reveals how eaters are not always made fully passive by contemporary food biopolitics, and that while their agency may be reduced, eaters are still “actively implicated in fashioning, making, and remaking innumerable microrealities through our multiple, contingent engagements and attunements with the world” (Evans & Miele 2012, 303). The potential for and power of visceral sense-making in these processes thus invites continued analysis in food research.
In 2013, the ‘future of food’ was announced to the world from a television studio in West London. This ‘future’ came in the form of a burger, created from in-vitro bovine muscle cells, and was presented by its creator, Mark Post, a vascular physiologist whose work had been funded by Google co-founder Sergey Brin. Despite these unconventional origins, the burger looked the same as a ‘regular’ animal burger. It was also shown to cook in the same way, producing the familiar sizzle and smells of meat on a hot grill, and, despite the lack of fat, delivered a ‘meaty’ taste in the opinions of the tasting panel. Elsewhere during the same year, the ‘future of food’ was materialising through different, yet similarly protein-based forms. Chicken strips, mayonnaise, and burgers that bled – but all made from plants – were being hailed as the next ‘unicorn’ start-ups of Silicon Valley and receiving hundreds of millions of dollars of investment from some of the biggest names in Big Tech. Around the same time, the FAO was declaring edible insects as the future of food and feed security, prompting the appearance of insect cookies, protein bars and flours in retailers across the US and in parts of Europe.

In the words of Josh Tetrick quoted above, these APs represent attempts to ‘start over’ in protein production – that is, to exceed what many in the AP sector see as the inefficiencies and thus limits of Nature by creating products that promise more sustainable, ethical and healthy alternatives to conventional animal foods. To use Silicon Valley parlance, they have become the latest cases of ‘disruptive’ technologies, following the likes of Facebook, Airbnb and Uber in seeking to uproot established industries and replace them with more progressive, efficient and high-tech products. ‘Starting over’ through APs is thus presented as an opportunity to dismantle the current political

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95 A ‘unicorn’ in Silicon Valley parlance refers to the statistical rarity of a start-up company reaching a valuation of over US$1 billion.
economies and negative impacts of global protein production, and with it work towards realising a fairer, healthier and more climate-stable post-Anthropocene.

Yet if we look more closely at APs we actually find a more complex picture that involves both elements of disruption and continuation. As the thesis has shown, the recent AP movement has emerged through a strategic balancing act of disturbing certain aspects of conventional animal foods, while being careful to retain others. It has, as the descriptions above highlight, involved distinct shifts in the geographies and expertise of protein production to the high-tech world of Silicon Valley, while at the same time these ‘disruptive’ innovations have materialised through the purposefully familiar forms and visceral experiences of burgers, mayonnaise and cookies.

This doctoral thesis has used this negotiation of sameness – i.e. simulation – and difference – i.e. disruption – as a lens to explore two overarching questions: first, what does the recent AP activity ‘mean’ for the geographies, political economies, materialities and biopolitics of the current and future agri-food system? And second, what do APs reveal about these factors in the contemporary moment of the global agri-food system? Over the last four years, a small but growing body of literature within the social sciences has begun, in part, to address these questions, with most studies focussed on examining the opportunities for (e.g. Datar & Betti 2010; Post 2012), the trajectories of (e.g. Stephens 2013; van der Weele & Driessen 2013; Jönsson 2016), and public attitudes towards APs (e.g. Verbeke et al 2015; House 2016). While important advancements have been made through these literatures, this thesis has argued that many aspects of the recent AP sector have remained critically understudied and under-theorised. These include questions over the shared timing (‘why now?’), the particular geographies (‘why Silicon Valley?’), the specific approaches (‘why high-tech?’) and materialities (‘why burgers, mayonnaise or cookies?’), and the political-economic and biopolitical implications entangled in, and materialised through, this AP activity.

As such, this project has adopted a critical food geography lens to both focus in and, importantly, zoom out in its examination of the recent AP sector. In doing so it offers a number of important contributions to AP scholarship specifically, but also to debates across critical food studies, economic geography, visceral geography, political economy, and alternative food research. To AP scholarship, the thesis contributes by broadening its empirical focus across the wider spectrum of AP products currently being developed.
(e.g. cellular agriculture, insects, and plant-based proteins), and focusing on US-based activity; this extends previous studies that have instead remained largely Europe-centric and siloed within each AP category. And second, the thesis has sought to contextualise APs within the ‘bigger picture’ of modern food production and consumption. It has done so by considering three distinct yet interrelated themes, including: food biopolitics and agri-food capitalism (Guthman 2003; Goodman, M. 2004; Bobrow-Strain 2008; Paxson 2008; Mansfield 2012a); the political economies, social anxieties (Jackson 2010), and geographies of global food security (both historic and emerging under the Anthropocene diagnosis); and, the ontological and visceral politics of why we eat, how we eat, and what we eat (Mol 1999; 2008; Hayes-Conroy & Hayes-Conroy 2008).

By situating the latest AP activity within these contexts, the thesis provides new and critical insights to understanding what APs both mean and signify regarding the current agri-food system and its potential future. What follows is a summary of these insights and how I see them contributing to current debates both within and beyond food geography research. The chapter then concludes by outlining future avenues for continued research on the themes covered in the thesis.

9.1.1 Situating APs

9.1.1.1 A history of the present

The first contribution of the thesis – explored primarily through discourse analysis of key food security policy reports – has been to consider APs as a materialisation of the contemporary moment of social anxieties and logics relating to (animal-based) food (Jackson 2010; 2015; Jackson & Everts 2010). To develop this argument, Chapter 5 drew on Foucauldian methodology to conduct a ‘history of the present’ to examine the conditions through which food security has been (re)problematised in international policy discourses over the last century, and, in turn, how this has had material effects in terms of the expertise and solutions mobilised in response. It was shown that the persistent reading of food security as a technical problem (i.e. that we need to produce more food in more efficient ways), and at times as a nutricentric problem, such as during the ‘world protein gap’ era, has resulted in the continued legitimisation of industrial
actors and (protein-based) technofixes as the *rational* and *necessary* strategies for feeding the world (Maxwell 1996; Jarosz 2011; Margulis 2014).

While it was argued that these historical conditions form a critical part of the enabling environment for the recent emergence and logics of APs, the chapter claimed that to more fully contextualise this movement required consideration of how food security has been reimagined under the Anthropocene diagnosis – a recent evolution in the history of global discourses that has yet to be examined in critical food security scholarship. The chapter documented how food security has again been reproblematised through a nutricentric lens, although this time it is specifically *animal* protein that has become a central concern of policy agendas. In doing so, we find notions of food insecurity now extended across a range of Anthropocenic tipping points, including climate change, obesity, non-communicable diseases (e.g. cancer, diabetes), animal welfare, deforestation, water pollution and antibiotic resistance.

I have argued that it is this evolution in food security thinking – combined with persistent technical interpretations which favour market-based solutions – that reveals key insights into the timing, geographies and materialities of the recent AP movement. To the question of ‘why now?’, the chapter claimed that it is the current atmosphere of social anxiety concerning animal foods and Anthropocenic tipping points that have catalysed interests in developing APs. To the question of ‘why these particular approaches?’, I argued that the historic tendency towards addressing food security through industrial technofixes has rationalised a similar turn in the present case of APs, although this time materialised through the Big Tech world of Silicon Valley. And to the question of ‘why Silicon Valley?’, I argued that the current reading of food insecurity as a combined issue of inefficiency, insufficient quantity, and animal-based foods has created a dominant discourse around the need for ‘better’ ways to produce and consume protein. As the chapter discusses, this discourse has played a direct role in bringing the topic of food to the attention of Valley actors; in the words of Bill Gates (2013b), it has served to highlight food – and specifically protein-based products – as an area “ripe for reinvention”. Through the urgency and legitimising power of Anthropocenic anxieties, we thus find protein reimagined as the new frontier for technological salvation and capital accumulation. APs thereby follow the long history of food ‘fixes’ that claim to be kind to society while also remaining kind to capitalism (Guthman 2015). Developing
this theorisation further, I have begun to think about and plan future work on the idea of APs as an ‘edibility fix’, a conceptual direction which is discussed in more detail in the final section of this chapter.

In tandem with the Valley’s continuous search for the next techno-capitalist frontier, it was also shown that the recent convergence of this industrial region with food security activity has been advanced by the international policy community itself. The Valley’s reputation for ‘big holistic thinking’ and for creating ‘disruptive’ change has led agencies such as the UN to recently call upon the region to lead in the fight against contemporary global issues, such as food security (Mis 2016). A key contribution of the chapter was thus to highlight the recent shifts in the geographies and expertise being legitimised into the project of feeding the world. While earlier periods saw policy discourses calling on big industry, it is now the technology start-ups and entrepreneurs of Silicon Valley that have become the new ‘problem-solvers’ of global food security. Such observations serve to further unpack the enabling conditions for APs to have emerged at this particular moment, and through the particular geographies and methods they have involved. Yet they also highlight a broader evolution in the problematisation of food security – introduced by the thesis as the ‘Nerd’s Burden’ – that is materialising through the deepening relationships between global agencies and Silicon Valley. Such developments raise important questions regarding the implications of addressing global issues ‘Silicon Valley-style’ (Mis 2016). For example, what does it mean for the World Food Programme to be tackling hunger through the mechanisms of tech start-up accelerators, both its own recently-launched programmes and those run by private institutions in the Valley? How might this shape the way food security is problematised, and in turn, what solutions are deemed most appropriate? To my knowledge, such questions have yet to receive sufficient, if any, attention in food security scholarship; as such, Chapter 5 served to provide important initial steps towards analysis of this recent evolution within food security thinking and activity.

9.1.1.2 Place, culture and (food) innovation

The second contribution of the thesis was to unpack the relationship between place-based culture and the logics and trajectories of innovation within the AP sector. This analysis, conducted in Chapter 6, worked largely in response to the questions raised in Chapter 5 regarding the recent trend of Valley actors becoming legitimised as the new
problem-solvers of global issues. In doing so, this part of the study served to extend AP scholarship by examining the understudied role of place and culture in shaping how the AP sector has developed to date. Furthermore, it has attempted to make an original contribution to current theorisations of innovation in economic geography and innovation studies, as well as begin critical discussions within (food) geography more broadly on what the Nerd's Burden phase means for current understandings and responses to global food insecurity.

To conduct this task, the chapter looked to recent thinking in economic geography and innovation studies that has done much to reveal how the processes of innovation are entangled with and dependent upon local and regional geographies (Bunnell & Coe 2001). However, I argued that such debates, particularly those focussed on Silicon Valley, have largely conceptualised these geographical contexts as simply facilitating the 'successfulness' of innovation (Saxenian & Hsu 2001; Sturgeon 2003). Less attention has been focussed on considering the 'stickiness' of place and culture in not simply facilitating innovation, but rather shaping how it is practiced and conceptualised – in other words, what comes to qualify and be valued as ‘innovation’ within particular place-based cultures. Many existing studies of innovation have either downplayed or altogether stripped the political, material and geographical situatedness of innovation as a concept, and have instead often treated it as a singular and always-beneficial goal (Morozov 2013). To (re)acknowledge this situatedness, Chapter 6 looked to Longhurst's (2015) study on the alternative milieu of Totnes in Devon, UK, and argued that a similarly place-based analysis could be applied to better understand the (food) innovation practices of Silicon Valley.

This analysis revealed two key points: first, it showed the powerful spatial imaginary that exists today whereby the Valley is seen not only as a good place but in fact the place for doing innovation. As revealed in my interviews, this imaginary has played a prominent role in a number of AP founders’ decision to move to the Valley region to start their ventures: many shared a common belief that it was vital to ‘be there’ not only to access the area’s technical and business resources, but also to benefit in a more quasi-spiritual way, as if by being ‘there’ would awaken their “entrepreneur-spirit” (Schumpeter 1947) and allow them to become Big Tech's next big thing – or as one interviewee put it, to become the ‘Uber’ or ‘Airbnb’ of food. This finding thus contributes
further insights to the project’s question of why so much AP activity has concentrated within the Valley to date.

