

Cultured meat in between Anthropocene crises: A perspective from ecological feminism

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Abstract: Cultured meat is an emerging food technology that promises to revolutionise not only meat production techniques but also the relations between human beings and other animals, and the rest of the biosphere. Cultured meat might be read as a food innovation for the Anthropocene, since it addresses ecological, health and inter-species issues that characterise this historical phase and its problematisation. I propose a reading of the potentiality and pitfalls of this emerging technology based on a perspective of political ecology, which I believe fundamental in highlighting the social shaping of innovation and its embeddedness in wider symbolic and material dynamics shaped by power. In particular, I engage with feminist debates over science, technology, inter-species relations and the issue of ecological crisis to put into light the highly ambivalent nature of this “hybrid” object. Given this complexity, I argue for a methodological approach to technoscience innovation and the shaping of future food imaginaries that draws on processes of mapping to stay close to marginal, unrepresented, and yet politically crucial voices.

Keywords: Cultured meat, Anthropocene, biocapitalism, political ecology, (trans)feminism

1. *Introduction. Contextualising an emerging food technology*

Cultured meat, also called “cultivated”, “cell-based” or (misleadingly) “synthetic” meat is an emerging food technology based on the proliferation of animal cells in bioreactors due to culture mediums. Biopsies are taken from living or dead animals, from which staminal cells are identified that, in the right conditions, can divide and multiply relatively rapidly. These are made to mature and differentiate in muscle or fat cells, making it possible to produce large quantities of animal protein starting from a very small mass of biological material (Melzener *et al.* 2021). The cells proliferate in thread-like strands and are then put together in the form of burgers or other similar unstructured products; alternatively, they can be distributed on a scaffold or 3D printed for better resembling meat in the form of steaks. The promises attributed to this technology are multiple, and it is presented as one of the most disruptive food innovations of the present (Guthman and Biltekoff 2021), not only, and possibly not mainly, in itself but rather for the role that it is taking up in future

imaginaries of food (Driessen and Korthals 2012) and the “promissory narratives” that technoscience deploys within the challenges of the multiple crises of the present (Stephens 2013; Jönsson 2016).

In this article I propose that cultured meat is peculiarly imbricated in the Anthropocene, understood both as narrative and as a condition: it emerges in a space where known relationships between human beings and the rest of nature are put in crisis (Haraway 2015). The multiple planes on which it is justified, narrated and contested concern crucial aspects of the Anthropocene. The most evident regards environmental and climate crises. It is said – although not uncontroversially – to minimise the environmental impact of meat production, with reduced soil, energy, and resource use (Tuomisto 2019). This would also allow to face emerging challenges related to climate instability and population growth: it would provide nutritious food to social groups in geographical areas that are not fit for food production, thus addressing issues of food security. Further, as a growing world population and the Westernisation of lifestyles are expected to put further strain on planetary ecosystems, cultured meat would provide a food production technology implementable almost everywhere with little resources. The second concern is health. Human health seems to be severely compromised by current rates of meat consumption, especially in terms of antibiotics resistance and non-communicable diseases, but also pandemics due to the degradation of wild habitats and the closeness of humans and farmed animals (Parker 2020). In the present, human physical and mental health conditions are the embodied expression of ecosystem and social collapses that link human and planetary destinies, showing their interdependence (Dal Gobbo 2023a). Thirdly, interspecies relations are a key element of this picture: the way human beings relate to nonhuman animals is certainly expression of wider categories and hierarchies separating humanity from nature and supporting its instrumentalization and appropriation. Cultured meat promises to “liberate” animals from suffering and domination, since it does not – in principle, although often not in practice – require the killing of animals (Lo Sapio 2019). Finally, the role of technoscience as a medium that shapes relations between humans and the rest of nature, and planetary destinies, is a key aspect of conceptualising the legitimacy and acceptability of cultured meat for the public, as well as a key part of Anthropocene narratives (Dal Gobbo and Leonardi 2020).

Despite a rather monolithically positive construction of cultured meat as a win-win solution not only by technoscience but also by mainstream discourses and marketing, the public sphere has been traversed by sometimes strong and heated controversies and political mobilisations across the scientific community and publics (Driessen and Korthals 2012; Dal Gobbo and Bertuzzi 2024).

The Italian case of the 2023 law that bans “synthetic products” from production, consumption, and distribution is probably the most telling (see Dal Gobbo 2023b). It produced a highly polarised debate, divided between subjects who supported cultured meat’s potentials for facing the multiple ethical and ecological challenges of meat production, and the ones who strongly opposed this novel food because of supposed threats to health, traditions, culture, and local economies. This debate is marked by a rather clear political siding: science’s proposal for technology is supported by leftists, while the right embraces a more “political” positioning with regards to this innovation, opposing it mostly out of value propositions rather than on scientific grounds. It has also been populated mainly by white privileged men. Beyond the specificities of the Italian context, this polarisation seems to put into light key questions pertaining to how the Anthropocene narrative shapes and constrains the possibility to truly promote just and sustainable food transitions. Technoscientific knowledge has supported cultured meat as neutral and apolitical (Paulson 2024) and, by consequence, the opposing public as simply ignorant and/or ideological (Neresini *et al.* 2024). This has delegitimated dissent and especially undermined the possibility of an open and informed democratic debate around the benefits and risks of this technology, and its contributions in terms of really meeting objectives of food sustainability and justice.

