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Memoir and the laboratory

The Human Genome Project took place in the same decade that saw a proliferation of popular memoirs in Anglo American publishing, heaving on airport bestseller shelves and piling up on buffet tables in chain bookshops. The extension of chain bookshops from the high street to warehouse superstores in shopping parks on the outskirts of cities meant a boom for popular non-fiction. Biotechnology was also going through a moment in the sun, with billions invested in laboratories around the world working to sequence the human genome, and the bulk of funding coming from the United States. To justify massive amounts of funding, and to ensure a legacy for the project and its key players, several of the Human Genome Project's main protagonists published science memoirs of the project. These memoirs – particularly James Watson's *DNA: The Secret of Life* (2003) and J. Craig Venter's *A Life Decoded: My Genome, My Life* (2007) – quickly ascended bestseller lists, sandwiched between sports stars and film actors. Venter and Watson draw techniques from the blockbuster memoir: a constant (often explicit) refrain of '*you won't believe what happened next*', cascading vignettes of overcoming obstacles for the sake of a higher goal, shock twists in the tale and a cast of protagonists, antagonists and commodities plucked from the thrillers and romances that competed for shelf space. These included men in dark suits from the US Department of Energy, billionaire investors, mad scientists, yacht races and motorbike accidents, and the spectre of Soviet biology.

Two decades on, it seems inconceivable that the Human Genome Project might not have happened, but its huge technological and ideological victory in the 1980s and 1990s was made possible by a constellation of factors: the end of the Cold War, the acceleration of global neoliberal consumption through a handful of brands targeting every level of salary, and deregulated finance capitalism becoming the basis of the world-system. These factors were not only instrumental in allowing the Human Genome Project the scale and global reach that it achieved, but also became part of narrating why and to whom the project

mattered and – at a formal level – what a genomic world looked like, its science-fictional forms and utopian promises.

These narratives were instrumental in transforming the genome from a strange, distant object in laboratories to a technology of post-industrial domesticity, and prepared the ground for direct-to-consumer DNA testing from the early 2000s. The genome changed the terms and possibilities of the bourgeois private sphere even as it eradicated the subjects it targeted, as Kazuo Ishiguro's *Never Let Me Go* (2005) and Andrew Niccol's *Gattaca* (1997) show. This was also connected to an often-haphazard collocation of national and international governance structures, where genomics offered technological shorthand for ethnonational investigations of population and phenotype. These investigations took existing descriptions of national identity as their starting point, privileging eighteenth-century mappings of individual traits onto national character.

Jenny Reardon situates this turn from ungovernable international programmes to national imaginaries in the wider context of creating value and meaning in the afterlives of decolonization and deindustrialization. By the mid-1990s, she argues,

Genomes, in turn, appeared to promise nations the opportunity to create new natural resources out of the bodily tissues of their citizens when resources in their lands and seas were disappearing. (2017, 94)

This links the shift of genomics from obscure laboratory practices to the domestic sphere via the promise of disease-free futures, facilitated by the instrumentalization of national exceptionalism (as in the case of Iceland's deCODE project) to new forms of accumulation. Giovanni Arrighi figures this transformation through the internalizing of transaction costs by the post-war US regime, and the creation of 'economies of speed' rather than 'economies of size' (1994, 247). These economies of speed have been characterized by – following Alfred Chandler – 'the development of new machinery, better raw materials, and intensified application of energy, followed by the creation of organisational design and procedures to coordinate and control the new high-volume flows through several processes of production', and the development of managerial hierarchies (1977, 244). US-driven globalization promised a multiple modes of national identification programmed within this structure, and genomics was no exception. Collecting DNA and tissue was a way of promoting national sovereignty while making this data available for global biotech (Reardon 2016, 102). This global-national model of exporting raw resources (in the case of national genomics projects, of biodata) levied with population-level ethnonationalism

helped foster the recent rise of various fascisms across the world. Through these new extractive techniques allied to logics of national sovereignty, a new form of worker emerged: one whose biomatter could be extracted as flesh-made-data, a donor for the bio-consumption of other people's bodies.

This depended on micro-level assemblies of national character, embedded in longer projects of modern European self-narration and its attendant distinctions between flesh and body (Spillers 1987). In this chapter, I consider the memoir form as central to the imagining of a composite genome as a normative reference against which new revolutionary health care practices could be measured. These practices were increasingly organized around an idea of personalized or individualized medicine, representing what Aravinda Chakravarti identifies as 'a fundamental change in medicine that has long relied on the idea of a typological patient' (2015, 12). A crossing place of aesthetic and political formations of the subject, memoir is tied to economies of property and genealogy. It is a genre for writing the self as a legible participant in public affairs, offering a set of discursive techniques for attaching this self to the development of consciousness in literary form.

The turn in medicine from typological models to individualized ones is two centuries behind literary culture. Jerome Hamilton Buckley charts a turn in late eighteenth-century literature from the type to the individual, the novel-form as a 'gallery of eccentrics, whose conduct may image the peculiar foibles of the presiding novelist', and when biography 'moves from the depiction of general human nature to the portrayal of a distinctive individual' (1994, 14). This allowed new forms of value to be attached to the self, which could be rearranged and reorganized, iterations of subjectivity as means of attaining access to the bourgeois public sphere. These new forms depend on a normalization of certain forms of sociality, with the nuclear family often at the centre of what makes the visibility of self possible: its facilitation and perpetuation. When Jürgen Habermas notes a correspondence between 'the autonomy of property owners in the market' and 'a self-presentation of human beings in the family' (1989, 46), this depends on a certain arrangement of private relations that can be narrated as chronological, reproducible and – crucially – believable. These forms are part of the legislation of a set of social relations that became central to participation in a market economy. They offered an alibi for 'a private autonomy denying its economic origins . . . provided the bourgeois family with its consciousness of itself' (Habermas 1991, 47). This is ultimately tied to the creation of a national body politic, a conglomerate character made up of idiosyncrasies, nuances and recognizable traits. In this oscillation between conglomerate and individual, the

narrative integrity of a subject developing through chronological time who is pervious to various kinds of influence as they move through their environment disappears. In place of this, the individual becomes a storehouse of data, unmoored from typology and an object from which information might be extracted, or a subject who might extract information from others.

Part of the Human Genome Project's victory was making whole-genome sequencing seem as if it was a historical inevitability. Miguel García Sancho notes that sequencing was positioned rhetorically as the culmination of the DNA revolution that started in the 1950s, a strategy that kept DNA central as molecular biology's principal object of study (2012, 7–8). In Chapter 1, I considered how Doris Lessing and Samuel Delany explored this transformation first as (in Lessing) a reconstitution of whiteness during a crisis for Anglo American post-war hegemony, and second as (in Delany) the formation of a neoliberal subject who can choose between a myriad of identifications, genomics as a technology of personalization. By the 1990s, the Human Genome Project had brought something different into the centre of focus: the idea of genetic disease.

As well as its domination of biotechnology, the long-term impact of the Human Genome Project was also in transforming the social space afforded to genetics in culture. Feminist scholars of biology writing during the 1990s argued that genomics was formed in part through a masculinist co-option of life processes into the rhetoric of automation, entrepreneurialism and engineering. Hilary Rose observes that the 'political interventionism of the new genetics, the product of an alliance between an aggressively entrepreneurial culture and the life sciences, fused the conservatism of biology as destiny with the modernist philosophy of genetic manipulation' (1994, 173). For Rose, the Human Genome Project was not only embedded in the political economy of the 1980s but also 'unquestionably marked the self-inserted entry of molecular biologists into runaway industrialised science' (1994, 197). Writing in 1992, Evelyn Fox Keller stresses that the expansion of molecular biology from the 1970s onwards 'was not just technical', but that there was 'an ideological expansion of molecular biology into both popular culture and medicine' (1992, 291). For her, the idea of genetic disease is key to this. Expanding across health and behaviour, genetic understandings of disease came to dominate both justifications for funding and popular imaginaries around the power (and relevance) of genetics. While this was organized rhetorically around the individual – adhering to the neoliberal privileging of individual choice – this resulted in something different: the creation of a genomic norm, which derives its value from its elusiveness and

intangibility, an elusiveness that nonetheless came to ‘implicitly define the concept of abnormality’ (Keller, 297).

Under the terms of neoliberal subjectivity – the individual as consumer – this elusiveness drives investment in the idea of the genome as a technology of self-fashioning. Keller also gestures, if obliquely, to a new kind of governmentality for which sequencing became a prototype: what Antoinette Rouvroy has called ‘algorithmic governmentality’, which replaces the individual (and liberal concepts of commons, public and the idea of project itself) with an amorphous ‘data-body’ with no fixed average or norm (2012; Rouvroy and Berns 2013). This data-body is premised on the forgetting of non-calculable data, and it in turn puts forward its own précis of reality (which is, in turn, constantly shifting). While mass genomic sequencing gave way to the development of precision medicine organized around an individual human subject, this technology has also precipitated a more fundamental shift in the way this subject is constituted, both technologically and ideologically.

