

*Time Considered as a Helix of Infinite Possibilities*  
(Samuel R. Delany)

My first encounter with genome time may have been in a science fiction story I read as a teenager in the *Nebula Award* volume for 1969, Samuel R. Delany's "Time Considered as a Helix of Semi-Precious Stones." The title intrigued me immediately, as it did the American composer Marc Satterwhite twenty-five years later when he tried to capture in music the "images of dazzling, swirling brilliance" that Delany's words evoked. Satterwhite's piece for violin, clarinet, and piano attempts to mimic in its formal construction the symmetry of the helix, which he describes as "ever spiraling outward and changing, yet ever the same" (Satterwhite).

The idea of a spiraling narrative, changing yet formally the same, is at the core of Delany's award-winning short story, a work that was seen at the time as a landmark of the New Wave movement in science fiction, later rechristened by Delany and others as "speculative fiction." Evoking the double helix of genetics, Delany constructs a narrative that is simultaneously linear and recursive. In the story, the advent of something called "hologramic information storage" allows officers of the Special Services to discover and predict everything a suspect has done or will be doing at any time in the past, present, or future. Hence, every episode in the story is always known (both before and after the fact); every moment is only the manifestation of a preordained time. Yet the narrative moves forward in a chronological order spanning fifteen months, a linear timeline marked each month among members of the criminal class by a new password, a changing shibboleth of semiprecious stones.

This chapter explores Delany's striking conception of a data structure that enables probable assessments of past and future events as a way of elaborating on the temporal implications of genomics. Juxtaposing Delany's vision of "hologramic information storage" with the "information metaphor" (Keller, *Refiguring Life* 18) in genomics reveals new dimensions of the temporal logic at work in the latter and reveals some of the social consequences enabled by this logic.

Delany's helical narrative, like Satterwhite's spiraling musical composition, might be seen as the aesthetic correlative of another helical structure, the double helix of DNA. As I have argued throughout this book, genomics possesses a distinctive time signature, a paradoxical embrace of both linearity and simultaneity. Delany's narrator is a con artist who changes his name as often as Melville's Confidence Man or HCE in Joyce's *Finnegan's Wake* (from whom Delany borrows the initials for each of his aliases). Heretofore, the narrator has survived by his wits on the margins of interplanetary society, but a Special Services' hologram has traced all his past deeds and identities, and at the same time, has discovered that he is about to graduate from petty larceny to burst on the scene as a major criminal. This forecast is as much a revelation to him as it is to the enforcement agencies that now must synchronize their movements to his calendar. Month by bejeweled month, Special Services and HCE (as I will call him) play cat and mouse, their movement through time coordinated by an information system that identifies from nearly infinite possibilities the one that will occur next.

The Special Services agent explains the unique qualities of "hologramic information" this way: "hologramic information storage simply means that each bit of information we have – about you, let us say – relates to your entire career, your overall situation, the complete set of tensions between you and your environment" (224). The parallel with the genetic information contained in each cell of the body is striking. Today, one can read out a person's entire genome from a tiny tissue sample, thereby gaining knowledge of a multitude of physical and behavioral traits.

With the exception of single-gene disorders such as Huntington's disease, however, genomic analysis deals with probabilities, not certainties, and so, it turns out, does Delany's vision of hologramic information. Despite the Special Service agent's claim to know everything about HCE's future actions, he always manages to stay one step ahead of the police. As with genomics, hologramic sequencing does not actually predict (still less, determine) one's life course. Rather, it generates a quantitative distribution of probabilities to forecast future outcomes. A character in the story cautions that people should not take such forecasting at face value. "You must remember . . . that if everything, everything were known, statistical estimates would be unnecessary. The science of probability gives mathematical expression to our ignorance, not to our wisdom" (232).

The fantasy of an information system in which "each bit of information we have . . . relates to your entire career, your overall situation, the complete set of tensions between you and your environment" (Delany 240) is the

dream behind genome time. It fosters the illusion that data encoded in your DNA relates to your entire life – not only where you came from but what you will become – and that it is knowable from a single test in the present. Instead of Delany’s “holographic information storage,” think whole genome sequencing, and you have the idea. Linear as jewels on a string, yet endlessly spiraling, ever the same, genome time claims to consolidate in a moment of revelation all times and places, all nature and nurture, “the complete set of tensions between you and your environment” (Delany 240).

