

Biocapitalism and Culture

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From the mass extinction of megafauna in the late Pleistocene epoch, to the introduction of settled agriculture during the Neolithic era, to the breeding of hybrid seeds during the Green Revolution, *Homo sapiens* has always tinkered with evolution. But it is only since the “discovery” of the structure of DNA in 1953 that human beings have begun to understand and to manipulate our genetic inheritance, and the rest of biological life, in a self-conscious fashion. The deciphering of DNA unleashed a multitude of technologies that transform organisms through manipulation of their cellular and subcellular structures, using techniques such as gene splicing, cell fusion, and cell culturing. The revolutionary potential of genomics made its strongest impact on the popular imagination during the 1990s and early 2000s, when efforts to decode the human genome were spurred on by hyperbolic claims about the medical and social benefits of genetics. Plans were hatched to create massive DNA databanks, linking the health records of entire populations with their DNA, identifying supposed disease genes, and developing personalized forms of medicine based on genetic analysis. In the media hype that surrounded the Human Genome Project, new forms of genetic determinism suffused popular culture, and our genes were held to be responsible for everything from individual human beings’ irresponsible behavior to broader social phenomena such as homosexuality.

Despite the breathtakingly quick decoding of the human genome, most of the Promethean claims of the boosters of genomics have failed to pan out. Genetic analysis has allowed doctors to identify genetic risk factors for certain diseases, but gene therapy as it was once imagined is a nonstarter. It turns out that human beings are far more complicated than the molecular reductionists imagined, with the complex links between individual genes, cells, proteins, the body as a whole, and the socio-ecological systems in which we are embedded confounding the unilinear efforts at disaggregation proposed by Crick and Watson, the discoverers of DNA, and subsequent reductionists

like Richard Dawkins, whose selfish gene theory provided a convenient alibi for the worst excesses of neoliberalism.

Since the sequencing of the human genome just over a decade ago, hopes for medical miracles have moved on from genomics to neurology, which today holds the limelight with its promises to cure disordered minds and explain various social ills. But the emerging technology of Synthetic Biology or SynBio promises to place molecular biology at the center of public attention once again. SynBio allows scientists to engage in novel and extreme forms of genetic engineering. Rather than swapping existing genes from one species to another as in “traditional” genetic engineering, scientists can now write entirely new genetic code on a computer, print it out using a 3D laser printer, and insert it into living organisms – or even create brand new forms of life. Proponents of SynBio such as the ubiquitous biochemist J. Craig Venter promise to turn cells into living machines, re-engineering their DNA so that they pump out whatever chemicals we desire. This is not pure theory. Each year, for example, the iGem jamboree - an acronym for International Genetically Engineered Machines, a great band name if I ever heard one - allows hundreds of high school and college students from around the world to invent their own synthetic organisms using so-called biobricks, standardized Lego-like units of DNA constructed by MIT scientists. SynBio’s proponents promise miraculous products, from algae that synthesize petroleum-like chemicals to the revival of extinct species like the woolly mammoth.

By promising to turn living organisms into biological machines and by generating entirely unprecedented forms of life, SynBio raises fundamental ethical and political questions that should not be left solely to scientists and corporate executives to address, particularly since many scientists are now also CEOs. Researchers such as molecular engineer George Church are clear about the scope of these emerging technologies. In his book *Regenesis*, Church bubbles over with enthusiasm about the dawning new order, saying, “Synthetic genomics has the potential to recapitulate the course of natural genomic evolution, with the difference that the course of synthetic genomics will be under our own

conscious deliberation and control instead of being directed by blind and opportunistic processes of natural selection.”¹ In other words, SynBio gives humanity unprecedented, even God-like, control over the genetic future, effectively ending evolution.

