

CHAPTER I

A New Project for the Humanities
(Ian McEwan)

The misfortune lies with a single gene, in an excessive repeat of a single sequence – CAG. Here's biological determinism in its purest form. More than forty repeats of that one little codon, and you're doomed.

Ian McEwan, *Saturday* (2005)

Huntington's disease. Perowne, the neurosurgeon in Ian McEwan's novel *Saturday*, readily diagnoses the genetic abnormality that afflicts Baxter, a petty criminal who is in the midst of assaulting him. It is like a tic with Perowne. He cannot stop himself from analyzing the biological causes of the poor emotional control, the violent temper, of the man who is beating him. Perowne regards himself as a "professional reductionist," a man of science who "can't help thinking it's down to invisible folds and kinks of character, written in code, at the level of molecules" (281). A lifetime of medical experience has led him to conclude that much of our behavior is dictated by biology. But Huntington's disease represents an extreme case. For someone with this condition, the "future is fixed and easily foretold" (94).

In the same year McEwan's novel was published, a committee established by the Institute of Medicine (IOM) was completing a study of how best to respond to emerging scientific discourses exploring interactions between genes and behavior. The committee developed fourteen recommendations for future research in this contentious area. The first was a call for transdisciplinary research into the "social, cultural, psychological, historical, political, genetic, and geographic/ancestral" factors that influence "fundamental aspects of human identity" such as "sex/gender and race/ethnicity" (Institute of Medicine, *Genes* 4). This appeal would seem to open a door to humanities professors to participate in an important collaborative endeavor. After all, these are topics that many humanists teach and write about every day. But most of us in the humanities are not even aware that such an opportunity exists.

Saturday tells the story of a doctor who makes some questionable ethical choices under extreme duress. To escape being beaten senseless, Perowne exposes the medical condition of his assailant in front of his companions. This act is not a violation of professional ethics since Baxter is not Perowne's patient, but it later turns out to be an error of judgment and makes Perowne worry that he was responsible for the events that follow. If there was an ethical lapse, it is personal, not professional, but the novel gives its readers considerable latitude in determining for themselves if this first choice was the right thing to do. Later, Perowne lies about the existence of a treatment for Huntington's disease to save his daughter from sexual assault by Baxter, who is still humiliated by the doctor's earlier revelation. Finally, Perowne consents to perform brain surgery on Baxter, despite the conflict of interest created by his personal involvement – even culpability – in Baxter's injury. The novel's complex portrayal of these ethical choices would make it an excellent text for a course in medical humanities or medical ethics. But its chief interest for genetics policy lies elsewhere. The novel's framing of the question of genetic determinism in terms of literary vs. scientific knowledge suggests that we reconsider this concept's central role in many policy debates.

Huntington's disease is one of the few adult-onset conditions for which one can say unequivocally that a mutation in a particular region of the genome is at fault, and it looms so large in writing about the field that one might be surprised to learn that the gene was identified only in 1993. Judging from the media, which breathlessly announces a new gene for some medical condition every few months, one would think that doctors and scientists believed that genes "cause" virtually every aspect of life, but that is far from the case. The belief that genes by themselves cause things to happen is called "genetic determinism"; it stems from a misunderstanding of the relationship between genetics and people's lives.

Huntington's disease results from an error in a single region on chromosome four where a three-letter DNA sequence (or codon) – CAG – may be repeated too many times. Everyone has multiple copies of this codon – anywhere between six and thirty is typical – but more than thirty-eight in a row and you will inevitably come down with Huntington's disease, if you do not die of something else first. In general, the more copies of CAG, the earlier the onset of symptoms. And there is no cure. The disease is always fatal. McEwan writes: "Anyone with significantly more than forty CAG repeats in the middle of an obscure gene on chromosome four is obliged to share this fate in their own particular way. *It is written*" (217, italics in original). The illness begins with telltale

tremors, which escalate to uncontrollable movements of the limbs, and later, the neck and torso. These physical signs are accompanied by behavioral changes. At the very moment his assailant is confronting him, Perowne observes symptoms that will lead him to diagnose Baxter's condition: "a false sense of superiority," "tiny movements with his head, little nods and shakes," "poor self-control, emotional lability, explosive temper, suggestive of reduced levels of GABA among the appropriate binding sites on striatal neurons" (92, italics in original).

The fact that Huntington's disease manifests in dramatic alterations of the personality – uncontrollable swings of mood and behavior – feeds into a symbolic opposition between science and literature that is a major feature of the novel. Perowne admits to being "a coarse, unredeemable materialist" (135), while other characters – notably his daughter, a young poet on the verge of publishing her first book, and his father-in-law, an elderly poet sometimes mentioned as a candidate for the Nobel Prize in literature – uphold the claims of the literary. A disease with both clear genetic origins and a brutal, inexorable course provides an apt foil to humanistic explanations of character. According to Perowne, Baxter's fate is "spelled out in fragile proteins, but it could be carved in stone, or tempered steel" (217). From Perowne's perspective, science can teach us more about the well-springs of human behavior than the novels his daughter presses him to read. "There is much in human affairs," Perowne maintains, "that can be accounted for at the level of the complex molecule" (92).

The debate McEwan stages between Perowne's belief in genetic determinism and his daughter's commitment to the transformative power of literature is but a single instance of a larger social debate. Fate vs. free will. The biological animal vs. the autonomous self. Brute materialism vs. the soul or spirit. "This is his dim, fixed fate, to have one tiny slip, an error of repetition in the codes of his being, in his genotype, the modern variant of a soul, and he must unravel" (McEwan 289). The novel brings to light the tangled implications of this debate for our society. And it does so in a way distinctive to literature – through the implicit and explicit arguments it embodies in its plot, dialogue, style, point of view, and form. The narrative reveals the unstated assumptions, the confused perceptions of right and wrong, the unintended consequences of decisions, and the subtle connections of individual lives with a larger world that enter into people's encounter with genetic disease. Its exploration of these issues is relevant to the problem posed by the IOM report on *Genes, Behavior, and the Social Environment* of assessing "fundamental aspects of human identity" (4). If transdisciplinary research into the "social, cultural, psychological,

historical, political, genetic, and geographic/ancestral” (4) factors that influence behavior is an important task for genetic policy, literary studies should stake its claim to be one of the disciplines addressing such questions.