The laboratory was a key space in transmitting this new genomic imaginary, and the memoir a crucial form. Here, I look at both fictional and non-fiction memoirs emerging around the Human Genome Project. I consider how memoir – a form that is explicitly about personal memory – becomes the generic totem for a science that tends towards the annihilation of any kind of memory (cultural, social, biological) that cannot be captured by sequencing. In these texts, the memoir becomes a kind of laboratory for experimenting with narrative forms generated by the syntax and technology of sequencing: what the objects and objectives of genomics were, and what subject these practices imagined on the other side of the first draft. Rather than collapsing the story of the Human Genome Project into a more general narrative of technology having its own logic and rhythm separate from ideological interests, I consider how the laboratory and its literary counterpart – here, the memoir – function as sites of ideological production. The laboratory is not restricted to places where (mostly) men in white coats look into test tubes through microscopes; in *Never Let Me Go*, the laboratory is extended to the boarding school – one of the classic monuments to liberal education given up to the mass production of organ donor clones; and in *Gattaca* to the domestic sphere, with hand-held DNA sequencing kits (a prescient foreshadowing of home DNA testing kits in the 2010s). Memoir becomes crucial in sustaining a sense of developmental time, a form that allows a subject to narrate themselves as a character on a trajectory, moving from point A to B. But these texts, in different ways, expose this effort as futile. Post-war domestic and developmental utopias disappear, infiltrated by outsourced

biotechnological production, and with it, the aspirational fiction of a subject able to improve their lot through hard work and buy-in.

These texts stage the disappearance of the subject privileged and foregrounded in post-Enlightenment modernity into Big Data: what Sylvia Wynter calls Man 2, or the biocentric descriptive statement of humanity (2003). In its creation of a composite reference genome the Human Genome Project upheld an idea of the normative subject as bourgeois, male and white, even going so far as to use Leonardo Da Vinci's Vitruvian Man as its logo, but this subject could not survive the more compelling and world-dominating possibilities afforded by sequencing. Rather than upholding the colonial episteme of aspirational whiteness as a global standard, sequencing offers an infrastructure for reality as proliferating and endlessly shifting – all that is needed is more technology to identify 'good'. This 'good' is not fixed to something external, but to feedback loops generated by self-learning algorithms (Rouvroy 2013). Memoirs of genomics are monuments to the ideal subject of the European Renaissance, but also register (knowingly or not) the disappearance of this ideal into what Rouvroy calls 'data behaviourism' – the pre-emption of individual and collective behaviours 'to cope with the complexities of a world of massive flows of persons, objects, and information, and to compensate for the difficulties of governing by the law in a complex, globalised world' (2012, 143). Genomics became the technological prototype for the algorithmic data-body.

The question of legality is key: as Ruha Benjamin notes, data worlds are by no means free from the kinds of ellipses and blindness that constitute racial capitalism, and they actively perpetuate it (2019). Rather, the challenge of the present moment – which both these texts anticipate – is the increasing irrelevance of state legislations of human freedom documented in national and international texts of human rights. Rather, the question has returned to the relation between flows of labour and violence, across borders, wherein legal parameters of citizenship can only go so far, as I explore in Chapter 4. The ideological disintegration of Man 2 has been facilitated in part by a technological system that was designed – paradoxically – to facilitate not only this figure's technological perpetuation, but also its immortality. Genomics is part of a new panoply of technological possibilities that bring about the accelerated destruction of liberal humanism, by introducing a new grammar of existence.

These texts trace how the sequencing imaginary of the 1990s emerges out of the homonyms of the Human Genome Project: code, pairs, clones, overlaps, map and sequence. Loss of memory is implicit: the reformulation of words corresponds to what Hans-Jörg Rheinburger and Staffan Müller-Wille have

called the ‘partial amnesia’ of the genomic revolution, when ‘the gene’ as a concept starts to dissolve, replaced by ‘complex assemblages of diverse activating and inhibiting mechanisms’ (2017, 108, 68); alongside this takeover of language, there was a forgetting of older models of systems biology. They cite the work of French biologists Francois Jacob and Jacques Monod on the *lactose* operon during the 1960s, a gene control mechanism in *E. coli* and other bacteria that facilitates the transport and metabolism of lactose. The broader influence of their work has resulted in ‘the findings of how many different ways such transacting events can be molecularly mediated’, in Stephen Baylin’s words (2016, 2060). It is not so much that Jacob and Monod were not taken seriously at the time; rather, these sorts of regulatory mechanisms were less easily determined from a genetic blueprint. In a critique of the gene-centrism of personalized medicine, Charles Joseph Kowalski and Adam Joel Mrdjenovich note ‘even if it were possible to know the exact sequence of A, C, G, and Ts comprising the DNA of a “normal” human being, this could tell at most a limited part of the story of that person’ (2017, 79) Nonetheless, telling this story of a ‘normal’ human being through their code was a central component of the Human Genome Project and the promises it heralded for Big Bio (Garay and Gray 2012).

The figure of partial amnesia offers a trenchant point of departure for considering how memoir functions as a technology of forgetting, the neurotic inscription of a liberal subject on the surface of a present in the process of subsuming this subject into data. *Gattaca* and *Never Let Me Go* are both interested in the body as a machine – a syntactical unit whose actions can be pre-empted – as well as the engineered inequity programmed into the system. And because genomic data-bodies do not exist ‘in reality’, they cannot die. Hence, individual death in these texts is outsourced or made invisible: what matters is that information keeps moving across systems, extracted and displaced from an assumed material source.

Metaphors of the Human Genome Project

The Human Genome Project began in the early 1980s, and it ended in 2003 with the first draft sequence of the human genome, fifty years after the publication of the double helix. Watson recalls bets being taken on the human gene count:

At the Cold Spring Harbor Laboratory conference on the genome in May 2000, Ewan Birney, who was spearheading the Sanger Centre’s computer analysis of

the sequence, organised a contest he called Genesweep. It was a lottery based on estimating the correct gene count, which would finally be determined with the completion of the sequences in 2003; the winner would be the one who had been closest to the right answer. . . . I was able to get in on the ground floor, putting \$1 down on 72,415. My bet was a calculated attempt to reconcile the textbook figure, 100,000, and the new best guess of around 50,000, based on the chromosome 22 result. Birney announced the result in May 2003: 21,000 genes – many fewer than anyone had guessed. (Watson 2004, 197)

The emphasis on number, on winning and losing, and on the correspondence of human complexity with a higher number of genes gesture to the expectation that the sequencing genome would tell us *what makes us human* in the new language of genomics. Bets are a good analogy: Watson describes a moment of speculation in which all the assumptions of some of the Human Genome Project's leading scientists and proponents became temporarily visible. Namely, that complexity equates to the amount of genes amassed, couched in a stock-market imaginary for envisioning genetic identity.

This bet also registers a shift in economic metaphors around biological life: from property to trading. Whereas genetics had been based on an older model of property relations attached to particular persons and lineages, genomics is attached to an economic model of neoliberal mutability, in which stock can be isolated and traded, moving around the system, to be implanted or subtracted according to need. If imagining genetics was about the combined sum of individual stock and the discipline of individuals, genomic sequencing became a technological prototype for imagining individuals as conglomerations of shared (and tradable) code. The individual disappears, their property (as inherited genetic code) subsumed into extractable components of use-value (as tradable genetic commodity). The metaphorical power of the genome as a script for life bridged the classical concept of genes as immutable inheritance, and the post-Synthesis concept of genetic mutation as calculable.

The turn of the twentieth-first century saw the publication of numerous first-person accounts of the project, from some of its key players: most notably, John Sulston, Venter and Watson. Memoir became a way of controlling the narrative in the Anglophone world about the Human Genome Project and its legacy, and one of its big selling points was the acrimonious cross-Atlantic drama between UK and US laboratories over the question of whether genomic information should be for public good or private profit. This drama went some way in obscuring the relatively underwhelming results of the project. Far from offering a map of human complexity, the first draft sequence of the human

genome showed that humans share a similar number of protein-coding genes to *C. elegans*, type of worm. Nonetheless, these memoirs became bestsellers, and Watson's *DNA* and Venter's *A Life Decoded* continue to stand as the definitive popular accounts of the project's history, aims and long-term vision. The focus of these texts is placed squarely on the dawn of a new age in biotechnology and on the unlocking of human potential for new routes in healthcare and reproductive technologies. Social welfare competes with state security, with molecular biology becoming increasingly tied to military budgets from the early 1950s onwards. By the late 1970s, the unmooring of science from its social implications (or the reduction of the social to national security) became part of the broader project of neoliberalism, with scientific expertise increasingly drawn into private capital flows.

Mike Fortun has addressed the importance of paying attention to 'the affective register of scientific developments' (2016, 7). Although in memoir, affect isn't always trustworthy – even when it is positing itself as such – it indicates the affective register the Human Genome Project's main players wanted to associate with the project, and how this register shaped both its technological and epistemological stakes. Building the imaginative infrastructure of whole-genome sequencing through memoir cemented the project's ideological underpinnings: in the United States, private entrepreneurialism organized around a neoliberal subject. While there was some resistance to this in the UK – Sulston considered genomics as a potential instrument of state welfare and therefore public good – the genome came to stand for individual potential, broken down into its component parts. In Sulston, Venter and Watson's books, a string of personal memories threads together the narrative of the Human Genome Project's main events, interwoven with details from the author's lives: Venter's experiences as a young medic in Vietnam; Watson's intransigent Scottish mother; and the motorbike accident that took Sulston away from the Sanger Institute for extended leave at a crucial moment. These details communicate some of the stakes of the project for its main proponents: for Sulston, taking responsibility for a team and sharing out the work, as well as the data, was central to his methods and hopes for a truly public science. Watson positions himself at the centre of the consortium, diplomat and antagonist across the public-private divide: the old guard keeping pace. And from a medical tent in Vietnam, Venter tells the story of the race for the genome as a race against death, building an implacable defence system that might extend human life indefinitely through big business.