Second, the chapter showed that a consequence of AP founders ‘being there’ has been that the development of their innovations has followed specific and generally uniform trajectories: namely, that all have typically evolved as for-profit companies creating tech-based products which can be protected through intellectual property rights, such as patents. In this way, a fundamental factor in the ways APs have emerged has been what I refer to as – building on Longhurst’s (2015) terminology – the ‘ontological and epistemological singularity’ of the Valley region. It shows that in addition to the atmosphere of Anthropocenic anxiety and the legitimising forces of policy discourses discussed in Chapter 5, the geographical locale within which APs have emerged has also had a significant influence on the materialities, discourses and methods involved in the sector. The shared characteristics of most Valley-based APs – i.e. capitalist-friendly, high-tech products – can thus be viewed as a materialisation of the specificities of the local milieu regarding what counts and is valued as ‘innovation’.

In addition to attending to the project’s research questions, these findings aim to extend theoretical debates in economic geography and innovation studies by both acknowledging and unpacking the political, material and geographical situatedness of innovation practices. Through this work, the chapter has also worked as a critical intervention in the hype through which APs and other (food) technologies are currently emerging: that is, rather than viewing these products as automatically ‘desirable’ and ‘necessary’ on account of their claimed ‘innovativeness’ (Bunnell & Coe 2001), the thesis has pointed to the particular Valley-based variety of innovation they represent, and as such invites questions as to whether they do indeed offer the most desirable and necessary solutions to Anthropocenic tipping points. Moreover, building on existing critical analyses of the Valley’s innovation culture (Pellow & Park 2002; Matthews 2003; Morozov 2013), the chapter also contributes to the question set up in Chapter 5 regarding what it means for global agencies to be looking to address food security ‘Silicon Valley-style’. In answer, Chapter 6 shows through the case of APs that to turn to the Valley for ‘innovative’ and ‘disruptive’ thinking on food security, is to be met with a (re)problematisation of this issue as one for technology and the markets to solve,
thereby leading to solutions that leave capitalism and productivist ideologies resolutely undisrupted.

9.1.2 Materialising biopolitics

9.1.2.1 Responsible eating and the biopolitics of edibility

While the genealogical and political-economic approaches of Chapters 5 and 6 provide critical insights to the project's research questions, such analyses can ultimately only tell part of the story of what APs mean and signify regarding the current agri-food system, and its potential future. Such a task also requires consideration of the moralising dynamics of APs, and how these have been mobilised through the ontological and visceral politics of their development (Mol 1999; Hayes-Conroy & Hayes-Conroy 2008). Acknowledging these factors builds on thinking both within and beyond geography that has highlighted the “moral charge” around eating (Mintz 1996), and the uniqueness of food as a consumption practice due to the intermingling of subjectivities and visceralities it involves through the act of ingestion (Mol 2008). The thesis has thus sought to respond to recent calls for food researchers to consider eating as ‘more-than-consumption’ (Goodman 2016) on account of the messy, intimate and moralising relations it involves, and through which bodies are made as eaters and things as food (Probyn 2000; Roe 2006; Mol 2008; Evans & Miele 2012).

In light of these themes, the first aim of Chapter 7 was to situate APs within the long history of ‘responsible’ eating. To do so, the chapter looked to recent literatures that have examined food-related moral economies (Goodman, M. 2004; Bryant & Goodman 2004; Clarke et al 2007; Jackson et al 2009; Barnett et al 2017), and biopolitics (Andrée 2002; Bobrow-Strain 2008; Paxson 2008; Mansfield 2012a). The chapter argued that APs represent the latest example whereby individuals are being responsibilised to use personal food choice as a means for managing the prosperity of the self and the planet. Like products before them such as Fairtrade (Goodman, M. 2004), industrial white bread (Bobrow-Strain 2008), and GM crops (Andrée 2002), the chapter argued that AP developers are similarly involved in a series of material and discursive strategies designed to encourage eaters to view APs as the ‘better’ choice for human health, animal welfare and the environment, and to thereby adopt them into their eating practices in
the name of realising the post-Anthropocene. Such dynamics, I argue, align closely with the Foucauldian concept of biopolitics as they work to reimagine eating as a central and everyday means by which people problematise “what they are, what they do, and the world in which they live” (Foucault 1992). Through this theorisation, the chapter sought to reveal how AP developers are presenting the choice of APs over conventional animal foods as a principal means “of forming oneself as a responsible, ethical subject in relation to a larger social formation” (Bobrow-Strain 2008, 23).

While distinct parallels can be drawn between APs and the mechanisms of responsibilisation discussed in these literatures, the chapter highlighted the novelty of these food products as an important difference that required further theorisation. In developing this argument, ‘novelty’ was taken to mean food products that either had no history of human consumption (e.g. cellular agriculture), or were unfamiliar to certain cultural contexts (e.g. insects, plant-based proteins). Given this novelty, I argued that AP developers have been engaged in a more radical form of responsibilisation that has worked to not only convince eaters to choose APs over conventional animal foods, but to also convince them that APs actually qualify as ‘food’. The chapter showed how animal products already represent an anxious and ambiguous form of eating in human diets (Chiles 2013) due to their strong associations with taboo and the risk of moral and physical defilement (Douglas 2003 [1966]). For many eaters, then, the use of stem cells, insects and high-tech methods are among the many novelties of APs that have presented further ambiguity to an already ambiguous and precarious form of eating (Chiles 2013, 479). A central part of the responsibilising dynamics of APs has thus required material and discursive strategies that overcome this ambiguity by traversing the conceptual divide between inedible (non-food) and edible (food). To unpack these strategies, the chapter looked to recent studies by geographers and other food scholars that have examined the processes by which ‘things become food’ (e.g. Vialles 1994; Roe 2006; Probyn 2011; Evans & Miele 2012). This work has shown how the category of ‘edibility’ is not only physiologically determined – i.e. being technically safe to eat – but is also dependent on particular cultural, material and discursive assemblages, and it is through these assemblages that an inedible substance (e.g. a living animal) is transformed into an edible food (meat).
A further contribution of the chapter, then, has been to bring these debates into dialogue with food biopolitics literatures and, in doing so, highlight the ways in which APs are ‘becoming food’ as a new site of biopolitics: a theorisation I introduce as the ‘biopolitics of edibility’. Through this original theoretical lens – combined with empirical data collected via interviews with key AP personnel – the chapter examined the different strategies being conducted by AP developers through which this biopolitics of edibility is materialising. First, I examined the process by which AP developers are encouraging eaters to understand their products through a molecularised lens of what qualifies as ‘meat’, ‘dairy’ and ‘eggs’. Reimagining these foods purely through their constituent parts – e.g. amino acids, lipids, water – has allowed AP developers to divorce animal foods from animal bodies, a separation which has brought with it claims of more sustainable, hygienic, controlled and ethical (i.e. better) forms of meat, dairy and eggs.

Yet in all my interviews with AP personnel it was frequently emphasised that such a reductionist approach to food was not enough to win the acceptance of consumers. It was not enough, they claimed, to technically build edibility from the bottom up; rather, APs needed to appeal to the ‘messier’, more bodily and emotional aspects of food-eater relations referred to at the start of this section (Probyn 2000; Roe 2006; Mol 2008; Evans & Miele 2012; Goodman 2016). As such, the edibility formation of APs was shown to also include strategies of normalisation that have worked to align these products with the practices, materialities, sensory expectations and discourses of conventional animal foods. This was demonstrated by examining the choice of end products APs have materialised through (e.g. burgers, protein bars, mayonnaise); the emphasis on their ability to slip seamlessly into already-familiar shopping, cooking and eating practices; the attempts to make APs indistinguishable in terms of the sensory characteristics of conventional animal foods; and, the insistence by AP developers on using familiar terminology to describe their products and production methods (e.g. ‘meat’, ‘livestock’, ‘cellular agriculture’).

These strategies were shown to underpin the ultimate goal of the AP sector which, in the words of one of my interviewees, is to create products that are “the same but better” than conventional animal foods. And it is this goal I identified as being at the heart of the biopolitics of their edibility formation. For in seeking to offer the ‘same’ in terms of the materialities, practices, visceral properties and discourses of conventional animal foods,
the AP movement sees itself as making the ‘right’ choice become the ‘easy’ choice by creating products that do not disrupt the convenience, cultural value, familiarity, or visceral enjoyment associated with animal foods. As such, in the process of APs becoming ‘food’ the chapter documents a moral-laden ‘logic’ that has emerged within the sector: that is, if these products deliver the same experience and enjoyment as conventional animal foods, but also address Anthropocenic crises, then why wouldn’t consumers choose them? We can thus understand the edibility formation of APs as an inherently biopolitical process, as eaters are responsibilised – through the material and discursive strategies documented above – to practice their ethical ‘competence’ (Miele & Evans 2010) by accepting APs as ‘food’ and adopting them into their everyday eating practices. To refuse to do so implicitly positions those eaters as inhumane, ‘unclean’ and even cruel; they become the irresponsible subjects who threaten the reality of a post-Anthropocene era through their ‘bad’ and ‘inflexible’ tastes (Mol 2009).

By examining APs through the theoretical lens of ‘biopolitics of edibility’, the chapter provides three key contributions: first, it offers further insights into the project’s research question of why APs have developed through particular material forms and discourses. The choice to introduce cultured meat as a burger, to make plants ‘bleed’, and to describe insects as ‘mini-livestock’ can all be understood as an integral part of convincing eaters these products are in fact ‘food’, and thereby increases the likelihood of their adoption into people’s eating practices. Second, the chapter brings together previously disconnected theorisations on edibility (Vialles 1994; Roe 2006; Parasecoli 2011; Evans & Miele 2012) and food biopolitics (Andrée 2002; Bobrow-Strain 2008; Paxson 2008; Mansfield 2012a), and in doing so extends both traditions by demonstrating how the study of novel foods reveals edibility formation as another site through which eaters can be responsibilised to manage societal and personal welfare. And third, the chapter contributes to ongoing debates about the increasing convergence between food and technoscience (Goodman et al 1987; Goodman 2001; Marsden 2008), and how this trend can open the ontological categories of food to new molecular scales, and consequently, new moral and material potentialities.

Yet the chapter also highlights the limits to attempts by agri-capitalism to continue blurring the boundaries between food and technology. In the case of APs, the visceral realm has posed a powerful barrier as well as biopolitical opportunity in their
development. The chapter showed that it has not been enough for AP developers to simply present rational arguments for the benefits of their products, but rather hundreds of millions of dollars have been spent on making them viscerally indistinguishable to the conventional animal foods they seek to replace. These observations speak to recent work by critical food and feminist geographers on the importance of visceral factors in how we come to perceive and interact with food (Longhurst et al. 2008; Hayes-Conroy & Hayes-Conroy 2010; Evans & Miele 2012). The case of APs, then, invites new avenues of research on how the visceral realm has been opened to biopolitical dynamics so that the ways we ‘sense and make sense’ of food (Evans & Miele 2012) are now acting as a new site through which the post-Anthropocene is being managed. As the next section shows, the final empirical chapter (Ch. 8) has offered initial steps towards this line of enquiry, and further directions are outlined in the conclusion of this chapter.

9.1.2.2 Visceral (bio)politics

Having identified the visceral as a site of biopolitics in AP development, Chapter 8 sought to examine these dynamics further by adopting a different research perspective and methodology from the other empirical chapters. To complement Chapter 7’s analysis of AP biopolitics through the decision-making of their developers, I wanted to examine these strategies from the perspective of those they aim to target – i.e. eaters. Using myself as an “instrument of research” (Longhurst et al. 2008), the chapter provided a visceral autoethnographical account of my experiences of shopping for, cooking with and eating a specific AP product – Beyond Meat’s ‘chicken’ strips – during fieldwork.

In adopting this methodology, the chapter builds on previous work by feminist scholars (Moss 2001), and more recently by critical food researchers who have both called for (Goodman 2016) and used similar approaches in their work (Mol 2008; Longhurst 2012; Hayes-Conroy 2010). As highlighted in the chapter, the reflections gained through this approach were not intended to speak for all eaters on how they engage with and perceive AP products. Rather, the visceral exercise offered just ‘one story of many’ that could have been told (Longhurst 2012). While not claiming universality, like other researchers who have used similar methods I found this approach highly effective for accessing the more bodily aspects of food-eater relations, and for using the findings to
empirically think through and test the theoretical ideas discussed elsewhere in the thesis (Moss 2001; Longhurst 2012). Moreover, as argued in the methods chapter of this thesis, a further benefit of using auto-based methods was that it provided methodological tools for not only thinking through my situatedness in the research process (Haraway 1988), but also enacting it in more conscious and explicit ways.