Science Policy Today

Humanists have an opportunity to make their voices heard in public policy circles today because a change has taken place in the way policy is formulated in the United States and most other developed nations. Over the last fifty years, the rules governing scientific research and much medical practice have been negotiated through a messy but now well-established process. The negotiations take place in a semiautonomous zone of activity informally known as the “policy arena.” This arena is made up of ad hoc commissions, working groups, and standing committees convened by professional organizations, such as the American Academy of Pediatrics or the American Society of Human Genetics; by government and quasi-governmental agencies, including the three National Academies, the National Institutes of Health (NIH), and the President’s Council on Bioethics; and by international bodies such as UNESCO, the Human Genome Organization (HUGO), and the World Health Organization (WHO). Designed to be inclusive, these bodies are made up of scientists, doctors, lawyers, social scientists, ethicists, and religious leaders. They solicit advice from other scholars, nonprofit foundations, patient advocacy groups, corporations, and more. The ethicists Wolpe and McGee have called this method “expert bioethics,” a process “in which issues are framed and conceptualized at a high level of academic sophistication and political authority by groups of highly skilled professionals who are deputized to identify and resolve moral conflict” (182). The goal is to offer a broad-based, scholarly consideration of the factors that should inform political decisions.

The process typically begins with meetings of multidisciplinary committees. These committees pursue a variety of paths: they may hold hearings, take testimony from additional experts, sponsor colloquia, host town halls, submit their findings to peer review, and ultimately issue recommendations. The recommendations may be published in individual volumes, as reports of the National Academies generally are, or appear in peer-reviewed journals where they frequently are accompanied by editorials, commentary, or critical responses. It is not uncommon to have rival sets of recommendations on a given issue. For a pressing current issue,

such as human gene editing using CRISPR-Cas9, a wide cross-section of these organizations will commission reports; private foundations, religious dominations, and advocacy groups may do so as well.¹ While scientists and practitioners in affected areas may find this state of affairs confusing for a period, the effectiveness of a policy recommendation stands or falls, to a reasonable degree, on the quality of its insights and argumentation. Inevitably, the process is political. Lobbying by interest groups, public opinion, media coverage, corporate influence, institutional priorities, and political partisanship attempts to shape recommendations. But it is no messier than any other form of democratic contestation, and it has one distinguishing characteristic: at its core lies a substantive debate over ideas generated through research, scholarship, and intellectual exchange.

Eventually, policy recommendations may become the basis of state or national law. But here is a crucial point: whether written into law or not, policy recommendations have the potential to influence practice in their fields and become factors in decisions by funding agencies and the courts. Lawmaking is the exception in this arena, not the rule. Law defines the outer boundaries of what people can do. Within those boundaries, norms of practice and administrative structures shape the vast majority of behaviors. As Ellen Wright Clayton puts it, "Policy, in this view, is also the product of the unwritten practices of governmental entities and of the explicit and unspoken actions of numerous actors in society, including third-party payers, health care professionals and institutions, and employers" ("Policy Challenges" 23–24). By articulating norms and influencing behavior, policy recommendations make an impact, regardless of whether they become the law of the land.²

The new process of developing science policy arose first in biomedical fields. According to Albert Jonsen, the field of bioethics began in the United States in the mid-1960s and had established itself in university medical centers by the end of the next decade (Jonsen 115–16).³ The growth of the field was stimulated by a series of high-profile biomedical events: the revelation of the Tuskegee experiments in 1972; the *Roe v. Wade* decision in 1973; the birth of the first "test tube" baby, Louise Brown, in 1978; and the controversy that erupted over removing Baby Doe from a ventilator in 1982 (108–13).

In the area of genetics, the field was given a special impetus by a bold move on the part of James Watson, the codiscoverer of the structure of DNA. When Watson became the first leader of the Human Genome Project in the United States, he announced that 3 percent of the annual budget would be set aside for research into the social, ethical, and legal

implications of genetics (Cook-Deegan 163, 237). Three percent of one of the largest expenditures on science in human history was an unprecedented investment in research on the social implications of science. As a result of Watson's commitment, a branch of the National Human Genetics Research Institute in the NIH was dedicated to research on the ethical, legal, and social implications of genetics – or ELSI, as it is still known today.

A third factor contributing to the rise of this new policy process was the creation of institutional review boards (IRBs) within hospitals and universities.⁴ IRBs are charged with assessing risks to human subjects and other ethical or legal problems with research. First prominent within biomedical fields, the process has now penetrated throughout the university so that even people in the humanities have often heard about some projects needing IRB approval (although I suspect few humanists know in detail what that involves). The structure is designed to head off ethical and legal problems with research projects before they occur. Scientists often regard IRB requirements as a nuisance or a bureaucratic nightmare, but they cannot initiate even the simplest investigation involving human subjects without it. Much of the funding of science through public, private, or university agencies requires IRB approval in advance. As a result, the ethical impact of much science is weighed before – rather than after – research commences.

For much of the twentieth century, the reverse was the case. The idea that science would be subject to ethical review beforehand was rarely contemplated. The independence of science from social or political considerations was crucial to its growth in status and influence. The image of the neutral, and therefore unimpeachable, authority figure in a lab coat became an icon of the modern imagination, ubiquitous in print advertising and television commercials. The autonomy of science was the principal guarantor of its impartiality.⁵ Researchers were not supposed to consider the social implications of their findings but to pursue truth wherever it lay. Leave the consequences of their discoveries for others to deal with – that was not their job. “Science cannot determine what is right and wrong, and should not try to,” wrote the early twentieth century geneticist J. B. S. Haldane (*Science* 2).⁶ Robert Oppenheimer famously said, “When you see something that is technically sweet, you go ahead and do it, and you argue about what to do about it only after you have had your technical success” (qtd. in Polenberg 46–47). Only after Hiroshima and Nagasaki did scientists such as Oppenheimer become outspoken about their doubts concerning the older norms of ethical neutrality. Oppenheimer's later call

for researchers to consider the consequences of a discovery ahead of time, along with similar public statements in the 1960s by Bertrand Russell, Hermann J. Muller, and other eminent figures, presaged the emergence of the new policy sphere.

Contemporary scientists encounter pressures from numerous directions to assess ethical questions before initiating research. Not only IRB requirements and the existence of the policy world but also new social movements focused on race, gender, and sexuality; animal rights; disability; and the environment have given impetus to this change. Moreover, the transdisciplinary character of contemporary science, with its shifting project-oriented teams, challenges researchers to think beyond old boundaries, and in the process, rethink assumptions that might be normative in their home disciplines.⁷ Ethical standards demand that investigators respond to the very political, social, and cultural forces that once would have been seen as tainting science. If scientific *practice* lays as much stress as ever on neutrality and objectivity, scientific *policy* now frankly wrestles with the controversies of the day.