If SynBio inspires starry-eyed visions of immortality among advocates of Transhumanism, it simultaneously conjures dollar signs in the eyes of venture capitalists. The US government spent \$3.8 billion on the Human Genome Project, which in turn added \$796 billion to the US economy, \$244 billion of which was personal income.² The imminent SynBio revolution promises to dwarf these substantial sums. The SynBio industry is already booming, with a projected market value of \$11 billion by 2016. We are, it seems, on the cusp of a fresh round of accumulation, in which molecular biology, venture capital, and neoliberal governance combine not simply to commodify life itself but to drive accumulation into the hitherto unimaginable realm of genetically novel life forms. It is this new mode of accumulation that I term biocapitalism.

Biocapitalism’s implications for questions of social justice and environmental sustainability are, I believe, some of the gravest faced by our society, yet there has been virtually no regulation of the industry and little adequate assessment of the potential risks associated with synthetic organisms. Nor are there plans for significant governance of the industry going forward. President Obama’s 2012 Commission for the Study of Bioethical Issues concluded, in fact, that the SynBio industry should regulate itself. Paralleling and exacerbating these failures of oversight, there has been shockingly little engagement with biocapitalism on the part of cultural studies critics. For example, there has not been a single issue of the journal *Social Text* dedicated to science studies since 1996, when Alan Sokal perpetrated his hoax in order to discredit cultural studies’ efforts to intervene in the science wars. Furthermore, there has been almost no attention to the fundamental questions about biopolitics raised by the revolution in genomics. The closest we (disclosure: I’m a member of the ST Collective) have come is the 2011 special issue on *Interspecies* edited by Julie Livingston and Jasbir Puar, but although

this issue focused on the intersection of animal, postcolonial and queer studies, it made no mention of the implications of the new synthetic biology for these fields. The Sokal hoax may be somewhat responsible for this reticence on the part of cultural studies to tackle today's burning scientific issues, but I suspect that it is also a reflection of the enduring disconnection between the natural sciences and other parts of academia that the British scientist C.P. Snow diagnosed as the problem of the Two Cultures.

Although cultural critics have been surprisingly mute in discussions of emerging biotechnologies, artists and writers have filled this void by broaching key questions about the SynBio revolution. Among these questions are the following: what ethical obligations does the creation of synthetic organisms entail? Will SynBio foster human liberation, as its boosters proclaim, or entrench existing forms of inequality and imperialism? Are there processes or institutions through which a global citizenry can challenge novel forms of biopower? This presentation explores these questions by considering two examples of recent aesthetic engagements with biocapitalism: the sculptures of Australian Bioartist Patricia Piccinini and the *Oryx and Crake* trilogy of Canadian novelist Margaret Atwood. Piccinini and Atwood employ what might be termed speculative fiction and figuration, aesthetic forms that explore the potential ramifications of emerging SynBio technologies in not-too-distant futures. As Atwood puts it in the acknowledgements to *MaddAddam*, the concluding novel in her trilogy: "Although *MaddAddam* is a work of fiction, it does not include any technologies or biobeings that do not already exist, are not under construction, or are not possible in theory."³ These speculative representations allow Atwood and Piccinini to collapse time, and, in doing so, to explore and critique the forms of slow violence that characterize biocapitalism.⁴ My hope is that discussion of Atwood and Piccinini's speculative fictions and figurations will help us gain critical perspective on – and a ground for activist intervention in - biocapitalism's brave new world.

-1: How I Learned to Stop Worrying and Love Biocapitalism

In May 2010, Craig Venter's company Synthetic Genomics announced its creation of the world's first organism with a completely synthetic genome. Although it's not exactly a charismatic beastie, the entire biological makeup of Venter's organism was created using a computer. As I mentioned in my introduction, Synthetic Biology is a radical new form of genetic engineering that departs from previous forms of modification inasmuch as SynBio does not recombine existing sequences of DNA but rather is capable of synthesizing wholly new genomes using complex algorithms involving millions of variants. To give you a sense of how SynBio works, let me take an example from one of the student-led iGEM contests I mentioned earlier.⁵ Imagine you confront a public health crisis such as arsenic-polluted drinking water. Using SynBio, you could use your computer to create bacteria which have DNA sequences that sense arsenic, that contain on-off switches, and that code for luminescence. You would then test your newly created organism by plopping some into a bottle of water containing arsenic. If they start to glow, you would have a simple SynBio solution to your groundwater pollution problem. This experiment was carried out successfully by iGEM contestants in 2006, an eon ago by today's standards of innovation. While it cost nearly \$3 billion to decode the human genome a decade ago, for instance, today a basic sequencing device that would allow one to decode one's own genome at home costs only a few thousand dollars. Commercial sequencing costs have plummeted so dramatically that the task has been almost wholly outsourced to China, where massive automated sequencers in warehouses outside Shenzhen, Shanghai, and Beijing decode and store more genetic information every month than the sum total of information amassed from the discovery of DNA in 1953 to Venter's synthesis of the phi X174 genome in 2003.⁶

