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Real Artificial: Tissue-cultured Meat, Genetically Modified Farm Animals, and Fictions

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Abstract

Although touted by promoters as the cutting edge of food science, meat produced in vitro (rather than from a whole animal) is emerging more directly from developments in fine art—more specifically, from the aesthetic experiments of Australian-based artists Oron Catts and Ionat Zurr, who ask: What language do we have to describe the agency of tissue-cultured life? This essay begins to answer this question by tracing a tradition whereby bioengineered meat mediates complex environmental critiques in literary fiction over the past century, including Margaret Atwood's exemplary novel *Oryx and Crake* (2003), which depicts biotech industries producing three distinct kinds of "real artificial meat," all sourced in genetically modified animals.

Novelists have long used the disgust elicited by fake meat as a flash point for eco-minded critique. Describing the experience of biting into his first ersatz frankfurter—"a rubber skin" that he discovers, to his horror, to be "filled with fish!"—the protagonist of George Orwell's novel *Coming Up for Air* (1939) immediately casts the meat as an indicator of nature's perversion in industrial society:

It gave me the feeling that I'd bitten into the modern world and discovered what it was really made of. That's the way we're going nowadays. Everything slick and streamlined, everything made out of something else. Celluloid, rubber, chromium-steel everywhere, arc-lamps blazing all night, glass roofs over your head, radios all playing the same tune, no vegetation left, everything

cemented over, mock-turtles grazing under the neutral fruit-trees. But when you come down to brass tacks and get your teeth into something solid, that's what you get. Rotten fish in a rubber skin. Bombs of filth bursting in your mouth.¹

Writing in the late 1930s, Orwell ostensibly is concerned with the more ordinary kinds of bombs that are about to set Europe ablaze. Yet with this vision of a peculiarly botched form of fake meat comes a distinctly postmodern-animal sense of disenchantment with the modern historical subject.² Nauseating the narrator, the phony frankfurter here abruptly brings him to a global sense of gone-wrongedness in the environmental relations across species as characteristic of modern living.

At first blush, the Orwellian view of fake meat might not seem so familiar to twenty-first-century readers, accustomed to seeing a vast array of products shaped, textured, and flavored to resemble various meats that are marketed to vegetarians, even vegans, on supermarket shelves. Yet the fact that these nonanimal-sourced meat substitutes remain unavailable in countries built on meat-export industries indicates one of the many ways in which they continue to serve as political flash points.³ Like fake fur, such products inspire skepticism among animal advocates, who question the effectiveness of promoting plant-based diets with the illusion of animal killing. While so much more could be said about the real carbon hoofprints of fake-animal food—their largely nonorganic, chemical-additive ingredients, plastic packaging, refrigeration requirements, and so on—soy-based “pups” or “not-dogs” and the like remain most familiarly reviled as disgusting to meat eaters, who complain of the same sort of nasty surprise as that elicited by Orwell’s “[r]otten fish in a rubber skin.” Perhaps most effectively developing the revolting potentials of ersatz meat, particularly that which is sourced from animals, novelists and visual artists grapple with the social and environmental implications of these new bodies of industry, so to speak.

1. George Orwell, *Coming Up for Air* (New York: Harcourt, Brace, Jovanovich, 1999), pp. 27–28.

2. Steve Baker identifies the aesthetics of “botched taxidermy,” in which the “botchedness or gone-wrongedness” characteristic of contemporary fine-art images of animals does not signal artistic failure so much as a more complicated set of engagements with animal form, each of which is “deliberate, and has its own integrity”; see Baker, *The Postmodern Animal* (London: Reaktion, 2000), p. 156.

3. While walking around a Wild Oats grocery store in the United States, I was shocked to learn from Annie Potts and Philip Armstrong, co-directors of the New Zealand Centre for Human–Animal Studies, that a powerful meat-industry lobby ensures that such products are banned from import to their country.

By sketching the literary and visual history of fake meat across the past century, this essay explores how farm animals are valued (and not valued) as actors in commodity systems and with what consequences for inter-species relations, from local to planetary scales. My point, in part, is to explain how these texts open perspectives that sharply contrast the common and ahistoricizing view (most often attributed to Jacques Derrida) of meat as means and marker of how the Western metaphysical subject is produced through sacrifice.⁴ Instead, the stories and images assembled here locate in meat, especially fake meat, forms of agency that exceed the human-subject form. More specifically, challenging the notion that fake meat will prove a panacea for the eco-catastrophes wrought by modern meat industries, these artistic and literary forerunners of emergent scientific realities come to position meat substitutes in ways that trouble the linkage of the human subject with all forms of authority, and in so doing pursue deeper inquiry into whether and how fake meat leverages more responsive and responsible environmental ethics.