The new process of developing public policy alters the type of actors who are empowered to speak about scientific questions. The people who gain a voice in this arena are sometimes referred to as “policy experts,” but the source of their expertise often lies in disciplines outside the policy arena. For example, one may get a master’s degree or do a postdoc in health policy, but this credential generally complements rather than replaces the MD, JD, or PhD that constitutes the expert’s primary qualification. At the higher levels of the policy world, the credential that matters is scholarly distinction in one’s home discipline. The process depends on drawing experts from a representative assortment of disciplines who come together to forge positions on specific problems. In the twenty-first century, expertise plays its greatest role in public life through the intermediary of shifting, transdisciplinary gatherings of specialists who meet, deliberate, and speak in a defined set of venues.⁸

To date, few members of the literary, artistic, or historical branches of the humanities have become participants in this process. Consider the makeup of ethics committees: the professional schools send law, medical, business, and education experts; the social science division sends anthropologists, sociologists, political scientists, and economists; the natural sciences send every discipline relevant to a given problem. Testimony is taken from the corporate world, insurers, patient groups, special interest or advocacy groups, and any other organized body of citizens who are seen as stakeholders. The only professional sector of society not involved in

forging public policy is the humanities. There are two exceptions. Ethicists in philosophy and religious studies departments have gained access. But scholars of literature, foreign languages, history, art and art history, music, performance studies, film, media studies, and theater are missing. This imbalance represents both a problem and an opportunity for the humanities. The problem is that our absence from the room skews the resulting image of culture, and the large role that arts and entertainment play in shaping social norms makes this a serious issue. The opportunity is for literary and historical perspectives to begin to affect political and civic decisions more decisively than at any time since the Victorian era.

Three times now I have been part of humanities groups that have taken steps in this direction. In 2003, Priscilla Wald and I created a consortium between our universities (Duke and Vanderbilt, respectively) to promote the study of literature and genetics, and we established a working group of twelve literature professors at other universities to pursue collaborative research in the area. We received a large grant from the NIH, the first ever given to scholars in literature, to conduct meetings at our respective campuses and develop pedagogical and research methods for using literature and film to explore the ethical and social issues raised by genetics. From this beginning, genetics and literature has grown into a recognized specialization in literary studies well beyond our small group, opening doors for renewed collaborations. Accomplished scholars such as Jenny Bangham, Clare Barker, Michael Bess, Lara Choksey, Patricia E. Chu, Lennard Davis, Jerome De Groot, Regenia Gagnier, Josie Gill, Paul Hamann, Everett Hamner, Clare Hanson, Heather J. Hicks, Karla Holloway, Lisa Lynch, Susan McHugh, Frans Meulenberg, Robert Mitchell, Timothy Murray, Anna Neill, Judith Roof, Heather Schell, Philip Thurtle, Stephanie Turner, Sherryl Vint, Priscilla Wald, Alys Eve Weinbaum, Rebecca Wilbanks, and Hub Zwart have turned their attention to the field and are collaborating with one another and, in many cases, scientists and bioethicists, to address issues of genetics and culture.

Currently, I am one of the codirectors of a second transdisciplinary project on Genetic Privacy and Identity in Community Settings. Funded by an initial \$4 million grant from the ELSI division of the NIH and renewed in 2020 for an additional \$4 million, our group consists of nearly forty faculty, graduate students, and undergraduates at Vanderbilt University from a diverse array of fields including genetics, medicine, law, biomedical informatics, computer science, health policy, sociology, anthropology, economics, history, communication studies, English, and the foreign languages. I lead the Humanities team, which is tasked with

weighing the cultural factors that influence public attitudes toward genetic privacy. Our team meets regularly with the other two groups (the Law team and the Big Data team) with the aim of developing collaborative publications and synthesizing our collective efforts to formulate policy recommendations. During the renewal process, the peer reviewers singled out the humanities' contributions for particular praise, signaling that the ELSI community and the public policy world can see the merit in humanities approaches to science policy. The experience of working with colleagues from all parts of the university has been fascinating and has produced important results.

Here is a concrete example of the kind of insights that our humanities team has brought to the discussion of genetic privacy. One of the first publications our group produced was a coauthored article looking at Rebecca Skloot's 2010 bestseller *The Immortal Life of Henrietta Lacks* and the film adaptation directed by George C. Wolfe and starring Oprah Winfrey, which aired on HBO on April 22, 2017 (Clayton and King). Our reading highlighted the far-reaching collateral damages that can be caused by lost genetic privacy and the depth of psychic harms that can befall a family and community, especially for those living in poverty and subject to racial discrimination. Such intersectional harms have proven difficult to capture in existing survey-based studies, but the increased burden of this privacy violation on an African American family and community comes through with extraordinary power in Skloot's book and Wolfe's film. As a result of our reading, we reached several conclusions of interest to the public policy community. First, breeches of genetic privacy affect families and communities, not just individuals; communities, in turn, shape individual attitudes in multiple, interlocking ways. Policy recommendations should take into account harms touching relatives and other community members, not just affected individuals. This means not simply relying on metrics that assess how individuals want their genetic information to be treated but also attending to cultural markers that can signal how wider communities perceive genetic harms. Second, the affective dimension of a person's response to genetic information is not superfluous but fundamental to any research into public attitudes. Finally, researchers need to attend to the intersectional nature of the forces shaping the public's encounter with genetic information and threats to genetic privacy. Such intersections include not only overlapping oppressions or conditions of precarity, such as racism, sexism, class inequities, or disability but also the intersections among their personal, familial, religious, and communal lives.

Other humanities scholars are pursuing research that could have similar impacts on science policy and have led to grants and interdisciplinary collaborations. Michael Bess, a historian at Vanderbilt, received a grant from the NIH to look at the cultural history of genetics and robotics. Holly Tucker, in the French department, compared the reception of early modern blood transfusion to recent stem cell controversies in her widely acclaimed book, *Blood Work*. At Duke, Priscilla Wald's work on genetics and race, John Moore's spleen, and other topics in genomics have earned her important roles on interdisciplinary working groups, serving on the Governance Committee of Science and Society and the Steering Committee of Information Sciences and Information Studies. Wald's colleague Karla Holloway, a coinvestigator on our first NIH grant, spent a fellowship year at a bioethics think tank in Washington, D.C., and has published articles in the *American Journal of Bioethics* and a book on what she calls "cultural bioethics." Lennard Davis, another member of our first NIH working group, founded Project Biocultures at the University of Illinois – Chicago, and has published books that have been widely reviewed in science and medical journals such as *Nature*, *Lancet*, and the *British Medical Journal*. Kirsten Ostherr founded the Medical Futures Lab, a collaborative effort between Rice, Baylor College of Medicine, and University of Texas Health Science Center; her editorial on how the humanities can establish itself as an essential service in response to the corona virus pandemic recommends many of the same strategies for humanists that I discuss here (Ostherr). At Yale, Wai Chee Dimock has been disseminating information about collaborative programs and funding opportunities that bring together the sciences and literature to a wide network of scholars. Dimock regularly publicizes innovative programs such as UCLA's Laboratory for Environmental Narrative Strategies (LENS); the Health and Humanities Network at Columbia and five other universities; and the University of North Carolina's Health and Humanities Interdisciplinary Venue for Exploration (HHIVE). Internationally, Regenia Gagnier, Hub Zwart, and Frans Meulenberg have had success in gaining funding from the British Economic and Social Research Council (ESRC) and the European Union for literary approaches to genetics. Egenis (University of Exeter's Centre for Genomics in Society) includes literary scholars in its grant proposals and conferences.