### Double Temporality: Nanoscience, Climate Science, and Queer Time

Genomics is not the only twenty-first century science that exhibits a double temporality, but the powerful symbolism of the double helix may make it the most memorable. Nanoscience is another field that has inspired models of time that combine eventfulness in the present with a synchronic perspective that encompasses past and future. Colin Milburn relates the temporal logic of nanotechnology to the Christian figural interpretation of history. Comparing the time of nanotech to Biblical typology, Milburn quotes Eric Auerbach’s famous description of typology’s dominant trope, *figura*: “The here and now is no longer a mere link in an earthly chain of events, it is simultaneously something which has always been, and which will be fulfilled in the future.” (Milburn 207n38, quoting Auerbach, *Mimesis*, 74).<sup>1</sup> Milburn’s insight may be derived from Donna Haraway’s extended discussion of technoscience as “a millenarian discourse about beginnings and ends, first and last things, suffering and progress, figure and fulfillment” (Haraway, *Modest Witness* 10). Haraway begins with Auerbach’s concept of *figura* as well, noting that “The discourses of genetics and information sciences are especially replete with instances of barely secularized Christian figural realism at work” (10).

The social scientist Cynthia Selin, however, argues that there is not “a temporal logic inherent in nanotechnology” but rather “a temporal dimension coded in the way that nanotechnology is framed and represented” (122). Selin believes that

the dreamy aspect of nanotechnology . . . makes it an apt case for looking at the role of time and technology. Since the term was coined and the field first began to take shape, nanotechnology has been saturated in futuristic promises and threats. Both the uncertainty and expectancy of nanotechnology lend a certain degree of fantasy or science fiction to most characterizations. (123)

Her conclusion is that “time is embedded in the representations of the technology” (131). Whether one accepts Milburn’s account of nanotechnology or prefers Selin’s more cautious formulation, the distinction between a temporality inherent in genomics or one only contained within our representations is harder to maintain, even though representations of genomics have proliferated in realist fiction (Roxburgh and Clayton 22) and science fiction since the 1990s (Slonczewski and Levy; Yaszek and Ellis; Schmeink 9–10). The temporal logic of the genome is so deeply imbricated with the science itself that it is hard to distinguish what is inherent in the concept from what is metaphorical. Lily Kay makes this point on the opening page of her influential study, *Who Wrote the Book of Life?*: “the ‘language of DNA’ is not merely a popularization or rhetoric of persuasion, but rather a representation qua intervention with operational force” (1).<sup>2</sup>

A third scientific project that has led to profound re-theorizations of time is the effort to understand climate change. The historian Dipesh Chakrabarty writes, “The crisis of climate change calls for thinking simultaneously on [two] registers, to mix together the immiscible chronologies of capital and species history” (220). The chronology of capital, for Chakrabarty, is the linear history in which the world is immured, whereas “species history” is a time scale of such magnitude that it requires a different relation to time. A prominent scholar of climate fiction, Ursula Heise, also argues that climate change has engendered “a particular kind of temporality, a dual and seemingly contradictory emphasis on slowness and speed” (“Extinction” 55), with “slow” corresponding to the ungraspable *durée* of geological time and “speed” gesturing toward the historical onrush of impending climate disaster. The science of climate change is an outlier, however. It appears to have largely purged the millenarian impulse that still haunts other twenty-first century fields such as genomics and nanotechnology. The extinction of all life on earth that shadows climate change seems to have discouraged eschatology.

I will come back to this difference between the sciences of climate change and genomics, but first I want to range even further afield to consider a social and political model of time that is prominent in the humanities, “queer time.” The comparison of queer time with Delany’s narrative seems relevant, even urgent, because Delany’s story emphasizes what the queer theorist José Muñoz has called “queer relationality” (6). Crucial developments in “Time Considered as a Helix of Semi-Precious Stones” depend on queer relations from the narrator’s past, which remain unspecified in the present, yet shape future events decisively. Fleeing from

his first encounter with the Special Services, HCE runs across a friend he has not seen for several years, a boy named Hawk. This boy is one of the celebrated Singers of the City, a band of oral storytellers whose gift for singing stories of vital importance to their worlds make them revered throughout the planets. Their power comes from immediacy, an art that stands apart from the avalanche of media, advertisements, and fake news: “it was a spontaneous reaction to the mass media which blanket our lives” (Delany 235). What makes these Singers exceptional is that their songs may be heard only once. They are unique performances, and interplanetary law prohibits recording any of their spontaneous recitals.