It was crucial to tell a story about the genome for a number of reasons: to garner public support for its uses in biomedicine, important in the generation

of further funding and legacy work. In Sulston's case, public opinion was vital in his (and others') efforts to keep the data of the reference genome public. But above all, this was a crowning moment for technological modernity: sequencing the genome was a Copernican overturning, repositioning the human in space and time, unravelling the mysteries of human complexity and instrumentaliing these answers for a better future. Thematically, these books set the terms of the Human Genome Project's drama (whether or not to patent genes, and who won the argument) and formally, they recapitulate the value of the individual as the fundamental unit of biological calculation. They present the genome project as a paradigm of academic-industrial cooperation, and centre DNA as the governing interest of molecular biology (Sancho 2012). As Sancho argues, this 'oversimplified' view centring DNA 'marginalises other disciplines, along with other historically relevant molecules, e.g. proteins' (2012, 8). But for reasons that others have noted (Keller 2000; Rajan 2006; Fortun 2008), the story of DNA was the one that sold, rather than more complex accounts of intracellular interactions between proteins and segments of DNA. In the latter decades of the twentieth century, the molecular of molecular biology was the gene, and ways of isolating, cloning and modifying it was where the funding was. In the new era of biological citizenship described by Nikolas Rose, 'vitality is decomposed into a series of distinct and discrete objects – that can be isolated, delimited, stored, accumulated, mobilized, and exchanged, accorded a discrete value, traded across time, space, species, contexts, enterprises', processes which have meant in inextricable intertwining of biopolitics with bioeconomics (Rose 2007, 7). *Memoirs of the Human Genome Project* situate the project as the first Big Science project of the neoliberal era, promising new frontiers for health. 'We can never turn back,' writes Watson at the end of *DNA*; 'what the public wants is not to be sick' (174). Questions remained around who and by whom this 'public' was constituted.

Rose uses the word 'decomposed', a suggestive adverb steeped in a gothic imaginary, calling up an image of a body decaying around genetic objects which it both houses and which are uncannily alien to it: the irreversible breaking down of an organism into smaller parts of matter. Here is the contradiction of neoliberal subjectivity: value in the system relies on sustaining an image of the individual subject and the augmentation through biotechnological intervention, while simultaneously breaking this subject down into exchangeable material, genes as commodities to be copied and sold on the market. The promise of precision medicine is that the patient-as-consumer can choose from a range of options specifically designed around their genetic make-up, as long as they

buy-in to donating their data and biomatter. But Rose suggests that there is something deathly about this situation; as the patient is co-opted into this way of reading themselves – as collections of genetic segments that might be rearranged, exchanged and can be ascribed particular values – the living matter of their body decays. In this sense, genomic subjects do not inhabit whole bodies. The environment is side-lined as a constitutive influence over development. Character becomes genetic blueprint, without any potential for development, a collection of parts that might be extracted and exchanged.

Welfare, profit and ethics: The Vitruvian Man

The symbol chosen to represent the Human Genome Project was Leonardo Da Vinci's Vitruvian Man, an image of a universal human body that symbolized the birth of a new world-system in the sixteenth century, at the dawn of a new age for scientific and artistic creativity. As others have noted, the driving force of the Human Genome Project was based on national competition as much as transnational collaboration, and dominated by interests, ideologies and agendas of Anglo American biology. Beyond this, the project combined the moral economy of eighteenth-century liberalism and twentieth-century neoliberalism into new valuations of living a good life for the twenty-first. The central ethical question of the project was derived from the transition from liberalism to neoliberalism: whether the genome was a public good (data to be released for public use), or private property (broken up into exchangeable commodities). But this obscured the political gesture that made this debate so charged: the assumed reliability and efficacy of the genome as an instrument of universal human progress, even while the longer history of genetics has been embedded in histories of racialized exclusion (Saini 2019; Rutherford 2020). The false binary of welfare/profit came to define memoirs of the Human Genome Project, concealing the deeper ethical and epistemological questions around the genome's status as a universal description of human biological history, privileging genetic heredity over other forms of influence and change, and attaching a new standard of individual moral choice to its legibility.

As a moniker, the Human Genome Project stands in for a consortium of research centres across the world working on sequencing the human genome – the International Human Genome Sequencing Consortium (IHGSC). The project began officially in 1990, but it had been in development since the mid-1980s under shifting terms of negotiation between different scientific bodies and

funding sources. The aim of the project was twofold: to determine the sequence of DNA base pairs, and from this to map the whole genome to determine both the place and function of certain genes. The two strands of the double helix are made up of chemical links between them (nucleobases), called base pairs. The four nucleobases are adenine (A), thymine (T), guanine (G) and cytosine (C). Like rhyming couplets, A always goes with T, and G with C. Sequencing these means working out their order in a molecule of DNA. By the end of the project, 3.5 billion base pairs had been sequenced. The final draft sequence was not from one individual, but an aggregated collection of genetic material composed of genomes from anonymous donors, all with European ancestry. This continues to be the reference genome in human genomics.

Due to the complex arrangements and negotiations around attracting and sustaining funding, the technological demands of the project moved at pace. Venter developed a method called 'shotgun sequencing.' Shotgun sequencing involves isolating parts of the genome, cloning them, sequencing the clone and comparing these to other clones to determine their overlaps. This method was not as precise as the slower process of 'walking the genome', but it meant much faster results. Venter's haste was driven by a division among key players in the project over the question of whether cloned segments of DNA could or should be patented. Venter felt that they should, and he set up his own private biotechnology company – Celera Genetics – to continue sequencing. This was in the context of a broader proliferation of private genomics laboratories across the United States, which would become the infrastructure for new techniques of precision genomic healthcare from the early 2000s on. This proliferation was enabled, in part, by a landmark ruling in the US Supreme Court in 1980 over whether a genetically engineered bacterium could be patented in *Diamond vs. Chakrabarty*. A legal team representing the microbiologist Ananda Chakrabarty successfully argued that the bacterium was not a naturally occurring substance, but rather his own product, and should be awarded a patent. This ruling paved the way for an unprecedented new standard for biological innovation: the ability to patent and profit from engineering organic matter. While it was not possible to patent unaltered genetic material, it was – in theory – possible to do so for engineered DNA.

In the early 1990s, Venter was still employed at the United States's National Institute of Health at Bethesda, Maryland. When he proposed to patent gene fragments (expressed sequence tags, or ESTs), there was a big pushback. This was a turning point for the Human Genome Project in terms of speed and stakes, pushing the debate over whether sequenced data should be made publicly

available immediately for the sake of the development of the field, or whether it should be classed as the intellectual property of individual laboratories. Venter was unsuccessful: the Pharmaceutical Manufacturers' Association argued, 'a governmental policy of ownership and licensing of gene sequences would inevitably impede the research and development of new medicines,' and that access to ESTs should remain publicly available. For Venter, this threatened to damage America's lead in the race for the genome (publicly available meant internationally available). Wallace Steinberg of venture capital group HealthCare Investment Corporation agreed with him, and awarded Venter \$70 million to set up his own institute: the Institute for Genomic Research (suggestively shortened to TIGR) in Maryland. TIGR was linked to a sister company – Human Genome Sciences – whose purpose was to develop products out of TIGR's research. In 1995, Venter's team – including Hamilton Smith and Claire Fraser – published the first whole sequence of a bacterial genome (*Haemophilus influenzae*) in *Science*, an opportunity for Venter to place whole-genome shotgun sequencing at the forefront of genomic technology. The race between public and private genomic sequencing was unambiguously on.

Meanwhile, in the UK, John Sulston's group at the MRC Laboratory of Molecular Biology in Cambridge had been working on another model organism: *C. elegans*, a worm. Sulston's team was interested in working out the genetic programming that caused a worm to develop across its lifecourse, as well as basic tasks like feeding, moving and reproducing (Sulston 2002, 39). How were living things put together, how did they do the things they do and what ensures the relative stability of such processes and functions? These were research questions the bridged the supposed divide between molecular and evolutionary biology, placing the issue of development at the forefront of investigation. On the subject of so-called junk DNA, Sulston writes that it is 'a collection of fossils from our evolutionary history, which makes it interesting in the same way that a midden is interesting to archaeologists' (2002, 40). At the time of writing, it was not yet widely appreciated how much more significant this 'junk' was, but Sulston's description is not meant to be dismissive: he was keenly aware of the importance of attending to the archaeological as well the futuristic when it came to molecular biology's history. Outlooks like his – broader and longer than some of his peers – kept the imaginary of evolutionary history alive. When it turned out that this supposed junk played a much more active role in genetic expression, and particularly for complex organisms like humans, the language of disuse and recycling – or, perhaps a better metaphor – sedimentation of older genetic material – came into its own. What was key for Sulston was that

excavating our evolutionary past was not restricted to protein-coding genes and that non-coding DNA could also tell us important things about human history. The difference between humans and worms, it turned out, is not the number of protein-coding genes, but the relatively large amount of non-coding DNA held in human genomes.

Sulston's memoir documents his concern with the increasing focus on genetic material as an extractable and exchangeable commodity. The issue of patenting was, for Sulston, a moot point: there is 'no invention in finding [genes]', and owning them would be 'rather like owning a piece of the moon' (2002, 87). But he, too, recognized the stakes of the Human Genome Project, and that the outcomes of debates over ownership and profit would set the tone for years to come. Echoing Watson, he wrote, 'You can never go back' (2002, 104). Sulston was instrumental in setting up the Wellcome Trust's Sanger Centre at the outskirts of Cambridge, which was the largest centre involved in the project in terms of the scale of its sequencing output. The Sanger Centre was the only non-US centre involved in the G5, and while laboratories in France, Germany and Japan also played significant roles in the broader consortium, 'there was no doubt at all who was in the driving seat' (Sulston and Ferry 2002, 195). But the involvement of Wellcome in its funding of the UK contingent – a private funding body with a focus on public health – as well as the relatively smaller role of the British government when compared to the National Institute of Health in the United States brought a slightly different vision to the G5. As time went on, the focus of the group became beating Venter to sequencing the genome first.