These are examples of projects in the humanities that have received funding from sources not usually accessible to our disciplines and scholars. These efforts have begun to shift the boundaries of humanities research. But no one from the humanities has taken the next step. No one, so far as

I know, has begun to give testimony or serve on policy committees. But the time is ripe. Writing in the journal *Science*, Claire Craig and Sarah Dillon advocate embedding experts on narrative in science advisory systems “to tackle long-standing gaps in evidence for policy. What is needed now is for innovative practitioners to start asking for the narrative evidence that might be relevant to their specific and pressing questions, and for researchers to take on the challenge of creating it” (Craig and Dillon 136). The next time the National Academy of Medicine commissions a study on blood transfusions, for example, Holly Tucker should be considered for the panel. The same could be said for Lennard Davis and Michael Bérubé when next there is a committee looking into medical approaches to people with disabilities; or Priscilla Wald and Karla Holloway for investigations of racial disparities in science and medicine. But for that to happen, we must continue to demonstrate what literary studies have to offer to public policy.

Literary Studies and Science Policy: Four Methods

Let me open the case for the humanities by proposing four ways that literary studies can contribute to science policy. My claim is that the study of literature provides insights into the public’s understanding of genetics that are not available elsewhere and that cannot be uncovered by the research methods employed in other disciplines. Establishing this point will have an additional benefit for the humanities: it will help reposition our field within the institutional framework of the university and the professional economy of the nation.

(1) *New Archives*. The simplest contribution is to draw attention to a largely unexplored archive of art, literature, and films that provide a sophisticated reflection on the science of genetics. As I mentioned in the Preface, the last twenty-five years have seen an outpouring of literature with a bearing on genetics. This recent generation of novels has ancestors dating back to Victorian horror stories and eugenicist fantasies that began coming out soon after Darwin published *The Origin of Species* (1859) – these earlier works will be the focus of Part II of this book. A similar boom in genetic fiction greeted the modern synthesis, the focus of Part III. But the greatest interest has been displayed in the twenty-first century, to which I turn in Part IV.

This diverse archive of evolutionary, genetic, and genomic fiction is worthy of study for its own sake and because it can contribute to the field

of bioethics in multiple ways. First, literature prompts us to reflect on ethical questions. As countless readers have pointed out, great works of literature bring ethical issues alive. They make us confront questions emotionally as well as intellectually. They inspire and caution, lead us to speculate, and give us pause. Kwame Anthony Appiah puts this aspect of literature well: narrative “reinforces our common understanding, and the values we share.” Stories “help us decide not only what we feel about the characters but how we should act in the world” (29–30).

Second, this archive offers humanities scholars the possibility of new institutional homes outside the Arts and Sciences division of universities in fields such as medical humanities, bioethics, and narrative medicine, many of which are located in medical schools, interdisciplinary centers, and foundations. These disciplines are among the fields that serve to legitimize researchers for participation in policy work. They provide a sanction or credential to a researcher in the eyes of policy experts. Such institutional considerations will be crucial to opening the policy world to humanities scholarship.

Finally, novels sometimes have a direct bearing on issues of genetics policy: the error of genetic determinism; the promise and perils of cloning; the dangers of bioterrorism; the ontological status of chimeras; the risk of environmental damage from genetically modified animals and crops; the issues surrounding genetic engineering of organs for transplants; the privacy of medical records; the genetic component of race and sexuality; the possibility that genetic screening programs could stigmatize people with undesirable characteristics; the genetics of behavior; the advent of a new eugenics; and the fear that the “geneticization” of society could desensitize people to data-driven stereotypes. Literature is capable of portraying the complexity of motives, the rich variety of meanings, the emotional impact, and the subtle resonance of such questions in individuals and communities in ways that survey questionnaires are unlikely to reach.

(2) *New Methods*. Literary study can add its distinctive methods of close textual analysis to the quantitative and qualitative investigations of attitudes toward genetics already underway in the social sciences. The impact of popular culture on perceptions of science has been studied successfully by communications scholars such as Celeste Condit or sociologists such as Dorothy Nelkin and Susan Lindee, who have done pioneering analyses of advertising, newspapers, television, and the Internet using surveys, focus groups, and methods of discourse analysis.⁹ Work of this sort in the social

sciences has a recognized place in public debates about science and is regularly funded by the ELSI program and other agencies in the United States and abroad.

The role that the humanities can play in assessing this material differs from the approaches common in the social sciences. Discourse analysis, for example, a method often employed by researchers in sociology and communication studies, codes large corpora of texts – sometimes numbering in the thousands – for frequent images, themes, or topics. This qualitative methodology differs from literary criticism’s emphasis on the study of individual texts. Discourse analysis also differs from distant reading and other emerging methods of the digital humanities. In discourse analysis, the coding of topics in a group of interviews or other body of texts is generally done by individual researchers whereas quantitative literary studies more often rely on machine reading of large collections of novels or other literary texts. Further, literary interpretation rarely involves empirical surveys or interview methodology. Rather, it analyzes imaginative works to bring out their nuances and conflicts, often revealing meanings that are not apparent on first reading. This procedure requires being sensitive to both the formal structures and the explicit themes of texts.

The dual focus on both formal structures and explicit meanings leverages important recent developments in literary studies, the aesthetic turn in literary criticism, on the one hand, and “surface reading,” on the other.¹⁰ Formal features such as genre, style, point of view, narrative technique, metaphor, irony, and much, much more shape the messages that audiences take away from literature and film. Attending to aesthetics and formal structures highlights what literary studies brings to the table in policy discussions – an approach to the ambivalent symbols and affects that circulate in our culture. The buried, sometimes contradictory feelings raised by genetic discoveries often find their most powerful expression in aesthetic modes, something humanities researchers are well equipped to explore. Surface reading, on the other hand, accounts for the explicit meanings of cultural texts, ideas that often connect with audiences in profoundly emotional ways and help shape people’s opinions about biomedical research. Together, these methods grant access to both the buried, often unconscious impact of culture and to the explicit, even polemical, force of cultural narratives.

