

Preface

The germ for this book was planted back in the 1990s when I first noticed that novelists were growing intrigued with how our newfound power to alter the genome might change us. The prospect of being able to clone yourself or create designer babies opened up new perspectives on age-old philosophical questions. Who are we? What is the human? What are our responsibilities to others and to future generations?

Soon fiction in this vein began to increase. Although one could point to a trickle of novels and stories that concerned genetics in earlier decades – Ursula K. Le Guin’s “Nine Lives” (1968) is a strong, early example – by the end of the 1990s, the stream had become deep and steady, a forceful current that swept up readers, critics, and prizes alike in its flow.¹ These novels ranged from horror stories, thrillers, and science fiction to dystopias, neo-Victorian novels, and every variety of “literary” fiction you can imagine – realistic novels, postmodernist works, fictional memoirs, family sagas, climate fiction, and more. C. P. Snow once famously lamented the separation between literature and science, remarking that novelists were “natural luddites” (22). Today, in the third decade of the twenty-first century, this part of Snow’s diagnosis of the “two-culture” divide has clearly become obsolete.

The increasing prominence of novels that pose serious questions about the social and ethical implications of genetics leads to the main theme of this book: the potential for literary studies – and the humanities generally – to play a greater role in public policy than it has in the past. Once it would have been difficult to imagine literature or literary studies contributing anything to discussions of science policy. At the nadir of the two-culture split during the Cold War, the notion that literary approaches to culture could have anything of value to say about genetics would have seemed implausible. In the last few decades, however, things have changed. Science policy is now formulated in ways that allow a wide range of new actors to participate, giving the humanities a renewed opportunity to make their voices heard in the public sphere. This book will explain how. Each chapter highlights the kind of insights literary approaches can bring to controversies spawned by discoveries in the life sciences. Equally important, each introduces readers to some fascinating novels from the

nineteenth century to the present that confront the challenge of evolution, then genetics, and now genomics.

The germ for this book may have been planted in the 1990s, but the ground had been prepared earlier in conversations with a leading figure in genetics policy, my wife of forty years, Ellen Wright Clayton. To Ellen, I owe much of my knowledge about how science policy is formulated in today's world. Over time, reading her articles and those of her colleagues in the ethical, legal, and social implications (ELSI) community,² I learned a great deal about genetics and about the policy issues that arise in that field. Virtually every time a new breakthrough was announced, our household would shift into high gear. At breakfast, I would read in the *New York Times* or hear on NPR of a new genetic discovery, and my wife would go back to her bedside table to find the journal that had published the original study. That evening over dinner, Ellen would try out arguments with me – and later with our two sons as well – about who owned the DNA in leftover blood samples or whether states should mandate screening of all newborn infants for certain genetic conditions. Did doctors have a duty to tell a patient's relatives about a genetic abnormality even when the patient objected? Were they required by law to do so? Could a mining company deny employment to workers with a genetic predisposition for lung cancer? How about a pilot with a heart condition? Should an insurance company be allowed to cancel coverage as a result of genetic testing? Was there a slippery slope leading from cloning for therapeutic purposes to reproductive cloning? What did we think of genetically modifying children? How about genetically modified (GM) foods? Should people worry about the privacy concerns that arise from collecting DNA samples for health and ancestry testing? And, these last several years, where do we stand on CRISPR/Cas9 and gene editing?

One thing was a constant – we all found ourselves drawing parallels with novels like *Frankenstein* and *Brave New World*, or movies like *Blade Runner* and *Gattaca*, or television shows like *Orphan Black* and *Black Mirror*. It was clear that the way issues were represented in our culture had an impact on our attitudes and those of the public at large. News media and the internet played a huge role too. I remember Ellen rehearsing arguments in our living room before she went on the *MacNeill/Lehrer NewsHour* to talk about a divorced husband who had sued his ex-wife over custody of their frozen embryos. As the years went by, the importance of communicating her ideas to the public only grew more apparent. Her interview following a vaccine safety report was carried by over 700 news outlets worldwide. Reporting on her committee recommendations about chronic fatigue

syndrome (now often called ME/CFS) was almost as extensive. This kind of attention made me aware of something policy experts already knew – that public attitudes are a crucial part of the equation when policy questions arise.

Distortions of the science are an ever-present problem. The press notoriously raises undue hopes and exaggerated fears about genetics. To combat this problem, scientists are frequently exhorted to write clearly and speak with restraint about the nature of their findings, which unfortunately they do not always do. But accurate communication of scientific results will never be enough. Long experience has shown that media hype, internet memes, personal stories, cultural myths, fictitious monsters, dystopian novels, postapocalyptic tales, and literary slogans like “Frankenfood” and “brave new biology” will overwhelm any amount of careful language about the limitations of a particular research finding.