The Singers have the kind of aura Walter Benjamin famously attributed to the work of art before the age of mechanical reproduction (Benjamin 217–53). Delany, however, emphasizes the figure of the Singer, not the song. Male or female, old or young, the Singers are auratic figures. Their aura comes from performances that listeners find too compelling to ignore. “What makes them Singers is their ability to make people listen,” Delany writes (234). Once identified, a Singer becomes a node in a network of trusted meanings. “Hundreds of people stopped to listen; a hundred more; and another hundred. And they told hundreds more what they had heard” (234). The media theorist Alan Liu relates this capacity of oral storytellers to function as nodes in communities to contemporary information systems that work through “store-and-forward networking” (Liu 13). Delany has something similar in mind, unlikely as a return to oral storytelling might seem in the context of global information networks. Indeed, this idea may be the most improbable conceit in Delany’s sweeping science fiction story. But the notion that an interplanetary civilization would grow so weary of untrustworthy media that it would put faith in Singers allows the story to connect Hawk’s queer aura to a different order of time.

Liu’s account of oral storytelling can help clarify the status of Delany’s Singers in an information age. Liu writes: “The time of the voice was simply a different order of time. It was legendary time: *so was the world in the beginning; so it is for us now*” (15, italics in original). With the advent of writing, we lost the ability to understand how storytellers could function as nodes in a network, how their ephemeral performances could persist and spread. With writing, “permanence changed into a new kind of renewable permanence: reproducibility . . . or the reliable reappearance of the same text in multiple copies” (Liu 16). The very facility of this diffusion of information changed our relation to networks. The nodes in contemporary information systems became more functional – not people so much as industries, professions, and technologies – publishers, printers, distributors, book

sellers, news vendors, and ultimately, media channels.<sup>3</sup> Delany wagers that a postmodern, posthuman, post-everything society might just grow so suspicious of the cacophony of disembodied information channels that it would reembrace legendary time, reinvest faith in an embodied performance whose immediacy and power catalyzes oral storytelling as “store-and-forward networking.”

This is an outlandish wager – more *outlandish* than interplanetary travel, far more outlandish than the notion of a “hologramic information system.” After all, many people believe whole genome sequencing already constitutes such a total information system with all the temporal consequences that entails. But the improbability of a near-future society putting its faith in Singers should not obscure Delany’s insight – that to know our past and future all at once, whether in a hologram or a genome, returns us to something like legendary time.

Delany’s story underlines the queerness of this conception of time by queering it in explicitly sexual terms. Years ago, our narrator “did something for [his friend]” (240) that left scars on the Singer’s body and a debt of love. Everything turns on how the Singer repays that debt – all the foreordained events in the story spiral out from that effaced “something” that happened years before. But the nature of their bond remains too queer to be easily expressed. Hawk’s struggle to articulate his feelings is riddled with gaps: “Look . . . you touch a person softly, gently, and maybe you even do it with love. And, well, I guess a piece of information goes on up to the brain where something interprets it as pleasure. Maybe something up there in my head interprets the information in a way you would say is all wrong . . .” (240) [ellipses in original].

The ellipses in the story – both the absence of details about what happened between the two men and Hawk’s struggle to find words to explain their bond – accords with the ideas of another queer theorist, Elizabeth Freeman, who notes that queer relationality “fold[s] subjects into structures of belonging and duration that may be invisible to the historicist eye” (xi). Such bonds, according to Freeman, evoke “an affective register irreducible to traditional historical inquiry, what has been forgotten, abandoned, discredited, or otherwise effaced” (3). Freeman’s contrast between normative time and the “invisible,” “abandoned, discredited, or otherwise effaced” moments of queer time helps us understand why Delany chose to represent the bond between HCE and Hawk through ellipsis.