Literary criticism also differs from philosophic methods employed in the field of bioethics. Analytic philosophy is a common approach used to determine the ethical principles that should govern genetic research and practice. Additionally, philosophers often compose case studies of real-life

ethical dilemmas. Either mode of inquiry may use interpretive procedures like those found in literary criticism to assess the validity of practitioners' underlying assumptions, but the goals differ from those of literary studies. Whereas philosophers aim to determine governing principles, literary critics analyze the symbolic meanings and associations evoked by genetics. Literary study identifies the images and motifs that circulate in the larger culture and play a role in constituting us as individuals and groups – subjects who may engage with genetics as patients, doctors, scientists, or simply citizens.

(3) *New Focus on Scientific Language*. Another approach is to bring the techniques of literary analysis to bear on the language of science. The geneticist Richard Lewontin and the historian Evelyn Fox Keller, among others, have done valuable work on the role of metaphors in genetics.¹¹ Lewontin writes: “It is not possible to do the work of science without using a language that is filled with metaphors” (*Triple 3*). Keller emphasizes that much theoretical work in genetics depends on “the cognitive tensions generated by multiple meanings, by ambiguity, and, more generally, by the introduction of novel metaphors” (*Making Sense* 117). Lewontin and the historians of science who have looked at this question, however, are not literary critics, and they understandably pay less attention to other ways language affects science.

The mediation of language extends far beyond the use of metaphors; it encompasses every dimension of communication. The stories we tell and the words we choose structure our understanding of the world. From the smallest units of speech (grammar, syntax, idiom) to the largest conventions governing writing (form, genre, national language, cultural traditions), the way we communicate affects what is said. *Form shapes meaning*, even in the sciences. Researchers need a nuanced understanding of how the language they use affects their audience, whether other scientists or the general public. Health personnel need an awareness of the same issues to aid them in their communications with patients and fellow practitioners. Science policy needs to understand how the entire circuit of visual and verbal communications shapes the way people understand the ethical questions surrounding science. Language may register assumptions of which the author is unaware; all too frequently, it conveys connotations that are unintended. Literary criticism can yield important insight into those assumptions, and it can elucidate the linguistic sources of many biases and anxieties. Knowing how language conditions ideas about science will facilitate communication for everyone involved.¹²

(4) *New Pedagogy*. Literary studies can play an important pedagogical role in deepening ethical reflection not only in the policy community but also among students in high schools, colleges, and postgraduate programs, including medical schools. In the United States, every student in secondary schools and in most four-year colleges and universities takes literature courses. At a time when educators worry about the low level of scientific literacy in society, literature classes provide a valuable new platform for engaging students with the issues that surround science.¹³ The benefit would extend not only to humanities majors but also to science majors. After all, educators in science, medicine, and engineering complain that their students often do not grasp the larger social context of their subjects. Teaching courses in literature and science – or, better yet, coteaching with a colleague in the sciences, as I do regularly – will introduce an untapped audience of students to the importance of understanding the role of science in society.

Universities around the globe are focusing renewed resources on STEM education (science, technology, engineering, and mathematics).¹⁴ In a recent book, Richard Posner reproduces appalling statistics about the state of scientific knowledge among the public: “Only a third of American adults know what a molecule is, 39 percent believe that astrology is scientific, and 46 percent deny that human beings evolved from earlier animal species. . . . One study found that fewer than 20 percent of Americans can understand the *New York Times*’s Tuesday science section” (*Catastrophe* 93–94). Although Posner cautions readers not to overestimate results derived from surveys that may cause respondents to freeze up and forget what they know, he endorses Jon D. Miller’s call for increasing “civic scientific literacy” in the public at large.¹⁵ Posner notes that by Miller’s metric, “only 17 percent of the adult U.S. population was scientifically literate in 1999” (*Catastrophe* 94). Miller’s term captures the place at which literary pedagogy can intervene. If “civic scientific literacy” is defined as the ability to understand the *New York Times*’s science section, English department classes in literature and science can help create citizens who rise well above such minimal standards.

The classes I teach in this area attract a mixed clientele of students majoring in the biosciences, engineering, science communication, public policy, and English. The discussions that result are some of the most stimulating exchanges of my years in university teaching. Students quickly learn that the diverse skills they bring to the classroom enhance everyone’s understanding of ethical dilemmas. Science students feel valued for their

ability to clarify unfamiliar genetic concepts or debunk misconceptions they detect in the fiction. Literature students are able to supply information about genre conventions, historical contexts, and literary techniques, which complicate the themes of the text in ways the science students do not always see for themselves. All learn to speak with respect about controversial matters with classmates whose rival perspectives are shaped by very different knowledge bases. The objective of such pedagogy is not to enhance competence in the sciences themselves but to create citizens educated enough to make informed decisions about scientific questions. That in itself is a recognized goal of the science policy world.

Saturday and Time

Ian McEwan's *Saturday* is an apt text to illustrate the contributions that literary studies can make to genetics policy and pedagogy. The novel's most salient policy lesson lies in its critique of genetic determinism. Its greatest pedagogic value stems from the dialogue it stages between literature and science.¹⁶

The novel's handling of time is a good place to begin, for it nicely balances the claims of both science and literature. Set on a single day, the story moves forward through the hours from early morning until late at night, charting a course that is both chronologically straightforward and symbolically circular. The dual temporality is registered in both form and content. The hours of Perowne's day are linked to his past through memories, to the future through Baxter's inevitable death – and the prospective deaths of Perowne's mother and stepfather, mentioned on the final pages of the novel. "The time will come . . .," the novel concludes, when his son will leave home, his daughter will have a child, the house will empty out, and he and his wife will turn inward, cling to one another. "A time will come when they find they no longer have the strength for the square" and move out of the city. A time will come. "Their Saturday will become a Sunday" (285–86). Perowne's present cannot be disentangled from a past and future – no more for him than for anyone else.

Except that it can. The novel gives us glimpses of a different kind of time, a time in which the present expands to encompass everything and one forgets past and future. Such moments are granted to artist and scientist alike. In McEwan's book, they serve as common ground for the two cultures.