The aim of this article is to propose a reading of cultured meat from the lens of a feminist and intersectional political ecology, reflecting on its transformative potentials and risks with regards to existing power dynamics. These are understood as articulated along the multiple axes of modern-capitalist domination, and especially: gender, race, class, species, ability, etc. Feminism gives crucial contributions for the disruption of normative constructions of technological innovation as an inherently good and neutral instrument for human development, showing that science and research themselves are characterised by positionality and interests, as well as by systemic power relations that determine its pathways (Hartsock 1998; Avelino *et al.* 2019). The specific debates that I will draw upon includes feminist STS (Coole and Frost 2010) and a consolidating literature that holds together feminist, ecological and antispeciesist concerns (Gaard 2002; Timeto 2024). Adopting a political ecology perspective (Pellizzoni 2023) will help me read the multiple Anthropocene challenges considered above as intrinsic to the very nature of capitalist modernity, rather than “externalities” or incidents: its separation between “Nature” and society, its forms of labour and value, its expropriation and exploitation of life itself (Moore 2015).

The key questions driving my investigation are: To what extent might cultured meat disrupt or reinforce the patterns of domination that foreground multiple Anthropocene crises? And if the systemic drive of climate and oth-

er environmental crises are processes of capitalist accumulation and growth (Moore 2016): what role might it play within this logic? These questions hold a wider relevance in the context of the debates over the breaks and continuities that the Anthropocene epoch represents *vis à vis* the previous “modernist” phase of capitalist development (Povinelli 2017). In line with Stengers’ (2005) “cosmopolitical proposal”, the aim of this inquiry into cultured meat is not to determine once and for all whether this technology might or might not be beneficial (although a critical positioning will be developed), but rather to “slow down reasoning” (994), opening and complexifying the perception around this ontologically ambiguous object.

2. *Questioning or embracing technoscience? Inquiring into cultured meat from feminist perspectives*

The Anthropocene condition calls on human beings, especially those located in the global north and other positions of privilege, to re-think their situatedness in planetary ecologies, as well as the relations that they establish among themselves and with other beings. Feminist and trans-feminist strands of thought ranging from feminist STS and new materialism, through to eco-feminism and feminist political ecology have been at the forefront of these debates since decades (Coole and Frost 2010; Haraway 2016; Salleh 2017). These considerations, albeit often developing within the sphere of ecology and more-than-human relations have been interweaved with the more or less poignant critique of the capitalist political economy and its relations of (re)production. The crucial concern over the sphere of reproduction and the body has been an important leeway for a dialogue with antispeciesist and animal liberation debates. Often the parallel between the exploitation of human and non-human bodies has become the terrain to build alliances and common claims (Balzano 2021; Timeto 2020). One key discussion in this context has revolved around technology and the role that it might have in the context of these necessary transformations (Stephens 2024). Feminist lenses on food tech and innovation (see Lee 2018) have therefore a threefold interest: a) inquiring into the ontologies and epistemologies at the heart of cultured meat and evaluating the political ecologies that they foreground, including interspecies relations; b) considering their embeddedness into capitalist forms of value and labour; c) evaluating the role of technoscience therein. It is unnecessary to underscore that these three spheres are interrelated, so that it is not possible to consider them apart. The rest of this section is devoted to developing a theoretical and methodological reflection around the tools for investigating and think-with food innovation and technoscience in the Anthropocene, one that takes con-

troversies and the uncertainty of science as the starting point for a transformative politics of liberation and just transition (Lawhon and Murphy 2012).

2.1. *Hybridity and overcoming “Nature” as a space of domination*

Probably one of the reasons why cultured meat has the capacity – at least in some specific spaces and times – to ignite controversies is that it introduces an “ontological disturbance in which the things on which we rely as unexamined parts of the material fabric of our everyday lives become molten and make their agential force felt” (Whatmore 2009: 587-8). It puts into question established relations between human beings and non-human animals, offering, for the first time, the opportunity to eat meat without sacrificing their life (Stephens 2013). But it also introduces a further level of ‘strange(r)ness’: edible matter is no longer produced by and in an organism, but rather from cells. It is biological matter without a body, a tissue without an organism... a Body without Organs (Deleuze and Guattari 2014)? As such, it opens questions about the relationship between animal life and individuality and subjectivity. It contributes to de-stabilise an already shaky distinction between what is natural and what is artificial: cultured meat is certainly made by humans through highly technologized procedures, but developers claim that growth happens thanks to natural raw materials and that it just mimics what happens in nature. As such, this technology challenges the ontological foundations of the distinction between what is dead and what is alive, what is human-made and what is nature-made. It truly is a “hybrid” (Latour 1993) that lays bare what is already true for contemporary industrialised food production: that within modern capitalist ecologies of re/production there is no absolute distinction between humanity/technology and nature.