The aim of this visceral auto-based exercise was to examine how, and to what extent, the ‘chicken’ strips worked to responsibilise me to accept them not only as ‘meat’, but as better ‘meat’. This analysis continued Chapter 7’s interest in how things become food, although this time focussing more on what Roe (2006) terms a ‘fork-to-farm’ approach. In adopting this approach, the chapter took seriously the argument advanced in recent critical food scholarship that eating forms an essential part of a thing becoming food; as Goodman (2016, 242) states, it is through this visceral relationality that “food is only really ‘food’” (see also Roe 2006; House forthcoming). My aim, then, was to examine how I came to “sense and make sense” (Evans & Miele 2012, 300) of the Beyond Meat product as ‘better meat’ through eating, as well as through the other everyday practices of shopping and cooking. In addition, included in this visceral exercise was also an analysis of the language the company uses on their labelling and in other promotional materials. This approach builds on Evans & Miele’s (2012, 303) observation that language can function as an “additional sense” in how we come to know and interact with food.

A fundamental part of this sense-making process was shown to involve a careful curation by Beyond Meat of the ‘good’ stuffs of conventional meat made present, and the ‘bad’ stuffs made absent from their products. The first aim of the chapter, then, was to explore which ‘stuffs’ were deemed good and bad by the company, and as such have been made present or absent from the materialities and discourses of their products. The category of ‘good’ stuff was found to contain the longheld cultural and nutritional associations of animal meat with power and bodily strength. This was made apparent to me through the product’s labelling which stated the strips provided as much protein as conventional chicken, a message accompanied by an image of a muscular arm. The strips thus became ‘meatlike’ to me through their promise of providing equivalent nutritional properties and the culturally desirable benefits – i.e. a lean, muscular physique – currently associated with these properties. The sensory aspects of the strips
were also a key example of what the company considers to be the ‘good’ stuff of animal meat. As such, I was encouraged to perceive them as meat through their appearance, the promise on the packaging to provide the ‘taste’ and ‘texture’ of conventional chicken, and my general satisfaction that such promises were delivered – at least to a greater extent than other meat analogues I had previously tried – during the cooking and eating stages of the exercise.

As the chapter highlighted, it was the long list of ‘bad’ stuffs made absent from the strips that struck me most during my initial engagement with them in the shop, and it was these characteristics that inspired me to theorise APs as comprising not only the ‘stuff’ of meat, but also the ‘non-stuff’. This latter category ranged from the problematic inputs (e.g. hormones, antibiotics), nutritional components (e.g. cholesterol, saturated fats), and impacts (e.g. environmental, ethical and human health) the company links to conventional meat production. A key part of my sense-making was thus not only to perceive them as meat-like, but also as better than conventional chicken on account of their absence of these bad stuffs. The chapter found that through this process I also came to view myself as becoming a better eater by choosing the strips over other conventional meat products.

Regarding the question of how I came to be responsibilised to make sense of the strips as ‘better meat’, the chapter thus revealed the series of material and discursive mechanisms coordinated by Beyond Meat to emphasise the (non)stuff of their products, which overall worked to position the product as better than conventional meat. In extension, I found myself reimagining myself as a better eater for choosing the product in the supermarket, and also during the act of eating and sharing the meal with friends.

Yet the exercise also revealed two instances whereby I resisted these interpretations, both of which arose during certain visceral engagements with the product. The first occurred during the shopping stage when I opted to buy tuna as a ‘backup’ option in case the strips did not deliver an enjoyable meal; and the second during the preparation and eating of the meal when the sensory characteristics reminded me of ‘processed’, and thus less desirable, meat.

These occurrences highlight two important points: first, that despite the sense-making I had conducted in the supermarket it was not until I had eaten them that I could fully
‘make sense’ of them as meat. This provides further empirical support to the literatures cited above which have argued we cannot fully ‘know’ food until the act of ingestion (Roe 2006; Evans & Miele 2012; Goodman 2016; House forthcoming). Second, it highlighted the potential for what I term ‘visceral biopolitics-in-reverse’ – that is, through my visceral sense-making during eating I came to exceed the regime of responsibilisation exercised through the materialities and discourses of the product, and instead resisted the company’s imaginary of it representing better meat.

These findings contribute to literatures that have highlighted the potential for governed bodies to not always, or at least fully, be made ‘docile’ through the mechanisms of responsibilisation enacted upon them (e.g. Pickett 1996; Heyes 2006) – a potentiality that can often be missing from biopolitical studies, and has been a common critique of their analyses. Building on these literatures, the chapter exposes the visceral realm as a powerful site through which this biopolitics-in-reverse can manifest. As such, the chapter directly builds on the contribution made in Chapter 7: that is, on the one hand the thesis has shown that APs represent the opening of the visceral realm to biopolitical mechanisms. In doing so, it has argued that our sensory understandings of food have become a key site through which eaters are being encouraged to manage Anthropocenic crises, and ultimately choose to buy APs over conventional animal foods. Yet on the other, the findings of Chapter 8 reveal that while the visceral is being mobilised towards agri-capitalist interests through AP products, at the same time it also represents a powerful barrier against this process. Such findings invite further research on the role of the visceral as both mechanism and resistance to food biopolitics, and by extension, as both mechanism and resistance to the continued penetration of capitalism into agri-food processes. These themes will be discussed further in the final section of this chapter.

9.1.3 APs as ‘starting over’?

Bringing these observations together, the thesis offers a number of key insights on the questions of what APs both mean and signify regarding the current agri-food system and its potential future. Speaking to the first question of what these products ‘mean’, the study has shown that the recent AP movement represents disruption and simulation in particular ways to the geographies, political economies, biopolitics, sociocultural
practices and materialities of modern food production and consumption. In the category of ‘disrupted’ elements we find protein production and global food security activities shifted to new geographies (i.e. Silicon Valley) and expertise (high-tech). With these developments, new political economies of food production have emerged that bring with them the ideological and methodological approaches of Valley entrepreneurs, start-ups and Big Tech billionaires. APs also signal attempts by their developers to disrupt the ontological categories of ‘meat’, ‘milk’ and ‘eggs’ so that their association with animal bodies is both materially and conceptually disconnected. By reimagining these foods through their molecular makeup, APs are presented as an opportunity to build meat, milk and eggs from the bottom-up through high-tech means, and thereby overcome the limits and negative impacts of what Nature can currently provide. It is in these ways that many AP advocates have hailed this movement as ‘starting over’ in the global food system, through which the promise of the post-Anthropocene can be fully realised.

Yet in tandem with these ‘disruptive’ characteristics, APs also represent elements of simulation in a number of key ways. First, the mission of ‘starting over’ through APs has, to date, overwhelmingly been married to the mechanisms of capitalism – and more specifically, the high-tech, venture-funded, entrepreneurial mechanisms of Silicon Valley. As the thesis has shown, the turn to for-profit, market-based solutions has been a conscious decision by the majority of AP developers I interviewed, with many explicitly expressing this direction as the most effective for “reorient[ing] the system” (Solon 2016), and thus achieving their post-Anthropocenic goals. In this way, APs offer the perfect ‘fix’ (Guthman 2015) as they promise to realise the post-Anthropocene while at the same time creating new opportunities for continued capital accumulation. The ‘disruptive’ agenda of the AP movement can thus be understood as remaining resolutely within – and indeed actively advancing – the contemporary systems and logics of agricapitalism.

In doing so, APs can be firmly situated within current trends of ‘green neoliberalism’ (Goldman 2005; Bakker 2010) through alternative food networks (AFNs) – in other words, they continue the turn to markets and individual consumption for solutions to socioenvironmental issues, rather than disrupting the status quo through politically-led structural reforms. This invites similar critiques against previous AFNs over the
contradictions inherent to the mainstreaming of ‘alterity’ (Goodman et al 2012), and the moralising implications of scapegoating individuals rather than locating and addressing problems at the system level (Eli et al 2016). Examples of these implications were revealed through the thesis’ biopolitical analysis, which demonstrated that APs represent another case through which biopolitics is being advanced within contemporary eating practices. Despite manifesting in new ways – i.e. through edibility formation – APs join a long list of morally-charged products that have reimagined individual consumption as a primary mechanism for managing socioenvironmental issues, as well as managing the self as a responsible and ‘competent’ consumer-citizen (Bobrow-Strain 2008; Mol 2009; Miele & Evans 2010). In this way, APs actively maintain the conceptual link between personal food choice and planetary prosperity, thereby reinforcing the normative link between personal food choice and planetary prosperity, and thus ‘good’ from ‘bad’ eaters.

As a further example of APs as a continuance of existing practices, these products also advance the penetration of capitalist technoscience into the processes of Nature, in this case by bringing the production of protein-based foods under new regimes of high-tech, corporate-led ownership and control (Mansfield 2008). Such characteristics place APs within a long and troubled heritage of previous green-minded technofixes, such as GMOs, that similarly claimed planetary prosperity through technocapitalist salvation (e.g. Shiva 1991). In making this link, the thesis serves to raise concerns regarding the potential for APs to create new and/or reinforce the Anthropocenic tipping points they claim to solve, as well as maintaining social inequality through the continued monopolisation of global food production by corporate powers.

And finally, key to AP development has been the collective attempt to create products that simulate the visceral experience, material forms and cultural practices of conventional animal foods to the point of being indistinguishable. As such, the ‘future of food’ has remained remarkably familiar and decisively taste-full as it has materialised through the well-known, popular products of burgers, mayonnaise and cookies, all of which have required very little, if any, changes to the everyday practices of conventional animal food consumption. In adopting this approach, the taste for and cultural dominance of conventional animal foods in contemporary – and increasingly global – diets remains completely undisturbed by APs, and is even actively encouraged.
Such insights are useful not only for asking what APs mean for the agri-food system, but also for reflecting on the contemporary moment of food and eating practices; and, in turn, highlighting new themes and conceptual approaches for agri-food research. In telling this particular story of APs, the thesis has revealed the direct and complex relations between modern agri-food processes and social anxieties, particularly those that have been reimagined under the Anthropocene diagnosis. The study thus contributes to recent literatures that have begun the important work of making these connections (e.g. Jackson 2010), and points to the particular atmosphere of Anthropocenic anxieties as requiring further analytical attention in agri-food research.

To conduct this work, the thesis made the case for turning to Foucauldian methodological approaches (i.e. ‘history of the present’) as a valuable tool for making visible the historical conditions, truth regimes, and moralising dynamics that shape the modern food system. Such an approach was shown to reveal further insights into the anxious atmospheres and ‘logics’ through which global problems are conceptualised, and in turn how certain solutions and ‘experts’ come to be rationalised as the necessary and logical responses. The study makes important first steps, then, in theorising the contemporary project of global food security under the Anthropocenic diagnosis, and in contemplating its new directions through the particular geographies and ideologies of Silicon Valley.

The thesis also supports the centrality of visceral politics in food and eating that has been advanced by feminist geographers and others over recent years (Probyn 2000; Roe 2006; Hayes-Conroy 2010; Evans & Miele 2012). By considering the visceral politics of APs we can understand why they have materialised in the ways they have, and why they have proven considerably more successful in generating hype and investment compared with the many protein analogues, such as tofu and seitan, that have long existed on the market. However, as the case of APs has shown, there is much need and scope for examining how the politics of ‘good’ taste (Mol 2009), and our sensory and ontological understandings of food have become entangled with the biopolitics of social anxieties and the moral economies of responsible eating. This focus extends previous analyses by revealing the additional stakes now bound up in the ways eaters ‘sense and make sense’ of food (Evans & Miele 2012). In the case of APs, practicing ‘good’ taste has become connected to the fate not only of the self but also the prosperity and future of the planet, and it is through the visceral realm and perceptions of edibility that eaters
are being responsibilised to practice this ‘good’ taste. Revealing these connections contributes another critical intervention into the increasing co-option of the visceral realm by agri-food capitalism (Hayes-Conroy 2014), as well as the expansion of what qualifies as ‘food’ through technoscientific means (Goodman et al 1987; Guthman 2015). However, the thesis has also sought to highlight the visceral as a powerful site of resistance to this trend. Due to the necessarily intimate engagement we have with food, our visceral perceptions can pose considerable barriers to the inventions of agricapitalism (Guthman 2015). As such, the case of APs highlights the significant scope for advancing dialogue between debates on food biopolitics and visceral geographies, as well as broader theorisations of edibility – a direction that I develop in the final section of this chapter.