What precedents may we draw on in order to gain critical perspective on this emerging mode of biocapitalism? Certainly Foucault's analyses of biopower, the explosion of techniques through which the modern nation state learned to subjugate bodies and control populations beginning in the late

eighteenth century, offers important insights. But while biopolitics is certainly necessary for the emergence of biocapitalism, I think a true biocapitalist order has emerged only relatively recently. I am defining biocapitalism as a regime of accumulation that is based on a shift from the production of money by means of the commodity – Marx’s M-C-M’ – to the production of money by means of the commodification of *bios*.⁷ Key to the foundation of biocapitalism, I would argue, is the process through which, over the second half of the twentieth century, communication was transformed cybernetically into information, and information was subsequently reduced electronically to digital bytes. In tandem with this process, biological life was parsed as a molecular code in the form of DNA’s strings of four basic nucleotides: cytosine (C), guanine (G), adenine (A), and thymine (T). Transformed into such a biological code, *bios* can potentially be circulated seamlessly as information, as commodity, and as material artifact. SynBio represents the fusion of these two technological transformations, with contemporary computer scientists increasingly talking about “DNA-based computation” and synthetic biologists speaking of “life circuit boards.”⁸

Yet such technological revolutions are necessary but not sufficient to explain the emergence of biocapitalism. A whole array of new legal, institutional, social and cultural mechanisms and alignments were necessary in order to facilitate this new regime of accumulation. As Kaushik Sunder Rajan explains in *Lively Capital*, the emergence of the biotech industry was a product of a confluence of developments in the 1970s and ‘80s. Some of the most important of these include: the development of recombinant DNA techniques by Herbert Boyer and Stanley Cohen in 1973, which allowed the life sciences to become technological; the 1980 US Supreme Court ruling in *Diamond v. Chakrabarty* that established patent rights on a genetically engineered microorganism; the Bayh-Dole Act, also of 1980, which promoted the transfer of technology between academia and industry, leading to the commercialization of basic scientific research; and, finally, the infusion of significant sums of capital from the US federal government’s National Institutes of Health and from venture capitalists.⁹ Note that

only the first of these developments is technological - equally key to the corporatization of the life sciences was the emergence of the entrepreneurial university and the attraction of federal research funding and venture capital to biotechnology.

It is even more important to note, I think, that the colossal growth of biotech over the last two decades was facilitated by and dependent upon the consolidation of US debt imperialism. In her important book *Life as Surplus*, Melinda Cooper links capital's expansion into a novel space of production – molecular biology – with a new regime of accumulation based on the financial liberalization and monetarist policies of the Reagan administration that inaugurated the neoliberal era.¹⁰ During this period, the US Treasury's interest rate policies funneled global financial flows into the dollar and US markets, allowing the US to run unlimited balance-of-payments deficits. What I find most suggestive about Cooper's analysis is not simply the links she makes between Reagan-era modifications in intellectual property laws, the deregulation of banking and financial markets, and the growth of the biotechnology sector. Equally significant is Cooper's insistence that this new regime of accumulation is characterized by inextricable links between the economic and the ecological. As Cooper puts it, “the debt form is also deeply materialist. It seeks to materialize its promise in the production of matter, forces, things. In the long run what it wants to do is return to the earth, recapturing the reproduction of life itself within the promissory accumulation of the debt form, so that the renewal of debt coincides with the regeneration of life on earth – and beyond. It dreams of reproducing the self-valorization of debt in the form of biological autopoiesis.”¹¹