One recent novel provides an exceptional framework for this discussion. Invoking the promises as well as the fears of present technologies, Margaret Atwood's *Oryx and Crake* (2003) depicts biotech industries producing three kinds of fake meat, all sourced in genetically modified (GM) animals. One kind appears to fulfill the dream of what Australian-based artists Oron Catts and Ionat Zurr term "victimless meat" that industry designers project into the fast food of the future; another (more like cloned cattle and goats in the United States today) enters food chains only as a by-product of medical technology; and a third is constructed specifically to minimize the environmental impact of livestock production. Akin to GM prototypes presently under patent review, this last kind offers a limited technical solution to meat-industry pollution problems.

Distinguishing the genealogies of these animal sources of fake meat helps to explain why a critical focus on either the meat or the animals in *Oryx and Crake* has led literary and cultural critics to oppositional interpretations. While some conclude that the "agency of animals" appears to overwhelm the bioengineering designs on

4. But even this model is, of course, exceeded by Derrida's theory "of the trace, of iterability, of *difference*," the "possibilities or necessities, without which there would be no language" and that "*are themselves not only human*," which is most clearly articulated in his "Eating Well, or The Calculation of the Subject: An Interview with Jacques Derrida," in *Who Comes after the Subject?* trans. Peter Connor and Avital Ronell, ed. Eduardo Cadava, Peter Connor, and Jean-Luc Nancy (New York: Routledge, 1991), p. 116. On the possibility of an "aesthetics of livingness" as a counter to the relentlessly reductive logic of sacrifice, see Jonathan Burt, "The Aesthetics of Livingness," *Antennae: The Journal of Nature in Visual Culture* 5 (2008): 8.

their meat in the novel,⁵ others argue that its pattern of imaging rendered flesh appeals to a “new nostalgia” for killing and dressing along with consuming meat that renders animals all the more abject.⁶ Examining the sources of Atwood’s three kinds of animal—or what seem a special sort of “post-animal”—products as they have emerged in art and fiction, what follows focuses instead on the ways in which fake meat appears to enable distinctions among human, animal, and other agency forms. In this way, fake meat proves one of the most effective mechanisms with which the novel, albeit “by default,” entertains without finally deciding between humanist and posthumanist environmental perspectives.⁷

One potential problem with my approach here to Atwood’s novel is its post-apocalyptic perspective: it is set in a world in which some humans apparently have bio-engineered our collective doom, alongside that of countless other species, and so trades heavily in the “dated and formulaic clichés” of global transformation like destroyed cities and (via the consequent flourishing of feral GM animals) alien invasion.⁸ Some ecocritics note the limited potential of such narrative strategies to motivate productive interventions. Outlining a disjoint between environmentalist motivations and fatalistic conclusions as characteristic of contemporary fiction, Richard Kerridge points to the “apocalyptic resignation” characterizing several recent novels as undermining hope for any reformist politics.⁹

5. See Traci Warkentin, “Dis/integrating Animals: Ethical Dimensions of the Genetic Engineering of Animals for Human Consumption,” in *Genetic Technologies and Animals*, ed. Carol Gigliotti (special issue of *AI & Society* 20:1 [2006]), p. 94; and Helen Tiffin, “Pigs, Pigeons, and People,” in *Knowing Animals*, ed. Laurence Simons and Philip Armstrong (Boston: Brill, 2007), p. 260.

6. Jovian Parry, “*Oryx and Crake* and the New Nostalgia for Meat,” *Society & Animals* 17 (2009).

7. Here I take the point, but disagree with the conclusions, of Graham Huggan and Helen Tiffin, who focus on the human characters to argue more broadly that “Atwood’s novel emerges by default as a feminist, environmentalist, and, not least, a humanist text,” because it elaborates how “age-old practices of physical domination and oppression are now being revisited on what social theorists have increasingly taken to describing as a ‘post-bodied and post-human’ modern world”; see Huggan and Tiffin, *Postcolonial Ecocriticism: Literature, Animals, Environment* (New York: Routledge, 2010), p. 211.

8. Ursula Heise, *Sense of Place and Sense of Planet: The Environmental Imagination of the Global* (New York: Oxford University Press, 2008), p. 206. Diagnosing the representational challenges of climate-change stories, Heise seems skeptical more generally of how the apocalyptic “narrative architecture” might be used “to bridge precisely the gap between stories of individuals and accounts of global transformations” (p. 208).

9. Richard Kerridge, “Narratives of Resignation: Environmentalism in Recent Fiction,” in *The Environmental Tradition in English Literature*, ed. John Parham (Burlington, VT: Ashgate, 2002), p. 87. I thank Sally Borrell for directing me to this article.

Kerridge's argument predicts *Oryx and Crake's* apparently unequivocal isolation of its narrator from human communities amid the final unfolding of ecological catastrophe. But, as is the case with analyses focused on meat or animals, this approach strikes me as risking a too narrow focus on that human subject, which in turn obscures the novel's multifaceted attempts to engage with broader biopolitical transformations of the terms of relating within, as well as across, a variety of species and on a planetary scale.