Obliviousness to time comes over Perowne both when absorbed in music and when performing surgery. "Perhaps only music has such purity"

(67), Perowne reflects, especially Bach's *Goldberg Variations* (a piece that has a special place in the canon of fiction about genetics).¹⁷ Time also dilates for Perowne when listening to his son play one of his blues compositions: "There are these rare moments when musicians together touch something sweeter than they've ever found before . . . [giving] us a glimpse of what we might be, of our best selves, and of an impossible world in which you give everything you have to others, but lose nothing of yourself" (176). Perowne's thoughts about giving to others while losing nothing of himself prepare for an elaborate description of this phenomenon, which comes at the end of the novel when he operates on Baxter:

For the past two hours he's been in a dream of absorption that has dissolved all sense of time, and all awareness of the other parts of his life. Even his awareness of his own existence has vanished. He's been delivered into a pure present, free of the weight of the past or any anxieties about the future. In retrospect, though never at the time, it feels like profound happiness. It's a little like sex, in that he feels himself in another medium, but it's less obviously pleasurable, and clearly not sensual. . . . He feels calm, and spacious, fully qualified to exist. It's a feeling of clarified emptiness, of deep, muted joy. (266)

The passing comparison to sex reminds us that a similar transport begins and ends the novel when Perowne and his wife make love. They are beautiful scenes of married love, rare in fiction, and they have the same power to suspend time. His love for his wife, like his absorption in music, suspends time as effectively as his immersion in surgery: "Now he is freed from thought, from memory, from the passing seconds and from the state of the world. Sex is a different medium, refracting time and sense, a biological hyperspace as remote from conscious existence as dreams, or as water is from air" (52). His daughter claims the same power for poetry and fiction. Athletes too, when they are "in the zone," experience the same absorption, and McEwan portrays that feeling during Perowne's long squash match in Chapter 2. The message is clear – this time out of time is available to all: poet, musician, scientist, lover, athlete, and the rest.

The two senses of time – everyday, personal time, in which the present is linked to a given past and an unknown future, and an impersonal time, or timelessness – appear in one contemporary novel after another when the topic of genetics arises. *Saturday* does not explain why – McEwan is more interested in finding a common ground between art and science than exploring the relation of this altered sense of time to genetics. But a close reading of the novel can perhaps disclose a reason for the association. The second chapter begins with a sustained passage about Darwin that includes the following meditation on time:

What better creation myth? An unimaginable sweep of time, numberless generations spawning by infinitesimal steps complex living beauty out of inert matter, driven on by the blind furies of random mutation, natural selection and environmental change, with the tragedy of forms continually dying, and lately the wonder of minds emerging and with them morality, love, art, cities – and the unprecedented bonus of this story happening to be demonstrably true. (54)

The unimaginable sweep of time is what novelists cannot resist. They are intrigued by the paradox of a temporal span beyond the scope of personal perspective that nevertheless evokes the tragedy of forms continually dying and the wonder of individual minds emerging to experience history within time.

Literary Studies and Genetic Determinism

The same paradox arises from the novel's treatment of genetic determinism, its chief contribution to a debate in the policy world. More than two decades ago, influential voices in the policy realm pointed to the tendency of literature, film, and other forms of popular culture to instill mistaken views about the power of genes to determine our identity and fate. Most prominent among these voices were two social scientists, Dorothy Nelkin and Susan Lindee, authors of *The DNA Mystique: The Gene as a Cultural Icon* (1995). In this influential book, Nelkin and Lindee argued that cultural representations of the gene portrayed it as the “master molecule,” the origin of who we are and what we might become. Naming this belief “genetic essentialism,” they criticized it as unduly deterministic and false to the actual science of genetics.¹⁸ Since that day, it has been taken as a given in policy circles that we must work against this impulse. Critiques of genetic determinism are legion, many emanating from some of the most respected commentators on contemporary genetics: Richard Lewontin, Steven Rose, Ruth Hubbard, Evelyn Fox Keller, Lily Kay, Susan Oyama, John Dupré, and Donna Haraway.

One might conclude from this damning chorus that cultural representations of genetics irredeemably corrupt the public understanding of the science, but that is not the conclusion that Celeste Condit draws from her comprehensive survey of the effect of popular culture on people's belief in genetic determinism. Condit and her colleagues find that “general trends indicate that, contrary to the claims of the critics, there has not been a significant increase, over time, in the level of determinism in the public

discourse about heredity and genetics” (980) and conclude that “scientific research on human genetics can be accompanied by the development of public vocabularies that recognize the ways in which genetic factors exert influence on human outcomes without portraying those factors either simplistically or as all-powerful” (983).

Much of the literature discussed in this book facilitates “the development of public vocabularies” and shared understandings of genetics that do not portray it “simplistically or as all-powerful.” I do the same in my teaching as my students and I explicate these same texts. As a result, I see a clear role for literary studies both in educating the public about such issues and in dispelling some of the misperceptions in the policy world about the effect of cultural representations of genetics. Although gross exaggerations of genetics abound, the impact of such representations is neither simple nor direct. Hence, it is hard to get a clear picture of how fiction or film affect the public’s understanding of genetics by tabulating mistaken references to genetics in the media or asking people to respond to questionnaires, common methods of ELSI research. Literary studies and other humanities approaches present an alternative.

Literary scholars generally do not canvas individual readers to understand the impact of a particular text. Rather, we look at how texts position the reading subject within culture.¹⁹ Individual works participate in larger networks of meaning. A single novel such as *Saturday* may have a negligible effect on public attitudes toward genetics – and that effect will differ from reader to reader and across varied demographics (gender, sexuality, race, class, abledness, age, etc.) – but interpreting McEwan’s novel can tell us much about the cultural meanings encoded in its genre, conventions, metaphors, symbols, and narrative structure. By focusing closely on representative texts, we gain access to the kind of images that are circulating in the culture at large. This approach has affinities with what the anthropologist Clifford Geertz has called “thick description.” Defending “an interpretive theory of culture,” Geertz calls for a practice that is “much more like that of the literary critic” (9). We need this approach, Geertz says, because culture is not “something to which social events, behaviors, institutions, or processes can be causally attributed; it is a context, something within which they can be intelligibly – that is, thickly – described” (14). That is one of the things literary studies and other disciplines in the humanities can add to the existing policy discourse, a rich, nuanced description of the culture in which attitudes toward ideas like genetic determinism thrive.

Genetic Determinism in *Saturday*

McEwan's novel identifies, yet avoids, the problem of genetic determinism by balancing the claims of both science and literature. *Saturday* reaches its climax in a harrowing confrontation in Perowne's living room. Baxter and one of his henchmen invade the Perowne household as the doctor and his family are gathering to celebrate the publication of the daughter's first book of poetry. The scene quickly turns violent. What transpires feels inevitable, both because it is triggered by Baxter's genetic condition and because the novel draws together causal clues from throughout the day. As Aristotle recommended over 2,000 years ago, the narrative culminates in a recognition scene (*anagnorisis*) that precipitates a reversal of fortunes (*peripeteia*) with the ensuing final chapter serving as denouement. In short, the novel is structured in accordance with classic principles of literary narrative, an elegant – if traditional – formal shape that reinforces the novel's own thematic emphasis on the claims of literature.