Speed and competition drove the narrative of the Human Genome Project, despite the reservations of its more cautious and publicly minded leaders, Sulston included. This public-private debate reflected, to some extent, the different agendas of the Human Genome Project's forerunners, and became its key source of tension and disagreement. By 1998, Venter had set up a new venture – Celera Genomics – which he continues to head, and which is now owned by Quest Diagnostics. The last couple of years of the project were fraught with fears over lost time, and high stakes in getting there first. In the end, it was declared a tie, with Bill Clinton effectively calling for a truce between private innovation and public good. In 2005, Celera announced that it would make all of its data public, partly because they realized soon after the first results came in that 'the promised profits were not going to materialise' (Marris 2005, 6).

Where promises of revolutionizing healthcare fell short, genomic imaginaries still held huge commercial potential. Genomics might not have been in a position to cure cancer, but it could tell different kinds of stories about human

connection, social organization and family history, and it was clear that during the early 2000s, the cultural power of the gene as a kind of transcendental signified – a keystone for life itself – was not going anywhere. For Watson, the metaphorical power of the genome was even greater than that of the double helix. His account in *DNA* is full of the drama of that decade, with a larger and more glamorous cast of characters than the comparatively small-scale fallouts between small research teams in small laboratories at Cambridge University and University College London during the early 1950s in his earlier book, *The Double Helix* (1968). *DNA* blurs the script of the Human Genome Project blockbuster with the script for life itself, and cinematic metaphors proliferate: the book is a screenplay for a film, just as the genome is – for him – ‘life’s screenplay’ (2004, 164). No longer just a work of modern art suspended from the ceiling of a lab, the genome enfolded all kinds of genres into its realm of possibility: forensics and the thriller, aptitude and Bildungsroman, reproduction and romance, paternity testing and reality TV, DNA fingerprinting as ‘the ultimate in infotainment’ (293). While unevenly and not-always-reliably critical of Venter’s patenting, Watson shows a keen awareness of the commercial possibilities of the genome, because he realized that it fed into powerful and pre-existing imaginaries around human relationships – personal and ancestral.

The phenomenal imaginative power of the genome stems in part from a merging of scales, and the ambiguous relation between the macro and micro: worlds in grains of sand. The possibility of these worlds is allied to older narratives about transcending bodily matter, intellect taking the body to new heights of potential. The genome holds the largest secrets of life itself in the smallest molecules of the body, the key to existence packed into the tiniest of spaces. What was key was to imagine what these possibilities for human progress might be. After the political vacuum left by the end of the Cold War, the early 1990s was a critical time for imagining other worlds. This moment saw a rejuvenation of science-fictional imaginaries, where outer space marked the limits of the Western frontier, rather than East Kreuzberg: new territories for expansion. The Human Genome Project coincided with the recapitulation and extension of the American frontier as a metaphor for technological progress.

Watson is fascinated by modes of transport – Venter’s yacht and Sulston’s motorbike – and describes the genome as something akin to the American Mid-West:

Studded with noncoding segments (introns), genes can sometimes straddle enormous expanses of DNA, the coding parts like so many towns isolated between barren stretches of molecular highway. (199)

This is an image of settlement in vast open spaces, the gene not so much a finite entity but whole region, with remote sections split off from each other. 'Molecular highway' is a particularly suggestive and fantastical image of white noise in uncharted space, closer to postmodern video game visuals than the naturalism of genealogical trees or the elegant modernism of linked helixes. It imagines the genome as vast as a sparsely populated continent, (almost) terra nullius, whose transport infrastructure resembles that of industrial modernity. In this eerie landscape, the intervention of modern science serves to light up these dark spaces, tracing connections and working out their relation.

The power of the genome also pivots on the borders of modern fears – life/death, knowledge/ignorance, connection/isolation. Mediating these fears required creating a language of precision, in which messy matter could be reduced to function or image, using familiar vocabulary: 'code', 'segment', 'pair', 'clone', 'overlap', and 'sequence' were repurposed for genomic descriptions of spatial organization, no longer just descriptions but also performative utterances that bring a novel way of seeing into language. New figures for managing, viewing, reproducing and profiting from life abound: forensics, cloning, trading and disease elimination, each attached to different kinds of biotechnical management. Forensics relies on a database of DNA to identify certain biological traces, particularly in the realm of policing and security, which Carlos Novas and Nikolas Rose link to a growing infrastructure of biological citizenship founded on the collocation of healthcare and security (2005). Sequencing technology developed around copying segments of DNA (cDNA), which then are then analysed as discrete units, swapped and traded with others to account for certain parts of the code. Out of copying comes cloning and exchange.

These words engender a reformulation of subjectivity, which is connected to a broader transition in the ways that the human body is understood as distinct and exceptional in the realm of living matter. Part of the radical suggestion of the Human Genome Project in its creation of a new reference point for comparing humans with each other and other species was that 'the individual' as such no longer really matters. What's key instead is the ability to compare and aggregate shared elements – segment, pair and strand. In this phase of the genomic era, the individual disappears as the primary reference subject; instead, making conglomerations of individuals comparable with each other becomes possible.

The genomic sequencing revolution was organized around new technologies of substitution, embedded in the structural dehumanization of non-European peoples. While the individual disappears into a conglomeration, an imaginary of a model individual remains. This serves to both bolster visions of transhuman

futures and to sustain a racialized ordering of human life, to follow Alexander Weheliye, ‘discipline humanity into full humans, not-quite humans, and nonhumans’ (2014, 4). Recently, Ruha Benjamin has offered a framework of ‘race critical code studies’ in her merging of science and technology studies and critical race studies, to ‘open the Black box of coded inequity’ (2019, 26). For Benjamin, technology does not roll on apace beyond or outside the control of social worlds, but rather, ‘social norms, ideologies and practices are a constitutive part of technological design’ (2019, 30). Race continues to function as the core organizing technique of biopolitics’ right to ‘make live and let die’, by ‘appealing to the principle that the death of others makes one biologically stronger insofar as one is a member of a race or a population, insofar as one is an element in a unitary living plurality’ (Foucault 2003, 258). This is also a question of genre, with memoir instrumentalized to reiterate a narrative about aspirational individualism, or to contend this with its presumed alternative: public good. While Venter is for the most part telling a story about himself, Sulston is interested in the question of genomics’ potential to be a commonly held resource available to everyone. But what genomics does is actually abolish both the classic liberal, developmental self, as well as the neoliberal entrepreneurial one: it smashes apart liberal humanism, its material referents and the concept of time as teleology on which it depends.

Never Let Me Go and the end of development

Watson’s assertions that ‘what the public want is to be healthy’ and that there is no possibility of going back to a pre-genomic era are repeated almost ad verbatim by the former headteacher of Hailsham, the school for clones in *Never Let Me Go*. Ishiguro’s novel is a fictional memoir by Kathy H., relating the story of her childhood and adolescence, growing up with her friends Tommy and Ruth and the gradual revelation of their purpose in the world: to become donors of organ and tissue to prolong the lifespans of the rest of the nation. Explaining to Tommy and Kathy, who have come to request a deferral to the process, why such deferrals never existed, Miss Emily tells them: “‘How can you ask a world that has come to regard cancer as curable to put away that cure, to go back to the dark days? There was no going back’” (240).

Never Let Me Go is narrated by a character fixated on going back. The plot is carried forward by a series of ‘and thens . . .’, reminiscences of the past that Kathy tells us often she has gone over again and again. As Tia Byer points out,

the fragmentation of Kathy's memory 'suggests that certain aspects have been overemphasised during their retelling' – like the song of the title being played over and over again in her childhood – and that as a consequence, 'we do not know what has been left out' (74). This anxiety of amnesia and erasure derives its power, then, from a fixation on information as an economy between reader and narrator: what can be read, and what remains illegible or uncoded, in a text that is constructed via the gulf between code and context.

This gulf between code and context is mediated by an enforcement of chronological time, which gradually becomes a signifier of unreliable narration as the text unfolds. In memories carrying particular emotional weight, Kathy is brought into the present, where she works as a carer for donors, helping them through their process of donation. Some live through three or four donations (we are not told which organs or matter are being extracted), some through one or two. In Kathy's present, there is no room for chronology, save for the 'then' of another extraction. The past, on the other hand, can be narrated in chronological time: 'my approaching Tommy that afternoon was part of a phase I was going through', she says at the beginning of the second chapter (12). Going through a phase suggests a particular kind of developmental time, a sociology of growing up, a subject undergoing psychological changes. This banks onto a broader post-Enlightenment construction of human subjectivity, attached to the political metaphor of individual freedom: liberal humanism. The 'public' is not a commons, but rather individuals with access to the public sphere, based on ownership of property. The students of Hailsham are not considered human, because this biological property is not 'theirs': they are copied from genetic material of anonymous others. In liberal humanism, public desire is not collective or commonly held, but the desire of propertied humans, if 'property' is extended here to mean ownership over materiality: of shelter, of labour, of biology (Arendt 1958). This public is a liberal elite with access to corporate and state forms of healthcare, whose lives are sustained (economically and biologically) through the production of an underclass.

The novel only gives one name and date: 'England, late 1990s', with a number of references to years passed that permits a reconstruction of the time-span of its events to the late 1970s. The 2010 film gives four dates, charting the transition from the post-war consensus to neoliberalism: 1952, the year of the 'medical science breakthrough' that allowed us to 'cure the incurable' (the year before the double helix); 1978, when the students are at Hailsham (the year before Thatcher came to power); 1984 when they are at the Cottages (the year of the miners' strikes); and 1994, when Ruth and Tommy die (the tail end of almost

two decades of Tory rule). The film depicts this move through the sepia-toned public-private welfare utopianism of Hailsham, to the muddy greens of working-class rural communities in the dilapidated Cottages, to the greys of the Brutalist tower block that becomes Kathy's home while she works as a carer, and the blue corridors of the hospitals where Ruth and Tommy die. Kathy's flat number is 52, referencing the film's additional date of the scientific breakthrough that brought her existence into the realm of possibility. The date creates a through-line between scientific discovery and public policy, one of the ways that Kathy's life is determined by past events outside her control or, for most of the text, her knowledge.