For this reason, I want to highlight from the start a distinction made within other discussions of environmental writing between apocalypse scenarios featuring fanatical/hysterical projections, which all too readily lend themselves to ridicule, and "precautionary" visions of the future, which are distinguished by more skeptical (if often didactically motivated) renditions of the "potential yet avoidable consequences" of messing with ecosystems.¹⁰ Viewed this way, Atwood's fiction reads more like a complex and cautious exploration of the post-apocalyptic as a posthuman condition.¹¹ Such a reading requires understanding how the fake meat sourced in animals propels this precautionary tale, linking the dubious benefits for the human to rewards for other (post)species, radically altering environments on a global scale, as well as connecting this fiction and other aesthetic explorations to the current conditions of meat production.

The Art and Science of "Real Artificial Meat"

Even sympathetic commentators seem divided about whether meat industries need saving for—or from—people. Global consumption of meat is expected to double by 2050, bringing to crisis the so-called carbon hoofprint alone of an industry that already accounts for 18 percent of global greenhouse-gas emissions.¹² In many more ways as well, the immense, unprecedented, and growing numbers in which animals are raised to be killed for food threaten the health and environments of nearly all species.

10. Amy M. Patrick, "Apocalyptic or Precautionary? Revisioning Texts in Environmental Literature," in *Coming into Contact: Explorations in Ecocritical Theory and Practice*, ed. Annie Merrill Ingram, Ian Marshall, Daniel J. Philippon, and Adam W. Sweeting (Athens: University of Georgia Press, 2007), p. 145.

11. Sally Borrell, "Challenging Humanism: Human–Animal Relations in Recent Postcolonial Novels" (Ph.D. diss., Middlesex University, 2010).

12. Henning Steinfeld, Pierre Gerber, Tom Wassenaar, Vincent Castel, Mauricio Rosales, and Cees de Haan, *Livestock's Long Shadow: Environmental Issues and Options* (Rome: UN Food and Agriculture Organization, 2006), p. 272. I thank Jennifer Wolch for directing me to this book.

While outbreaks of viruses like swine and avian flu make headlines, more insidious threats like drug-resistant strains of bacteria quietly grow endemic within meat industries. With little hope of solving these problems through business as usual, proponents of the increasingly centralized and globalized meat-making industries focus instead on mitigating a still more pervasive sense of discomfort with cross-species intimacies at the site of slaughter. Facing enormous pressures to meet rising consumer demands, producers pin their hopes on technologically reconfiguring meat itself through tissue culturing, producing “real artificial meat” in vitro, in a Petri dish, rather than in whole-animal form. Banking on their faith, the website New Harvest went online in 2004 with the claim that tissue-cultured meat, or “meat produced in vitro, in a cell culture, rather than from an animal,” is the industries’ long-awaited messiah, promising them a seemingly endless future of “advancing meat substitutes” to the point of creating revolutionary meat-based kinds that would be palatable to meat eaters.¹³

Although packaged by promoters as the cutting edge of food science, this technological potential stems from developments in biomedicine and more directly still from fine art, the culmination of nearly a century of “tissue-culture” (and, within the past twenty years, tissue-engineering) research that cuts across the arts and sciences.¹⁴ Real artificial meat is another term for its goal, and one that I think more accurately reflects the contradictions built into this spectral commodity.¹⁵ Despite being oxymoronic, this particular phrase foregrounds the conflicted status of animal tissues grown by others outside of their hosts’ bodies, and offers a necessary corrective

13. These descriptions are from the promotional website of New Harvest, which is the brainchild of Jason Matheny, then a graduate student in utilitarian philosophy. <http://www.new-harvest.org>.

14. Oron Catts, “The Art of the Semi-Living,” in *Live: Art and Performance*, ed. Adrian Heathfield and Hugo Glendinning (New York: Routledge, 2004), p. 154. Catts notes that while J. M. J. Jolly invented a technique for sustaining tissues from complex organisms in 1903, it was perfected in 1910 by Alexis Carrel, who coined the term “tissue culture” (p. 159n25). Eighty years later, the collaboration of surgeon Joseph Vacanti and material scientist Robert Langar led to the degradable scaffolding technique that allows cell clusters to be grown in three dimensions—“emblemized by one of the most important icons of the late twentieth century: the mouse with a human ear growing on its back”—which is the key development that revolutionized biomedicine with the prospect of tissue engineering (pp. 154–155). I thank Ionat Zurr for sending this reference, along with several others that follow in this essay.

15. “Real artificial meat” is the preferred phrasing of Marianne Heselmans, “The Dutch Cultivate Minced Meat in a Petri Dish,” *NRC Handelsblad*, September 10, 2005. www.new-harvest.org.

to rhetorics that elicit broad support for these potential products by compounding the deepening confusion regarding the relationships of meat and animal agents to each other and to human subjects.