Finally, APs call for new directions within economic geography that engage further with agri-food, AFN and STS debates (Winter 2005). The thesis offers initial steps towards this goal by calling attention to the specificities of place in shaping, and in some cases limiting, how innovation is conceptualised, valued and practiced. There is much scope to disturb the very notion of ‘disruptive innovation’ as an always singular and beneficial process, and instead conduct more critically-nuanced analyses of how innovations emerge. STS literatures were shown in Chapter 5 to offer promising avenues for this analysis, but further insights could also be gained by engaging AFN debates in this thinking. For example, should we consider the notion of ‘disruptive’ innovation as a new face of ‘alternative’ foods? If so, how might we continue to problematise the idea of alterity in food networks in light of the high-tech ideologies and Valley-based geographies that typically accompany this concept of ‘disruption’? These lines of enquiry speak to the increasing expansion of the Silicon Valley ‘model’ into new sectors, a theme that I elaborate further in the final section of this chapter.

The thesis has also served to highlight that in the specific case of food innovation, economic geography literatures must consider how the materialities of agricultural life pose a further influence on the trajectories of innovation. This builds directly on Goodman et al’s (1987) observations that agriculture has historically presented challenges to capitalist penetration on account of its material, biological and temporal characteristics. While certainly cellular agriculture represents efforts to ultimately surpass Nature and bring protein production within the complete control of
technoscience, all of the APs examined in this thesis have faced the challenge of applying high-tech processes to the inherently material nature of food, and the emotive reactions these approaches have evoked with the public. Food innovation thus cannot be generalised under the all-encompassing, ‘one-size-fits-all’ notion of innovation that typically characterises economic geography debates (see Shearmur et al. (2016)) – it requires more thorough understanding of the material, visceral and emotional elements that constitute contemporary food-eater relations. There is much value, then, in fostering increased dialogue between economic geography and recent thinking in critical food research that has made important headway on theorising the more fleshy, relational aspects of food and eating (Probyn 2000; Roe 2006; Hayes-Conroy 2010; Evans & Miele 2012; Goodman 2016).

All of these observations point to the necessity for agri-food debates to continue looking across disciplines for the conceptual and methodological tools to more fully attend to the multiplicities of food and eating. Moreover, agri-food research must continue making links between the micro and macro levels, for as this study has shown, it is in the relations between burgers, Anthropocenic anxieties, visceral bodies and Silicon Valley that we may understand the geographies, biopolitics, political economies and materialities that are shaping the contemporary moment of food production and consumption. By adopting these multidisciplinary and multi-scalar approaches, the thesis has been able to critically interrogate the AP movement as a route to ‘starting over’ in food, and instead reveal a complex and politicised picture of both disruption to and simulation of the existing agri-food system in different ways.

9.1.4 Future research directions

Building on the themes examined in the thesis, this concluding section outlines a number of directions for further research. First, building on Chapters 7 and 8 there is considerable scope for examining the ‘meaning-making’ (Roe 2006) that occurs through the visceral relationalities of eating, as well as during the practices of shopping and cooking. I have argued that the specific context of novel foods offers a promising and largely understudied direction for this enquiry, as it is through such cases that the dialogue – initiated by this thesis – between debates on visceral politics, edibility
formation and food biopolitics can be continued. Potential avenues to pursue would be to conduct more auto-based visceral exercises with other AP products to examine how my experiences of ‘sensing and making sense’ (Evans & Miele 2012) through their specific materialities and discourses compare with the empirical case of Chapter 8. I am also keen to conduct participant-based studies to develop these conceptual interests further. This would extend the analysis beyond my own experiences to incorporate those of other eaters, and thus attempt to capture more ‘stories’ of how different bodies sense and make sense of the things they eat (Longhurst 2012), and, importantly, how they are shaped by the morally-charged aspects of these processes. A suggested research design could be to invite participants to reflect on the various mechanisms through which they make sense of different APs, and to what extent these processes actively encouraged a perceived responsibility to both their own and planetary prosperity. Incorporated into this design would also be an interest in any instances of resistance to this responsibility, particularly those enacted through the visceral realm. This would contribute further empirical work to test and develop the conceptual idea of ‘visceral biopolitics-in-reverse’ that was introduced in Chapter 8 of the thesis. The collective aims across all of these lines of enquiry would be to continue developing the theorisation of the visceral realm as a site of biopolitics, both open to co-option by agri-food powers as well as resistance by eaters. As discussed above, these insights have profound consequences for understanding consumer agency in contemporary agri-food relations (Hayes-Conroy 2014; Guthman 2015), as well as providing new theorisations of why certain foods provoke the yuck factor for certain eaters.

In addition to building on the conceptual ideas of Chapters 7 and 8, these lines of enquiry would also contribute towards recent calls for reinforcing the use of visceral-based methodologies in human geography research (e.g. Sexton 2016). For example, extending the approach of Chapter 8 beyond myself as an “instrument of research” (Longhurst et al 2008), a potential research design could be to either accompany eaters through similar food practices of shopping for, cooking with, and eating APs, and/or invite them to record their feelings and experiences through autobiographical means. In attempts to go beyond the word-centric nature that is often involved in these methodologies, these studies could also engage with approaches such as body-mapping, a method whereby participants draw their visceral experiences within and around an outline of their bodies on a piece of paper. These more-than-textual approaches have
proven highly effective in articulating bodily experiences in studies beyond food-based topics (e.g. Sweet & Ortiz Escalante 2014), and thus promise valuable ways for bringing the visceral more fully into research on food and eating. Not only would this provide further empirical contributions to current debates on visceral understandings (Probyn 2000; Hayes-Conroy 2010; Evans & Miele 2012), it would also advance methodological approaches beyond those commonly used in consumer studies, many of which often physically and viscerally situate participants ‘outside’ their everyday eating contexts and instead tend towards written surveys or verbal discussions.

Second, there is much scope for developing the theoretical connections between AP political economies, economic geographies and biopolitics of edibility. One suggested avenue is through the concept I introduced above as the ‘edibility fix’. This builds directly on Guthman’s (2015) recent work in which she outlines how eating bodies have become a socioecological fix for agri-food capitalism – in her words, the creation of diet products has bypassed the limits that human physiology poses to continued accumulation, and has thereby enabled markets, but not bodies, to expand. In light of the thesis’ observations in Chapters 7 and 8, I suggest that we can look on APs as a similar fix, yet with an important distinction: rather than preventing bodies from materially expanding, this fix is instead focused on reconfiguring eaters’ perceptions of edibility. Due to the Anthropocenic anxieties associated with conventional animal foods, this conceptual approach argues that expanding what qualifies as ‘meat’, ‘milk’ and ‘eggs’ to include stem cells, insects and plants represents a mechanism for overcoming the current limits to accumulation in the protein industry. Rather than requiring a reduction in consumption, this fix operates by allowing people to continue consuming their favourite protein foods while simultaneously mitigating Anthropocenic tipping points. In doing so, I argue that APs serve to allow markets, but not global crises, to expand.

Developing this theorisation promises important contributions to current thinking on the advancement of agri-capitalism through technoscience. It suggests that while the trends of industrial appropriationism and substitutionism are continuing through APs (Goodman et al 1987), these approaches have themselves reached certain limits due to the negative associations industrial foods now hold for many consumers. We might ask, then, if APs represent a high-tech co-option of the ‘quality turn’ by industrial actors?
Indeed, a number of companies in the recent AP movement have used the terms ‘artisanal’ to describe their methods, and view their products as an evolution in the ‘craft’ of protein production. This raises questions as to how the high-tech approach of the Valley possibly challenges existing imaginaries of ‘artisanal’ and ‘quality’ food production (Holloway & Kneafsey 2000; Goodman 2002), and in doing so enables a new industrial sector (i.e. Big Tech) to respond to and capitalise on current consumer anxieties over how and where their food is produced.

This leads to a related line of enquiry concerning the shift to Big Tech as the new emerging powers of the global food system. This study has revealed that food innovation today is not being sought from established Big Industry, but rather new high-tech start-ups and entrepreneurs. As noted earlier in the chapter, this invites closer consideration of how we might situate the food tech ventures of Silicon Valley within existing understandings and practices of AFNs. A suggested line of enquiry is to ask whether the Valley approach presents a new understanding of ‘alterity’ in existing AFN thinking. In seeking to provide alternatives, AP companies have not struggled with the contradictions of mainstreaming their alterity (Goodman et al 2012), but rather have actively and explicitly sought to upscale their for-profit models as quickly and broadly as possible. Their alterity does not claim to come from providing alternatives to mainstream agri-capitalist models, but instead is performed through their ability to reclaim these models from existing agri-powers. In other words, it is their (re)appropriation of the power, geography and materialities of existing protein production that constitutes their alterity, rather than attempts to diversify economies through non-capitalist mechanisms (Gibson-Graham 1996; 2008).

Such developments evoke a kind of ‘Robin Hood’-esque development of contemporary AFNs: that is, it presents the ‘stealing’ of markets from existing agro-powers by start-ups as an unquestionably ‘alternative’ and therefore ‘good’ act. This neglects the potential outcome, at least in the case of APs, of those start-ups evolving into equally powerful industrial actors in the agri-food system that operate through the same economic models of the powers they have replaced. Such developments call for further thinking on the role Big Tech will play in shaping the power relations, geographies and materialities of AFNs over the coming years. Building on the observations of Chapter 6, agri-food research must also remain aware of how the term ‘disruptive’ may be masking
the contradictions and complexities of alternative food production in a similar manner to previous buzzwords, such as ‘local’ (see DuPuis & Goodman 2005). As Maye & Kirwan (2010, 8) note, terms such as this have often been “uncritically accepted as being ‘good’” in agri-food scholarship. It is important, then, for the notion of ‘disruption’ to not be treated in a similar way, but instead for agri-food research to remain critically aware of its political-economic, geographical and ideological specificities.

Third, I have argued there is a pressing need to continue examining the trajectories and implications of what I have termed the Nerd’s Burden phase of global food security – a framing that builds directly on William Easterly’s (2006) ‘White Man’s Burden’ in his critical study of the West’s systemic spread of economic policies and scientific knowledge in the name of global development. This phase represents a profound and as-yet underexplored development in the deepening relationships between global development agencies, such as the UN, and the high-tech morality of the Western private sector. It provokes questions on how these relationships have emerged, what roles are being played by the public and private actors involved, and how the specific ideologies of the Valley are contributing to the latest reproblematisation of global issues such as food security. The spatial aspects of these developments also require consideration, not only as we see food security activities and personnel relocating to the physical region of the Valley through the start-up scene, but also we find the Valley model of ‘doing’ innovation being exported to other places around the world. Examples of the latter are already apparent in the UN’s launch of high-tech accelerators and incubation programmes designed to solve world hunger through for-profit, high-tech start-ups (Mis 2016). Other cases include the government-sponsored Valley-inspired tech scenes currently developing in the Global South, such as ‘Silicon Wadi’ in Tel Aviv, Israel, and ‘Silicon Savannah’ in Nairobi, Kenya.

These lines of enquiry would continue the thesis’ analysis of the changing geographies, political economies and truth regimes of food security (and other global issues) that are materialising through the explicit turn by global development agencies, and also national governments, to Big Tech. In doing so, it would provide timely contributions to critical food security scholarship (Jarosz 2011; Margulis 2014), as well as to ongoing

96 ‘The White Man’s Burden’ is itself referenced by Easterly from Rudyard Kipling’s 1899 poem of the same title.
debates over the continued dominance of Western techno-colonialist agendas within
global development activities, both related to and beyond food (Escobar 1995; McGoey
2016). It would also continue the thesis’ interests in developing a more geographically-
sensitive understanding of innovation practices, a direction which aligns very closely
with new conversations within economic geography (e.g. Shearmur et al 2016a). Of
particular interest to this direction is to extend the thesis’ scope beyond the Global
North and consider the emergence of ‘Silicon Valleys’ in the South. Going beyond the
more traditional economic geography concepts of ‘cluster theory’ and ‘spatial
agglomeration’, this enquiry would be led by questions concerning how the
geographical contexts of these new ‘Valleys’ are shaping how innovation is practiced
and valued, and to what extent and in what ways have the ideologies of California’s
Valley been maintained.