Feminist thinking, especially that engaging with ecological issues (Merchant 1989; Rocheleau 1996; Salleh 2017; Mies and Shiva 2014) and technoscience (Haraway 1991, 2016; Alaimo 2008; Bennett 2010), has for long underscored that the roots of degrading socio-ecological relations and climate crises are to be found in so-called “cartesian dualisms” that separate mind from body, humanity from nature, spirit from matter, man from woman, human from animal, culture from nature, productive from reproductive labour, civilised from savage, etc. (Plumwood 2003). According to a widely accepted reading, such hierarchical divisions would be the ideological (and practical) justification of the domination of men over women and of humanity over the rest of nature: the first “major” term would be able to appropriate, use and dispose of the second, “minor,” one which is deemed inferior (Deleuze and Guattari 2014). This process – albeit dating far back – finds its most forceful articulation in

modern capitalism, also thanks to emerging colonial relations (Salleh 2017; Maldonado-Torres 2007). In this moment, in fact, a stable and neat boundary between subject and object would be traced, distinguishing deserving life from an undeserving and largely dead matter that can be appropriated and used at will (Dussel 2018). This process of splitting has been interpreted as patriarchal since – throughout history – it has been the means for subjecting women’s reproductive capacities to men’s will. It also cuts across ecological, interspecies and race relations, so it can be understood from intersectional perspectives (Timeto 2020).

Precisely for their marginality, their positioning on the “minor” side of this dualism, women have been able to show the betrayal at the heart of the construction of the modern subject as a disembodied, abstract, white, able, and middle-class man. They opened the way for subjective positionality to become an imaginative space: one that would promote socio-ecological transformations based on the recognition and affirmation of difference and partiality. Starting from their historical attribution to the sphere of nature, a strategic alliance between women and the rest of nature has been proposed (Mies and Shiva 2014). Showing the primacy of reproduction (normally attributed to women, racialised subjects and non-human nature) on production has been a way of undermining the ideological construct that naturalised women’s inferiority compared to men (Barca 2020; Salleh 2017). Feminist stances have often intersected with species issues, for the common attribution of both women and non-human animals to the category of Nature has been part of the reinforcement of their common domination, subjection, and the reduction of their bodies to mere matter functional to social reproduction (Gaard 2002). Feminism and vegetarianism – intended as a stance against the appropriation and exploitation of non-human animal bodies for human eating/pleasure – are thus linked. Meat-cultures are, on their part, masculine, reinforcing the idea of domination and the possibility to make use of bodies as if they were purely objects. The female body itself has been animalised and reduced to “pieces” that, much like meat, are (sexually) enjoyable by men. Most importantly, women’s bodies have been understood and valued in as far as they were functional to childbearing, perpetuating the labour force, family lineage, class privilege, etc. (Adams 2015). Vegan eco-feminism has also underlined the intrinsically *ecological* implications of the women/animal subjection, showing how environmental destruction is weaved in the system of domination that objectifies all that is not identifiable with the hegemonic subjectivity of the able, white, male, owner subject (Gaard 2002).

The key root of ecological degradation would lie in the identification of the biosphere and of feminised, racialised, animalised bodies as a “Nature”

separated from humanity, measurable, abstract, appropriable at will. A process of “disenchantment” that has voided nature from its intrinsic worth (Federici 2021) and which would not recognise the inherent vitality of matter (Bennett 2010), the limits of the biosphere (Stephens 2024), and thus an inherent clash between the logics of planetary reproduction and those of capitalist accumulation (Dal Gobbo 2024). On these premises, it has been proposed that overcoming the nature/society dualism and imagining human and non-human beings as pertaining to one ontological plane, one “web of life”, where matter would be vital again, would be conducive to more horizontal, less dominative, socio-ecological relations (Moore 2015; Coole and Frost 2010; Bennett 2010). So, while the modern-capitalist shaping of, and detachment from, nature has been seen as a key contribution to ecological and interspecies crises, critical (eco)feminist thinking has been careful to underscore that human relations with the environment and other beings are always-already shaped by culture, hence, there is no pristine natural bond to be re-established. To the contrary, “nature” has become the ideological justification of domination (Gaard 2017, 2020). Debunking the idea that society/culture/technology and nature pertain to two different domains meant for women claiming the space and right to be *both* nature and society, not simply nature domesticated by society.

Part of the feminist debate has therefore *embraced* natural-technical hybridity as a space of liberation and de-naturalisation of such bonds of oppression. Technoscience has been, for some, a key part of this: it made concrete the un-closeness and un-naturality of bodily existence, meaning that any appeal to a biological determinism in outlining gender roles and life/reproductive practices was debunked (e.g. Haraway 1991; 2016; Barad 2003; Alaimo 2016). Haraway’s (1991) embrace of the cyborg as a space of hybridization the natural and artificial is one of the most significant examples of this optimistic embrace of technology as a space for the re-invention of the (post-)human beyond the limits of humanity itself. It gave the opportunity to go beyond the dualisms and rigid oppositions of self/other, subject/object, human/non-human that were part of the project of domination in modernity (Balzano 2021). Xenofeminism (Hester 2018) is possibly the highest expression of this approach to technoscience as transformative tool, since it promises to de-link the very reproduction of (human, animal) life from the biological restrictions of the gendered body. Current reproduction technologies, as well as less diffused ones such as ectogenesis (enabling biological reproduction outside human bodies) or the shaping of masculine bodies to make them able to carry out tasks that would be attributable to feminine bodies only (e.g. breast-feeding), would allow to rethink parenting and the mothering role therein, to go beyond the very idea of the “family” and detach reproduction from the heterosexual couple with its

fixed roles (Balzano 2021). This would imply emancipation for women but also for humanity as such, allowing to overcome natural limits or, maybe better, the *naturalisation* of existing social relations.