Awareness of the important role of culture in shaping attitudes about scientific research made me realize that the humanities should play a part in policy discussions. It takes training and a fair amount of practice in the art of interpretation to disentangle stimulating insights from exaggerations and red herrings. Understanding the science is important. But that is only the first step. The impact of culture on our thinking goes far beyond the question of whether a story gets the facts right. Cultural representations convey multiple meanings, communicating beyond their explicit message in imagery, metaphor, characterization, point of view, genre, and narrative structure. The genre and form of cultural productions shape their meanings. The formal expression of an idea complicates the impact of any work. It may undercut, contradict, and make ambiguous; or it may reinforce, extend, and amplify the theme. Existing methods of inquiry in the policy world are inadequate to the task of elucidating the impact of form on public attitudes. Surveys and focus groups miss the hidden meanings, the deeper resonances, of literature, film, and the other arts – they even miss important aspects of the language used in science writing.

By the time I began reading novels about genetics in the 1990s, I realized that I had developed informed opinions about genetic policy, opinions that were grounded on a relevant knowledge base, namely my lifelong study of literature, film, and popular culture. These opinions were informed, as well, by a disciplinary training in close reading, a theoretical model of the role genres and conventions play in shaping public attitudes, and a critical approach to the power of metaphor, analogy, and narrative. In short, I began to see why my training as a humanist gave me a perspective on the social implications of genomics that was not common

in policy circles. I saw how literary scholars could supplement the viewpoints of other actors in the policy world with new methods and new bodies of knowledge. Most important, I realized that the failure to include these perspectives was diminishing the quality of debate in the policy world.

Over the years, I approached the intersection of literature and genetics from many angles. At first, I thought of organizing my ideas around particular ethical dilemmas such as cloning, genetic engineering, and genetically modified organism (GMO) foods. Eventually, though, the problem of what approach to take solved itself, for I found that I was drawn irresistibly to questions that had ramifications for *both* literature and genetics. Chief among them was the problem of time.

Time is intrinsic both to narrative and genomics. Stories track the course of lives through time, explore the vagaries of memory, rearrange events, foreshadow futures, prolong suspense, and look for (but do not always find) closure at the end. Genetics, too, opens new vistas on time. Darwin shocked the nineteenth century by revealing the *longue durée* of our evolution as a species. In the twentieth century, the modern synthesis of evolution and genetics transformed the gradual movement of natural selection into mathematical algorithms, enabling us to model temporal change as information or data.

Today, genomics brings home an essential paradox of our existence in time, one shared with countless other aspects of life. That paradox is this: we experience time as linear, but we are also governed by temporal rhythms that are circular in nature. We live in accordance with cycles that are larger than ourselves – the familiar round of day and night, the seasons of the year. Yet we eat, work, love, grow old, and die in moments caught in an apparently irresistible flow toward the future. Religions have always acknowledged this paradox, celebrating the seasons of the year with their own ritual calendars. Contemporary science recognizes this paradox too. Stephen Jay Gould identifies cyclical time as science's response to phenomena that “cycle in simple repeating (or oscillating) series because they are direct products of nature's timeless laws, not the contingent moments of complex historical pathways” (*Time's Arrow* 196).

The paradox of genome time is the way it fuses the personal timescale of everyday life with the immense impersonal timescale of the species. On the one hand, your genetic code is unique, a personal inheritance from your parents that influences important aspects of your identity: height, weight, sex, skin coloring, facial features, facets of your personality, propensity for some diseases, and more. From this perspective, genetic inheritance occurs

in a linear, historical timeframe. Your personal genetic code is the species' *parole*, a speech act that can never be repeated. On the other hand, the genome has a synchronic dimension. It is a sign system, a language consisting of a four-letter alphabet with three-letter codons or "words." Astonishingly complex messages can be sent with this simple code, including the instructions for generating every organism that has ever lived on the planet. From this perspective, the genome is a *langue* that runs through and beyond the individual, reaching back to the first primordial cell and forward to whatever future humanity may encounter. As a self-contained sign system, the relationship between past, present, and future seems arbitrary, a game of chance and necessity worked out in successive generations. Although actual variations occur in linear time, the set of possible evolutionary variations are always already "there," in *potentia*. The past and future appear inscribed as theoretical possibilities within the virtual space of the code. Think of all one can discover in the DNA from a cheek swab – the origin of distant ancestors, the risk of future health problems – all written in the present moment. The effect is paradoxical. The present becomes everything, but the past and future are not effaced. In fact, they are made knowable in ways previously unimaginable – the true identity of an adopted child's parents, the existence of unknown relatives, the lurking presence of future diseases. All times are inscribed in the present, encoded in the moment. This is the key to genome time – the present is made to contain every possible permutation of time as a suddenly legible system of signs.³

Novelists have made much of the analogy between linguistic and genetic codes. One of the earliest literary works to explore genomics, Richard Powers's brilliant novel, *The Gold Bug Variations* (1991), develops the parallel between the four-letter alphabet of the genome and the language of literature. Powers plays with this analogy at every stage of his novel, invoking it in puns, poetry, metaphors, and theme. Most important, he uses the dual temporality of his plot to dramatize the double temporality of the gene. I have written about this foundational work elsewhere, but the innovative temporal structures found in other novels about evolution, genetics, and genomics from the nineteenth century to today indicate a deeper affinity between literature and the life sciences. The two fields, despite all their differences, developed their responses in tandem to changing conceptions of time.