And finally, building on the findings of Chapter 5 a further research interest is to
conduct a more extensive ‘archaeology’ of APs, both during and beyond the last century.
Included in this study will also be an examination of other protein-based foods
including supplements, meal replacements, and disaster relief. While a number of
cultural histories of plant-based diets exist (Spencer 1995; Stuart 2006; Preece 2008),
as well as a few historical accounts of particular products (e.g. Shurtleff & Aoyagi 2013),
to my knowledge there has yet to be a study that situates APs and these other products
within the broader contexts of global food security, technocapitalist salvation, and the
moral economies of eating. Moreover, the focus on meal replacements and supplements
invites consideration of a ‘post-food’ future in which the nutricentric view of food
(Scrinis 2012) is taken to the extreme of pills and powders based on a curated selection
of nutrients needed for ‘optimal’ functioning. This ‘future’ is already materialising
through products such as Soylent, a powdered meal replacement company based in Los
Angeles. Much like the APs discussed in this thesis, Soylent claims to be “better for you
and the planet” and has recently partnered with the WFP’s Innovation Accelerator to
provide “positive nutrition” around the world (Soylent 2017).

These lines of enquiry thus continue the thesis’ interests in how food and eating are
being used as critical mechanisms for bringing about the post-Anthropocene, and more
specifically, the central role protein has and continues to play in this trend. As the
‘future of food’ continues to materialise through an expanding number of ‘alternative’
ways to produce animal-based foods, it remains for agri-food research to continue the task of examining what these developments mean for the political economies, biopolitics, geographies and materialities of the global food system, and what new insights they reveal about the contemporary moment of food production and consumption.


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APPENDICES

11.1 Appendix 1: Gastronomica publication


Research Essay | Alexandra Sexton, King’s College London

Alternative Proteins and the (Non)Stuff of “Meat”

Abstract: Beyond Meat, a food technology company based in California, is currently developing a range of plant-based products that aim to provide more sustainable, ethical, and healthful alternatives to conventional meat. Its products are also aiming to be visually equivalent in terms of their meatlike taste, texture, and overall sensory experience. These alternative proteins (APs) are not, however, intended merely as a substitute for conventional meat. Instead they are viewed and marketed by their developers as meat, made simply from a different raw material and via different methods. Yet, as animal meat has become increasingly linked with environmental, health, and ethical concerns, Beyond Meat is having to negotiate a careful balance between positioning its products as meatlike in some respects and not meatlike in others in order to gain consumer adoption. To become “meat” in consumer thinking not only depends on the things these APs are made of—both material and ideological—but also the things that are actively excluded; as such, their materiality is made purposefully chosen “stuff” and “non-stuff.” The article explores this decision-making via a fieldwork encounter with Beyond Meat’s products. Using a viisual/autophenographic approach, I discuss how certain (non)stuff was “made to matter and not matter” (Evans and Miele 2012) to me during these encounters, and how this careful balancing of stuff can create new and problematic imaginaries, moral politics, and misguided understandings of what constitutes “better” foods and “better” eaters. The observations made contribute to existing discussions on visceral methodologies, perceptions of (novel) foods, embodied consumption practices, and the ways in which bodies are made as tastes and things as food.

Keywords: meat, alternative proteins, free-from diets, materiality, viscerality, embodied consumption, autoethnography

Inside were four quarter-pound brown patties. I tossed one on the grill. It hit with a satisfying sizzle. Gobbets of lovely fat began to bubble out. A beauty slowly lifted the air. I drowned a bun. Popped a slice. Mustard, ketchup, pickle, relish. I threw it all together with some chips on the side and took a bite. I chewed. I thought. I chewed some more. And then I began to get excited about the future.

-JACOBSEN 2014: N. P.

...we want all of the good and none of the bad. We want to eat delicious meat but we don’t want any of the bad stuff that goes along with it... Together we can build a world that’s zero downside and all delicious upside.

—COURN UNION, BEYOND MEAT WEBSITE

The two quotes above encapsulate the concepts of the “stuff” and “non-stuff” of meat that are explored in this article. In line with the theme of this special issue, the “stuff” of meat (and food in general) is taken to mean both its materialities and imaginaries that is, the material objects, bodies, processes, and ingredients involved in turning substances into meat, as well as its rhetorical (i.e., discursive/virtual/textual) and sociocultural dimensions. It also includes the materiality of the end product and how eaters perceive meat through its shape, appearance, texture, and other physical characteristics. The first quote speaks to this visceral materiality, or the sensory “stuff” of meat. To anyone familiar with the food experience Jacobsen recounts, the rich description will likely have stimulated personal memories of, and visceral reactions to, the smells, sounds, sights, feel, and taste of burger cooking on a grill, and perhaps evoked particular occasions and contexts within which these experiences occurred. Jacobsen’s description also touches upon the cultural and social “stuff” of meat. It showcases a common practice of grilling burgers and enjoying them with familiar accompaniments of alcohol, savoury condiments, and a side of chips. For some it may have conjured wider notions of Western—or perhaps specifically North American—cultural identity and history (Parkin Talvar 2003), and possibly even the gendered roles that are performed through the cooking and eating of meat within different contexts (Pebryn 2000; Julier and Lindenfield 2005).

The second quote, from a California-based food technology company, speaks to how animal meat has become an increasingly contentious and ambiguous product over recent years (Chiles 2013). This is largely due to associations of (intensive) meat production with widespread environmental degradation, animal welfare concerns, and human health risks. As such, meat has become the stuff of climate change, food scares, cancer risks, and corporate cover-ups in recent public discourses (Lawrence 2013; WITO 2015). At the same time, global tastes
for animal meat have grown rapidly and are projected to continue rising over the coming decades, particularly within emerging economies (FAO 2013). Yet notably within this growth there has been increasing consumer demand, particularly in the West, for meat products that are aware of and have successfully navigated the negative issues listed above. As the second quote highlights, many consumers now want meat to be full of the “good” stuff and not the “bad.” They also want meat to remain tasting delicious and not to fulfill the many cultural and social functions that have evolved around this food throughout human history. As Jacobson (2014: n.p.) wistfully recounts at the beginning of his article, “some of my most treasured moments have involved a deck, a beer, and a cheeseburger.”

Both of these quotes, then, bring attention to the material and visceral expectations, preferences, desires, and realities that make up meat in the modern food system. They show how many eaters today want meat to (not) contain specific materialities and to (not) represent particular imaginaries—to be and not be certain “stuff.” Building on the view of food as a collection of “stuff,” the first aim of this article is to explore the stuff that is not wanted and thus excluded from meat. I introduce the concept of “non-stuff” to get at those things that are purposefully and increasingly being made absent from meat products, and indeed many other modern food items. This absencing, as will be shown, can occur within the production process and supply chain (for example, the exclusion of certain methods), or it can relate to the ingredients and discourses omitted from the final product.

The second aim of the article is to explore the selection of (non)stuff by producers in their meat products. This selection refers to how cultural trends and the expectations and concerns of consumers regarding what they want meat to be—i.e., the things that “matter” to them regarding meat (Evans and Miele 2012)—are balanced with other factors, such as the realities of production and market opportunities. The presence or absence of stuff in the end product can thus be viewed as a materialization of this balance. Furthermore, I discuss how the presence or absence of particular stuff can often be viewed by consumers as indicative of a “better” product.

My focus, however, will not be on conventional animal meat, but rather meat made from plants. Despite first impressions, the eating experience Jacobsen describes is not in fact animal meat but rather Beyond Meat’s plant-based “Beef Burger.” The burger is a recent addition to the company’s other, mostly-plant-based “chicken” and “beef” lines, as well as a collection of ready-meals. Unlike other alternative proteins (APs) on the market (e.g., tofu), Beyond Meat’s products are not intended as substitutes for meat. In interviews discussing his company’s work, CEO Ethan Brown specifically describes and promotes his products as meat. For him, the raw materials may be different but the end products remain the same.

Meat is really made up of five constituent parts: the amino acids, lipids, carbohydrates, minerals and water. They’re all actually present in plants. What we’re doing is building a piece of meat directly from these plants, so the composition are basically the same. And in that case we are delivering meat.3

Exactly how Beyond Meat is “delivering meat” from plants is what I explore in this article. I demonstrate how the company is striking a careful balance between presenting their products as meatlike in some respects and not meatlike in others. Put another way, the company emphasizes that certain stuff of conventional meat have been made materially present and absent from their products; as such the materiality of these foods can be seen to contain the stuff and non-stuff of conventional meat. Through my encounters with their “chicken” products during fieldwork in California, I reflect upon this decision-making and how certain (non)stuff was “made to matter and not ‘matter’” (Evans and Miele 2012: 299) to me as a consumer and eater. In particular, I call attention to how the non-stuff of these foods forms an integral part of their framing as desirable meat products. This is examined within the context of other foods that also emphasize the stuff abscended from the materialities of their supply chains and end products. In situating Beyond Meat’s products within this wider trend, I build upon scholarship that examines food/body relationships (Mc 2008) and things becoming food (Roel 2006; Miele 2011) by exploring how the non-stuff of foods is increasingly becoming part of the materiality of the modern food system. Furthermore, both my fieldwork experiences and the descriptions I have encountered in the media, such as Jacobson’s reveal that the visceral stuff of Beyond Meat’s products is integral to them becoming “meat” in public thinking. These products thus offer valuable opportunities for calling attention to and furthering understandings of visceral encounters in food research; I argue that they highlight the critical role such encounters play in things becoming “food,” and how both the visceral and ideological work together in shaping our food choices.

**Things Becoming Food**

There has been a distinct turn within agro-food studies to “get behind the veil, the fetishism of the market and commodity” (Harvey 1990: 433). Traditional approaches have sought to “follow the thing” (Cook et al. 2004) from farm to
fork so as to uncover the myriad discourses, materialities, geographies, and relationships that are involved within commodity chains (de Sousa and Bouch 1998). However, others have stressed the need to also look backward along these chains, beginning instead with the eater in order to understand how things become “food” (e.g., Hayes-Conroy and Hayes-Conroy 2008; Carolan 2011). Roe (2006: 109) describes this as a “fork to farm” approach in that it seeks to trace meaning-making enacted through how foodstuff is handled by eaters, as well as how it is translated through the embodied practices and material processes of other bodies (e.g., butchers, chefs). This process of how eaters “sense and make sense” of foods (Evans and Miele 2012: 306) challenges the view of eaters as merely passive consumers. As Evans and Miele remind us, “[w]e do not merely consume foods; rather, we taste them, we smell them, we feel their textures with our hands and our tongues—we enter into an embodied relationship with them” (ibid.: 302).

The process of sensing and making sense of food also extends to rhetorical/conceptual mechanisms. Evans and Miele posit that, in addition to embodied perception, “language can function like an additional sense” (ibid.: 304) through which individuals come to not only feel but also “know and shape our worlds” (ibid.: 303). In taking this approach, the authors work to reveal how animals are made to matter and not matter in food consumption practices, both through textual and visual representations as well as the visceral properties of the end products. For example, they found that the presentation of chicken in highly processed form—such as chicken nuggets—does much to “background” its animal origins in consumer thinking. Conversely, the inclusion of more “bodily” features (e.g., legs, skin, bones), certification labels, and descriptions of “happy animals” can have the opposite effect and instead invite contemplation on the life of the animal (Miele 2001). This balance of presenting and absenting particular qualities, imaginaries, and histories of animals highlights the complex process of turning living bodies into food, and also how this process is dependent upon a careful foregrounding and forgetting of the many things that happen in between. Moreover, it stresses the need to understand eaters not solely as passive consumers or as willful deniers (Evans and Miele 2012: 303) of the things that go into making food. Rather the process of things becoming food can be conceptualized as a “performance” that is conducted through both producer and consumer (and other bodies in between), and by which certain imaginaries, perceptions, expectations, and realities are made to matter and not matter.