Not surprisingly, Delany’s writing is invoked by some of the most influential theorists of queer time. Both Muñoz and Jack Halberstam adduce Delany’s works as important touchstones.<sup>4</sup> Halberstam’s *In a*

*Queer Time and Place* (2005) offers one of the most influential definitions of queer time. For Halberstam and many theorists who followed, queer time refers to those “models of temporality that emerge within postmodernism once one leaves the temporal frames of bourgeois reproduction and family, longevity, risk/safety, and inheritance” (6). It offers alternatives to the “time of reproduction [that] is ruled by a biological clock for women and by strict bourgeois rules of respectability and scheduling for married couples” (5). Most queer theorists, including Halberstam, focus on Delany’s theoretical writings and autobiography, not his science fiction. Delany’s autobiographical *Times Square Red, Times Square Blue* (1999) is crucial for Halberstam in articulating “the relations between sexuality and time and space” (13). Delany’s volume dramatizes how “queers use space and time in ways that challenge conventional logics of development, maturity, adulthood, and responsibility” (Halberstam 13). But these words could easily be applied to Delany’s earlier story. The unconventional logic of Hawk’s development, his boyish maturity, and the iconoclastic way he bears his adult responsibility as a Singer of the City all attest to Halberstam’s insight.

With adolescent glee, Hawk revels in using “space and time in ways that challenge conventional logics.” To help HCE unload some precious stolen goods, Hawk decides to take him, uninvited, to an elegant party held in the penthouse of one of the most exclusive buildings on the planet. Here is how Hawk enters the cordoned-off space of the ultra-rich and politically connected: barefoot with black grimy feet, “very dirty black denim jacket, no shirt beneath; very ripe pair of black jeans” (226). He attracts the frowns of guests from clear across the lobby: “A cluster of men and women in evening dress were coming out. Three tiers of doors away they saw us. You could see them frowning at the guttersnipe who’d somehow gotten into the lobby . . . [but] one of the men recognized him, said something to the others. When they passed us, they were smiling” (230). Their entrance to the party creates a similar stir. Hawk refuses to introduce his guest, leaving the host grasping at hints to discover if HCE is “a miscellaneous Nobel laureate . . . or a varlet whose manners and morals were even lower than mine happen to be” (231).

The story’s style, in its postmodern dislocations, winking allusions to both high and low culture (Joyce, Henry James, *Just So Stories*), and poetically intensified descriptions violated the expectations of science fiction readers too, who at the time were more accustomed to formulaic plots and conventional character types. The literary critic Tyler Bradway has astutely analyzed Delany’s commitment to “queer experimental

writing” as a vehicle for subversive politics (1–50). Here, Delany’s experimental style not only violates the genre norms of science fiction but also brands the story as New Wave, a consciously iconoclastic movement of the 1960s that provoked outrage and prizes in equal number.

But the question remains. How do the queer dislocations of plot, character, time, and style in Delany’s story relate to the helical time structure of contemporary genomics? My answer requires distinguishing between two broad currents in theories of queer temporality. The first includes the figures from whom I have been quoting, Halberstam, Muñoz, and Freeman. These theorists all speak of queer time in terms of potentiality and possibility, not foreclosed futures. Halberstam writes of the “potentiality of a life unscripted by the conventions of family, inheritance, and child rearing” (2). Muñoz values “queer relationality” because it serves as a form of “encrypted sociality” and promises a “utopian potentiality” (6). Freeman embraces “embarrassing utopias” and other fugitive “forms of being and belonging” (xiii). This emphasis on relationships, sociality, utopian possibilities, and belonging is an affirmative conception of queer time. It is an example of what Eve Sedgwick called the “reparative” impulse in critical thinking, a precedent all three theorists invoke. Like Sedgwick, they celebrate the healing, reparative nature of a queer time that insists on “potentiality or concrete possibility for another world” (Muñoz 1).

Muñoz contrasts his perspective with what he characterizes as “antisocial queer theories,” theories he identifies with the work of Leo Bersani and Lee Edelman. Muñoz calls their ideas “antirelational,” and he rejects the rhetoric of “no future” that Edelman develops in a book of that name, *No Future: Queer Theory and the Death Drive* (2004).<sup>5</sup> Writing in a polemical vein, Muñoz argues that “antirelational approaches to queer theory are romances of the negative, wishful thinking, and investments in deferring various dreams of difference” (11). Instead, he insists “on the essential need for an understanding of queerness as collectivity” (11). It is this vein of queer relationality, I maintain, that is cherished in Delany’s story and modeled in his helical narrative.