From this perspective, the ontologically ambiguous, hybrid, status of cultured meat might contribute to push beyond dualisms and the natural-artificial divide, unveiling how the “naturalness” that justifies the relations of domination involved in meat production is indeed a social construction (Gaard 2002). As seen, cultured meat disrupts established natural/artificial boundaries as well as the necessity of domination on other animals for eating. It draws on a vitality inherent in cells that partly challenges a modernist idea of materiality as dead and appropriable (Bennett 2010). This might politicise issues around diet, food production, inter-species and ecological relations, re-embedding the “natural” within a socio-ecological sphere of co-emergence and mutual accomplishment. Nature is no longer a separate and transcendent sphere that might dictate what is right or wrong to do, based on universal and unchanging rules. As such, it has the potential to reshape the relations of domination that have historically traversed meat eating, towards less violence and a way of eating animals that does not involve death. Technoscientific innovation would in this sense be liberatory, allowing to produce animal foods without the deep and violent involvement of their bodies, their exploitation, and their killing (Stephens 2015: 161). Possibly, this technology might also disrupt the identification of meat-eating with masculinity and of the woman’s body with the non-human animal as body-object whose task is procreation or being “slaughtering meat” (Adams 2015): a disembodied and dematerialised form of meat-production promises to de-link it from the concrete, factual, “carnal” elements of traditional farming (Guthman and Biltekoff 2021). Animal protein consumption might then be re-thought beyond the dualistic and appropriative meanings that have been shaping it throughout capitalist modernity. Technoscience would contribute to destabilise existing boundaries and contribute to the emergence of post-human assemblages and alliances, characterised by complexity and by the necessity of “staying with the trouble” (Haraway 2016) of an imbricated world.

2.2. *The capitalist quest for control over life: from reproduction to the bioeconomy*

From a feminist perspective, nevertheless, it is also possible to adopt a critical stance on cultured meat, emphasising that although technologies *can and do* transform socio-ecological and interspecies relations, they are also never neutral (Almazán and Prádanos 2024). The power-value networks in which they emerge are characterised by inequalities and practices of domination,

to which specific ontologies and epistemologies correspond. These may re-inscribe, rather than liberate, bodies, as well as perpetuate socio-ecological injustices and unsustainability.

Ecofeminist perspectives look at the intersection of ecological crises with gender, but also racial, class and species injustices. Critique to the unsustainability of the capitalist food system is not rooted in its *technical* or even technological organisation. Rather, the focus is on the ways in which capitalist relations of re/production are intrinsically prone to the extraction of reproductive labour from feminised, racialised and animalised bodies: one that is considered as infinite and free, and thus freely appropriable (Moore 2016). As this labour is plied to capital's demands of infinite growth and accumulation, the exhaustion of these "forces of reproduction" (Barca 2020) ensues. This process is mirrored in ontological and epistemological assumptions. Ecological crisis is, in fact, seen as the result of a patriarchal organisation of material and symbolic domains that favours abstraction, quantification, splitting, simplification and exchange over materiality and the embodied, organic, intermingling with the qualities that conjure to determine the worth (or use value) of things. Masculine-centred ontologies favour an ever-increasing *separation* between humanity and nature, whereby technoscience becomes the means for the realisation of human freedom through the domination not only of 'external' nature, but also of human nature itself (Adorno 1973). Such an approach is reflected in policies, markets and technologies that have become hegemonic in the last decades: from chemical inputs in the so-called "green revolution" to genetically modified crops (Giraldo 2018). Innovation aims at increasing yields and productivity, but it has been demonstrated to fail on social, ecological, health planes in the long run.

Ecofeminist thinkers have for long proposed a different philosophy for the cultivation of ecologically sound and socially just relationships with the land (Shiva 1988). This would be based on valuing local knowledges and technologies that emerge from the concrete labour that communities carry out in their daily practices of subsistence. In this, the labour of women is central because they are the ones who are mostly in charge of maintaining ecosystems through agriculture and forestry and water management, as well as of reproducing bodies and caring for their wellbeing (Resurrección 2017). Limit and sufficiency are values rather than hindrances from this perspective (Salleh 2009; Mellor 2019), since human and non-human flourishing are seen as based on cooperation and *commoning* both within our own species and across species (Federici 2019).