The novel situates its critique of liberal humanism as a model for self-determination in post-war meritocracy – its organization first around a creaky consensus of welfare, private benevolence and social mobility, and its corporate reformulation under Thatcher. First, the organs are for public good, but an apostrophized public that excludes those who carry out the labour necessary to sustain it, unevenly written into the social contract via gestures of social responsibility (state-funded education, housing and maintenance benefits). By the 1990s, Hailsham has been closed down, and clones are now bred in 'vast government "homes"' akin to mass animal breeding farms (242). Hailsham was supposed to be a reprieve from the reality of cloning, turning clones into students, even though there was no future for them to prepare for. Miss Emily calls them "lucky pawns," who have been able to build their lives "on what we gave you": "we were able to do that principally sheltering you" (245). This final conversation reveals to Tommy and Kathy that the provision of welfare was never about proving themselves worthy of a reprieve (a deferral), but a charitable organization's uneven intervention into a system of cultivated inequality.

For much of the novel, meritocracy structures character development, a form of social mobility explicitly organized around heteronormativity. There is a rumour that a couple might be able to 'defer' from donations if they can prove that they are genuinely in love, and same-sex couples are excluded from this possibility. The supposed great betrayal of the text – Ruth keeping apart the novel's 'true' couple, Tommy and Kathy – is premised on an ideal of human community centred on the union between man and woman (Foucault 1978; Sedgwick 1990; Warner 1991). Rachel Carroll argues that in the novel, 'coupledom is understood less as an elective expression of a romantic or sexual affinity than as a necessary assumption of a culturally coded set of practices' (2012, 142). Hailsham is a site of indoctrination into the 'the paradoxes and perversity of heteronormativity', even while its students are incapable of

sexual reproduction (144). What is being protected, then, is not survival as such, but rather overdeterminations of normativity that uphold particular taxonomies of human. It is the fiction of heteronormativity – narratively coded as tragedy through Ruth's betrayal – that keeps the clones locked into the mythology of their own necessary destruction. Even as they realize that they are excluded from the script of social mobility, they are still compelled to uphold this in service to a greater purpose, and heteronormativity is central to this compulsion.

Ishiguro also charts the contraction of whiteness in post-imperial Britain, where material and epistemological infrastructures of enslavement – the epistemological field that continues to make enslavement possible – sequester freedom along lines of genetic 'originality', while genetic cloning makes possible the harvesting of body parts for other humans' use. While on the surface meritocracy is an ideology of equal opportunity, Ishiguro shows that this is laced with restrictions that prevent certain subjects from ever attaining it, even as places like Hailsham promote it. Racialization figures in important ways in the text. Ishiguro's world here is not a post-racial nation where 'even' white people now suffer; rather, the text shows how the racializing infrastructure of enslavement coordinates with an updated taxonomy of copy/original and donor/client throughout post-war liberalism and neoliberalism. As Josie Gill points out, readings of the novel as post-racial miss one of the key (and more or less silent) figures of the text, given no space for character development and who, in the film version, is shown only from the neck down, his hands on the back of Miss Emily's wheelchair: George, who Miss Emily describes as 'the big Nigerian man', with no given surname, her live-in care-worker. George never speaks directly; Kathy and Tommy hear 'a gruff male voice . . . so muffled it might have been two floors up' (229). Their meeting with Miss Emily and Madame draws Kathy and Tommy out of the illusion suggested by their being invited in: two couples debating the possibility of freedom in a middle-class sitting room. They are not supposed to be in the more public space of the sitting room, but somewhere upstairs, muffled and offstage. The scene annihilates their hope of attaining some degree of deferred freedom through faith and hard work (their love for each other and their creative outputs); they were never on an upward trajectory of social mobility, but on a continuum of underpaid or enslaved labour, now represented by an unseen migrant worker from a former British colony. Gill argues, 'As bodies that have been created to serve the needs of the "normal" population, the clones' experience appears little different from the contemporary exploitation of the black and minority ethnic workers who are often reduced simply to bodies that carry out various forms of undesirable and poorly paid

labour' (2020, 64). They are not subjects with autonomy over their development: they are substitutes who are consigned to a temporality determined by the needs of other people's bodies.

Rather than being set in post-racial lifeworld, the pathos of Kathy's memoir is facilitated by her reliance on individual memoirs of systemic oppression, focused not just on 'documenting the suffering self but also, necessarily, recording the tormenting other' (Mendlesohn 2010). At the same time, these histories are held off and out of sight, the shadows of imperial infrastructure rendered into a perpetual present. Shaping a narrative of development for herself and her fellow students should figure as a mode of resistance, forcibly writing them into history, but Kathy finds herself caught, without the vocabulary to arrive at an end. In her efforts to deal with the past – the constant turning over of what she sees as critical turning points in the complicated dynamics between her, Tommy and Ruth – the wider narrative eludes her:

As I've said, it wasn't until a long time afterwards – long after I'd left the Cottages – that I realised just how significant our little encounter in the churchyard had been. I was upset at the time, yes. But I didn't believe it to be anything so different from other tiffs we'd had. It never occurred to me that our lives, until then so closely interwoven, could unravel and separate over a thing like that.

But the fact was, I suppose, there were powerful tides tugging us apart by then, and it only needed something like that to finish the task. If we'd understood that back then – who knows? – maybe we'd have kept a tighter hold of one another. (180)

The encounter that Kathy refers to is the penultimate conversation between the three of them before she decides to become a carer. Tommy has shown Ruth and Kathy his animal drawings, his deferred contribution to the artistic endeavours they were encouraged to participate in at Hailsham, which he had refused to do at the time. Ruth encourages Kathy to laugh at Tommy's drawings, and in the churchyard, reports this back to him: "It's not just me, sweetie. Kathy here finds your animals a complete hoot" (178). At the time, Kathy is unable to say anything, 'like being given a maths problem when your brain's exhausted, and you know there's some far-off solution, but you can't work up the energy even to give it a go' (179). The moment passes her by without telling him that she does not find his drawings worthy of ridicule, and – in the passage above – she attributes this moment to their subsequent separation. Here, as in other moments of going over past hurts, she reads their behaviour as indications of character, and their failure to stay together as something to do with the interpersonal dynamic between the three of them.

Kathy's narrative style is suffused with recursive inscriptions that separate past from present in anxious reverberations – 'as I've said', 'afterwards . . . I realised', 'if we'd understood back then.' These asides enclose the architecture of nostalgia that hold the story together. Memoir becomes a way of documenting regret: missed opportunities, monuments to lost time. The characters live a deferred existence, and when Tommy and Kathy finally come together in the way Ruth feels they should have done to begin with, it is less a narrative culmination than a case of too little, too late. After they start having sex, Kathy notes Tommy's manner 'tinged with sadness, that seemed to say: "Yes, we're doing this now and I'm glad we're doing it now. But what a pity we left it so late"' (218). If only Ruth hadn't felt so jealous; if only Kathy had said something; if only Tommy have forgiven them both sooner. These regrets are given greater poignancy in the present, where Tommy is lined up for a third donation, and Kathy's time as a carer is coming to an end. An alternative set of decisions that might have prevented their unravelling and separation hangs over the text, emphasizing the importance of the individual's autonomy to put things right in the moment, rather than merely waiting for life to take its course. In Miss Emily's words to them when they are children, a "missed opportunity" (39). Kathy's efforts of documentation and revision are determined by this fear of missing an opportunity, a fold in the fabric of her life that she might seize and hold onto.

The paragraph break of the passage provided in the previous paragraph breaks up the illusion of personal autonomy, and the (assumed) precedence of this ostensibly private moment between three individuals over the public desire for their biomatter. The metaphor moves from fabric ('closely interwoven') to waves ('powerful tides tugging'), setting up a movement between activities of the private (knitting, weaving) and public spaces (organized – ostensibly – around natural laws, or at least which uphold an idea of natural checks to human freedom). The reality of this private sphere is grammatically ambivalent, disappearing into a horizon of uncertainty. The 'it' in 'it only needed something like that to finish the task', does not have a preceding referent (the waves are plural); 'it' refers to some uncategorised, undeclared relation, too fragile to survive tides. The break between paragraphs is also a break between individual code as a weaving, and the context which determines its possibilities, the tides of a social environment that splits them from their biopower.

On a more prosaic level, public health policy is equated with natural processes; more than this, the material and metaphorical resources of the natural world have been co-opted for human ends. The speculative aside, 'who knows?', undermines Kathy's assertion that they might have acted differently had they

realized the bigger picture. But this keeps the three of them stuck in the myth of individual autonomy tied to a meritocratic promise of moving out of their lot, and the idea that simply having access to knowledge equals fair opportunity to make the best of a bad situation: Hailsham's final victory of indoctrination. The final metaphor, 'keeping tighter hold', is a euphemism for acts of apology, forgiveness and honesty, and a gesture to Kathy's own tight hold over their collective memories: it underscores Kathy's narratively suffocating belief that their behaviour can change their circumstances, which ends up preventing her from imagining other possibilities for freedom.