The contrast between these two models of queer temporality can help us contextualize the difference mentioned previously between genome time and the temporality of much thinking about climate change. In the writing of Chakrabarty and others, the time of climate science chimes perfectly with Edelman’s rhetoric of “no future.” The “current crisis,” Chakrabarty writes, “disconnects the future from the past by putting such a future beyond the grasp of historical sensibility” (197). Faced with the prospect of human extinction, the queer objection to conceptualizing our future

largely in terms of a reproductive logic makes a new type of sense. Edelman and Bersani developed their ideas in the shadow of the AIDS epidemic. Writing for and about a queer community under threat of extinction, they paired their rejection of reproductive futurity with a celebration of erotic self-shattering. They answered the prospect of “no future” by reveling in ecstatic moments that disconnect the present from any thought of futurity. Outside a queer context, in countless apocalyptic movies, we have seen a hackneyed version of this response – the scenes of rioting and sexual abandon that Hollywood seems to think would be the inevitable outcome of learning the world was coming to an end. But Edelman and Bersani reframe the erotics of “no future” in terms of its effect on the subject, a *self*-shattering, not an indiscriminate riot, that represents a viable mode of living in the absence of reproductive futurity.

Delany signals his affinity with a reparative vision of queer time by the story’s invocation of an open future, full of possibility, and its explicit rejection of paranoia as an “occupational disease,” a “dilly of a delusional system” (257–58).<sup>6</sup> Near the end of “Time Considered as a Helix of Semi-Precious Stones,” HCE shares a moment with a major rival, someone he anticipates having to fight against for survival in the high-status criminal circles he now occupies. The two rivals muse over their interlaced futures, speaking philosophically of their inevitable conflict. The conclusion of their conversation is not angry or fearful, but hopeful: “If you can fight me off long enough . . . we’ll get to the point where it’ll be worth both our whiles to work together again. If you can just hold out, we’ll be friends again. Someday. You just watch. Just wait” (257). The ending, like the story as a whole, describes queer ways of inhabiting time in spite of probabilities that would seem to foreclose possibilities. “We’ll be friends again. Someday.”

### Double Temporality in Other Contemporary Fiction

Other novelists have aligned genome time with queer relationality. In an earlier chapter, I explored David Mitchell’s image of time in *Cloud Atlas* as nested Matryoshka dolls, each present moment “encased inside a nest of . . . previous presents” (393). But Matryoshka dolls are only one of Mitchell’s many images for genome time. Others spill out in a love letter that a young composer, preparing for suicide, writes to another man. The composer has just finished his masterpiece, “Cloud Atlas Sextet,” a work for six musicians that spirals circularly around six repeated motifs. Like Satterwhite’s composition, “Cloud Atlas Sextet” aspires to capture both

linear and cyclical conceptions of time. As experienced by the characters, the events of their lives are unique, charting a linear course through history, but history itself, Mitchell proposes, operates according to a principle of “Eternal Return” played on “Nietzsche’s gramophone.” “Rome’ll decline and fall again, Cortés’ll lay Tenochtitlán to waste again, and later . . . you and I’ll sleep under Corsican stars again, I’ll come to Bruges again, fall in and out of love with Eva again, you’ll read this letter again, the sun’ll grow cold again” (471). The sextet, with its melancholy echoes of other artists but also its startling originality, mirrors the structure of the novel in which it appears, and it links *Cloud Atlas* to a beautifully reparative vision of queer time.

The queerness of genome time is not always aligned with queer sexuality, however. In fact, there are some accounts of genome time that are heteronormative in orientation, such as Ian McEwan’s *Saturday* (2005) with its tender evocation of married, heterosexual lovemaking. But sexuality – whether normative or non-normative – is not essential to the representation of genome time as paradoxical. Novels do not have to talk about sexuality at all to provide powerful musings on the queerness of genome time.<sup>7</sup> Hence, there are novels that multiply other analogies for its dual temporality. One of the earliest novels about genomics, Richard Powers’s magisterial *The Gold Bug Variations* (1991), found musical, seasonal, and spatial analogues for genome time’s paradoxical structure: the fourfold patterns in Bach’s *Goldberg Variations*, the four seasons of the year, the four-letter code of DNA, and the four-part poem, composed in quatrains, which serves as the novel’s epigraph. The most memorable analogy for genome time in Powers’ work is that of the fractal. In fractals, self-organizing forms reveal similar patterns of organization at every level of scale. Snowflakes are the classic example – each crystalline shape replicates the same pattern at every power of magnification. Powers’s articulation of this principle comes late in his novel:

The double helix is a fractal curve . . . [E]very part – regardless of the magnification, however large the assembled spin-off or small the enzymatic trigger – carries in it some terraced, infinitely dense ecosystem, an inherited hint of the whole. . . . The code is universal. Here, this city, me, the forest of infection on my hands, the sea of silver cells scraped from the inside of my mouth. Every word I have, . . . every predication, every sculpted metaphor. (627)

“An inherited hint of the whole” – the phrase connects the scalar thinking of fractals to the concept of genome time. Inheritance is set free from exclusively linear conceptions of historical time. Now an alternative

presents itself: recurrence can be thought of intrinsic to life cycles not just different members of a series. Delany's "holographic information storage" worked this way too. An operative of the Special Services explained: "even if you have a square centimeter of the original hologram, you will have the whole image – unrecognizable but complete" (1115). This enables the Special Services Department to translate a tiny data point from an individual – a sample as small as a cheek swab – into a model of the whole. And not just the whole in the present moment but its past and future as well. Forensic geneticists possess this capability already. They can use it to reconstruct the likely appearance of an extinct species from fragments of ancient DNA or to build models of the (probable) appearance of suspects or missing children from decades old genetic material (Aldhous; Evans, Skrzynia, and Burke).

We find this scalar thinking elsewhere in contemporary responses to genomics. As we saw in Chapter 1, McEwan's narrator analogizes the scalability of genomic information to the city of London. The city is "a biological masterpiece – millions teeming around the accumulated and layered achievements of the centuries, as though around a coral reef" (McEwan 3). The analogy spirals out from the protagonist's city square to encompass the largest historical event of the day, the impending invasion of Iraq. The leap from DNA to cell to organism, and from there, to consciousness, literature, London, the war with Iraq, and beyond is breathtaking. Yet this scalar movement recurs frequently when one turns to twenty-first century novelists who care about science.

The common thread that unites these images and distinguishes them from nineteenth-century attempts to come to terms with deep time is the concept of scalability. Chakrabarty sees the two perspectives on time of climate change as "immiscible," but genomics, like the queer temporality of Delany's story, sees the two ways of perceiving time as a matter of scale. Up close, one sees only contingency, but zoom out to a level where one can see the entire hologram or whole genome, and the pattern becomes clear. Providing a DNA sample or outwitting an agent of the Special Services are punctual moments in a linear sequence, but each moment yields data that, seen in its entirety, becomes a microcosm of the whole.

Mark McGurl shares my sense that scalability is one of the keys to recent literature's interest in science.<sup>8</sup> Writing about "the turn toward science" in literary studies, he comments: "The appeal of fractal geometry . . . would appear to be what Albert-László Barabási called its 'scale-free' nature – the same lovely (and appealingly organic-looking) patterns repeating themselves at all levels of observation" (535–36). Later

in the same article, McGurl expands this generalization to apply not just to current trends in the humanities but to “all literature,” which tends “to facilitate this recursive sequence of scaling up and scaling down” (541). That is what we see in Delany’s hologram, McEwan’s London, Mitchell’s love letter, and Powers’s fractal curve – genomic fictions that trace the dynamics of genome time at every level of magnification.

### The Temporality of Ancestry Tests

Lest this discussion leave readers with the impression that the temporality of genomics is only a theoretical question of little practical importance to our lives, I want to conclude with an example of its impact on public policy, for the temporal assumptions embedded in genomics have consequences of importance to society. Haraway attributes problems like “genetic fetishism” and genetic determinism, in part, to taking the temporality of genetics too literally: “The fetishist ends up believing in the code of codes, the book of life, and even the search for the grail” (*Modest\_Witness* 146). The prominence of Christian imagery and figural structures by commentators on genomics reflects the continuing force of religious paradigms even in secular, scientific contexts. The fictions we have examined in this chapter dismantle these religious paradigms, acknowledging the power of genome time but reframing that power in demystified terms.