New Harvest's spurious claims that laboratory meat-making is "more humane than conventional meat" spur some to the erroneous conclusion that its product is "violence-free meat."¹⁶ So, in 2008, the prominent animal rights organization People for the Ethical Treatment of Animals (PETA) announced a controversial million-dollar prize for the first outfit to bring real artificial meat to market. Animal-advocacy efforts may be bolstered by PETA representatives' claims, echoed by philosophers and policy makers, that they are "morally required to support" what appears to be simply an "interesting technological phenomenon."¹⁷ Indicating no engagement with the bloodier details of this research, such responses portend still more profound misunderstanding not only of how people and animals presently are involved in these processes, but also of meat's liminal life among human and animal bodies.

Although the PETA contest aims specifically for real artificial-chicken "nuggets," the most successful of the tissue-cultured meat experiments to date have produced a ground- or minced-meat-like substance grown from pigs—more precisely, from muscle-derived stem cells placed to grow on an embryonic cell isolated from piglets conceived in sterile laboratory conditions. As artificial-meat promoters are quick to note, it is "precisely because of the animal-friendly image cultivated meat must maintain" that they emphasize the potential use of nonanimal-sourced polymer scaffolding (required to reproduce the three-dimensional texture of meat) and a cell-growth medium derived from maitake (hen-of-the-woods mushrooms) in real artificial meat production.¹⁸ For now, however, this technology relies heavily on animals and animal products.¹⁹ Genealogically linked back to in vivo farm animals, and laterally to in vitro meat

16. Oron Catts and Ionat Zurr, "Towards a New Class of Being: The Extended Body," *intelligent agent* 6:2 (2006). http://www.intelligentagent.com/archive/Vol6_No2_convergence_cattszurr.htm.

17. Patrick D. Hopkins and Austin Dacey, "Vegetarian Meat: Could Technology Save Animals and Satisfy Meat Eaters?" *Journal of Agricultural and Environmental Ethics* 21:6 (2008): 595.

18. These quotations are from the New Harvest website. <http://www.new-harvest.org>.

19. P. D. Edelman, D. C. McFarland, V. A. Mironov, and J. G. Matheny, in "In-Vitro Cultured Meat Production" (*Tissue Engineering* 11 [2005]: 659), observe that the greatest quantities of cells have been produced in the shortest periods of time through experiments with goldfish skeletal-muscle tissue grown with large amounts of fetal bovine serum.

cultivated from goldfish, sheep, and toad cells kept alive with serum derived from still more kinds of animals, the ersatz frankfurter of the future may promise meat's transcendence from animal life. But, for now, such a dream is fast being brought to fruition in ways that compound further the numbers and kinds of intercorporeal intimacies shared in meat.

In the rush to find less controversial means of meeting consumers' meat demands, what remains largely neglected are some serious considerations about what cultured meat is, let alone where it has come from and where it is going in the lives of people and animals (and maybe mushrooms). In this respect, it seems curious that, while a Dutch research team holds the patent on the scaffold techniques projected to produce marketable tissue-cultured meat during the next six years, the most likely production route of tomorrow's fake hot dogs was established by artists Oron Catts and Ionat Zurr, whose collective The Tissue Culture and Art Project designs and publicly stages experiments that link aesthetic responses to responsibilities in producing and consuming life forms like real artificial meat.

"Scavenging leftovers" from research laboratories, as well as from food production, Catts and Zurr create what they call "semi-living sculptures."²⁰ As opposed to monikers like real artificial meat, the artists' choice of terms highlights their ethical insistence on the peculiar materiality of their art, its special sense of aliveness. Naming is one of many aspects of their work that is designed to call attention to the ways in which these creations are not simulations or variations on existing life forms to be commercially exploited; rather, these sculptures exemplify "a type of being (semi-being, semi-living) that does not fall under current biological or cultural classifications," one that they argue constitutes "a new class of being" that raises unique concerns about configurations of species and social agency.²¹ Resisting trends in biomedicine toward privileging anthropocentric perspectives at the expense of the semi-livings, Catts and Zurr question how the fragile, dependent life forms of cells and tissues made to live outside bodies—"a fragmented out-of-context collection of 'kind-of-alive' beings"—can be seen as exercising "an agency or even a proto-

20. Ionat Zurr and Oron Catts, "The Ethical Claims of Bio Art: Killing the Other or Self-Cannibalism?" *Australian and New Zealand Journal of Art: Art & Ethics* 4-5:2-1 (2003-04): 167-188. <http://www.tca.uwa.edu.au/publication/TheEthicalClaimsofBioart.pdf>.

21. Catts and Zurr, "Towards a New Class" (above, n. 16). By redeploing biotechnology in the realm of art in order to critique scientific classification, Catts and Zurr contribute another example to "dispute biology's claim that life only emerges in cells and organisms," according to Lauren Seiler in "What Are We? The Social Construction of the Human Biological Self," *Journal for the Theory of Social Behavior* 37 (2007): 266.