Kathy relies on the fiction of the individual and on memoir to provide a safe structure to demonstrate character development. Her anxious need for her life to move forward in time drives her creation of characters with different motivations, even as these characters tell her that they have no belief in character. For Kathy, survival requires becoming a good user of language and a good reader of people, skills that Hailsham equips her with: she is the archetypal good student, working as hard as she can to follow the shifting paths of the maze into which she has been placed, unable to see the whole picture. In her journeys to the past, she steals back the organs that are being taken from those she loves, seizing them from operating table back to metaphor, using nostalgia like a crowbar to break into wish-fulfilment. For instance, remembering the way that 'Norfolk' became a metonym for the outside world, the chance of a normal life, 'something that was once close to our hearts' (61). Norfolk becomes a possibility of a whole life, a place where they might end up one day, a 'fantasy land' to which one day they will be 'free to travel', but also a place where 'heart' can signify a certain kind of spirit, or – to use Tommy's word – a soul, rather than an organ available for extraction (61). This fantasy is less fearsome than some of the other metaphors that slide across the peripheries of her consciousness, like the helium balloons she sees a clown pulling down a street one day:

I thought about Hailsham closing, and how it was like someone coming along with a pair of shears and snipping the balloon strings just where they entwined above the man's fist. Once that happened, there'd be no real sense in which those balloons belonged with each other any more. (194)

Character development is a defence tactic to mitigate the logic of substitution and surrogacy that the clones are otherwise forced to participate in. It is a way of forgetting the fragility of their relations with each other, the insubstantiality of their lives and the lurking violence ('shears . . . snipping the balloon strings') which will end them. It is this violence that makes their lives incommensurable

with the fantasies that feed them, and Kathy's focus on character means holding this reality at bay for as long as possible.

While, for Kathy, character is a way to speak about desire (and about not having what she wants), Tommy and Ruth have different coping strategies: where Kathy writes, Ruth copies and Tommy resists. This characterization is analogous to moments of genetic programming – transcription, translation and expression; even as Kathy tries to give them full lives, mechanized description infiltrates. Tommy's animal drawings are works of surrealist impressionism, and upon seeing them for the first time, Kathy notes that 'it took a moment to see they were animals at all':

The first impression was like one you'd get if you took off the back of a radio set: tiny canals, weaving tendons, miniature screws and wheels were all drawn with obsessive precision, and only when you held the page away could you see it was some kind of armadillo, say, or a bird. (171)

Tommy's art plays with the reduction of body to mechanism, placing biological matter (tendons) next to engineering and infrastructural innovation (screws, wheels and canals). The living body is incorporated into the machinery of technological modernity, compressed into an object of mass transmission. This disaggregation of mechanisms is described in a vocabulary that is transferrable between body and technology: the bodies here are reduced to pure mechanism, a collection of separable parts that might be taken apart and reassembled in another object.

Ruth's technique is to copy. For much of the text, the reader shares Kathy's sense of not quite knowing or trusting Ruth, even as Kathy tries to work her out. Ruth is constantly pulling the rug out, keeping Kathy on her toes, rearranging alliances as much as she needs to in order to maintain her position. From Kathy's vantage point – and through her, the reader's – Ruth seems prone to taking away from others (their sense of self, their happiness, their passions). Her efforts to counteract this always seem to fall short; when it's implied that she steals Kathy's beloved tape, she makes up for it by replacing it with a tape that doesn't have the same significance. But this is an instructive error on her part; Kathy recognizes that Ruth does not have the same appreciation for art and music that she does: 'to Ruth, who didn't know the first thing about music, this tape might easily make up for the one I'd lost' (69). For Ruth, one tape can replace another, and that's what Hailsham's market is for: the constant exchange and substitution of things for other things.

For this reason, Ruth's worst fear is different to Kathy and Tommy's. While Kathy fears the insignificance of their desires – nostalgic life-writing as defence,

and Tommy fears their reduction to mere mechanism – turning to art, Ruth fears that they are akin to the junk of their small collections amassed at The Sales: easily lost, and easily forgotten. This comes out on their trip to Norfolk, to see someone who their new Cottages friends – Chrissie and Rod – think could be Ruth’s ‘possible’; here, ‘possible’ means the person whose DNA might have been used to clone her. This possible works in an office with big glass windows, “a lovely office”, in Chrissie’s words, a white-collar worker in a seaside town (146). Ruth’s desire to see the person from whom she may have been copied is linked to a more general desire to have descended from people who are living lives that are cut off to them: people who have used their education to move up the ladder, free to choose where they work. A woman making the best out of the opportunities afforded by a mid-1980s economy premised on aspirational individualism and the ethos of equal opportunity in third-wave feminism.

When it becomes clear that the woman is not Ruth’s possible – they follow her into an art gallery – Ruth reacts angrily to Tommy’s suggestion that this was “just a bit of fun” (151). This is the first moment of the text where Ruth is honest with Kathy and Tommy about what she really thinks about their lives, herself and them. While they have been busy trying to work things out, playing detective (which they continue to do until the final meeting with Miss Emily), Ruth lays out what, for her, is the reality of their existence:

We’re not modelled from that sort. . . . We all know it. We’re modelled from trash. Junkies, prostitutes, winos, tramps. Convicts, maybe, just so long as they aren’t psychos. That’s where we all come from. We all know it, so why don’t we say it? A woman like that? Come on. Yeah, right, Tommy. A bit of fun. Let’s have a bit of fun pretending. That other woman in there, her friend, the old one in the gallery. Art students, that’s she thought we were. . . . If you want to look for possibles, if you want to do it properly, then you look in the gutter. You look in rubbish bins. Look down the toilet, that’s where you’ll find where we all came from. (152–3)

In the film, this speech is delivered on a beach overlooked by a pier: Clevedon in Somerset, a Victorian pleasure beach which by the 1980s had become part of the UK’s forgotten periphery of former holiday towns. This beach is another symbol of a dying post-war consensus, the domestic holiday of the 1950s, 1960s and 1970s in the process of being replaced by cheap travel to Mediterranean beaches further south. They are too late: this trip to the seaside comes as everyone else is moving on into new middle-class dreamworlds. This beach scene emphasizes the recognisability of this place, its allusion to carefree childhood summers

– swimming and jumping into the water – while cutting them off from the possibility of doing the same things, in the same way. The fantasy of the beach gives way as they stand on the sand, as Ruth's speech cuts them out of the scene, its own technology of deletion. Even here, there are not at leisure: their labour is to stay alive and to keep healthy for as long as their body parts are required.

The act of placing oneself in landscapes that are not meant for you is also an intervention in the traffic between sociopolitical formation and aesthetic forms. Being mistaken for art students carries a particular irony, but not the one that Ruth suggests. All three of them are all in different ways students of art, adopting distinct styles. Ruth's speech conjures another modernist aesthetic, not Kathy's *Bildungsroman* nostalgia, nor Tommy's surrealist impressionism, but more akin to Brecht and Beckett. The rhythm of her language tends towards annihilation and closing-down – a list of degenerates connected by violent commas – while the imprecision of the ideas and subjects prevents full comprehension: the syllable-heavy 'prostitutes' lining up with the single-syllable 'tramps'; she starts sentences mid-way through, the speech patterns broken into fragments, forcing a reader into tracking the metre of her anger to follow her meaning. Tommy can accept the pretence, having access to an imaginary that in some way allows him to reshape reality according to principles that fall outside realism; Ruth, on the other hand, pushes realism to its limits. In her speech, pretence is not a gesture of resistance, but rather a way of putting blinders on their self-image. Throughout the novel, Ruth fears exposure: her fraudulence, her selfishness, her sexuality, her desire to divide and rule. At the same time, she is the character most exposed to the structural reality of their situation: their bodies will soon be disposed of, flushed away, forgotten; they are marginal, undesired, peripheral nobodies.

The novel is strung together by episodes that come to resemble a long list of anecdotes tied together by Kathy's desire to keep the three of them together – if only in narrative. The plot moves forward at the end of section breaks with repeated allusions to 'what happened next . . .'. This pedestrian plotting, where a truth might be revealed or a set piece staged, draws the reader through the text, going back and forth over anecdotes and their possible meanings. There is the sense of an underlying script that moves event through to consequence, cause and effect, the form of the text akin to a code expressed through repetition and copying; the content changes, but the same basic structure of events is repeated again and again: a mystery, a revelation, a splitting apart and the hope of reconciliation. The episodic form leads the narrative away from Kathy's insistence on finding a greater meaning for their lives, and it is this that makes it difficult for her to see why it would not take that much for their connection

to become unravelled and for them to be separated from each other. This form makes the narrative more easily reducible to fragments of memory – snapshots that resemble, across metaphor, the pieces of flesh that will be extracted from the students. It mirrors the disaggregation of parts from the whole.

Repetition as narrative form reveals something about the correlation of memoir with sequencing imaginaries: in terms of structure, there is no real change or development, not so much phases leading to other phases, but different manifestations of the same set of events, responses and outcomes. Remembering the last conversation between the three of them, Kathy notes, 'The way it began, it was a bit like a repeat of earlier' (208). This 'earlier' refers to earlier in the day, but also to the persistence of 'earlier' in the way she keeps time. 'Earlier' recurs throughout her narrative, like segments of code ending and repeating, the beginning a recapitulation of something that has come before.

Gabriele Griffin reads *Never Let Me Go* in the context of debates over cloning in the late 1990s and early 2000s, after the successful cloning of Dolly the sheep. Contending with M. John Harrison's indictment that there is 'no science' in the novel (2005), Griffin argues that Ishiguro's text is not interested so much in the minutiae of scientific process, 'the practicalities of cloning and organ donation', as it is in the effect of 'scienticity as the actualisation of scientific practice' (647). Rather, the text is invested in the effect of these processes on understanding the self as human in the midst of an acceleration of posthuman imaginaries through technologies of genetic modification (2009, 646–7). For Griffin, this comes out in the relation between specialist scientific language and ordinary language in the novel. Following Barbara Duden, this involves both the emigration of scientific terms into ordinary language, as well as making ordinary language strange through its proximity to a scientific and medical (and historical) context which remains mostly offstage (Duden and Samerski 2008). This estrangement of ordinary language is made possible not (only) through scientific literacy, but (also) by socio-economic and political descriptions of human life that have positioned the biological at its core.