From this perspective, cultured meat seems the continuation of a project of domination, rather than the opportunity for liberation (Lee 2018). The most evident aspect would refer to the susceptibility of this food technology to pat-

ents, privatisation and continuing injustices in access to nutritious and safe food across the globe (Clapp and Isakson 2018). But on a more philosophical level, the idea of producing in a closed environment food from cells recalls the dreams of control, simplification and abstraction that are typical of the whole logic of capitalist, patriarchal, industrial food systems. Since Churchill's visionary proposition of culturing meat, the production of body-parts has always been utilitarianly reified as a way of making production processes more efficient (see Jönsson 2016). Stem cells, with their pluripotency and capacity to reproduce (possibly indefinitely), recall an imaginary of unconstrained abundance that might indeed produce its opposite: a scarcity produced by the enclosure of knowledge and technologies. And if, as Adams (2015) suggests, there is a coincidence between carnist culture and the objectification of female bodies as made up of juxtaposed "pieces", one might wonder whether cultured meat might indeed support the idea of life as made of discrete parts that can do without the organism as life form. From this perspective, cultured meat does not seem to change the ways in which life itself is valued, its objectification, its instrumentalization to the imperatives of profit and accumulation; it does not conjure to the creation of a culture where animals are considered subjects seeking for self-determination (Reggio 2022), or subjects of rights (Regan 1983). In fact, a future and hypothetical industrial production of cultured meat is welcomed as a way of further controlling biological processes, often in a mechanised way, and in so doing improving standardisation, efficiency, control over error and therefore food safety and hygiene. Indeed, one of the strengths advertised of this novel food is precisely its being "efficient" and avoiding the "waste" of rearing a whole animal – a whole living being – in order to produce, sell, and consume only parts of it (Jönsson 2016).

Surely, reasoning around access, distribution and property of technology is crucial for social emancipation. Yet what is also important are the ontologies, epistemologies and deeper logics that technologies embody. This product is not only mostly supported by financial investments from venture capital, but it also strongly relies on expert scientific knowledge and complex infrastructures that cannot be replicated easily by communities. Also, these processes involve further detachment of human beings from their very conditions of existence. Hence, from a point of view that favours sufficiency as well as access, autonomy and control by end-users, i.e. "conviviality" (Illich 1973; Gorz 1990; Vetter 2018), this technology appears unfit for both human self-determination *and* for rebuilding socio-ecological relations based on a non-anthropocentric respect of the intrinsic qualities and logics of life. From this point of view, a technology by itself will not change the *overall* socio-ecological relations nor their logic, hence even if we were to face partial improvements in terms of environmental

indicators and animal welfare, the separation, the quest for appropriation and the deployment of animals-as-objects and food as commodity might not be changed at all.

This goes for the theme of animal liberation too (Weisberg 2015). Reducing the suffering of animals is certainly an important endeavour (Singer 1975). Nevertheless, cultured meat does not – despite its own self-narrative – completely bracket out the animal body from meat production. Foetal bovine serum remains an important ingredient for culture mediums, which implies suffering and death for cows and calves. Despite the promises of overcoming this through the advance of research and the development of technology, results are lagging, implying that the achievements of science are relatively uncertain and shaky (Stephens 2015). Second, the need to continuously extract cells from living, able and “fitting” animal bodies confronts us with their materiality, the question of reproduction, of death, of what their destinies will be when they are no longer “useful” for the system (Ferrari 2024). In a political economy based on valorisation and accumulation it is difficult to imagine that technoscience achievements will allow a transformation of inter-species relations in the wider sense of re-positioning the animal body within a different hierarchy of being (Timeto 2020). Indeed, the narratives of efficiency and non-waste that underlie cultured meat production seem to further reinforce a utilitarian understanding of animals’ existence. Finally, valuing this technology might reinforce rather than diminish the value socially attributed to meat consumption.

Critical reflections over the “bioeconomy” or “biocapitalism” might be useful to better qualify from a different perspective and situate what has just been said (Birch and Tyfield 2013). While the idea of deploying stem cells and their productive capacity in production does seem to open up the recognition of the vitality of matter and its power of being (Bennett 2010), if one considers how this happens within capitalist processes of value production, it might be argued that food technologies are one of the most evident expressions of the capitalist drive to the real subsumption of life itself (Fumagalli and Morini 2009). In the context of an impending poly-crisis that invests the whole capitalist system on ecological, economic, human and social planes, conquering the very micro processes at the heart of life reproduction becomes the promise of a new frontier for accumulation (Cooper 2008). And indeed, as Cooper herself notices, neoliberal economics and governance rely on the con-fusion of human and non-human, while favouring deeper control of humans on matter and the principles of life reproduction. Technoscience plays an important role in “intensifying embroilments” between the natural and the artificial (Pellizzoni 2015; 2019). Now the confines between what is natural and what is artificial and human-made tend to vanish, there is a positive *embracing* of the openness

and malleability of matter, of the bio-physical world, of the complex capacities of bodies that become able to open themselves beyond the very constraints of biological limits. Indeed, as seen above, the narratives of hybridity and control play out together in cultured meat, as developers underscore both naturalness and the disruptiveness of this technology, particularly referring to the capacity of strictly monitoring and determining production processes.

Culturing cells is a step forward in a hybridisation process, yet one that – despite its promises in terms of ecology and animal welfare – does not grant much agency and vital capacities to matter and the non-human. This seems deeply linked to, and realised in, cultured meat’s commodity character: born for the market and from processes of capitalist investment and valorisation, it presents itself as purely exchangeable abstract matter, a meat finally dis-embodied and therefore purified of all the “uncontrollable”, singular, specific, qualitative and irreducible characters that are typical of living organisms and of the labour that subtends their re/production (Deleuze and Guattari 2014; Dal Gobbo 2023a). In this sense, the con-fusion of natural and artificial is not the means to put into question human control and domination, or the opening of the human/technoscientific sphere to the stubbornness of life itself (Bennett 2010). Rather, it becomes a way of perfecting that process of reduction of living beings to manipulable and quantifiable entities without qualities. Indeed, hybridisation might not be so disruptive of modern capitalist existence at all, if we follow Latour’s (1993) point that, despite the ideological opposition between nature and society being the bedrock of modernity, technoscientific advancements have always led to a “proliferation of hybrids” that confused the two spheres.

