



David Lisser, *CleanMeat Massaging Claw* (2017).

All Bets Are Off

David Lisser

Global food security is becoming a pressing issue of our times; we need to respond, but all bets are off concerning the actions we should take. In this interview, David Lisser explores through the 'The CleanMeat Revolution' (1) what a 'future historical retrospective' might reveal about the path we take now and the unexpected events that may befall us.

It is the year 2120, and in your current historical research you are exploring the rise and fall of *in vitro* (cultured) meat products around the middle of the last century. What were the challenges around food security that first emerged at the beginning of that century, and how did they prompt a flourishing of different food solutions prior to the dominance of the 'CleanMeat' movement?

At the beginning of the 21st century, popular opinion held that the predominant global challenge facing food production was a warming climate and the inconsistent growing conditions that this caused. Although this is accepted as a primary driver, many other interacting factors can be identified, so producing a more complex and nuanced picture. There are too many individual causes to go into detail here, but academics now accept that a cocktail of factors contributed to the emergence of worldwide food insecurity, including: rising global temperatures (with effects on cycles of drought and flooding), social upheaval related to changing patterns

of migration and displacement, systemic failures in the form of resource mismanagement, the production of excessive waste, the over-reliance on biofuels, and cultural factors such as the status-driven increase in the consumption of meat-based food products.

The common Malthusian pre-conception that we simply could not feed a growing population has proven incorrect. For decades, we have produced far more food than the world's population could actually consume, but, due to critical imbalances in the distribution of power within the food system, and a lack of regulatory oversight to tackle such market failures, around a third of food production has been lost to waste, with the remaining two-thirds unequally, and even unhealthily, distributed. By the turn of the 2020s, the inequalities built into this system were becoming more readily apparent: Nearly a billion people malnourished in a world sustaining over two billion classified as overweight or obese. This points us towards the rise of CleanMeat and its immediate precursors – all attempts to stabilise global food production and consumption.

A note on taste: The watchword for the diet of the 2010's was protein. In the west, the ideal body image, for both sexes, had shifted from skinny to muscular; in developing economies, rising incomes resulted in a greater demand for meat products. The rather lazy characterisation that the 'protein-obsessed' people of the West demanded high-welfare meat and/or vegan alternatives, whilst those in China, India, and other growing economies were unfussy about sourcing policy, was popular at the time, but proved untrue on closer analysis. The breakdown on meat consumption globally reveals that industrially prepared meat was popular in early 21st century regardless of the country in question, and that cost was a primary determining factor in the choice of meat product.

With the emergence of CleanMeat, we saw the creation of a new living medium through innovative forms of techno-cultural intervention – a non-reproducing form of life dependent on human activity. What was the `living' status of clean meat in this form (a form removed from any known natural ecology)? Further, what was the consequence of CleanMeat's development for traditional Livestock of that era once the pressure of human domestication and selective breeding was removed?

The 'Livingness' of CleanMeat was initially a controversial subject, and one that large commercial producers spent a great deal of time and money negotiating. A series of creative public awareness campaigns were successful in persuading the public that CleanMeat was essentially a 'natural' non-animal product in its own right. Their efforts were helped by the fact that, since the early 2010 s, PETA (People for the Ethical Treatment of Animals) had been funding research in this area and were vocal advocates for the positive, ethical implications of commercially available CleanMeat. One of the more successful campaigns in the West showed a tour of the CleanMeat production facilities (termed 'carneries'), comparing the manufacturing process to that of brewing beer ; this played heavily on a comparison between the living cells used in Clean Meat (originally derived from animals) and the status of yeast in the brewing process. Fermented drinks have been produced for millennia, so this comparison helped CleanMeat attain a high degree of cultural normalcy. In alcohol-abstaining cultures, the campaign was tailored to draw comparisons with yoghurt production and other fermented products. Any allusion to foetal bovine serum was carefully avoided.

All the while, the emergence of full-scale CleanMeat production did not spell the end for traditionally reared livestock. Throughout the 21st century, farmers continued animal husbandry practices along the lines of previous generations. In fact, because CleanMeat took such a large market share from industrially farmed animals, there was a resurgence in low-yield and

high-welfare livestock practices (Slow Livestock). Free-range and organic became the new standards for 'real' animals. A two-tier market emerged, whereby CleanMeat filled the requirement for cheap, healthy meat, whilst traditional meat stocks acquired the status of a luxury product. Arguably, although CleanMeat significantly reduced the number of animals raised at any given time, it did drive considerable improvements in animal welfare for those artisanal farming operations that remained. Indeed, this shift from large-scale to specialist production drove an overall change in the labour market – with interesting consequences. As industrial farming had become so heavily automated by the late 2020 s, the scope for further redundancies in that sector was fairly limited. So, although a handful of major producers did lose business, a significant number of farmers intensified their focus on traditional techniques and the luxury meat market, with the effect that the number of skilled workers in animal husbandry, butchery, and meat preparation actually increased over this period.

Looking back at the predictions of the 21st century around food security, was the meteoric rise of CleanMeat and its equally rapid collapse as a food source in anyway predictable? Can we learn anything about the course of disruptive innovation?