Literature, music, and the arts were among the first to perceive the social implications of the temporality of genomics, insistently reflecting on the paradoxes at the heart of our identities as biological beings. Mortality and continuity, the individual and the species – art personalizes these dual temporal frames, giving us intimate glimpses of how we live on both planes at once. Art speaks to our most profound intuitions of why our lives matter, transient though they may be in the shadow of infinitely longer cycles of flourishing and extinction.

Throughout the last two centuries of western civilization, art has had only one real competitor for addressing these mysteries, and that is religion. That competition represents one of the reasons for the emergence of art, in an age of growing skepticism in the nineteenth century, as a substitute for religion – a displacement we saw in the work of Matthew Arnold and many others. But today, a strange reversal has occurred. Politicians and policy makers who address fundamental questions about life and death do so almost exclusively in religious terms.

One immensely consequential example of the reach of religion in setting genetic policy comes from George W. Bush's President's Council on Bioethics (now replaced by the President's Commission for the Study of Bioethical Issues). The numerous and vocal religious conservatives on the panel successfully framed the debate on stem cell research in moral terms drawn from the Judeo-Christian tradition. The only counterarguments that garnered much attention were those made by devoted secularists – most notably, Steven Pinker and Richard Dawkins – who were not on the Council.<sup>9</sup> Secularist arguments such as theirs, which foregrounded their commitment to atheism, have rarely gained much traction in US public policy. Purely materialist arguments seem to have been too stark to persuade those who create the policies that regulate crucial scientific endeavors. The secular resources of art and culture – great wellsprings of symbols and meanings, which provide a different mode of access to what often seem imponderable mysteries – have scarcely been tapped by bioethicists who oppose religious restrictions on science. We should remember the example of Thomas H. Huxley, who in an age of fierce debate between religion and science, did not rely on brute materialism to convince a public worried about the implications of evolution but instead drew upon a panoply of cultural resources – Greek myth, Eastern religions, ancient philosophy, art, and poetry.

Today, policy analysts or policy makers rarely invoke the resources of literature and the arts when they struggle to address moral and religious arguments against genetics. When issues are framed in moral terms, as they often have been in this arena, the neglect of literature and the arts has impoverished the debate, reducing the public responses to a stark choice between secular science and religious dogma – with the latter increasingly carrying the day. By contrast with fundamentalist movements, literature and the arts are more likely to prize human aspirations than to proscribe behaviors. This difference is on display in a reparative work like Delany's "Time Considered as a Helix of Semi-Precious Stones" – or, indeed, in the other affirmative visions we have glanced at in this chapter, *Saturday*, *Cloud Atlas*, and *The Gold Bug Variations*. Imagine how Delany's vision of queer relationality, for example, speaks of the deep rhythms of time to an audience unwilling to endorse more restrictive understandings of human relationships. It could – and should – speak to policy makers too.

With much religious thought about genomics preoccupied by opposition to specific forms of genetic research, the absence of cogent guidance in this sphere has had unfortunate social consequences. One striking example of these consequences is the unthinking use of direct-to-consumer genetic

testing (DTC-GT) services, which I mentioned in the introduction to Part IV of this book. At first, it may seem unclear what genome time has to do with the trend toward sending your DNA off to companies which, for a price, claim to be able to disclose all the mysteries of your ancestry, your race, and your geographical origins, as well as your future risk of developing a growing number of health conditions. But companies like 23andMe and Ancestry.com rely on genome time for their very existence. They have built their business models on the promise of genomics to reveal the mysteries of a customer's past and future, ready to hand via a simple spit test. If these companies needed marketing help, they could sell their wares as real-life time travel. Some perhaps would were it not for another sleight of hand that hides the temporal nature of their product – the spatial and alpha-numerical nature of genomic data, a visual display that condenses diachronic movement down to the synchrony of the code. DTC-GT companies hardly need further marketing assistance. According to the *MIT Technology Review*, by the end of 2019, more than 26 million people had paid to have their DNA sequenced by a commercial entity (Regaldo).