As such, cultured meat is well placed within the Anthropocene “Master narrative” – i.e. that produced by dominant subjects –, which suggests that an over-powerful Man (*sic*) responsible of such an epochal transformation would be well-positioned to solve it through the *further* deployment of technoscience (Barca 2020; see also Sexton and Goodman 2022). This narrative tends to obscure the possibilities of social and political transformation in practices and diets (e.g. meat reduction and the spread of vegan diets) as well as farming. This is even more striking as one recognises that what cultured meat represents in terms of “fixing” the Anthropocene crises is merely a promise, with little potential of material transformation (Stephens 2013; Jönsson 2016; Sexton and Goodman 2021). From this point of view, cultured meat seems functional to supporting the “economy of promise” that characterises the financialized bio-economy (Cooper 2008; Birch and Tyfield 2013; Stephens *et al.* 2018). It might then be argued that, despite stated objectives of reducing animal suffering and ecological impact, a food technology whose feasibility and availability are continuously deferred in the future might have little to contribute to achieving

food justice and sustainability (Jönsson 2016; Sexton and Goodman 2021). The putting-to-value of the vitality of matter itself seems a further appropriation in the interests of racialised, classed, gendered accumulation rather than the positive embrace of hybridity as a leeway for more horizontal human-non-human relations.

3. *Controversies around food tech and valuing situated knowledges*

The discussion up to now has meant to sketch a critical but also multifaceted view on cultured meat as simultaneously “disruptive” and in continuity with the modern-capitalist quest for control over nature, which matches a drive to the valorisation of life itself as part of a project of infinite accumulation. While some of its features, especially the promise of sparing animals from suffering and of reducing the impact of farming through a redefinition of the boundaries between “natural” and “social-technological”, do resonate with some feminist perspectives, I have also proposed a different, critical reading that goes to the heart of capitalist processes of valorisation and that sees cultured meat as a way of further subsuming life reproduction by capital and as an instrument for the inherently unsustainable expansion of the capitalist economy. Yet the futures of technologies and the social relations surrounding them are always open to redefinition. For this reason, it is important to stay close to the social discourses emerging around innovations: they point to unmet social needs, fears, hopes and the critical capacity to shape food futures by hegemonic, but also marginal, subjects.

Cultured meat has been invested of different and contrasting meanings, values, and political functions: from animal liberation to a conservative reactionary defence of current “business as usual”, from green growth to the push for agroecology as a response to food systems crisis. Some of these debates, like the Italian one, might seem disproportionate if one considers that there are no commercialised products in the EU and, at world level, they are so marginal that they do not seem to hold any significance in terms of socio-economic and ecological impact. Yet, their relevance goes well beyond the specific case and shows that the stakes at the heart of innovation for food transitions are more complex than what is often portrayed by the white, male, technoscience establishment (often portrayed by as the only and most authoritative voice). In this context, cultured meat has truly been an “actant” (Latour 2005): it has stirred a proliferation of discursive practices and defined a space of debate, delineating a political geography of consensus and dissent around the key themes that characterise the Anthropocene. Installed in a socio-technical and political-ecological field characterised by tensions and power asymmetries, this novel food can lay visible existing unequal socio-ecological relations and distribution

patterns, most notably those regarding interspecies justice (Weisberg 2015), the role of techno-science in “sustainable transitions”, the possibility and opportunity to fuel growth within planetary boundaries (Guerrero Lara 2023), the ownership of knowledge and biological material (see e.g. Cooper 2008; Birch and Tyfield 2013). Its ontological novelty opens a space for public debate over the foods of the future, and the futures of food.

While for the “promissory narratives” (Jönsson 2016) of technoscience cultured meat is a straightforwardly positive endeavour that will be integrated into human and non-human food practices in the more or less near future, contestations, legislative measures, approval processes, fears, and expectations shape a far less linear and simple trajectory. They problematise a narrative of technological development as neutral and disembedded from the social that silences a wider reflection around the forms and pathways of ecological transitions, and the spaces of technoscience therein (Jasanoff 2010). A feminist, intersectional, political ecology approach starts from these discursive margins to make evident all those practices that might support fair and secure access to food for all. Often, while not much represented by the media, those who are critical of cultured meat are not rejecting technoscience *per se*, but rather valuing the spaces for the autonomous emergence of “convivial technologies” (Vetter 2018) that respond to the concrete needs of human and non-human subjects. Feminism pushes researchers to study these matters from the perspective of “situated knowledges” (Haraway 2020): a perspective that allows to show the partiality and embedded character of technoscientific innovation, opening up spaces for the promotion of difference and the recognition of marginal forms of knowledge. Included in this proposal is a tension towards justice, for the recognition of multiple voices within a debate means uncovering the hidden dynamics of domination and (in)visibility within a field. A situated inquiry helps to uncover the implicit premises of different positionalities, while also questioning their power effects in the complex tracing of the material and symbolic field of food innovation.