CleanMeat promised a form of meat production that was less water-, land-, and energy-intensive and resulted in negligible GreenHouse Gas emissions. This was highly desirable for major food producers, with the wider potential economic and environmental benefits being a key target for government policy. That it all but eliminated animal suffering within its own supply chain was not in itself valuable to the industry, but was considered, none the less, a highly marketable concept. During its early development in the 2020s, a number of nation states identified key values in the idea of self-reliance in meat production. Short supply chains and increased control over the whole production process reduced a reliance on global markets and food aid, enhanced food security, provided greater control over food

safety regulations, and reduced the threat of food terrorism. As a politically powerful message at the time, this helped bolster a rising nationalism across the globe. Enormous sums of money were invested in the race to develop commercially viable and palatable cultured meats. As the cost of production tumbled, research activities began to focus on overcoming long-standing issues around food texture and the wider public perception of this new, innovative product.

Food fashions are inextricably linked with socio-economic status, and, initially, it was the middle-class that took to CleanMeat most enthusiastically, lured both by its environmental credentials and rejection of animal suffering. It soon became an aspirational product, driving product innovation that targeted a broader range of socio-economic groups. The ease with which CleanMeat came to dominate the global market was truly unprecedented, but also a contributing factor to its eventual downfall. During its emergence, CleanMeat was one of the most heavily monitored industries in the food sector – arguably, a necessity in gaining consumer trust. But, as the demand for sector growth and cost-reduction increased, a period of deregulation ensued (secured by lobbyists and environmental groups), followed by market failure.

For instance, cases of antibiotic resistance had occurred only infrequently in its initial period of development; quickly identified, these high-risk products were prevented from coming to market. As the regulatory environment was relaxed, however, incidences of resistance began to increase and a small number of products carrying resistant bacteria entered into the food supply chain. Only a few deaths resulted, but this was to have an enormous impact on public trust. Mainstream and social media heavily publicised the deaths, with investigative journalists soon uncovering mixed donor cell-reactors; although as safe as many other widely consumed products, the so-called pig-cken meat was considered unacceptable. The smaller clean-fish, mocktopus, and crustacea industries fared worse – small quantities of cockroach-derived stem cells were found in prawn-sticks and lobster meat. There was public outcry.

Some historians have compared this wave of public mistrust to the BSE crisis of the late 20th century in Europe. A more apt analogy, perhaps, would be that of the banking crises that occurred in 2008 – 2010, 2036 – 2040, and, most recently, the global freeze of 1989. We can readily discern the perennial favourites of the economic historian: market failure driven by deregulation, irregular competition practices, misguided environmental economics, the collapse of a shared-resource systems (the tragedy of the commons), and so on.

CleanMeat was eventually replaced with the fully synthetic protein substitute Synthein. How was it an advancement on its predecessor in terms of customer appeal, customisation, and business model? As such, is Synthein the perfect technological solution, or do you see a more fraught pathway ahead for this new product?

Although Synthein largely replaced CleanMeat as the primary source of cheap protein, it must be understood as a very different kind of product, with a very different sourcing chain. Synthein producers supply the base growth medium, but then, for the majority of consumers, product maturation, flavouring, and harvesting are done in the home or on a slightly larger scale at community co-ops. The development of sophisticated flavour coding modules suitable for home use proved an absolute game-changer for the industry. Even at the peak of CleanMeat's market dominance, production techniques were unable to recreate the subtlety of natural meat's flavour and aroma; indeed, due to inadequacies in the waste removal systems, many of the cheaper, unrefined CleanMeat forms had a faint, but pervasive, tang of urea. It would be very hard for us to accept that today, but, at the time, many considered this an acceptable pay-off for such a cheap protein source. And, besides, all but the most prohibitively expensive natural animal meats had, by that time, been engineered towards a rather homogeneous flavour palate.

Synthein producers initially worked alongside Michelin-star chefs, social innovators, and haute-vlogueurs to develop celebrity-endorsed flavours. Once the domestic flavour-synthesisers became available, however, many more became self-styled TJs (Taste Jockeys), 'laying down' new tastes and olfactory experiences. Although the application of these new flavours to CleanMeat was attempted, it proved near-impossible to chemically bond flavour compounds to the product. Whilst it is still not fully understood why, in the few successful cases that were documented, the newly applied flavours were reported only to exaggerate the product's underlying urea-characteristic.

In one sense, Synthein producers were successful in developing a business model adopting the best of patent protection whilst embracing an open-source movement that could secure its status as an endlessly customisable and bespoke product. The core processes behind substrate growth and cell proliferation remain a tightly guarded secret, whilst customisation activities are not only accepted but also actively encouraged. The many competitions annually to celebrate flavour innovation are hotly contested affairs. There are risks, however, associated with the Synthein approach. It is theoretically possible to hack the cloud-connected taste-synthesisers ; so it may not be long before system vulnerabilities are identified and exploited (whether for a prank or to more malevolent ends), weakening the brand's current dominance. It seems almost inevitable that this sector will suffer from the same pains originally experienced in the smart home industry.