These literatures have done much to uncover the human and nonhuman, material and ideological, political and visceral “stuffs” involved in transforming substances into food, as well as the selective foregrounding and forgetting of these stuffs within the producer-consumer relationship. There is, however, more room within these analyses to examine how such processes are being conducted at the material level of foods, particularly the material abscence of certain stuffs. The modern (Western) food system is becoming increasingly defined by the non-stuff of food, and the products of Beyond Meat are an exception to this trend. Yet this shift toward food’s non-stuff remains underexamined from a critical food studies perspective. I argue that the material abscence of stuff from food offers a unique lens for exploring the political systems, cultural trends, food/body relationships, and materialities of the modern food system. It speaks to what is considered “good” and “bad” food, and in turn, what constitutes “good” and “bad” eating. It also calls attention to why certain (non)stuffs are specifically chosen by food producers, and how these choices can create new and problematic imaginaries, moral politics, and misguided understandings of what constitutes “better” foods and “better” eaters. Using the conceptual tool of the (non)stuff of food, I explore these issues through the case study of Beyond Meat and, in particular, bring existing food scholarship into dialogue with the stuffs being increasingly abscended from contemporary food products.

A Note on Methods

To unpack my fieldwork encounters with Beyond Meat’s products I draw upon autoethnographic methods (Anderson 2005; Ellis et al. 2011) and previous work that has used the body as a visceral “instrument of research” (Cragg 2003; 499, see also Longhurst et al. 2008). This is done to explore how, through sensing and eating, I came to personally situate and make sense of these products, both as “food” and in relation to conventional meat. Ellis et al. (2011: 277) describe autoethnography as “an approach to research and writing that seeks to describe and systematically analyze (graphy) personal experience (auto) in order to understand cultural experience (ethnos).” They view it as combining elements of autobiography and ethnography, and stress that “as a method, autoethnography is both process and product” (ibid.). In line with this model, I used autoethnography as a method for exploring the products of Beyond Meat as a consumer and eater during my fieldwork (process), and I use it now in this article as a method for narrating, reflecting, and analyzing these encounters through my written descriptions (product).

I draw on the work of other food scholars who have adopted similar methodological approaches and have proven them a highly effective method for getting at less “visible” aspects of food/body research (cf. Abbott 2013; Longhurst 2012). Like these
writers, I use autoethnography with awareness that my experiences and reflections have a "partial-ness" and "momentariness" to them (Lather 2003, quoted in Hayes-Conroy 2010: 735). As such, they are not intended to present a "whole picture" (Hayes-Conroy 2010: 736) of how others necessarily interact with and understand the products of Beyond Meat. Rather I use autoethnography, in combination with the visceral methods of shopping, cooking, and eating, to reflect upon my bodily encounters with the (non)stuff of Beyond Meat's products and how these experiences formed an integral part of the ways in which I personally "sensed and made sense" (Evans and Miele 2012) of the All as food. And to avoid "self-absorbed digestion," as Anderson (2006: 316) cautions in his discussion of autoethnographic approaches, I take care to situate and consider my personal experiences in connection with wider theoretical debates around eating practices, visceral knowing (Hayes-Conroy 2010), and how bodies are made as eaten and things as food (Probyn 2002; Roe 2006). The article also draws on interviews conducted with members of the Beyond Meat team and others working within the plant-based protein space in California.

The (Non)stuff of Meat and "Meat": Free from Bad Health and Big Food

During fieldwork I visited a Whole Foods Market in an affluent, residential area of San Francisco to purchase some Beyond Meat products to cook and eat for the first time. The store's layout steered me first through bountiful displays of fresh produce, then via a row of self-service salad bars, and on to a series of aisles that stretched across the width of the building. The first one happened to be a specialist diet aisle and it was there I found the Beyond Chicken strips among other plant-based meat, dairy, and egg alternatives. On the front of the packaging was a chicken-shaped image covered with vegetables (Fig. 1). To the right of this is a caption real "REAL MEAT" in large capital letters, and underneath "100% plant protein, as much protein as chicken." What struck me most, however, was on the back of the packaging: running the width of the reverse sleeve was a series of icons listing the many things the strips did and did not contain (Fig. 2). They were labeled as being "100% vegan," "kosher," and containing "zero of protein per serving." They were also "cholesterol-free," "homone-free," "non-GMO," "antibiotics-free," and "certified gluten-free" (with the latter three also displayed on the front of the packaging).

It is perhaps not surprising from a commercial perspective that Beyond Meat has displayed these labels on its products. Over recent years the vegan market has experienced significant growth in the United States as consumers are increasingly adopting more plant-based diets (Crawford 2013). Similarly, protein has become the latest star of the functional food trend and as such is now advertised as a desirable selling point on a wide range of products, from breakfast cereals to beer (Daniels 2014). The "free from" trend has also experienced a dramatic upward trajectory over recent years, the gluten-free market in the United States was valued at $5.6 billion in 2013 (Llewellyn Smith 2014), and a recent Mintel report revealed similar growth in wheat- and dairy-free markets elsewhere in the American and in Europe (Brockman 2014). Its market share within the United Kingdom is expected to exceed £500 million by 2018 (Phillipson 2014), and over half of the national population—55.2 percent—now reportedly buy free-from products (McGowan 2016).

Prior to these developments, plant-based and free-from products were largely limited to specialist health stores. Today, however, it is common to find entire plant-based and free-from sections in major supermarkets, as well as numerous options on the menus of high-street restaurants and public institutions. An increasing number of everyday foods has since been reformulated under the plant-based and free-from model which has enabled eaters to continue enjoying the taste, convenience, and familiarity of these items (albeit often for higher prices). A factor that has been attributed to this increased demand has been the rise in awareness and medical diagnoses of ingredient-based sensitivities (Copelton and Valle 2005; Rubio-Tapia et al. 2009). However, recent studies reveal that consumer adoption of these foods extends far beyond reasons of medical necessity (Brockman 2014). For many, these consumption practices have instead been motivated by plant-based and free-from products becoming synonymous with "healthier" and "cleaner" foods (Crawford 2013), despite many of these foods containing high quantities of sugar as well as often being highly processed and industrially manufactured (Llewellyn Smith 2014). Such attitudes fall into the pattern Scrinis (2012) terms "nutritionism," a phenomenon that involves the narrowing of industry and public focus onto specific nutrients and recasting them as either good or bad. As a result, foods that contain or are devoid of these nutrients are viewed (and often marketed) as the better option, regardless of the other ingredients and inputs within them. A well-known example of this process is margarine (Scrinis 2012; see also Hocknell this issue).

Plant-based and free-from products have thus become viewed by many eaters as devoid of the "undesirables" of the modern food system (Brockman 2014). They are perceived as offering equivalent versions of everyday foods—i.e., comparable in taste, convenience, and familiarity—without the ethical misgivings, harmful ingredients, and seemingly "dirty" political economies of industrialized food. To allude back to the
words of Beyond Meat at the beginning of the article, free-from products are perceived as providing the “good” stuff without the “bad.” For many consumers, then, these products enable them to continue eating their favorite foods without feeling like they are eating the stuff of bad health and Big Food.

The labels on the packaging of the Beyond Chicken strips can thus be considered as much more than simply signifying an absence of particular ingredients. By calling attention to the non-stuff of these strips the consumer is invited to position this food as free from the undesirable stuff of modern (industrial) food production. As mentioned earlier, conventional meat has increasingly become associated with negative health consequences and many of these have been linked with the inputs commonly used in industrial production, such as growth hormones and antibiotics. The free-from labels on the Beyond Chicken strips actively call attention to the bad stuff of intensively reared animal meat and invite the consumer to understand the strips as being devoid of such things, both in terms of their material inputs and the less care-full political economies associated with them. Thus as I stood considering the packaging of the “chicken” strips, I came to understand their materiality through their non-stuff (i.e., the stuff that had been made absent), and perceive this absencing as a materialization of a more healthful and care-full product. Moreover, by extension I felt that by eating this product I would be materialized through its non-stuff as a more healthful and care-full eater. This was further supported by its placement within the “specialist diets” aisle, in addition to the overall environs of the Whole Foods Market, both added to my sense-making of these foods as distinct from the “normal” fare and less desirable “stuff” of modern food production, and also as the products of a “feelgood business” (Johnson 2008: 248) that promotes itself as mindful of farmer livelihoods, animal welfare, the environment, and ultimately, the well-being and culinary enjoyment of its consumers.

The Cultural Stuff of Meat

The non-stuff of the Beyond Chicken strips—or more specifically, the non-stuff that distinguishes this product from conventional meat—was “made to matter” (Evans and Micle 2011) through the free-from labels on the packaging. In this moment the strips were not meatlike in terms of their health impacts, production methods, and political economies. Yet elsewhere on the packaging other stuff were made to matter, and attempted to position the strips as very much like conventional meat. This was most salient in the description of the product as “real meat” and the promise of containing “as much protein as chicken.” This latter claim was also repeated on the back of the packaging where one of the labels stated “20g protein per
serving” undermines an illustration of a muscular arm. At the same time as being framed as devoid of the buzz-inducing ingredients of conventional meat, these labels reassure the eater that the health benefits of the latter are still present. When I read these statements the strips become meatlike through their equivalent nutritional properties, and also by offering the same culturally desirable benefits associated with these properties.

Of these benefits, body-strength was particularly emphasized and made visible. It is also inferred through the product endorsements of elite US athletes on the company’s website. The association between eating conventional meat and acquiring muscular strength has a long history in many food cultures, and has come to define meat-based corporate advertising, public health discourse, and claims to the “naturality” of eating meat (Jay 2010). The strength-giving abilities of animal protein are clearly viewed by Beyond Meat as an example of the “good” stuff of meat. As such, in this context they position their Beyond Chicken strips as very much like meat by offering these equivalent abilities, and by aligning with and reinforcing the cultural association between meat-eating and building strength. The eater is invited to see the strips as a means by which they can acquire the health benefits of conventional meat and in turn come to embody all of the desirable cultural associations that are attached to this particular physique (e.g., attractiveness, masculinity, power, virility, and self-confidence) (Bordo 1997; Calvert 2014).

Here I have shown how the plant-based products of Beyond Meat are navigating the realities, imaginaries, and expectations of conventional meat in terms of the latter’s health impacts and the methods of its production. As animal meat has become an increasingly “ambiguous good” (Chiles 2013: 473), due to its existence as a desirable yet problematic and healthful yet risky substance, a careful balance is required by APs seeking to become “meat” in consumer thinking. They must be meatlike enough to satisfy expectations regarding health properties and cultural associations, but not meatlike in the production methods and ethical dilemmas of modern protein production. As seen with other free-from foods, a consequence of this balance has been a distinct emphasis on the nonstuff of these AP products, an absence that is materialized through their packaging, their positioning within specialist aisles, and within the end products themselves. In so doing, this nonstuff is often seen as a signifier of a more healthful and careful product and another means by which the “ethically-competent” consumer (Mick and Evans 2010) may come to embody these properties through eating.

Free-from Guilt: Animals, Farmers, Earth

The term “free from” has largely come to represent food products where particular ingredients and/or industrial inputs have been excluded. However, a separate trend has emerged within the modern food system that represents another form of free-from eating. At the same time as ingredients and inputs have been removed from food products in response to the industrialization of food production, a similar exclusion has occurred with regard to their environmental and ethical footprints. In recent years consumer awareness of the animal welfare and planetary impacts associated with the modern food system has grown, as well as the often unjust political economies that exist particularly between producers in the Global South and consumers in the North. A number of schemes have evolved in response to these concerns, with fair trade arguably being the most notable. Through providing fairer prices, transparency, and claims of
sustainable and ethical practices, the products of these schemes have come to represent more care-full, place-full, and meaningful options, and as such they are often perceived as impactful—and thus guilt-free—consumption choices (Lewis and Potter 2019, Polosa, White, and Song 2013). Like the free-from examples discussed above, these are products that claim all of the good staff and none of the bad, where in this instance the “bad” represents harm to the “distant others” (Smith 1994) of Southern farmers, animals, and the environment.

Similar mechanisms exist around the products of Beyond Meat, yet notably the cardboard sleeve of the Beyond Chicken strips did not possess any visual or textual references to the environment or animals, but instead focused on the health-related aspects of the product. However, the company’s “quest for better meat” is not limited to its health benefits. A page entitled “Our Vision” on the company’s website sets out the other components of this quest as follows:

We believe there is a better way to feed the planet. Our mission is to create mainstream solutions that perfectly replace animal protein with plant proteins. We are dedicated to improving human health, positively impacting climate change, conserving natural resources and respecting animal welfare. At Beyond Meat, we want to make the world a better place and we’re starting one delicious meal at a time.