Methodologically speaking, mapping these knowledge controversies (Whatmore 2019) allows to understand technoscientific objects such as cultured meat as emergent assemblages of matter and meanings that are created in between and across laboratories, industries, financial markets, social movements, and the civil society at large (Jasanoff 2010). Mapping means drawing objects’ trajectories both as they are born and as they are “received” and – as such – re-born. Seeing processes from within, from the eyes of the actors but also from the perspective of the *practice* of innovation rather than its self-depiction as unilinear and uncontradictory process is one first way to address the situatedness of scientific knowledge, to highlight and share the uncertainty, messiness, and

complex nature of innovation as it is both local and idiosyncratic *and* inserted into global chains of value, labour, and power. On the other hand, inquiring into cultured meat controversies from an “outside” perspective – i.e. that of its publics – is one way to contextualise it as part of wider processes. While Bruno Latour (1993) argues that social critique needs to engage with the “small” and banal gestures and choices of actual subjects, it is also important to situate these gestures in a field of forces that partially transcends them and that they contribute to reproduce or resist.

Mapping can bring to the fore the emerging contradictions, openness, and self-questioning that technoscience itself constantly carries out, to give it back to a public debate in need of complexity to navigate complex times. Here the work on technoscience and its own narratives and practices encounters the work on publics: for it is at their intersection that development trajectories get delineated and the spaces for resistance and transformation open (Neresini *et al.* 2024). This does not mean rejecting the role of technoscience as such, but rather questioning its principles within a space of multi-species planetary existence “in the ruins” of capitalism (Tsing 2017). Mapping from a feminist intersectional perspective also means paying attention to, *caring for*, the voices that are often invisibilised because distant from the hegemonic subject that is considered as the producer/custodian of “right” knowledge: the rational, disembodied, able, white, owner Man that stays on the Human side of the great modern divide (Puig de la Bellacasa 2017). For instance, what are the views of women, agroecologists, antispeciesist, climate justice and political ecology activists? Listening to these voices opens the space for alternative views and practices of technoscience that might be able to deal with contemporary “troubles” (Haraway 2016) without the need to resort to the promises of solutions to come, and to a displaced space-time of climate change mitigation/adaptation. The embodied and positioned practices of care that non-hegemonic subjects put in place as part of the re-weaving of socio-ecological and sociotechnical relations in times of crisis might thus become the bedrock for a situated and partial food knowledge in the Anthropocene, whose temporality – while opening to future questions – is in the present, in the existing reparative practices that are daily put in place by subjects engaged in food production, consumption and exchange (Guerrero Lara 2023).

Mapping practices and voices contributes to building collective democratic spaces of deliberation, showing how they trace a non-neutral space of ecological intervention and adaptation to changing planetary ecologies. From a feminist intersectional perspective, mapping is not tracing (Deleuze and Guattari 2014): it is not just simply the neutral and “balanced” accounting of relations in a field. It is a process that considers powers of (in)visibility and is positioned

with the minor subjects, those whose voices and practices contest modern-capitalist promises while enabling caring relations. It is also a militant project of opening up contradictions, showing spaces of domination and resistance, evidencing the cracks and transformative opportunities within hegemonic dispositives themselves. It is a practice of careful and affectionate hacking that listens to, and speaks with, the marginalised who claim justice, equity and a societal transformation towards liberation and non-domination. Like in Stengers' (2005) "cosmopolitical proposal", social scientists might become "diplomats" that slow down reasoning and open such pathways of debate. Yet the complex conundrum of crisis also compels us to take sides, to promote a politics of the living beyond present matrices of domination.

4. *Conclusions*

This paper's aim was to introduce a critical appraisal of cultured meat and its embeddedness into capitalist systems of domination and accumulation from a perspective of political ecology rooted in feminist thinking, ranging from debates in feminist STS and new materialisms, through to ecofeminism and critiques of the bioeconomy. Political ecology is in this sense the home to a multitude of approaches that help us read ecological issues and alternatives as always political and never neutral. The centrality of climate and environmental crisis, human and planetary health, and interspecies relations in the narrative supporting and justifying research on cultured meat well positions this food technology into the Anthropocene – here understood as a political and historical space where human beings recognise to be part of a wider planetary history, but also in which their established relationships with the rest of nature seem to fail (Chakrabarty 2014). The present condition of crisis extends well beyond nature, to encompass social, economic and political breakdowns. The current contradictions of industrialised food systems embody and show many of these issues: highly entropic, polluting and anti-ecological production practices that favour the production of excess food are at the same time responsible for malnutrition, waste, and the degradation of local and planetary habitats. Animal farming is responsible for a huge part of these effects. Alternatives to the current capitalist industrial food regime (McMicheal 2009) and its farming complex (Schneider 2017) exist and are widespread: agroecology and peasant agriculture, practices of sustainable procurement, vegan and vegetarian diets, etc. Yet, under the spell of a projected population growth and increasing meat consumption, many efforts have been devoted to the development of high-tech "alternative proteins" (Guthman and Biltekoff 2021) that could resemble their traditional counterpart, to move the unconvinced towards more sustainable

eating. Cultured meat emerges in this context as possibly the most disruptive technology, one that for the first time promises to deliver ‘real’ meat without killing animals (Stephens 2013). This food innovation would provide a win-win solution to the challenges of the Anthropocene, without the need for any change in cultural or daily practices.