The innocent act of using a DTC-GT company to sequence your genetic information can have far-reaching social consequences. Sometimes these consequences can be gratifying – uniting adopted children with their biological parents, finding unknown relatives, revealing treasured details about one's cultural heritage. Alondra Nelson highlights African Americans who “use genetic ancestry testing with the hopes of shedding light” on ancestral ties that were obliterated by “the Middle Passage and racial slavery” (5). For this group, genetic analysis has the potential to “contribute to community cohesion, collective memory, or social transformation” (8). For others, particularly those in LGBTQIA+ relationships, locating genetic strangers can aid in establishing alternative kinship networks more accommodating of difference, the process Donna Haraway calls “making kin” (*Staying* 99–103; see also Casey and Clayton). But often the social consequences can be destructive. As a growing number of people are discovering, genetic information has the potential to reveal private details not only about the customer who submitted a DNA sample but that of family members, more distant relatives, and even total strangers. A disturbing but little-known consequence of seeking information about one's ancestry is that this act may disclose to an ever-widening circle of people private details that one might never have imagined making public – children born out of wedlock, the infidelity of partners, a criminal past, unwanted kin, and more. The fact is that revealing data about one person's genome unavoidably reveals information about the DNA of their

parents and children, their cousins, and their cousins' cousins, extending outward to hundreds of people, many of whom might be total strangers. A single disturbing revelation can have rippling consequences for others who never agreed to have their DNA sequenced or dreamed that someone else's decision might have an impact on their lives. And these are merely the personal risks that one runs by taking a simple genetic test. Most people have by now heard of the risks of surveillance by government agencies, ranging from law enforcement to immigration control, that come with depositories of genetic data, whether collected by the government or uploaded by well-meaning relatives to open-access databases.<sup>10</sup> In 2018, it was estimated that 60 percent of white Americans could be identified by existing ancestry databases and that within three years, that number will have risen to 90 percent (H. Murphy).

Public trust in the revelations of genomics is truly astounding. Travel to the past via genetic ancestry research carries enormous credibility for many people and institutions. Newspapers have reported cases of adoptees and donor-conceived children jettisoning life-long relationships in favor of their newly revealed biological "family." In their book *Random Families: Genetic Strangers, Sperm Donor Siblings, and the Creation of New Kin* (2018), Rosanna Hertz and Margaret K. Nelson document numerous examples of "genetic strangers" bonding on the basis of nothing more than data about their biological kinship, sometimes at the expense of the families that have raised them. The nation's courts have also been open to the revelations of genetic sequencing. Despite some studies that show that DNA evidence is not always reliable, courts often accept its testimony about the past – sometime to exonerate, more often to condemn (Hoeffel).

Travel to the future is equally widespread. Consider the faith that consumers place in genetic tests to reveal their risk of acquiring future medical conditions. Since 2017, 23andMe has received FDA approval to market genetic health risk reports for an ever-growing list of conditions: late-onset Alzheimer's disease, Parkinson's disease, hereditary thrombophilia, and several types of cancer, including those associated with the BRCA1 and BRCA2 genes ("FDA allows marketing"). Despite the high percentage of false positives in direct-to-consumer genetic tests (Tandy-Connor et al.), the varying results from one company to another (Huml et al.), and the protests of clinicians who are confronted with data about genetic probabilities that they are unprepared to interpret (E. Clayton, "Be Ready"), consumers still flock to DTC-GT companies for what they regard as information about their future. Our nation's courts, too, have flirted from time to time with considering genetic evidence concerning a suspect's

propensity to commit future crimes, a topic that I discuss in detail in the next chapter (Greely and Farahany). The prophetic power of DNA continues to be trumpeted as if genome sequencing were one of the golden horns of Revelations blowing on judgment day.

We should not blame a gullible public for believing in the power of genomics to reveal our past and future. Such assumptions are deeply embedded in the temporality of genomics itself. Some of the most astute critical minds to take up problems such as genetic essentialism and genetic determinism – Richard Lewontin, Evelyn Fox Keller, and Lily Kay, among others – have made little headway against these assumptions. Perhaps the resources of secular scientific reason are not sufficient to overcome such wellsprings of belief. Speaking logically against temporal belief structures that have persisted through millennia of myths, ritual practices, and religious traditions may not suffice. Literature and the arts take up the burden of these belief structures, usually in secular terms, but they do not dismiss the enormous power of such temporal structures to give meaning to lives. Knowledge of the presence of our past and the promise of a future – whether for ourselves, our descendants, or even our species – has been an inexhaustible resource for as long as there has been literature.