Further down the page another passage makes more explicit the connection between adopting plant-based proteins and creating a better world—it states that “[r]eplacing animal protein with meat made from plants would do wonders for human health, for the environment, for conservation of natural resources and for animals,” and goes on to claim “It’s worth a fight.” These messages are commonly reiterated by the company’s CEO in media interviews and public talks, particularly the call for swapping animal with plant-based meat as a solution to mitigating climate change. Indeed, Jacobson’s article states that it was a report on climate change in particular that provided the catalyst for Brown to begin developing plant-based alternatives to conventional meat:

Brown’s aha moment came in 2009, when the Worldwatch Institute published “Livestock and Climate Change,” which carefully assessed the full contribution to greenhouse-gas emissions (GHGs) of the world’s cattle, buffalos, sheep, goats, camels, horses, pigs, and poultry . . . . That was all. Brown needed to hear to put the plant-based McDonald’s back at the top of his agenda. Forget fast cells. Forget Frisbee. If he could topple Macworld, he thought, he could stop climate change cold. (Jacobson 2014 p.p.)

Not only are the products of Beyond Meat framed as better in terms of their health benefits but also in terms of their environmental footprint. By eliminating the animal, these APs are presented as eliminating the concerning levels of water usage, deforestation, greenhouse gas emissions, and other pollutants associated with large-scale meat production. Moreover, they also remove the potential for animal suffering that has become associated with this type of livestock farming. The products of Beyond Meat thereby claim to offer the non-stuff (i.e., the absence) of environmental degradation and ethical concerns that have come to define modern meat production; instead they offer the good stuff of health but eliminate harm done to the “distant others” of animals and the planet. The emphasis on these particular non-stuffs thus encourages consumers to view the Beyond Meat strips as a more care-full, sustainable, and better alternative to conventional meat.

Up until now I have engaged with the textual and visual sense-making mechanisms that appeared to me as a consumer when making my food choices in the supermarket. Yet these are not the only ways in which we come to know food. It is a process of both “sensing and making sense” (Evans and Miele 2012, my emphasis), and it is to these more visceral and embodied encounters with the Beyond Meat products that I now turn.

Sensing Stuff

Standing in the specialist diet aisle in the Whole Foods Market, my choice of Beyond Chicken strips was between three different flavors: southwest style, lightly seasoned, and grilled (Fig. 3). I ended up choosing grilled. My decision was both personally and research motivated: the former because I try not to pick pre-flavored foods, preferring instead to season things myself and avoid any extra levels of processing and additional (often ambiguous) ingredients. To me, the grilled strips offered the absence (or non-stuff) of this extra processing and instead enabled me to decide how to flavor them. I also picked this variety because, for research purposes, I wanted to see how “chicken”-like they tasted in their simplest form without any additional flavorings.

I moved from the specialist diet aisle and carried out the rest of my shopping. After examining the shape of the strips I had decided to use them to make a curry for dinner and, if they tasted good, as an ingredient for a quick lunchtime wrap the following day. I picked up some coconut milk, spices, and vegetables for the former, and some salad for the latter. I also collected a couple of cans of tuna as a backup for the wraps. Later that evening I set about making the curry. My first action was to open the packet of strips and feel them in my hands. They were rather chunky and uniform in shape, but quite soft; not too dissimilar in fact from chicken found in pre-made sandwiches. They did not have much of an odor and the little they had was not unpleasant, though perhaps ever so slightly
“processed” in some way. Their appearance was a chicken-like pale cream and running diagonally across the pieces were dark brown lines to simulate the grilled effect. These lines triggered a taste of charcoal as I looked at them, inspired by a visceral memory of grilled meat. The main surprise, however, came when I broke the strip in half—they shredded, as promised, pretty much equivalently to conventional chicken. As a seasoned eaters of other plant-based proteins this struck me as a significant advancement over other products; nowhere was the crumbly or rubbery texture of many meat substitutes I had previously tried. This was fibrous. This was, indeed, meatlike.

Then came the tasting; one half first. Again, like its odor it was neither pleasant nor unpleasant. It had a subtle savoury flavor mixed with a slightly charcoal taste and the same “processed” quality I associate with pre-made foods. It was just pleasant enough to consider eating on its own, although I concluded it would probably be more enjoyable with other complementary flavors. I would rarely eat conventional chicken on its own so this was by no means a break in my usual eating habits. I proceeded to make the curry in exactly the same way as with conventional meat: I browned the strips, onions, and spices in oil before adding the coconut milk and vegetables to simmer until cooked (Fig. 4). The sounds and smells of the dish as it cooked were also largely comparable. The only notable differences to this whole process were the slightly reduced length in cooking time and the convenience of not needing to keep any raw meat separate from the other ingredients as I prepared the meal. I served the curry in a bowl with a naan bread on the side. The overall verdict was a tasty and enjoyable meal. Whereas the strips did not add distinctly to the flavor of the dish, they offered a satisfying meat-like texture. If I had not known they were plant-based I would have quite likely passed them off as pre-cooked conventional chicken pieces from a supermarket.

During my visceral sensing of the strips I found the ideologies that had been constructed in the supermarket (via the packaging and aisle positioning) were both reinforced and challenged by my “bodily experience” of the product (Hayes-Connor and Hayes-Connor 2005). Perhaps most guiltily given my research area, my decision to buy tuna as a backup in case the strips did not live up to my visceral expectations is a salient example of the attitude-behavior gap that shapes many consumers’ food purchases (Achamn and Augard 2014). Despite buying into the claims of a more sustainable, healthy, and ethical alternative, as I stood making my choice in the supermarket the visceral imaginings of my planned meal were still a powerful influence over my final decision, if not in fact a priority. Also, I knew the strips did not contain any animal products and were thereby devoid of the undesirable of industrially produced chicken, yet aspects of the texture, smell, appearance, and taste called upon memories of exactly this type of foodstuff. This led to a slightly diminished enjoyment, which maybe would have been avoided if the strips had instead called upon my visceral memories of, for example, my family’s roast chicken dinners. Yet the familiarity of the strips in terms of how I was able to handle and eat them, the ingredients I could pair them with, and the
to get him enthused about a future of plant-based proteins. These promises had to taste good and they had to slide effortlessly into existing social and cultural practices. For Jacobsen (2014: n.p.), the trade-off is nonnegotiable: “If I couldn’t have meat, I needed something damn close. A high-performance, low-commitment protein recharge, good with Budweiser.”

This somewhat reflects the trade-off I negotiated when deciding to buy tuna as a backup lunch option. In this decision-making process I was acting as a “consumer” and not merely a “consumer” of ideologies and political imaginaries (Abbott forthcoming; Goodman 2016). My personal politics around food and consumption came up against my visceral expectations and preferences in the moment of my food choice, and also later during the preparing and eating of this choice. I wanted a type of meat to include in the wraps, and with this wish came a set of visceral criteria. From previous encounters I knew that the tuna I picked fulfilled these criteria, whereas having not tried the Beyond Chicken strips before I was unsure if they could perform as meat in this particular meal. Thus despite the performance I engaged with via the packaging that encouraged me to see the strips as meat, it was not until my visceral encounter with them that they became (more) so. In short, and in a similar way to Jacobsen, I could not accept the strips as “meat” until the point of eating them.

**Thinking through (Non)stuff**

To “deliver meat from plants” involves a careful balance, by Beyond Meat, of the (non)stuff of their products—on the one hand, they are presented as the stuff of meat in terms of their nutritional properties and cultural value; on the other, they are the non-stuff as to their impacts on human health, animal welfare, and the environment. Ultimately, however, the company’s approach aims to avoid any significant change to the ways in which eaters engage with and eat meat. As I found during my fieldwork, their materials and imaginaries do not ask their customers to modify how they shop for, how they culturally situate it, and the ways in which they prepare, eat, and enjoy it. These products are not presented as substitutes for meat; they are meat, as Brown regularly asserts, simply made from different raw materials and via different production methods. And notably this, they present themselves as a better type of meat by offering the visceral familiarity, enjoyment, functionality, cultural value, and convenience of conventional meat without all of its associated “bad” stuff.

At this point we may ask why Beyond Meat is taking this particular approach. It would certainly remove significant financial and technical challenges if the company were not striving to simulate meat in the ways they are, particularly their quest to
create products that are viscerally equivalent to animal meat. A major reason for the company taking on these challenges is due to current consumer attitudes toward plant-based products that are already on the market (Hock et al. 2011). Although many of these products invite eaters to perceive and engage with them as “meat” (e.g., Quorn), sales for these foods remain significantly lower in comparison with animal meat. As such the view among the latest AP companies is that greater impact on planetary issues resides in convincing meat-eaters to choose APs over animal-derived foods, rather than appealing to the culinary adventurous or the much smaller vegetarian and vegan markets. Targeting meat-eaters also presents a much higher market share: the estimated value of global livestock production is estimated at around $1.4 trillion, and animal products account for approximately 17 percent of kilocaloric consumption and 33 percent of protein consumption globally (Thornton 2010). Thus, instead of fighting the global demand for animal meat, either through the production of non-meatlike products or encouraging a reduction in protein consumption, Beyond Meat seeks to shift this demand to a “better” type of meat. Capturing the meat-eating market through this strategy not only holds the promise of a larger consumer base and therefore greater planetary returns but also vast economic returns for the company.

There are other important factors to consider with regard to the approach Beyond Meat (and other AP companies) are taking. By not requiring their customers to change the way they eat, think about, and interact with meat, these products are doing—or rather not doing—a number of things. First, as discussed above, they do not challenge people’s taste for animal proteins. Quite the contrary, from the textual and visual language of their advertising to the materialities of the end products, these APs actively encourage eaters to continue indulging in the sensory pleasures of animal meat. Second, they do not challenge certain cultural imaginaries associated with animal protein. Instead of cultivating more positive notions around eating plant-based foods in their “original” forms, they are instead adopting and aligning themselves with the same ideas of hypermasculinity, power, and physical attractiveness that are commonly associated with animal meat (Calvert 2014; Edles 2004). This ties into the point above whereby consumer tastes for animal proteins—both in the visceral and cultural sense—are being actively encouraged through making plants meatlike. As such the current and a-times problematic ideals of meat-eating are reinforced and do little to improve the cultural and visceral value of plant-based foods in their original forms.

And third, the products are presented as more healthful and care-full than conventional meat, but they do not attend completely to these claims. As Scribini (2012) notes with other autocractic foods, the performance of making certain (non)stuff matter and not matter is inherently misleading. For example, the emphasis on the stuff made absent from the Beyond Chicken strips draws attention away from the ingredients and political economies they do “contain.” Upon closer inspection, the ingredients listed on the packaging punctuate the imaginary of the strips as free from the stuff of industrially produced food—these include “chicken flavor,” dipotassium phosphate, titanium dioxide, and potassium chloride. Issues have also been raised regarding the level of salt in the southwest style and lightly seasoned flavored strips (Tepper 2015), and Kammer (2015) noted similarly high levels of seasoning, including sugar, in the company’s “Beast Burger.” He attributes this decision as an attempt to mask the added nutrient powder, suggesting that by prioritizing nutritional equivalency with conventional meat the company has compromised other health-related aspects of their products. Moreover, the focus on the environmental and ethical non-stuff of these products gives little room for explaining exactly how the company is contributing to the planetary ideals it highlights on their website and in promotional talks; nor indeed is there any information regarding the traceability, ecological footprint, or labor conditions of their commodity chains.

The promotion of certain (non)stuff in food products such as these has important implications on how consumers make sense of food products, and by extension how they make sense of themselves. On the one hand, it can distract attention away from other potentially problematic components of foods, such as the lack of transparency and nutritional concerns of food products. On the other, it can lead to what Scribini (2013: 46) terms “the nutritionalized self” whereby food becomes known to the consumer predominantly through the presence (or absence) of particular stuff. This highly selective overview, mediated by food companies and marketing teams, is often then used by consumers to reimagine themselves as more healthful, care-full, and “better” eaters despite the food products not always living up to these claims.

An important observation of exploring the (non)stuff of Beyond Meat’s products is the recognition by their developers that visceral engagement is integral to how eaters understand food. The millions of dollars spent on making plants look, feel, taste, sound, and smell like conventional meat is testament to this importance (Lei.zen 2013). Despite more eaters wanting meat with less of the “bad” stuff, for many this is still not enough if the end product does not meet specific taste requirements and does not provide the same visceral experiences. Indeed, more than this—it appears that such a product cannot and will not truly become meat without these aspects.
The direction being taken and the improvements already made by companies such as Beyond Meat to their products’ sensory attributes could pose a more considerable threat to the current meat industry than previous attempts within the alternative protein sector. If the world cannot and will not yet give up conventional meat, then perhaps redefining our understandings of what constitutes “meat” without yet disturbing our taste for it may prove an effective first step toward more sustainable protein consumption. However, at the same time care must be taken to not simply view APs as inherently sustainable and healthful, nor as the only solution (e.g., Deyres and Voodouw 2019), rather they should be considered and problematized within the context of both their opportunities and impacts on the current system as they develop.