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This book charts the reciprocal exchange between literature and the life sciences across three exemplary “moments”: the late-nineteenth-century response to Darwin; the 1930s and on through the Cold War when the modern synthesis of evolution and genetics was developed in dialogue with a distinctive conception of modernity; and the twenty-first century, the age of genome time. Each chapter tells part of the story of how the literary culture of England and (later) America engaged with evolution, genetics, and genomics. In the process, the chapters demonstrate the kind of insights that I believe literary studies can bring to science policy.

While this book is primarily addressed to readers in literary studies and the medical humanities, it may also prove of value to researchers in science policy and to students in humanities disciplines who would like to discover how they could use their training in literature, history, film studies, theatre, art history, or the arts themselves to embark on a career in science policy. Part I of this book, in particular, argues for the value of humanities perspectives in science policy, and it outlines concrete steps for humanists who would like to prepare themselves for careers in this area. My focus throughout is on genetics, but the methods I demonstrate through close readings of genetics novels would be equally useful in thinking about policy in a wide range of areas, including artificial intelligence, neuroscience, nanotechnology, network theory, media, technology studies, climate science, animal rights, urban studies, poverty, homelessness, race, sexuality, and more.

Some chapters engage policy questions more directly than others, but all are meant to model ways that literary scholars can establish themselves as experts in the field. This aspect of my argument is crucial: an aspiring policy analyst must first demonstrate expertise in a “home” discipline before he or she can hope to join the debate. A track record of relevant publications in one’s own field is a necessary prerequisite. The readings here show one kind of work that would qualify. But there are many other canons and modes of humanistic inquiry that would serve to establish a relevant expertise – gender, sexuality, or race studies; global literatures; environmental humanities; digital humanities; as well as humanities disciplines outside of literary studies altogether. Close reading is perhaps the most recognizable mode of literary criticism to funding agencies and to the peer reviewers who evaluate grant proposals for those agencies. I will talk about three collaborative, multiyear grant proposals that my colleagues and I have submitted to the National Institutes of Health (NIH), all of which were successful in convincing funders that literary criticism should be considered a valid methodology for working on genetics policy. Our

argument was – and is – that close, historically sensitive attention to texts highlights the complexities with which public policy must grapple. The ability to read critically what people write, both what they explicitly mean and what may lie beneath the surface of their words, is valuable. Scientists do not have to be persuaded that language can be slippery, that buried metaphors can shape how messages are received, and that different communities often read texts in very different ways. The favorable response of reviewers to our NIH proposals and many conversations with audiences at medical schools and scientific conferences make that abundantly clear. Although this book features close readings, other methods in the humanities tool kit should work as well, as long as you are prepared to offer a clear account of your approach and are able to identify the distinctive benefits it will bring to the conversation.

By and large, the novels I explore in this book are impressive works of art. Consequently, novels and narrative theory play a prominent role in this discussion. Thinking about narrative can be of special value to policy work because of the power stories possess to immerse readers in richly imagined worlds, worlds in which the complexity of issues can be explored on multiple levels. A related focus is on questions of genre. Attending to the way in which genre molds expectations, often at the unconscious level, helps us understand why people respond in certain ways to stories, characters, and problems. Genre also encodes shared assumptions of particular historical periods or communities of readers. Tracing shifts in assumptions and expectations that are encoded in genres can be a powerful way of revealing how people are responding to a scientific discovery. The arc of narratives, the nuance of closely observed worlds, can speak to our society's greatest hopes and fears.

My emphasis on narrative, genre, form, and aesthetics is intended to underline the importance of doing what literary critics are trained to do – analyze literature. The only way the door to the policy arena will open for those of us in humanities disciplines is if we foreground our own distinctive methods and practices. Social science disciplines already assess the impact of culture from their perspective; we need to bring our methods to bear on the same problems. If we want to show that literature can lead to insights not easily revealed by philosophical reasoning or social surveys, then we should foreground the distinctive qualities of literature and literary culture.