With the development of this fully vegan – indeed non-life based – food source (Synthein), have we seen public attitudes changing towards other life-forms and the ethical relationships we form with them in our shared ecosystems?

We have seen a gradual realignment in our relationships with nature; although the development of synthetic food has played a key part in this,

it is the unprecedented consequences of climate change that has proven a primary driver in the modification of human behaviour towards the environment. Early efforts to combat climate change were, of course, too little and too late for Osaka, Shanghai, and Miami, but the devastation of these floods did mark a gear change in the seriousness of international response to our changing climate.

When I tell my students about the conception of *natural resources* in the mid- 20th century, they can hardly believe their ears! The notion that our fragile ecosystem was understood in merely financial terms is as alien to them as our current relinquishment targets would be to national politicians of the late 20th century. Indeed, we have come a long way: Concepts such as deep adaptation, sustainable intensification, and whole-world health – once popular only amongst the educated, wealthy, and liberal as value-signalling conversation pieces – are now much more pervasive and commonly held. Our de-growth strategies do appear to be helping a number of key natural habitats begin the long road to recovery, and, yes, a good proportion of global food consumption is now completely synthetic. These are considerable achievements and should be lauded.

However, as our relationship with the environment becomes increasingly the subject of global, algorithmically driven auto-responses, inherent problems in the system may emerge. Although designed to moderate political and financial interests in global decision-making, the very architecture of these decision systems has come under scrutiny. Some argue that the relationships between data collection systems and auto-response outputs reveal a misplaced philosophy of control and management of our biosphere. I am a proponent of updating these systems to better incorporate nuanced and adaptive decision protocols that emphasise our forms of co-existence within the world. Whether there is the will to see through such changes remains an open question.

Finally, is it fair to say that artists working with living media at the turn of the 21st century in some way played a role in the development of these new, secure food sources? To what degree did they inspire advances in the field by showing what was possible, whilst also offering dissenting and ethically motivated accounts of the dangers involved?

In the famous Greek myth, Daedalus crafts wings for himself and his son and warns Icarus not to cruise too low so that sea-spray will dampen the feathers but also not to fly too high lest the sun melt the wax that binds the wings: Icarus should keep a steady path, striving to avoid both indolence and arrogance. It could be suggested that, in the story of CleanMeat, early practitioners working with living media acted the part of Daedalus. Even the very name, which translates roughly as ‘cunningly wrought’, suggests a manner of working that navigates the possibilities of nature to bring forth new realities. Daedalus created his wings in order to escape from the legacy of his previous invention – The Labyrinth; our practitioners created art in order to help others escape from an overbearing legacy of the scientific method. The new forms that emerged from these practitioners were, therefore, points of contestation by their very nature: They were not created simply to showcase new methodologies with pre-ordained aims clearly in sight, but rather as working prototypes that, through their mere existence, interrogate the social and ethical potentials of research.

Early practitioners showed what was possible and, in the manner and context of presentation, challenged future adopters to carefully consider the consequences of pursuing such possibilities. Business leaders and entrepreneurs took enthusiastically, by and large, to these new models of working but less so to the challenging conceptual implications that came with them. Hindsight is a wonderful thing, and if we could show those early designers the fruits of their labour I am sure we would witness both elation and horror. For example, the development of semi-organic, self-growing buildings marked an important shift in the construction industry from a

damaging reliance on mineral extraction, but, as the recent documentary *'Incredible – the City that ate itself'* revealed, there were a number of unforeseen complications with such large scale bio-construction. Similarly, the new food sources originally conceived in the late 20th century came under the banner of contestable design – artists and experimental designers working at the very edges of disciplinary practice to imagine extraordinary responses to complex, contemporary challenges. Some years later, and after adoption and reform by Industry, this work can be seen to have heralded a new age of animal-free meat, one which has benefited the biosphere in some ways, but also been fraught with set-backs and controversies (as described). It would seem the large CleanMeat corporations flew both too high and too low.

Notes

1. 'The CleanMeat Revolution' was the result of a five-month Residency at the Pervasive Media Studio, Bristol (UK) in 2017. An exhibition was held at Bristol's 'We The Curious', taking the form of an imagined retrospective of 21st century lab-grown meat production. The show was a museum-style display, combining artefacts from the CleanMeat industry, interpretive models, items of social history, a corrupted video lecture, and curators' notes. Together, this built up a picture of the rise and fall of lab-grown meat, providing social, cultural, and economic context for this fictional CleanMeat movement.

Author Biography

David Lisser lives and works in Newcastle upon Tyne, UK. His work concerns our future relationships with nature and technology. David has exhibited in a number of solo and group exhibitions across the UK, with residencies playing an important role in advancing his understanding of contemporary societal issues. Most recently, he has created a series of pseudo-fossils depicting possible future food production techniques ('Future Artefacts') and built a mobile seed library that is being cycled around the North-East of England setting up seed-sharing networks ('Last Ditch Attempt'). Residencies have included working with local businesses in Sunderland to investigate the ways art and business can be brought together and working alongside an industrial robotics engineer to explore the relationships between craft, skill, and automation in production line technology. David holds a degree in Fine Art from Newcastle University.