Despite such positive presentations, several controversies have emerged around cultured meat, of which the most heated happened in Italy with its ban by the current government in 2023. The public sphere seemed to be divided between enthusiasts and sceptical. While the latter position is repeatedly presented by a white, male-centred and privileged elite of experts as the result of mere ignorance, ideology or self-interest, I started from the very observation of controversies as a means to disrupt hegemonic knowledge and bring to the fore the existence of multifaceted voices worthy of being heard. As such, controversies show the *political* rather than technically neutral pathways of food innovation, asking who does it benefit and what kinds of future worlds does it enable. Interrogating the politics of cultured meat from a feminist perspective seemed particularly useful (Dal Gobbo and Bertuzzi 2024). Feminist perspectives have been crucial in critically situating modern technoscience within wider questions that regard systems of domination, rather than simply exploitation and/or class control over the means of production. It has gone to the core of the ontologies and epistemologies embedded in technology itself, showing its non-neutrality and the way it reproduces social hierarchies and systems of value. As such, the feminist contribution opens to a wider intersectional critique of technoscience and innovation, allowing to see how gender is part a modern/colonial “matrix of domination” (Quijano 1992) that works on shifting balances of race, species, ability, and age domination and oppression. Feminist approaches are also key to the theme at hand because they have thoroughly considered the intersection between the “post-human” as part of technoscience innovation (Haraway 1991), as well as questions around inter-species justice (Timeto 2020).

The first issue that I addressed is the role that cultured meat might have in pursuing ecologically transformative objectives in the current situation of crisis. I started from the widely accepted premise that Anthropocene crises are really to be understood as “Capitalocene” ones – i.e. emerging within the specifically *capitalist* world-ecology (Moore 2016). Working with feminist STS and new materialisms, I have shown how this “hybrid” (Latour 1993) object makes tensions between “naturalness” and “artificiality” evident, with the potential to disrupt naturalised orders of domination and re-position human beings *vis à vis* other species. In this sense, hybridity and the technologization of reproduction might be liberatory for human and non-human bodies, lifting them of the

burdens of reproduction under conditions of domination. Nevertheless, from the perspective of ecofeminism and even more evidently from the critique of biocapitalism it emerged that hybridity and overcoming dualisms is not *per se* sufficient for a liberatory politics of food and innovation. First, at a closer look, the abstract and bodiless production of meat from cells in industrial plants seems to *continue* rather than question a modern anthropocentric and instrumental attitude towards the materials that, like food, support our existence. Second, the vitality of matter is subsumed by capital through patents and financial operations that re-inscribe it into the laws of value and accumulation (Cooper 2008). In this sense, cultured meat seems to contribute to the logics of growth and profit that are among the main drivers of crises of the present (Hickel and Kallis 2020). Ecological crisis, with its forceful “intrusion of Gaia” (Stengers 2017), makes evident that the project of reducing the biosphere and living bodies to value is failing to support the continuation of life on earth. And yet, as part of a feminist approach, I have also argued for the importance of “staying with the trouble” (Haraway 2016) and mapping controversies and voices as part of a process of integration of socio-technical innovation within the social and ecological spheres.

This paper is a first and limited attempt at considering cultured meat and its potentials for the promotion of just and sustainable food systems transitions from a feminist perspective, holding together questions of political ecology and economy, inter-species relations, culture and technology. This is also its key contribution: to bridge fields of debate and concerns that tend to be treated separately, like inter-species relations and biocapitalism, or ecofeminism and technoscience – showing how there might be a fruitful space of dialogue for unveiling the mutual shaping of intersectional domination, the appropriation of reproductive forces and the development of food tech. Given the breadth of these preoccupations, none of these issues could be truly considered sufficiently in-depth. I recognise the partiality of this contribution, as it seems to propose an agenda and some provocations, rather than a fully-fledged theory. Still, I believe the lines proposed might be fruitful for further research and I would like to close with some comments in this sense. First, a latent but not developed aspect of my discussion has been the theme of coloniality, something that will be important to consider in the future. Second, a potentially fruitful investigation might be devoted to the relations between feminist approaches on food technoscience and the post-growth debate on “convivial technologies” and “post-growth innovation” (Vetter 2018; Pansera and Fressoli 2021). This might be a way of reconceptualising socially-liberatory technologies from the perspective of planetary boundaries and social justice – including a technology like cultured meat. This also relates to the question of animal liberation:

under what conditions can a technology transform inter-species relations for emancipation? What role do *social* relations play? The role of innovation in the “economy of promise” of late capitalism seems an important avenue for inquiring into how promissory narratives are functional to the delay of both climate crisis and feasible solutions to another time-space, the delay of the visibility of ecological alternatives in the present. Finally, it might be worth delving into how – and if – cultured meat, as part of the capitalist bioeconomy, represents a novelty in capitalist logics of accumulation, or rather their continuation under a specific guise (Birch and Tyfield 2013).

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