In Part I, I explain how the policy process works today and discuss developments in related fields such as the medical humanities. I take Ian McEwan's *Saturday* (2005), a novel that foregrounds the relationship

between literature and science, as an exemplary first text. Since the growth of the policy world makes possible a new role for literature in a scientific age, it is important to understand how the relationship has changed over time. The literature of Darwin's age gave powerful expression to hereditary descent; with the rediscovery of Mendel's work in the twentieth century, modern genetics made the mechanism of descent clear. Genetics gave continuity with change a causal mechanism, and descent through time found an explanation at last. But when genomics arrived, linear descent suddenly seemed to be only part of the explanation. Then we had to allow for simultaneity as well as descent, for a system of the whole as well as individual variations. Later chapters will trace shifts in this relation through each of my three time periods: first, the science vs. literature debates of Thomas Huxley and Matthew Arnold in the nineteenth century; then the distinctively modern posture toward science and literature taken by Thomas Huxley's grandchildren, Aldous and Julian Huxley; and finally, the repositioning of literature vis-à-vis science occasioned by the growth of the policy world.

Part II turns back to the prehistory of genetics, examining the cultural response to Darwin. Darwin's theory of evolution was one of several scientific developments that led to a new understanding of time in the nineteenth century. The revelation that life had existed on earth for far longer than the Biblical 6,000 years contributed to a dizzying expansion of time, one that was difficult for the human mind to grasp. This disorienting new perspective has been called "Deep Time," and the concept is even more pertinent now as we struggle to come to terms with issues such as climate change that require a perspective that encompasses tens of thousands, if not millions, of years.

The flood of books in the wake of Darwin's *The Origin of Species* provides an illuminating counterpoint to cultural developments in our own day. One of the most significant methods that literary study can bring to policy discussions is the tool of comparative cultural analysis. But the lessons of the past rarely can be applied directly to the present. This section on the nineteenth century traces parallels and differences between three aspects of late-Victorian and twenty-first-century culture: sensationalistic debates about the ethical status of human-animal chimeras (Chapter 2), the seductive attractions of neo-Lamarckian thinking (Chapter 3), and the changing relationship of science and literature (Chapter 4).

Part III explores another turning point in the temporality of the life sciences. From the 1930s until almost the end of the twentieth century, the modern synthesis of evolution and genetics was the dominant

paradigm in biology. Chapter 5 explores a group of novelists, philosophers, and early geneticists who were prominent members of the Bloomsbury circle. It is not widely recognized that Aldous Huxley, author of one of the best-known novels about genetics, *Brave New World*, was the brother of Julian Huxley and friend of J. B. S. Haldane, two of the pioneers of the modern synthesis. The three of them, along with a few others in their extended Bloomsbury circle, shared a distinctive approach to modernity. The result was not only a revolutionary breakthrough in genetics but also an influential stance toward science and society.

The other chapter in this section examines science fiction (SF) written during the heyday of the modern synthesis from the early 1940s to the turn of the millennium, identifying two major phases in science fictional thinking about the posthuman – one relying on eugenics, the other on genetic engineering. This history of SF's engagement with genetics calls into question a widespread practice in policy discourse of narrating hypothetical futures that might result from current developments in genetics. By exposing the unacknowledged kinship between SF and the writing of some prominent bioethicists, this chapter models a double contribution that literary studies can make to policy: on the one hand, it can deconstruct the claims of scenario thinking to the status of nonfiction while on the other hand, it can help us see the policy value of some of the imaginary futures found in SF about genetics.

Part IV brings us up to the present. This section begins by defining the characteristic time signature of genomics, which can be traced in the public pronouncements of geneticists and policy experts alike. Genome time leads us to believe we can see the past and future already written in the present, encoded in our DNA. It is a millenarian attitude in which the present contains both past and future, legacy and prophecy all in one. Whether coded as damnation or salvation, or some mixture of both, the language of DNA is now seen as holding the secret of life itself.

The three chapters that bring the book to a close offer readings of novels that have a particularly strong bearing on contemporary ethical debates around genomics. Chapter 7 explores the implications of genome time in greater depth, paying special attention to how the temporal assumptions embedded in direct-to-consumer genetic testing shape the public's willingness to put their privacy at risk for uncertain health benefits. The chapter on biodystopias examines contemporary novels set in terrifying futures, futures that dramatize potential flaws in current US policies on genetic screening and GM foods. The final chapter considers the ethical implications of organ harvesting via an analysis of one of the most

poignant books of our time, *Never Let Me Go*, written by the Nobel Prize winning author Kazuo Ishiguro.

Powerful works of art, from *The Island of Doctor Moreau* to *Never Let Me Go*, enrich our understanding of the issues that matter most in our lives. They present questions that urgently need answering in all the complexity and ambiguity that policy makers need to grasp. By exploring the dense cultural networks that shape science and technology, these novels help us see multiple dimensions of policy issues that might be opaque to other forms of analysis. Ultimately, the novels discussed in the pages that follow provide a space for reflection, for deepening and expanding our awareness of the many forces that constrain and enable us – both as individuals and as communities – living in genome time.