This self-authoring drive, Cooper suggests, is evident in the new forms of biotechnology developed after the discovery of recombinant DNA technology (RDT). Biocapitalist production makes use of horizontal gene transfer, and, with the recent development of Synthetic Biology, of the creation of wholly novel gene sequences. SynBio indeed seems to confirm the contention of complexity theorists Ilya Prigogine and Isabelle Stengers that, while industrial production depends on the finite

material reserves available on Earth, life, like contemporary debt production, can be seen as infinitely self-generating.¹²

These theories of biological self-creation and increasing complexity became a convenient justification for neoliberal policies of deregulation among economists influenced by developments in molecular biology. Biologists like Stuart Kauffman and his protégés at the Santa Fe Institute drew parallels between the relentless, if crisis-ridden, growth of biological complexity that characterizes evolutionary history and neoliberal theories of self-regulating economic growth.¹³ If the capitalist economy could be seen as a complex evolving system, then Santa Fe theorists, embellishing on the work of Joseph Schumpeter, argued that periodic catastrophic economic crises are an inherent part of the system's tendency towards "creative destruction," bouts of cataclysm leading towards heightened complexity.¹⁴ Yet if for Schumpeter and his epigones at the Santa Fe Institute the periodic crises that punctuate capitalism are a normal part of the business cycle, we would do well to recall that for Marx and Engels, capitalism's "epidemics of overproduction" take an enormous toll, plunging bourgeois society back into a "state of momentary barbarism" as a result of the "enforced destruction of a mass of productive forces." According to Marx and Engels, during these period bouts of crisis, "it appears as if a famine, a universal war of devastation, had cut off the supply of every means of subsistence."¹⁵

It is precisely such a blasted world that Margaret Atwood presents us in her *Oryx and Crake* trilogy. North American society is dominated in the near-future scenario she depicts by biocapitalist corporations devoted to the commodification of life and the biopolitical manipulation of the populace, a kind of metastasis of contemporary neoliberalism. Furthermore, her trilogy hinges temporally on a pandemic released from within these same corporations that obliterates almost all of humanity. The novel switches between a post-apocalyptic present and the dystopian biocapitalist past that appears to be our near future, if we are to believe Atwood's explanation of her speculative fictional form. In this biocapitalist near-future, corporations such as HelthWyzer, OrganInc and RejoovenEsense employ

molecular biologists to create pharmaceutical drugs into which hostile bioforms are embedded, giving these corporations total control of the key perquisites of biopower as described by Foucault: the right to take life or let live. The pandemic that destroys most of humanity in Atwood's dystopian near-future is unleashed by the young genius Crake, who goes rogue after he finds out about such corporate biopolitical manipulation and decides to retaliate by engineering a perfect race of genetic hybrid beings. In order for these so-called Crakers to have dominion over the Earth, humanity must be obliterated.

One could perhaps accuse Atwood of a number of problematic moves here. First of all, the corporate-dominated world she depicts could be seen as an extrapolation based on a misrecognition of the fundamental lineaments of contemporary neoliberalism. After all, biocapitalism is a product of the sustained and massive application of state power to raise the rate of profit in the life sciences and associated sectors. Yet such critique misses the mark since Atwood, I would argue, is penning a speculative analogue to the violence of contemporary biocapitalism. While the state sets the basic conditions for contemporary accumulation today, as we have seen it currently leaves regulation almost entirely up to biocapitalist corporations. The result is what medical anthropologists like Ann Anagnost, Nancy Scheper-Hughes, and Kalinda Vora describe as a transfer of corporeal surplus from global South to North, through organ markets, surrogate reproduction clinics, and the outsourcing of clinical trials to "bioavailable" subject populations in the global South.¹⁶ In Atwood's phantasmagoria, biocapitalism extracts surplus life not simply from the destitute populations of the "pleeblands," but from among the complacent consumers of the elite corporate compounds. Corporations like HelthWyzer manipulate the population through dreams of biotechnological transcendence of all their physical and social problems, assassinating any who question their power. So thorough is this manipulation that even a brilliant dissident like Crake can only imagine political transformation through radicalization of the corporations' own strategies of creative destruction.