-agency," a concern that they explore through art installations like *Disembodied Cuisine* (2003).²²

Part of Catts and Zurr's Victimless Utopia series, designed to apply scientific methods in artistic examinations of human ways of relating to semi-living creations, *Disembodied Cuisine* began in a laboratory with a tiny "steak" grown from prenatal sheep cells. In pursuit of the possibility that such meat could be cultivated and eaten, all the while remaining victimless, Catts and Zurr next created *Disembodied Cuisine*, an installation devised around the proposal to grow two more semi-living steaks from biopsies taken from otherwise healthy, living frogs who were housed in an aquarium (later released in a botanical garden) alongside the steaks' bioreactor in a French art gallery. Especially in light of the artists' clarification that the source material for the "frog steaks" was a cell line derived from an aquatic toad, what might seem like the piece's central symbolic statements (i.e., about the dubiousness of embracing pure French food in an anti-genetically modified organism [anti-GMO] cultural moment) unfolds in profound tension with highly localized matters of life and death.²³

Other elements of the project emphasize that Catts and Zurr deliberately attempt to be responsive and responsible in negotiating these very tensions. For practical and ethical reasons, they choose to end such projects with an elaborate killing ritual involving artists, curators, and even audience members. Because the bacteria and fungi in our breath and skin prove deadly to the exceptionally fragile, semi-living organisms, ordinarily the end of such projects just requires casual human contact, such as opening up their sterile environments and touching them with bare hands. Connecting such rarified killings to the ordinary practices of cooking and eating meat, *Disembodied Cuisine* was designed more theatrically to end with a "nouvelle cuisine" dinner, in which the steaks were sautéed and mostly eaten (two of six participants spat theirs out) while the frogs looked on, not exactly animal hosts so much as "spectators" to these negotiations of ethics, agency, and place.²⁴ Certain details, such as the artists' estimation that serum from a whole calf was needed to grow these two small frog steaks, give the lie to both New Harvest's and PETA's animal-friendly fantasies of real artificial meat,

22. Catts and Zurr, "Towards a New Class" (above, n. 16).

23. Adele Senior, "In the Face of the Victim: Confronting the Other in the Tissue Culture and Art Project," in *SK-INTERFACES: Exploring Borders in Art, Science and Technology*, ed. Jens Hauser (Liverpool: FACT/Liverpool University Press, 2008), p. 82.

24. Deborah P. Dixon, "The Blade and the Claw: Science, Art and the Creation of the Lab-borne Monster," *Social & Cultural Geography* 9:6 (2008): 685.

and, more importantly, expose the complex, multi-species agricultural and laboratory systems underpinning them.

Amid “innumerable exhibits on the subject of biotechnology” wildly proliferating at the turn of the twenty-first century, *Disembodied Cuisine* emerges as a rare and powerful installation, because it underscores the unique ethical dilemmas raised by lives that are not (quite) subjects in human terms, and that are unable to live without specialized and diligent human care.²⁵ In pointed contrast to the efforts under way to market tissue-cultured meat as “nonanimal” sourced, Catts and Zurr’s artistic production and attempted consumption of real artificial meat confronts “the lack of current ethical frameworks to deal with the shifts in the continuum of life and the gradient of sentience” pinpointed by (in)edible semi-living sculptures.²⁶ Like all meat, these fragile, dependent life forms comprise federations of cells and tissues that extend life outside conventionally discrete bodily forms. And what the installation aimed to highlight is the wavering status of real artificial meat as it moves across artistic and scientific contexts, its “agency or even a proto-agency,” which remains dangerously under-theorized.²⁷

Critiques of their work—particularly those claiming “a bio-centered environmental ethics that sees all living organisms possessing intrinsic worth”²⁸—all too readily avoid their creative modeling of an ethics that can acknowledge the elusive grounds of such authoritative judgments as a prerequisite to assessing or addressing the needs of the not-quite-living organisms. In so doing, they miss what might be the most important point of semi-living sculptures: namely, that in making and enlisting the help of random people to destroy them, Catts and Zurr redeploy biotechnology in the realm of art precisely in order to challenge scientific authority, particularly the scientific classification of creatures who again are not simulations or variations on existing life forms to be commercially exploited (i.e., real artificial meat), but rather a sort of being that escapes the present taxonomies of the life sciences.²⁹ Along with all of the other participants in the final performative segment of these installations, critics

25. Jens Hauser, “Biotechnology as Mediality: Strategies of Organic Media Art,” *Performance Research* 11 (2006): 133.

26. Zurr and Catts, “Ethical Claims of Bio Art” (above, n. 20).

27. Catts and Zurr, “Towards a New Class” (above, n. 16).

28. Carol Gigliotti, “Leonardo’s Choice: The Ethics of Artists Working with Genetic Technologies,” in *Leonardo’s Choice: Genetic Technologies and Animals*, ed. Carol Gigliotti (New York: Springer, 2009), p. 72.