Perowne is unprepared for the events that unfold, despite not only his belief that Baxter's future was preordained by his disease but also numerous novelistic hints throughout the day that might have alerted him to the impending danger. Although no one believes that genetic determinism allows one to predict specific events in a person's life, Perowne's shock at the sudden turn of events needs to be interpreted in light of his faith in scientific certainty. It is a novelist's reminder of the uncertainty of human destiny. McEwan underlines the unexpected course of events by having Baxter undergo an abrupt change of heart. After learning that Perowne's daughter is a poet, Baxter makes her recite a poem for him while standing naked before him and her assembled family. Paralyzed, incapable of remembering a word of her own poetry, she is reminded by her grandfather of the lines she had learned as a girl from Matthew Arnold's "Dover Beach." Baxter's transformation is so abrupt that the novelist fears his readers will find it implausible, so McEwan adduces Huntington's disease as an excuse for what might be seen, from a strictly literary point of view, as a failure of realism: "Could it happen, is it within the bounds of the real, that a mere poem of Daisy's could precipitate a mood swing?" (229). Mood swings, we have been told more than once, are a common feature of Huntington's disease.

Let me pause over the novelist's careful staging of this scene of recognition and reversal. The narrative about-face leads to a more consequential reversal of fortune for Baxter when Perowne and his son manage to disarm their assailant and pitch him down the stairs, shattering his skull. The

climax is overdetermined by motives woven throughout the long day's events. Tangled causal relations extend everywhere: through the family's complex dynamics, their love as well as their quarrels, through Perowne's power and authority as a doctor, through Baxter's shaky standing among his criminal associates, and through factors beyond all these, far beyond in ways the novel adroitly registers, to aspects of life in the city, to inequities in wealth and education, and to England's complicity in the impending invasion of Iraq. Marshaling such a tangled web of motives and meaning is a traditional strength of fiction. But while the novelist arranges all these customary facets of realistic narrative to finesse the question of probability raised by Baxter's change of heart, McEwan holds a trump card in reserve. It is Huntington's disease itself. Neurological degeneration, a "wasting in his caudate nucleus and putamen, and in his frontal and temporal regions" (234), contributes to what happens next.

[Baxter is] becoming manic, he's tripping over his words, and shifting weight rapidly from one foot to the other. . . . It's of the essence of a degenerating mind, periodically to lose all sense of a continuous self, and therefore any regard for what others think of your lack of continuity. Baxter has forgotten that he forced Daisy to undress, or threatened [her mother]. Powerful feelings have obliterated the memory. In the sudden emotional rush of his mood swing, he inhabits the confining bright spotlight of the present. (232)

This passage establishes a balance between the claims of biology and literature. A cursory (mis)reading of the scene up until these sentences might lead one to conclude that the power of poetry won Baxter over; that the magic of literature humanized him, convincing him not to continue his attack on Daisy; that the beast was tamed by beauty, Caliban by Miranda's art. After this neurological passage, a cursory (mis)reading might suggest that irrationality stemming from Huntington's disease caused Baxter to act in an unpredictable way. But neither is true by itself. Both genetics and literature play their part. This is one of the things that make *Saturday* compelling: its equitable assaying of the claims of art and science.

Look at how the novel complicates the opposition between genetic determinism, on the one hand, and a view of literature as revealing a world too complex for any genetic explanation, on the other. The book opens with Perowne awakening in the early hours of the morning, and then (in a foreshadowing of Arnold's poem to come) going to the window of his bedroom. He reflects on the mystery of the city outside, London "a brilliant invention, a biological masterpiece – millions teeming around the accumulated and layered achievements of the centuries, as though around

a coral reef” (3), and he wonders about his odd mood of euphoria, whimsically supplying both a *scientific* and a *novelistic* explanation: “Perhaps down at the molecular level there’s been a chemical accident while he slept – something like a spilled tray of drinks, prompting dopamine-like receptors to initiate a kindly cascade of intracellular events; or it’s the prospect of a Saturday, or the paradoxical consequence of extreme tiredness” (4).

Perowne is an egotist but reflective too, and the novel is narrated in a meditative, observant stream of indirect discourse that gives us everything from his perspective. Only a few sentences later, Perowne is reflecting on his own “astounding ignorance” of literature, including Darwin’s *The Origin of Species*, which his “too literate daughter, Daisy” has given him, and which he has only recently dashed through (4). By the end of the chapter, in which we have followed his train of thoughts through a retrospect of his eight neurosurgeries on the previous day, his deep love for his wife, the awe he feels at the budding musical talent of his son, and his fears that a fiery airplane he has seen descending over darkened London might be a terrorist attack, we are ready to understand the words that begin Chapter 2, Darwin’s famous words from the ending of *The Origin of Species*, not just as a comment on the science of evolution but on the entangled bank of human existence: “There is grandeur in this view of life” (53).

The method is novelistic to the core. Take an individual life and make it resonate with larger meanings – that is how novels work, or at least a certain kind of realistic novel. The unique particularities of Perowne’s life are enlarged and given greater meaning by analogies, radiating out from his bedroom window to the city of London. The analogy is established by repeated passages about the city square on which his house fronts, the “perfect square laid out by Robert Adam” (16), the square celebrated by his son’s blues lyrics: “So let me take you there / City square, city square” (176). From the city square, the analogy continues expanding outward to encompass world historical events. Setting the novel on Saturday, February 3, 2003, the date of London’s mass protest against the impending Iraq invasion, establishes the largest context for Perowne’s narrative, the analogy between his quarrel with Baxter, in its asymmetrical relationship of power and wealth, and the imbalance of power between Iraq and the West. It all comes together with a clarity of meaning and emotion characteristic of the best fiction. For this is how realistic novels work.

Over the years, critics have occasionally complained about McEwan’s love of old-fashioned realist conventions. Here, the novel’s emphasis on realism’s traditional strengths becomes a way of signifying literariness *per*

se. The novel's structure thus plays a role in the book's central theme, the debate between literature and science, which is as much as to say, between the quotidian life of these characters and the power of a genetic condition like Huntington's disease to determine a person's fate. The conventional characteristics of the novel form become exhibit A for what literature can add to our understanding of the complexities of genetics.