-2: Animal Pharm

Patricia Piccinini's 2002 sculpture "The Young Family" evokes an uncanny proximity to the human through its central figure's size, proportions, and, above highly realistic fleshy finish.



Yet Piccinini's mother figure and her surrounding babies are clearly not human beings.

Notwithstanding the adorable poses of the babies and the mother's smiling face, there is something deeply unsettling about these not-quite-human figures. Indeed, it is precisely the combination of their difference *and* proximity to the human that is disquieting. Piccinini's work foregrounds key ontological and ethical provokes by contemporary interspecies relations. As I argue here, however, the onto-ethical register is ultimately inadequate to respond to the crises the biocapitalism is likely to unleash. The question of openness to the Other must be supplemented by a political ecology that asks who benefits from interspecies intimacies.

If, as Philip Armstrong argues in *What Animals Mean in the Fiction of Modernity*, the animal is that *against which* the human has been defined in the dominant culture of Euro-American modernity, Piccinini's "The Young Family" challenges that binary by offering us a group of hybrid transgenic figures that unsettle the firm boundaries that have subtended constructions of civilization.¹⁷ These

creatures are in some sense our own progeny since we could potentially bring them into being through genetic engineering. I'm particularly interested in the gaze of the mother figure in this family. She regards her nursing babies, it seems to me, with a combination of tender solicitude and vulnerability. As we look at Piccinini's sculpture, we are somewhat awkward witnesses to this most intimate moment, to the maternal gaze that expresses a visibly deep empathy. Why awkward? Because we witness not simply a moment of intimacy, but one of naked affect.

Piccinini's work brings to mind the moment in Jacques Derrida's *The Animal That I Am* when the philosopher's cat catches him emerging naked from the shower.¹⁸ Derrida writes in a typically playfully mode that he is overwhelmed in this moment by a feeling of shame at his nakedness, yet it is precisely this emotion that Derrida suggests has been seen as one of the factors that distinguishes humans from animals like his cat, who, he observes, is not aware of being naked and consequently cannot experience shame at being thus regarded. Or at least this is one of the ways in which Euro-American modernity has sought to cement the border between the human and the animal. The tradition of differentiation that Derrida tracks, extending backward from his moment of prudency to philosophical progenitors such as Heidegger and Descartes, is animated by an ontological and linguistic violence that reduces what he calls "the heterogeneous multiplicity of the living" to a singular Other: the animal.¹⁹ Such efforts to demarcate the human have been central to a range of historical atrocities, from the legal, medical, political, and economic efforts to differentiate species that characterized slavery and colonialism to contemporary manifestations of racial and species hierarchy in industrial slaughterhouses in the rural US. To disrupt such forms of human-animal dichotomy is to challenge some of the fundamental cultural logics of modernity and empire, which render other beings killable, or at least exploitable, without the need for ethical reflection.

The gaze of Piccinini's transgenic mother invokes such ethical questions precisely through her visible empathy for her progeny. If she responds so warmly to the imperative to care, how, the

sculpture asks, should we react to these fellow biobeings? As Donna Haraway puts it in a discussion of Piccinini's work, "unlike Frankenstein, who abandoned his creation, Piccinini urges that we bring an attitude of love to the products of technology, to accept our ethical mantle as creators, to take care of all our progeny, even of the artificial variety."²⁰ Such an ethic of solidarity is far from self-evident; pigs, after all, are the domesticated animals to which human misbehavior is most often compared. Allegories of liberation such as Orwell's *Animal Farm* and the film *Babe* often therefore take pigs as their protagonists, but Piccinini's "The Young Family" refers specifically to the field of xenotransplantation, whose goal, in Lesley Sharp's words, is "to merge human and animal species successfully within single bodies," with fleshy organs then "explanted" from animals and grafted into human patients whose lives are threatened by acute or chronic organ failure.²¹ A major obstacle to this process is the human immune system, which tends to attack organs transplanted from other species, making xenotransplantation an enduringly theoretical proposition, despite the successes of human-to-human alloplantation during the last century.