Viscerality, Materiality and Rethinking Food

Alternative proteins highlight the importance of attending to visceral encounters in food research, not only to reveal the ways in which these experiences contribute to (and are arguably integral to) things becoming “food,” but also to explore how ideological and visceral meanings cohere together in the moments of food choice. As such, this article adds to a growing body of literature focused on examining such encounters and similarly advocates for an extension of visceral autoethnographic engagement both within and beyond food-related research (Hayes-Conroy 2013; Sweet and Ortiz Escalante 2015). It also seeks to draw attention to the growing emphasis on the non-stuff of food as an important part of the materiality of foods, consumer identities, and the moral politics of eating today. Consumer awareness of, and preference for, what foods do not contain is a growing and lucrative space within the food system, and reinforces the popular model of impact- and guilt-free consumption that claims to be kind to the planet while remaining kind to capitalism (Cuthman 2015). Continued discussion is needed to reflect critically upon this model, and a focus on the non-stuff of food provides an important and little researched avenue for conducting this work and for further unpacking the everyday relationship in contemporary food systems.

Acknowledgments

I would like to express gratitude to Emma-Jayne Abbets, Melissa Caldwell, and Cristian Cederna, whose insightful comments and suggestions have vastly improved this article. Many thanks also to my interviewees for their time, and to the two anonymous reviewers for their helpful comments. This work was supported by a PhD scholarship from the Economic and Social Research Council [grant number ES/K500574], and a Small Grant for Postgraduate Research from the King’s College London Faculty of Social Science & Public Policy (SSPP) to support fieldwork.

NOTES
1. 1. Beyondmeat.com/about.
3. Despite becoming more mainstream, many plant-based and free-from products remain higher in price than their “regular” counterparts and as such present significant economic barriers to many eaters following these diets (Stevens and Rashid 2008; Scott-Thomas 2014).
5. www.beyondmeat.com/about.
6. Consumer awareness of these issues has increased over recent years, facilitated in part by the campaigns and exposés of animal welfare groups (Bec, Banley, and Roberts 2014), and also food scares such as BSE and avian flu that have brought public attention to the practices of intensive animal farming.
7. As well as being stocked in higher-end retailers like Whole Foods Market, Beyond Meat’s products have since expanded their availability into mainstream supermarkets such as Walmart, Target, and Safeway across the United States.
8. For clarification, the “chicken flavor” is listed as vegan and the dipotassium phosphate, titanium dioxide, and potassium chloride are stated as comprising “0.5% or less” of the product.

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11.2 Appendix 2: Ethical approval from King's College London

18th December 2013

Alexandra Sexton
Department of Geography

Dear Alexandra,

REP(GSSH7M)/13/14-13 - Accumulation by Simulation: In-vitro meat, food security and the materialisation of biopolitics

I am pleased to inform you that the above application has been reviewed by the GSSH7M Research Ethics Panel that FULL APPROVAL is now granted with the following provisos:

1. Information Sheet and Consent Form:
   i. Please provide a specific date, after which participants may no longer withdraw their data from the study. To avoid any last minute complications this date should be at least two weeks prior to submission of your final report.
   ii. Anonymity should be offered as the default unless participants agree to be identified. This should be made clear on the information sheet and participants should be given the opportunity to express whether they wish to remain anonymous or be identified in the final report via the consent form.

2. Information Sheet for Interviews:
   i. If you are video recording interviews, please make it clear that you will be doing this with the permission of the participant.

3. Information Sheet for focus groups:
   i. Please make it clear that although participants can withdraw it may not be possible to withdraw their data in its entirety due to the nature of focus group recordings.

4. Information Sheets:
   i. Please remove the statement relating to the standard of care you receive as this relates to medical studies.
   ii. Please include your Supervisor's full King's College London contact details

5. Consent Form:
   i. Please ensure that all consent form statements are above the Participant's statement.

6. Re-Use, Use and Retention form:
   i. Please remove any unnecessary template sections from this document.
For your information ethical approval is granted until 18/12/16. If you need approval beyond this point you will need to apply for an extension to approval at least two weeks prior to this explaining why the extension is needed, (please note however that a full re-application will not be necessary unless the protocol has changed). You should also note that if your approval is for one year, you will not be sent a reminder when it is due to lapse.

Please ensure that you follow all relevant guidance as laid out in the King’s College London Guidelines on Good Practice in Academic Research (http://www.kcl.ac.uk/college/policyzone/index.php?id=247).

Ethical approval is required to cover the duration of the research study, up to the conclusion of the research. The conclusion of the research is defined as the final date or event detailed in the study description section of your approved application form (usually the end of data collection when all work with human participants will have been completed), not the completion of data analysis or publication of the results. For projects that only involve the further analysis of pre-existing data, approval must cover any period during which the researcher will be accessing or evaluating individual sensitive and/or un-anonymised records. Note that after the point at which ethical approval for your study is no longer required due to the study being complete (as per the above definitions), you will still need to ensure all research data/records management and storage procedures agreed to as part of your application are adhered to and carried out accordingly.

If you do not start the project within three months of this letter please contact the Research Ethics Office.

Should you wish to make a modification to the project or request an extension to approval you will need approval for this and should follow the guidance relating to modifying approved applications: http://www.kcl.ac.uk/innovation/research/support/ethics/applications/modifications.aspx
The circumstances where modification requests are required include the addition/removal of participant groups, additions/removal/changes to research methods, asking for additional data from participants, extensions to the ethical approval period. Any proposed modifications should only be carried out once full approval for the modification request has been granted.

Any unforeseen ethical problems arising during the course of the project should be reported to the approving committee/panel. In the event of an unforeseen event or an adverse reaction a full report must be made to the Chair of the approving committee/review panel within one week of the incident.

Please would you also note that we may, for the purposes of audit, contact you from time to time to ascertain the status of your research.

If you have any query about any aspect of this ethical approval, please contact your panel/committee administrator in the first instance (http://www.kcl.ac.uk/innovation/research/support/ethics/contact.aspx). We wish you every success with this work.
Yours Sincerely,

[Signature]

Annah Whyton
Research Support Assistant
11.3 Appendix 3: Information sheet and consent form

INFORMATION SHEET FOR PARTICIPANTS
(Semi-structured interviews)

REC Reference Number:

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Research Project: In-vitro meat, food security and the materialisation of biopolitics

I would like to invite you to participate in this doctoral research project. You are under no obligation to participate if you do not wish to; choosing not to participate will not disadvantage you in any way. Before you decide whether you wish to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask the researcher if there is anything you would like further clarification on or if you would like more information.

Research Context and Background
The past five decades have seen a rising global demand for meat-based products, a trend which has contributed significantly to a variety of environmental, moral and health-related issues around the world. A possible ‘silver bullet’ solution to address these concerns is in-vitro meat, an innovation that utilises stem-cell technology to artificially cultivate meat in laboratories. The aim of this project is to investigate this phenomenon as it develops and explore what this means for our understanding of/relationship with meat and how in-vitro meat will play a part, if any, in a more sustainable future of meat production/consumption.

Participation in Study
If you decide to participate in this study please find further details about the methods and processes involved below:

Semi-structured interviews:
- Interviews will be conducted either at the site of the participant’s profession or at a suitable location agreed between researcher and participant; the duration will be dependent on the participant’s availability. Interviews will be recorded, subject to the participant’s permission. Recordings of interviews will be deleted upon transcription.

Participant Consent
- If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form.
- A decision to withdraw at any time, or a decision not to take part, will not affect the standard of care you receive.
- As a participant you maintain the right to withdraw your participation and your data at any point up until your data has been transcribed for the final report. In the event of you wishing to withdraw from the study, all of your data will be removed from the final report and permanently deleted.
- All participants have the right to remain anonymous as part of this study; please make your preference clear by selecting the appropriate option on the Appendix Form One.
If you agree to take part you will be asked whether you are happy to be contacted about participation in future studies. Your participation in this study will not be affected should you choose not to be re-contacted.

Data Handling and Final Report
- All handling of data as part of this research project will be done in compliance with the UK Data Protection Act 1998.
- Data from anonymous participants will remain anonymous throughout the study and in any subsequent publications and uses.
- Data collected and personal information as part of the study will not be shared with external third parties.
- A copy of the final published thesis will be made available to any participant who expresses an interest in receiving one.
- Anticipated plans for dissemination/publication of findings include formats such as journal/media articles, books, book chapters and conference papers.

Key points
- It is up to you to decide whether to participate or not in this study.
- You are free to withdraw from the study at any time up until the transcription of data for use in the final report, and without giving reason.
- If you have any questions or require more information about this study, please contact the researcher using the following details:

  Alexandra Sexton, PhD Candidate  
  alexandra.e.sexton@kcl.ac.uk  
  Department of Geography  
  Room K4.10  
  King’s College London  
  Strand Campus, Strand  
  London WC2R 2LS

- If this study has harmed you in any way, please contact the research supervisor using the following details:

  Dr. Mike Goodman  
  michael.k.goodman@kcl.ac.uk
APPENDIX FORM ONE: USE, RETENTION AND REUSE OF PARTICIPANT CONTRIBUTIONS

STUDY TITLE
Accumulation by Simulation: In-vitro meat, food security and the materialisation of biopolitics

RESEARCHER RESPONSIBLE FOR THE PROJECT
Alexandra Sexton

RESEARCH ETHICS COMMITTEE REFERENCE NUMBER
GSSHM REP

NAME OF PARTICIPANT


1. IDENTIFICATION
I agree to being identified and personally associated with my contribution in this study and in any subsequent publication and use.

Yes ☐

I do not agree to being identified and personally associated with my contribution in this study and in any subsequent publication and use. My name must be removed and my comments made unattributable.

Yes ☐

2. ARCHIVING AND SUBSEQUENT USE
I agree to my

Written contribution ☐
Audio recording ☐
Video recording ☐
Transcript ☐
None ☐

being archived in a public repository for use by other researchers.

3. COPYRIGHT
In order for us to make full use of your contribution and to copy, reformat and reuse it, it is necessary that you assign your copyright to King’s College London, and the researcher responsible for this project.

I hereby assign the copyright in my contribution to King’s College London, and the researcher responsible for this project

Signed: ________________________________

Date: ________________________________

Signed for the College: ________________________________

(Continued overleaf)
4. **SPECIAL CONDITIONS**

Should access to your contribution be restricted for any period of time? If so explain why.

*Please note that King’s College London is a public body and is subject to the Freedom of Information Act 2000. This means that the College has a general legal duty to make its information public and this can include research data. Personal and confidential material is excluded though and need not usually be disclosed.*
CONSENT FORM FOR PARTICIPANTS IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: ___________________________________________

King’s College Research Ethics Committee Ref: _________________

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanations already given to you, please ask the researcher before you decide whether to participate. You will be given a copy of this Consent Form to keep and refer to at any time.

Please tick or initial

• I understand that if I decide at any time during the research that I no longer wish to participate in this project, I can notify the researchers involved and withdraw from it immediately without giving any reason. Furthermore, I understand that I will be able to withdraw my data up to the point of it being transcribed for use in the final report.

• I consent to the processing of my personal information for the purposes explained to me. I understand that such information will be handled in accordance with the terms of the UK Data Protection Act 1998.

Participant’s Statement:

I __________________________ agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Information Sheet about the project, and understand what the research study involves.

Signed Date

Investigator’s Statement:

I __________________________ confirm that I have carefully explained the nature, demands and any foreseeable risks (where applicable) of the proposed research to the participant.

Signed Date

(Continued overleaf)
(Please tick or initial)

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<td>I agree that discussions in the focus groups should remain confidential between participants</td>
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<td>I agree that the research team may use my data for future research and understand that any such use of identifiable data would be reviewed and approved by a research ethics committee. I understand that all anonymous data used in this project will remain so in future research projects.</td>
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<td>Yes</td>
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