29. Lauren Seiler, “What Are We? The Social Construction of the Human Biological Self,” *Journal for the Theory of Social Behavior* 37 (2007): 266.

too are confronted with the choice to join in a wide-ranging, cross-disciplinary struggle with the aesthetics of agency forms, not the least because the terms of all organismal life and death are the stakes of engagements with fake steaks.

Significantly, Catts and Zurr's starting point remains nothing smaller than intact cells, a choice that deliberately and consistently builds a critique of geno-hype into their work. They note that the flurry of interest surrounding comparatively new and rarified genetic interventions frequently obscures the far more pervasive concerns inherent in the process of extending and ending fragile forms of life outside of what are ordinarily perceived as whole or intact bodies—for instance, the casual decisions to refrigerate, to sauté, or whatnot made every day by meat eaters. Admittedly, then, at some risk to the integrity of their work, I turn now to map the intersections of their aesthetic explorations with literary genealogies of real artificial meat that in pointed contrast have begun to breach cellular borders. My point is to trace how aesthetic experimentation more broadly leads to the emergence of some alternatives to the language of salvation (if not perhaps so clearly the logic of sacrifice) so readily attached to real artificial meat and GM animals, making room for discussions of the mixed “revolting” environmental potentials for such developments, perhaps nowhere more obviously than in Atwood's bestiary of meat animals.

GM Animal Parts: Revolting Nuggets, Nobs, and Nubbins

Questions about whether and how tissue-cultured meat remains animal (and consequently what it means to read such creations as agents or things) emerge in Atwood's *Oryx and Crake* through the fictional ChickieNob, a biotech creature designed as a renewable meat source. The choice of source species here historically ties ChickieNobs' production to Nobel laureate Alexis Carrel's success with keeping an embryonic chicken muscle growing in a bowl fed with nutrients for thirty-two years, an experiment that inspired Winston Churchill in a 1932 essay titled “Fifty Years Hence” wryly to observe that “[w]e 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.”³⁰ Meeting these desires and more, the fictional ChickieNob regenerates its own flesh and has no face, and therefore it seems to anticipate as well PETA's call for real artificial-chicken nuggets. Incapable of expressing any suffering, the utilitarian's dream creature in Atwood's novel lends itself to seemingly

30. Winston Churchill, “Fifty Years Hence,” in *Thoughts and Adventures* (London: Macmillan, 1943), p. 234.

endless harvesting for fast-food-chain products designed specially around it, like the ChickieNob Bucket O'Nubbins.

In this particular way, Atwood's ChickieNob still more directly reflects a literary predecessor, the amorphous Chicken Little of Frederick Pohl and C. M. Kornbluth's 1954 novel *The Space Merchants*.³¹ Both of these fictions present these meat animals as examples of a larger problem—namely, corporate greed run amok. The creatures are introduced through narrators, both of whom are admen, content with eating bioengineered chicken meat that at once reflects and propels depleted global environments. Yet, in the course of both novels, these characters express horror when confronted with the biotech source of the real artificial meat. The admen's mixed responses to this kind of meat and its makers might be read as adumbrating the ambivalence with which they eventually turn against their bosses as part of global capitalist implosions (these are, after all, speculative fictions). But there are important differences as well.

Only *Oryx and Crake* imagines the real artificial meat source as an utterly abject creature, an animal whose revolting qualities are decoupled from any sense of agency. Unlike ChickieNobs, the amorphous Chicken Little plays an active role in the earlier novel, sheltering members of the resistance movement working to bring down the system that exploits her (and she is distinctly gendered female as well). Intriguingly, the capacity of Chicken Little to revolt alongside human social revolutionaries does not mark a point of divergence between these fictions, so much as it aligns this character with another kind of artificial meat animal in *Oryx and Crake*.

Atwood projects this other sort of revolting potential through very different animal forms, the bio-engineered pigs nicknamed "pigoons" who, more like GM meat animals in the United States today, enter into human food chains as by-products of medical biology, not as the planned outcomes of food science. The GM pigoons initially are created to customize and thereby render more efficient the process of xenotransplantation; infused with human genetic material, eventually hosting "genuine human neocortex tissue," pigoons puncture genomic boundaries among species, and more.³²

The impending food scarcity driving the production of real artificial meat becomes compounded in Atwood's speculative fiction by bioengineered diseases that are deliberately spread as a form of

31. Commenting on *The Space Merchants* as an example of a dystopic food fiction, Warren Belasco notes: "The idea [of self-regenerating meat] was not quite new, as Winston Churchill had heralded almost this exact wonder back in 1932"; see Belasco, *Meals to Come: A History of the Future of Food* (Berkeley: University of California Press, 2006), p. 132.