As Sharp explains in her overview of experimental xenotransplantation, swine have recently become the prime targets of xeno research after nearly a century during which primates were the species of choice for organ transplants.²² Simians were preferred for such work because of their perceived physical similarity and evolutionary proximity to humans.²³ They were, in other words, more easy to image as vectors of interspecies hybridity and exchange. Yet it was ironically precisely such perceived kinship that eventually rendered them unfit for xeno work. Despite the fact that no simian organ transfer has ever been successful precisely as a result of their immunological difference from humans, growing concern about primates' similarity to human beings, about their rights among ethicists and activists as well as about the possibility of pathogen transfer given simians' genetic similarity to humans, led to the abandonment of experiments with simian-to-human xenotransplantation roughly a decade ago. Pigs have now taken simians' place as xenosubjects,

avored for their status as farm rather than lab animals, for their prolific litters, and, perhaps most significantly, for the lack of public ethical concern about these animals.

Pig-to-human xenotransplantation has been in the works since 1992, when a small biotech company in England announced the “creation” of Astrid, the world’s first transgenic pig. Since then, setbacks, most of them related to immunological problems, have continually pushed the promised era of “organ farms” into the future. Nonetheless, the advent of Synthetic Biology has given xeno a new lease of life. Xeno pigs today are transgenic creations, genetically engineered either so that their progeny lack particular proteins that would generate a human immunological response or to ensure that future generations incorporate enough human genetic material that their organs are read as human when implanted in people. Such bio-fungibility truly troubles the borders between the animal and human, helping to explain the implicit appeal for ethical recognition and reciprocity in Piccinini’s family tableau. As Eben Kirksey and his collaborators put it in their recently published volume *The Multispecies Salon*, “bioartists [such as Piccinini] are offering us conceptual, technical, and ethical resources for thinking through our obligations to the emergent forms of life in the age of biotechnology.”²⁴

Yet if the present moment is defined by what Donna Haraway calls “choreographic ontologies” that entangle animals, plants, machines, and humans, I think it’s important to note that these entanglements are not necessarily antithetical to the forms of representational and indeed physical violence noted by Derrida.²⁵ There is, I think, a palpable romanticism to some contemporary work in animal studies, which, in its efforts to decenter the human, focuses on processes of interspecies becoming in ways that elide the systematic forms of violence to which the great majority of nonhuman animals are currently subjected. For the vast majority of plant and animals species living today, entanglement with human culture comes either through reduction to the status of abject commodity or through obliteration as a result of capital accumulation. For example, as Adrian Parr argues in *The*

Wrath of Capital, her devastating analysis of neoliberalism and environmental politics, the contemporary industrial food complex “represents the antithesis of cyborg dissent as it disciplines and regulates the creative impulse of material life and living labor, placing it in the service of capital accumulation. It plugs the bodies of animals into machines as a way to dominate them.”²⁶ It is precisely because of their availability as pure embodiments of animal capital, for example, that pigs make convenient xeno-subjects. Ten billion animals are raised each year in the US for meat, milk, and eggs, every stage of their reproductive lives minutely managed through breeding management programs and artificial reproduction technologies. All of this biopolitical technology ends in slaughter, culminating what Derrida describes as animals’ “extermination by means of their continued existence.”²⁷ This killing is facilitated, Derrida notes, by systematic forms of disavowal by human beings. Such disavowal suggests that it may be quite possible for people to have pig organs implanted in them without feeling any kinship or ethical responsibility for transgenic pigs themselves. Critical scholars must not repeat this act of disavowal by ignoring biopolitical power relations in their zeal to elaborate multispecies entanglement.