Anjali Pandey develops this argument about the relation between scientific and ordinary language further, suggesting that Ishiguro's technique is to reconfigure not only the grammar but also semiotics of life after the genome; that is, the way in which life takes on or sheds meaning, through a technique that she calls 'lexical dissonance' (2011, 394). For Pandey, the power and ambivalence of Ishiguro's linguistic neologisms (donor, clone, carer) are derived from the tension between polysemic intent and polysemic copying: by moving words around the surface of the text, Ishiguro disturbs the meaning imposed by what

the clones take as reality. This strategy mimics techniques of copying, insertion and deletion of genetic material in practices of sequencing and modification. For Pandey, this is pastiche: while this model of experience is indomitably grammatical and derived from practices of lexicography (rather than biology making grammar), 'Ishiguro's meticulous use of lexical dissonance . . . creates literary cacophony,' wherein what emerges is not similitude or reducibility, but a railing against the attempted destruction of life via euphemism, synonymy, metonymy and sincerity, for the sake of dysphemism, antonymy, synecdoche and irony: 'lexemes in the service of literature' (2011, 395).

Pandey gestures to a form of resistance derived through this strategy of lexical dissonance, and this is registered at the level of semiotics; that is, in the way that the characters are able to hold off, move around, or annihilate meaning. Captured within a lexical form that constantly anticipates their annihilation through repetition and disaggregation, deferral becomes the only mode of resistance left to the students. This, too, has a genetic analogy, but not one restricted to the logic of sequencing. While sequencing technologies of the 1980s and 1990s were organized around what is expressed in the genome – the protein-coding genes – Ishiguro gestures to the deferral of expression, the holding back of meaning and silences that may or may not be filled. Often, a gap emerges in time between action and response: the time it takes for Tommy to forgive Kathy for laughing at his animals when he shows them to her, after Ruth's completion and in anticipation showing them to Miss Emily: 'I realised immediately that this was Tommy's way of putting behind us everything that had happened at the Cottages, and I felt relief, gratitude, sheer delight' (220). Kathy does not often realize things immediately; many of her realizations up to this point are the result of going over the past, and looking at it from a different vantage point. But the delay between Tommy's first act of showing and this one allows something different to be expressed, despite the formal repetition; instead of bewilderment, 'relief', and instead of guilt or confusion, 'sheer delight'. Tommy's deferral of forgiveness mimics the repetition established in their relationship so far (doomed to miss each other, to misunderstand, to not say the right thing at the right time), but ends up breaking it: some new possibility comes into play between them. It is this moment – as the breaking of habit out of mimesis – that constitutes something new, that allows them to exist, if temporarily, as a pair, in time with one another for the first time in the novel.

This moment is temporary. Deferral strategies cannot work to alter their position. The architecture of memoir – at least in the form it takes here – does not allow space for this. As in *Gattaca*, resistance in these texts is more

to do with breaking into the no-time of genomic sequencing, the immanence of their predetermined existence and the capture of ends in beginnings. This restricted field of resistance points to a bigger crisis – that of constructing the self in chronological time. Ruth is the character who understands this crisis most viscerally. The novel ends with an image of rubbish – plastic bags caught on the barbed wire of fences, in an anonymous part of rural England. This image situates the novel, finally, in a history of enclosure that technologies of nostalgia for a lost pastoral cannot fully cover over, and draws the clones into a topography of discarded debris and waste; ‘all sorts of rubbish’, echoing Ruth (263). This closing image – ‘two lines of wire’ presided over by trees in which ‘I could see, flapping about, torn plastic sheeting and bits of old carrier bags’ (263) – looks like a sequence, the lines corresponding to the two lines of the double helix, interspersed with genetic clusters. This material has fallen out of use, no longer required, like bits of redundant information on the nucleotide.

The end of *Never Let Me Go* anticipates the new imaginary for which sequencing offered a prototype, and for which the practice of organ extraction sets a precedent: not the formation of new subjects, not even reducing the body to code, but a new kind of governmentality based on differentiating genomic value via algorithm, rather than subject. Kathy’s strategy of trying to make meaning (value) via characterization is futile. This new precedent is a eugenic technology that does not need a single referent or ideal subject, but rather composes and recomposes avatars by aggregating disaggregated and de-individuated data: not the transformation of the (neo)liberal subject, but its disappearance into Big Data, a composite reference, a new normal that is constantly in flux. The liberal fiction of development collapses into what Maurizio Lazzarato calls ‘machinic enslavement’ (2014), a theme that *Gattaca* takes up through another first-person genre: the Hollywood noir. This time, the detective is displaced into machines, and the subject under investigation has disappeared into data.

Gattaca and algorithmic governmentality

Gattaca was released in 1997, six years before the first draft of the human genome was published. Its world is a future version of our own, where it is now normal to sequence the genomes of embryos to determine their propensities towards certain physical and mental diseases, as well as their skin colour and gender. Not only this, but it is possible to select the ‘best’ of parents’ genetic stock to construct genetically superior children. It is still possible to have what

are called ‘god children’ – children conceived without genetic engineering – but these children are usually at a severe disadvantage when it comes to professional mobility and interpersonal relationships. There are personal genetic testing stations where DNA can be sequenced quickly, anonymously and cheaply – in one scene, a woman has the saliva on her lips from kissing her date scraped off and sequenced immediately. It is implied that there is a composite reference genome that makes these practices of probabilization and comparison possible, but exactly what this is made up of and what constitutes ‘normal’ is never made clear. The cognitive dissonance of this invisibilized reference point goes across the social spectrum and it is the character closest to the current genomic ideal that ends up self-destructing.

The film received a wide release and was aimed at a mass audience already primed for science-fictional forensics by *The X-Files*; this partly accounts for why it does not need to establish the terms of reference for the model of genetic idealism it portrays. But the hype around the Human Genome Project was at this point so fevered, and its promises that diseases would be able to be pre-empted and exorcized at the level of DNA so widespread, that *Gattaca* is also able to skip a great deal of explication. Vincent’s narrative emerges in the middle of debate not about the scientific validity of genetic disease, but the ethical quandaries of diagnosis and treatment. The film’s enduring popularity as a reference film for future genomic dystopias, where discrimination is reduced to individual code, was made possible in part by its updating of older speculations on cloning, bioengineering and eugenics – notably, Aldous Huxley’s *Brave New World* (1932).

The lack of clarity around what constitutes normality in *Gattaca* extends Keller’s argument into the sphere of algorithmic governmentality. Communication between individuals no longer matters. Rather, a genomic lifeworld is ‘a scheme designed for communications between machines, where information [is] conceptualized in a manner divorced from content, subject matter, or nature of the channel’ (Kay 2000, 97). While liberal and neoliberal forms of governance centre an individual (whether part of a commons or self-fashioned), algorithmic governmentality does away with the need for a subject around which to organize data, and ‘carefully avoids any direct confrontation with and impact on flesh and blood persons’ (Rouvroy 2012, 157). The (neo)liberal subject located in a body that is considered separate from others, whose freedom is premised on autonomy over action, is replaced by ‘a statistical body’ composed of aggregated data, ‘constantly evolving data-body or network of localisations in actuarial tables’ (11). Rather than depending on a fixed norm or average, this points to an

'a-normative objectivity' or 'immanent normativity' which endlessly constructs reality out of data, and which needs to 'obscure social normativities, silencing these as far as possible because they cannot be translated digitally' (Rouvroy and Berns 2013, 163). Insofar as algorithmic governance is 'governance without a subject', it needs to silence and obscure subjective coherence, while abstract normative values emerge in continuing fixations on disability, gender, sexuality and race. Irene asks her boss if she will "lose her place in line" by doing tasks below her pay-grade, gesturing to ableist and sexist workplace discrimination without any measures put in place to prevent it.

The disappearance of the subject into algorithms is underscored by *Gattaca's* first-person narrative, delivered by Vincent – a 'god child' who leaves home to pursue his dream of travelling into space, a future that his genomic identity does not allow for. Vincent's predispositions and the probability of their expression are read out to his parents at birth: neurological condition, 60 per cent probability; manic depression, 43 per cent probability; attention deficit disorder, 89 per cent probability; and heart disorder, 99 per cent. He is given a life expectancy of 30.2 years. When we meet him as an adult, now working at the Gattaca space exploration station under a false identity, he is several thousand heartbeats over this prediction. The film is set in a future Detroit, Vincent telling us that he was conceived on 'the Detroit Riviera', locating it in a history of Fordist production and post-war US urbanization, the institution of suburbia and white-collar professionalism as a new post-war-US normal. This setting emphasizes a future of working-class aspiration that has already fallen into disrepair because of the outsourcing of production to cheaper sites across South and East Asia. In place of manufacturing cars, human beings are now assembled in laboratory factories (whose mechanics remain off-screen), factory managers replaced by biomedical consultants who advise parents on assembling the right constellation of genetic attributes for their future children in rooms that resemble doctors' offices. This is the engineering of a white-collar workforce via a fiction of individual choice, a buy-in model for a disease-free future that is explicitly tied to national development: this workforce will deliver the United States to new frontiers: 'Now we have enough of the right kind of people to warrant a new measuring stick: bodies with minds to match. Essential as we push out further and further,' says Gattaca's CEO.