32. Margaret Atwood, *Oryx and Crake* (New York: Doubleday, 2003), p. 56.

corporate sabotage. Consequently, the novel's pigeons quietly get added to the human food chain as both waste products of research and development for the biomedical industry and welcome additions to a depleted meat-production stream. But the cleverness of these pig-shaped genetic hybrids proves another unintended consequence of developing this animal as a biotech fix to human medical problems, only far more deadly. After humans unleash a plague on themselves of one last, exceptionally virulent GM pathogen, the pigeons roam free, becoming a sort of piggy goon squad. Given this advantage, these newly feral animals use their (post)human brain matter to plan and coordinate the hunting of humans in Atwood's cautionary vision of the end of agricultural history.

In this projected afterlife of farming, GM animals might be seen as extending an "environmental unconscious" beyond what Lawrence Buell theorizes in terms of "a residual capacity (of individual humans, authors, texts, readers, communities) to awake to a fuller apprehension of physical environment and one's interdependence with it."³³ Bringing together a range of twentieth-century hunting narratives, Buell notes the fixation on behavioral evidence of cognition in animals, envisioned as constitutive elements of a "global vision," arguing that these literary elements anchor the "ethical-aesthetic commitments" to environments as common grounds.³⁴ Toying with these narrative elements, Atwood's depiction of feral farm animals (who again are bioengineered to share cognitive capacities with humans, which inadvertently make them all the more readily prey to the GM animals) adds an intriguing twist to the pattern outlined by Buell.

His modernist literary progression from the depiction of men hunting wild animals as a means of dramatizing human dominance to a vehicle for articulating a more sustainable land ethic—if also eventually becoming perceptible as an "inherently evil" practice from "contemporary (sub)urbanite" perspectives³⁵—might be seen to backfire spectacularly in *Oryx and Crake*, where hunting becomes a means of redefining animals as active (here feral) agents and humans as meat.³⁶ Like the GM dinosaurs of the *Jurassic Park* films and novels, the feral pigeons become inadvertently liberated from their

33. Lawrence Buell, *Writing for an Endangered World* (Cambridge, MA: Belknap, 2001), p. 22.

34. *Ibid.*, pp. 222–223.

35. *Ibid.*, p. 187.

36. On the literary history of animals as feral agents, see Philip Armstrong, *What Animals Mean in the Fictions of Modernity* (New York: Routledge, 2008).

enclosures and instantly reveal how nature, red in tooth and (here) hoof, outlives laboratory experimentation. Moreover, Atwood's transformation of meat animals to hunters of humans spells out the conceptual and physical dangers to the human of thinking of environments as common grounds, leaving readers with a profoundly uneasy sense of real artificial meat as a meeting ground for very different notions of ethics and community than Buell has in mind.

A still more complex sense of the environmental unconscious emerges through Atwood's third category of GM animals: those sourced for real artificial meat. Along with the physical and social spaces that might sustain it, farm life has already become a thing of the past by the time the novel begins, which is in part why the only meat depicted is produced in laboratories. Calling attention to the severe environmental degradation conditioning such a world, Atwood introduces one more kind of meat that exemplifies how more species than humans and meat animals are affected by these developments. Ranged alongside the more familiar chicken and pork derivatives, the novel mentions a hybrid-meat animal that has been bioengineered for a different reason. The "kanga-lamb, a new Australian splice that combined the placid character and high-protein yield of sheep with the kangaroo's resistance to disease and absence of methane-producing, ozone-depleting flatulence" (and curiously not the ruminants' more alarming problem of belching methane) points to yet another potential for meat animals as environmental agents.³⁷ Mentioned only once as high-end restaurant fare, the kanga-lamb inscribes the frontline challenges to biotech implementations of GM animals, which includes seeing meat and animals together with humans as actors, in this case coming together (however nominally) to stave off the impending "farmageddon."

Recent interventions in the genetic science of livestock make these developments appear to be more than matters of idle speculation; arguably, they are the most pressing concerns of our time. With its same methane-minimizing purpose, the kanga-lamb addresses the same problem as GM fodder grasses presently under development in New Zealand. As an animal created to stem the tide of meat-industry pollution, however, the kanga-lamb's story more closely seems to follow that of an actual GM animal now pending approval for commercial implementation.

The first animal genetically modified in order to solve an environmental problem, the Canadian Enviropig™, is curious as a rare example not only of how GM technology can be introduced afford-

37. Atwood, *Oryx and Crake* (above, n. 32), p. 292.

ably and effectively in animal agriculture, but also of how desires of and for the flesh transform material along with social bodies.³⁸ Enviropig™ eliminates phosphorous pollution from pork production, a problem manifested in runoffs that cause algal blooms and fish kills in waterways and subsequently addressed with strict regulations enforcing waste management. Like real artificial meat, this animal embodies a tech fix, an industry solution to industrial problems, but for a very different purpose.