Margaret Atwood’s *Oryx and Crake* trilogy explores the dystopian implications of nascent xeno technologies in a manner that I think underlines the concerns I have been exploring here. Atwood’s novel shifts fluidly backwards and forwards between a near future in which currently emerging biotechnologies and biobeings have reached troubling maturity and a post-apocalyptic moment in which a handful of humanity has survived a man-made pandemic. The trilogy tackles xeno technologies directly through its depiction of the pigoons, living pharmaceutical factories that have been genetically engineered to provide kidneys, livers, hearts, skin, and brain matter for human recipients. The very thoroughness of their genetic manipulation, which includes the creation of human neocortex tissue, makes nonsense of the term xenotransplantation since the pigoons are effective hybrid doubles of human beings. As Chung-Hao Ku suggests in a brilliant analysis of Atwood’s work,

the pigeons function in *Oryx and Crake* in a manner similar to the mimic man in Homi Bhabha's account of the colonial context: the mimic is both a mockery and a menace to the colonial subject, a simulacrum of Englishness that is "almost the same but not quite/white."²⁸ This rupturing of species difference is particularly unsettling given the fate of the pigeons in the dystopian near future of Atwood's novel. Faced with the breakdown of industrial agriculture as a result of climate change, the corporations that dominate Atwood's fictional world quietly add pigeons to the human food chain. Ethical concerns about the resulting acts of effective cannibalism are waved away by the scientist-minions of corporate power since "it's just proteins... there's nothing sacred about cells and tissue."²⁹ Yet the pigeons, cannibalized waste products of the xeno R&D process, retain a feral agency. They survive the pandemic that destroys much of humanity as a result of their swine genes, going on to exact revenge for their subjection to corporate meat production by hunting down the slim remainder of the human race in the post-apocalyptic setting of the trilogy's first and second installments.

This denouement unequivocally raises what Donna Haraway calls "the onto-ethical question of care for the intra-acting and interacting generations."³⁰ Yet it seems to me that while it may be necessary to engage with such onto-ethical questions, such an orientation is not sufficient to challenge biocapitalism. This is particular true given the establishment in recent years of what might be called a bioethical-academic-industrial complex. As Ingun Moser has remarked, as the social movements of the past century have receded, issues of biotechnology have been marginalized and individualized as questions of ethics.³¹ Moreover, the field of bioethics has been professionalized, outsourced, and turned into a business enterprise.³² Biomedical researchers consequently no longer need to think too much about the ethical implications of their work since most major projects have a handsomely remunerated professional ethicist on the payroll.³³ Issues of great political import such as intellectual property rights are transformed into moral questions, which are then neutralized by committees of sycophantic bioethicists. Firmly embedded within biocapitalism, bioethics does little to challenge the

belief that technology offers a solution to all the problems that confront individuals today, with little thought given to questions of the common good, whether that collectivity is defined in terms of other human beings, future populations, or hybrid biobeings such as the transgenic pigs in Piccinini and Atwood's work.

In addition to cultivating a critical ethical sensitivity to the transgenic other, in other words, I think we also need to return to Marx's foundational question: *cui bono*, who benefits, when species meet?³⁴ While it may be true that contemporary genomics is kindling new forms of lively co-production, which in turn demand new forms of recognition and empathy, I think we need to see such changes in relation to the history of capital's appropriation of *bios*. Environmental historians have long been aware of the entanglement of various species. Alfred Crosby's seminal *The Columbian Exchange*, for example, tracks the interwoven movements of humans, mammals – pigs, in particular -, and microbes during the age of European colonial expansion into the Americas 500 years ago.³⁵ But Crosby's work is notable precisely for his insertion of these multispecies histories into a broader political ecology of imperialism. We should not, I am arguing, lose sight of the iron laws of today's biocapitalist economy and the global inequalities that it helps to cement in our efforts to survey and trouble fixed taxonomies of plant/animal/human.³⁶

In/Conclusion

Meeting in autumn 2014, delegates from 194 countries to the United Nations Convention on Biological Diversity (CBD) voted to regulate synthetic biology.³⁷ The decision came after ten days of tense negotiations between developing countries and a small group of wealthy nations with emerging SynBio industries. The United States was one of only three countries refusing to sign the treaty. During the negotiations, nations from the global South expressed strong concerns that SynBio products intended to replace agricultural commodities could devastate their economies and degrade biodiversity.