While this equates to the creation of a genetic elite, it leaves those who for whatever reason cannot fulfil either the social or genetic potential of being human peripheral. It also opens possibilities for an informal genomic market to emerge: 'When the elite fall on hard times, genetic identity becomes a commodity.' With

his income as a janitor, Vincent saves up to buy the identity of a man with a '9.3' score on his genome test – Jerome Morrow. The real Jerome was involved in a car accident and has lost the use of both legs, restricted to a wheelchair. A possible plot-hole emerges: why wouldn't authorities have recorded this, and why hasn't Jerome's information been altered on the central database? The post-accident Jerome, who now goes by Eugene (a play on 'good origins', eu-genic), lives alone in a two-storey development, but needs an income to sustain his alcohol addiction, hence selling his biomatter to Vincent. Taking on Jerome's identity involves Vincent undergoing an excruciating regime of daily shedding and erasing, through which evidence of Jerome's identity is placed at strategic locations across his body: blood for the finger-prick identification system at Gattaca's entrance, urine for the regular drug tests, strands of hair placed into the comb he keeps in his office desk. As he takes on the material of Jerome's DNA, Vincent must also vacuum and burn evidence of his own: he scours his skin everyday, burning it in an incinerator (part of his and Eugene's domestic laboratory), sucks up scattered bits of fallen biomatter from his office keyboard with a tiny vacuum, and – after a night with Irene, his office co-worker – carefully plucks a strand of fallen hair from the pillow beside her.

The early reference to Vincent's predisposition towards manic depression is offset by the social pathology this system generates. The idea that the Human Genome Project would lead to new biotechnologies for identifying and treating not only somatic disorders but also mental disorders – schizophrenia and manic depression (the implication being that these were genetic traits) – was put forward by some of its key players, Watson included. But in *Gattaca*, the psychic effort of living in this genomic regime leads to breakdown: despite his near-perfect genes and an absence of genetic predispositions towards depression or alcoholism (predispositions which the film's science endorse), Eugene is not only an alcoholic but also suicidal. His depression is never explicitly named, but it is clear that his genetic perfection has not only prevented but also possibly contributed towards it. When Vincent comes back from Gattaca jubilant at having "got the job", Eugene replies – looking away from Vincent, his eyes cast down towards the floor, with Vincent positioned behind him – "Of course you did." He points out later in the film, when Vincent is worried about being recognized, that 'they' don't see 'Vincent' at all – only a pre-accident version of 'him'. Jerome's DNA substitutes for a real body, made to stand for two bodies that are now socially invisible. To follow Rouvroy, Jerome-as-data-body does not represent a hypothesis about what individuals or society should be, but rather is part of a more general system of datamining which serves 'to structure,

in an anticipative way, the possible field of action of ‘bodies’ (2012, 149). This field sets the conditions for reality, and constitutes what she calls system of ‘data behaviourism’ which causes – following Lazzarato – ‘machinic enslavement’, rather than ‘subjective alienation’, when the subject becomes a slave of the machine, in a unidirectional flow of control – not unlike the model of gene action given by Dawkins in *The Selfish Gene* (Lazzarato 2014). In the genomic context, the body is slave to the code; in *Gattaca*, this enslavement equates to the disappearance of the subject into the code.

The film’s displacement of racializing infrastructure into the language of genetics does not make race disappear; rather, the reflexes of Jim Crow and the eventual flight from Earth form the film’s narrative architecture, while – as in *Never Let Me Go* – remaining offstage. Fears of miscegenation and the one-drop rule are conjured by the availability of instant sequencing technologies, wherein blood and genes are metonyms for the possibility of contamination. During their childhood, we see Vincent’s brother Anton refuse to exchange blood with his brother, demonstrating a pre-adolescent understanding of a difference in kind that might be contagious, as well as the spectre of AIDS and anxieties around pre-existing congenital vulnerability to the transmission of particular morbidities. The genetics consultant who attends Vincent’s parents is a Black man, who notes with a pause that they have specifically requested a child with ‘fair skin’ during a consultation. While there is a Black office manager who turns Vincent down for a job, and two Black astronauts who go up at the same time as him, these characters are also peripheral and – aside from the consultant – non-speaking, and in the latter’s case, unnamed. Jerome’s perfection is still premised on his racialization as someone of European ancestry; Eugene-Jerome is played by Jude Law with a received-pronunciation English accent, suggesting his proximity to upper-class European genomes.

This racializing infrastructure is extended to the architecture of the double helix and the genome, symbols which are everywhere and nowhere. DNA can only be seen and grasped through other materials – the symbol of a circle, a helix-shaped staircase, the string of letters on Jerome’s genome sequence. The film’s opening credits show what seem to be huge objects dropping to the ground, lit in phosphorescent blue, as if we’re in another world. These are nail clippings, flakes of skin and hair of various widths and diameters, strung across the screen like estranged hyperobjects: evidence of a human code, both eclipsing and falling away from the bodies they come from. When Eugene first appears on screen, he is sitting in a wheelchair at the bottom of a staircase

shaped like a double helix. Images of mechanical mobility abound: elevators, escalators, tunnels and roads. When Vincent and Irene kiss for the first time, a shadowed lattice appears across their bodies, segmenting them into parts on a grid: a frame that they are not aware of in that moment, but which fixes them into a social field that has been imagined out of the architecture of molecular biology. When Vincent tries to cross a busy road without his glasses, the viewer sees what he sees: the blurred lights of cars coming towards him and passing at great speed. Watson's later vision of a 'molecular highway' is almost literal here – Vincent-as-subject is caught in the blurry and obscure movement of biomatter, alienated from the processes going on in his body which determine his exclusion from the world into which he has been born. The architecture of the genome, as it appears in the film, is always depicted as excluding the protagonists. At a critical moment, Eugene has to haul himself up the double helix staircase with his arms and hands, his legs dragging behind him. The moment underscores the hostility of this architecture of human potential to chance events that might require adaptation and facilitation, and for bodies that are not designed to fit its specifications.

This infrastructural hostility results in forms of social blindness, a motif that repeats throughout the film. Vincent's bad eyesight functions as a metaphor for a more general blurring of people and environment into undetermined data objects, becoming part of a perpetual flow without a central reference point. And in this landscape, acts of not seeing become moments of small resistance: when Vincent's former janitor boss 'does not see' Vincent on Gattaca's back stairs, when Vincent purposefully lets Irene's eyelash blow away in the breeze so that he cannot have her sequenced (and when she, eventually, does the same), and when Gattaca's onsite medic – the person who comes closest to Vincent's fraudulent identity – 'does not see' that all along, Vincent (a left-handed man) has been holding his penis with his right while urinating into a cup. Letting details go under the radar, become obscure, get left out of documentation and evidence, is the single possibility for working the system, and the only way that agency emerges.

This resistance to the genome's status as a truth-object is reflected in how the unpredictable dynamics of social relations also resist the architecture of DNA, refusing the symmetry and linearity of its structure. The story is full of pairs that keep getting interrupted. Invalid Vincent and his brother Anton, then Vincent and Jerome, Vincent-Jerome and Eugene-Jerome, and Vincent-Jerome and Irene. If sequencing base pairs is the primary way of reading genomic code, then in *Gattaca*, this process is constantly frustrated, delayed, or abandoned. The

stability of the pair is repeatedly undermined, and splitting things up becomes an act of tacit resistance. Machines that read code can be tricked through the tactical use of waste material: forged fingerprints, fallen strands of hair. Precision can be mediated by disappearance, trickery and – in the film's final moments – empathy. No one believes the fiction, but it constitutes an economy which facilitates national development and competitive science.

While these strategies of not-seeing and interruption give the plot some resistive edge, it is Eugene's death that acknowledges the end of one particular formation of human agency. Eugene does end up committing suicide, locking himself into the incinerator. Before this, he tells Vincent that he has collected enough material evidence of Jerome to 'last you a lifetime'. A Jerome that exists only in genetic data is held in Eugene's home laboratory, while the original self-immolates. This moment outlines the annihilating violence of the laboratory, as well as drawing attention to the domestication of scientific infrastructure, its relocation from laboratories on the outskirts of major research centres (Stanford, Cambridge, MIT), to the homes of consumers. It also construes the disappearance of the neoliberal self-fashioning subject – to whom the domestic laboratory is marketed – into this molecular imaginary. Fulfilling one's potential means eventually getting divided into component parts and getting sucked into an amorphous, anonymous and composite field of data.

Eugene's death represents the death of the neoliberal self-fashioned subject, and its replacement with Jerome – the data-body who exists only as a genomic sequence. This data-body will not develop or change, but will remain in the system as comparative data, part of a deterritorialized assemblage without a fixed point of reference. He could be added to future embryos, or at some point, become redundant as the norm (inevitably) adapts to technological advances. Who knows what will happen in space, and what new kinds of genetic potential might come in useful in the future? What is important is not Jerome's near-perfection in and of itself, but the co-option of 'him' as a data object that remains a perpetual site of extraction. Eugene's final words to Vincent are directed towards a possible future, one in which Vincent comes back from his space mission; similarly, the field of action for algorithmic governmentality is not the present, but the future – to what could become, and in Rouvroy and Berns's words, 'to propensities rather than action taken' (2013, 18). As they note, this eliminates liberal ideals of critique, commons and project, for the sake of a new political regime without historical precedent.

The Human Genome Project destabilized narratives of individual development through its invention of technologies that break this individual up

into component parts. This chapter has considered how the Human Genome Project brought both liberal and neoliberal models of humanism into crisis, rendering metaphors of development (as environmental influence), critique (as checks and adaptations) and project (the individual) obsolete. But the data-body left behind already had a historical precedent, in the disaggregation and annihilation of lineage, genealogy, biomatter and history enacted systemically through the transatlantic slave trade. It is to this history and its prominence in postgenomic uses of genomic technologies that I now turn.