Instead of renewing the world through expanding consumer choices, the point of creating this GM feeder pig is to offer a new lease on the future for independent, small-time swineherds, at a time when this group is fast becoming economically endangered. More clearly than tissue-engineered meat, the coming into being of transgenic farm animals designed to pass as their more ordinary predecessors raises grave questions about perceptions of meat animals in urban industrial societies. But only Enviropig™ shows the potential for what can happen when scientists and regulatory officials alike approach meat animals and the humans who keep them together, as significant economic and social players who share fragile environments.

Regardless of whether these creatures follow cloned animals into the all-important U.S. market or if consumers suddenly balk at the prospect of eating “Frankenfood” with a face, those who stand to gain or lose the most from their commercialization will be the swineherds who presently occupy the indeterminate open spaces between the government- and corporate-owned lands that, as Atwood’s novel cautions, are shrinking at an alarming rate, enclosed within increasingly urbanized, built environments. Although the least developed of these creatures in *Oryx and Crake*, the kanga-lamb thus most forcefully introduces the ways in which GM animals, people, and a peculiar kind of real artificial meat are poised to work together at the last outposts of sustainable rural life. Again, although Catts and Zurr are quick to point out that their work does not involve genetic modification, the questions of agency raised by their semi-living sculptures, particularly *Disembodied Cuisine*, intersect with these GM animal stories in their concern about perceptions of meat and agency forms and, in turn, their connection to a sense of place.

38. Ann Bruce, “GM Animals—Another GM Crops?” *Genomics, Society and Policy* 3:3 (2006): 4. I learned about this pig from Jonathan L. Clark, whose dissertation on Enviropig™ as a “regulatory-friendly” organism explains the significance of this creature in terms of a special kind of biotech fix, one that conceptualizes the body not as a sink, but as a source of environmental toxins.

Confounding the largely polarized patterns of interpreting animals, especially in literary history, aesthetic and scientific experiments alike beg broader questions about how the interests of all life forms—human, animal, plant, tissue, cellular, and so forth—converge in the multiform intimacies on which meat industries depend. For instance, how does rendering animals as agents exceed the designs on them as commodities like ChickieNobs and PETA nuggets, or as eco-saviors like kanga-lambs and Enviropigs™? And how does it relate these creatures to other mutations of creatures exhibiting feral agency—that is, the often surprising transformations of meat animals into menaces like pigeons and antibiotic-resistant-pathogen incubators? Perhaps most importantly, how does it build potentials for coordinating mutually sustainable cooperation with semi-living agency forms like frog “steaks” and Chicken Little?

Reading these artistic, scientific, and literary developments in tandem clarifies further that the idea of meat’s (especially fake meat’s) agency is not only nothing new, but is also linked from its inception to the fraught bioethical terms through which people come to conceptualize relations with other species, which some see as subsequently brought to environmental crisis by manipulation at the genetic level. And it calls attention to the perplexing forms of species and social life already embedded deeply in our own and other tissues. From this perspective, representations of real artificial meat appear to sustain not so much fantastic extensions as practical examinations of these lived conditions.

Meeting Meat: Animal Studies and Ecocriticism

Rising today to unprecedented levels and with already apparently deleterious effects on fragile (especially arid and semi-arid) landscapes, biodiversity, and water resources, global meat consumption rightly becomes cause for widespread concern. For these reasons alone, real artificial meat’s impending production will be of interest to environmental as much as animal rights activists. As the PETA contest indicates, however, the greatest dangers might arise in confusion about who and what meets in the meats of the future.

The visual and literary explorations outlined above could therefore prove most useful in their cautions against naively retrofitting such complex entities into the terms of human subjects and inhuman objects (the familiar foundations of rights discourses), and their call for new terms and consequently politics of agency forms. For the same reasons that vegans should care more about the imperiled future of the world’s pollinators than about what other people are eating, these aesthetic experiments sharpen the focus on real

artificial meat to the relations of people and animals in particular places.

As our species heads into the sort of Orwellian future with which this essay began, and one that seems likely to feature tissue-cultured ersatz frankfurters, aesthetic experiments with real artificial meat already are mapping how much more is at stake in tissue culturing than minimizing ecological hoofprints or alleviating farm-animal suffering. Inscribing real artificial meat's histories as intimately shared across many species, shaping landscapes across millennia, they press for more complex engagements with agency beyond the form of the rights-bearing subject not only because such forms inadequately represent relations across species, but more importantly, because still others are needed to account for the interactions comprising multi-species communities with shared investments in environmental systems. And I would add further that the future of such communities hinges on aesthetic perhaps more than on any other transfigurations of biopolitical life—that is, on just this sort of creative cultivation of the conceptual places where individuals, species, and other living agents meet.

working on a book provisionally titled *The Avant-garde and the Forms of Nature*.

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