They also raised worries about biohazards resulting from SynBio. As important as this vote was, the CBD's regulatory efforts are at a very early stage. To give you a sense of just how early, suffice it to say that the CBD decision calls for the establishment of an expert group which will establish a definition of synthetic biology and identify whether existing governance mechanisms are adequate. In addition, the decision urges member countries to follow a precautionary approach to SynBio, to set up systems to regulate the environmental release of any SynBio organisms or products, and to support developing countries' efforts to enhance their capacity to assess SynBio. The decision makes it clear that SynBio threatens to further entrench the already yawning divide between developed and underdeveloped nations.

In the US, popular discussions of SynBio are woefully uninformed of these dimensions of technoscience and imperialism. Indeed, as I noted at the outset, cultural studies has yet to engage substantially with synthetic biology and the new biocapitalist regime of accumulation of which it is a linchpin. It is imperative that public intellectuals weigh in critically concerning biocapitalism. As I have argued in this presentation, I believe we live in a historical watershed, a transitional period during which many of the unrealized dreams and nightmares of biocapitalism are on the cusp of realization. It is a key moment in the struggle to stake claims of social and environmental justice in relation to this emerging regime of accumulation. Indeed, I believe that the nascent campaign to regulate SynBio should be seen as an essential component of the climate justice movement. Patricia Piccinini and Margaret Atwood contribute to this struggle, I have suggested, using speculative figuration and fiction to foreground some of the grave ethical and political crises that biocapitalism is unleashing on a largely unsuspecting public. They need allies.

Endnotes:

- ¹ Church, George and Ed Regis, *Regenesi: How Synthetic Biology Will Reinvent Nature and Ourselves* (New York: Basic Books, 2012), 12.
- ² Hilary Rose and Steven Rose, *Genes, Cells, and Brains: The Promethean Promises of the New Biology* (New York: Verso, 2012), 49.
- ³ Margaret Atwood, *MaddAddam* (New York: Doubleday, 2013), 393.
- ⁴ On slow violence, see Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge, MA: Harvard University Press, 2012).
- ⁵ This account is taken from Laurie Garnett, "[Biology's Brave New World](#): the Promise and Perils of the SynBio Revolution", *Foreign Affairs* (Dec 2013).
- ⁶ Garnett.
- ⁷ Andrea Fumagalli and Cristina Morini, "Life Put To Work: Towards a Life Theory of Value," *Ephemera: Theory and Politics in Organization* 10.3/4 (2010), 234-252.
- ⁸ Garnett.
- ⁹ Kaushik Sunder Rajan, "Introduction: The Capitalization of Life and the Liveliness of Capital" in Kaushik Sunder Rajan, ed., *Lively Capital: Biotechnologies, Ethics, and Governance in Global Markets* (Durham, NC: Duke University Press, 2012), 2.
- ¹⁰ Melinda Cooper, *Life as Surplus: Biotechnology and Capitalism in the Neoliberal Era* (Seattle, WA: University of Washington Press, 2008), 29.
- ¹¹ Cooper, 31.
- ¹² Cooper, 38.
- ¹³ Cooper, 42.
- ¹⁴ Cooper, 45.
- ¹⁵ Karl Marx and Friedrich Engels, *The Communist Manifesto*.
- ¹⁶ Ann Anagnost, "Strange Circulations: The Blood Economy in Rural China," *Economy and Society* 35.4 (November 2006), 509-529.
- ¹⁷ Philip Armstrong, *What Animals Mean In the Fiction of Modernity* (New York: Routledge, 2008).
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- ¹⁹ Derrida, 31.
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