What policy changes would I recommend based on my reading of Ian McEwan's *Saturday*? The most obvious proposal would be to reform how we try to dispel mistaken views about genetic determinism. Along these lines, Michael Dougherty, director of Education at the American Society of Human Genetics, has proposed that we alter how we teach genetics. Instead of beginning with single-gene traits (like Huntington's disease), which give students the impression that genes determine more areas of life than they do in reality, Dougherty proposes beginning the genetics curriculum with polygenic (or complex) traits, which make up the great majority of human behaviors. Understanding how gene-environment, gene-gene interactions, and epigenetic factors make it impossible to trace causal links for our actions back to a simple biological origin would help prevent numerous false beliefs about genetics. Perowne's mistake was focusing on a single-gene error on Baxter's fourth chromosome that would determine his death (at some unknown and still relatively remote time in the future) rather than on all the complex interactions of environment, character, circumstance, interpersonal dynamics, class relations, and yes, biology, which would lead to what happened on that day, that fateful Saturday. Inverting the genetics curriculum in medical schools, as Dougherty proposes, would be one step in the right direction. Another useful step would be to teach a single-gene disease like Huntington's through the lens of a novel like *Saturday*, a text that shows that even implacably deterministic conditions have indeterminate ends. This proposal would certainly work within high school and undergraduate curricula, and would even fit well within literature and medicine courses offered at some medical schools. In later chapters, my literary readings will lead to policy recommendations that are not tied to pedagogy, but it seems right to begin with education reforms when dealing with a novel that so dramatically poses the question of the two cultures.

Training Humanists for Science Policy

The well-known literary critic Louis Menand writes: "The most important intellectual development in the academy in the twenty-first century has to

do with the relationship between the life sciences – particularly neurobiology, genetics, and psychology – to fields outside the natural sciences, such as philosophy, economics, and literary studies” (19). For some, this development suggests that humanists should try to become more like scientists, should attempt to join cognitive scientists in the laboratory, for example, designing experiments on theory of the mind or investigating what mirror neurons can tell us about the mimetic faculty. I am fascinated when I hear of successful collaborations of this sort. And some scholars in the humanities have made progress in this direction, enough to have coined a new name for their field, neuroaesthetics. Literary-scientific collaborations are emerging in environmental studies, too, prompted by the urgent problems presented by climate change. I sometimes hear of artists being embedded for a fellowship year in science labs. But I am skeptical of the long-range viability of literary scholars collaborating directly on scientific research because neither area has much in the way of structural supports for this kind of interdisciplinary work. There is limited grant funding, few promotion pathways, almost no tenure lines, and little graduate and postdoctoral training. Further, scientists have no *professional* incentives to collaborate with the humanities and many disincentives for trying. Why, for example, would scientists ever be tempted to browse the journals in which we publish when a literature search in their own fields might routinely yield 7,000 or more relevant hits in PubMed, as did a systematic literature review we performed for my current ELSI project on the topic of genetic privacy? Given the pervasive suspicion of big science among literary scholars (Guillory, Anderson), what would tempt a scientist to support a humanist on an NIH or NSF grant other than in exceptional circumstances? Scientists are understandably eager to use their hard-won resources on advancing the research they think is crucial to solving problems in their own areas. Individual scientists may look beyond the limits of their field and be sympathetic to the value of the humanities, but there are few structural supports and countless structural barriers to widespread collaboration between the two cultures.

There is one area, however, that welcomes the kind of interpretation and critique that humanists bring to the table – science policy. It is a field that has dedicated grant support for collaborative work and that welcomes participants from multiple disciplines. Because public perceptions of science play a large role in policy recommendations, policy committees recognize the importance of studying culture (Carver et al. 943). They readily admit the role that metaphor and language play in scientific discovery. They also acknowledge that deep-seated desires or fears are at

stake and that norms of identity, as well as ethical principles, hang in the balance. Unlike debates over whether culture shapes the findings of science, no one disputes that culture influences science policy. As a result, language, values, myth, and emotion already figure in policy analyses. Criticism and interpretation of culture is built into the policy process – just not by humanists.²⁰

The President's Council on Bioethics underlined the importance of literary culture in its first meeting in 2002. Under the leadership of Leon Kass, a doctor and biochemist, the council devoted an entire session to discussing Nathaniel Hawthorne's "The Birth-Mark." In subsequent meetings, literature continued to receive attention, and the Council eventually released a fat anthology of stories, poems, and creative nonfiction ranging from Homer, Shakespeare, and the Bible to Isaac Bashevis Singer and Lorrie Moore.²¹ It is impressive to read the musings about literature of this very smart group of doctors, lawyers, geneticists, neuroscientists, political scientists, philosophers, and religious leaders.²² Any one of us might wish to be in such a seminar . . . and that is the point: we weren't. Of the scores of scholars who met with the President's Council and discussed the fundamental values of the nation's culture, invoking texts that we study and teach, not one was a scholar of literature, history, or the arts. It is ironic to hear poetry, myth, and fiction honored for how they prepare policy analysts for confronting the great biomedical issues of our time and to know that the people who have dedicated their lives to studying these cultural forms were never part of the discussion.

So how would one go about joining science policy discussions? Here are several initial steps that I would recommend.

- First, establish yourself in your own discipline. At the most basic level, this means completing an advanced degree in your field and publishing on relevant topics in your discipline's journals. You must have credibility in your own subject area before you can speak to the bearing of that area on policy issues.
- Second, use social media to follow organizations that focus on topics and issues with policy implications that match your own interests. In the area of bioethics, you might start with the Hastings Center, ELSIhub, American Society for Bioethics and Humanities, and International Health Humanities Consortium.
- Third, find a mentor at your own university or elsewhere who can guide you in your work, introduce you to colleagues, and include you

on projects as we have done on our grants with more than twenty humanities undergraduates and graduate students. Their participation has led to numerous publications, giving even undergraduate humanities students the rare opportunity to be co-authors of peer-reviewed papers.

- Fourth, meet others in the policy world by attending conferences, joining reading groups, and attending lectures at your home institution.
- Fifth, consider getting a second graduate degree. Acquiring a JD, MPP, MPH, MPA, or similar degree would be useful but perhaps not essential. A postdoctoral fellowship or affiliation with a university-based policy center might be an acceptable substitute. Short-term summer programs, which can enhance your credentials, are offered by a number of bioethics centers.
- Sixth, publish on relevant topics in academic venues both in and outside your home discipline. Additionally, op-ed pieces, blog posts, editorials, and commentaries in science or policy journals can help establish your presence in the field.
- Seventh, join collaborative grant proposals to funding sources outside the humanities. The NIH has shown itself to be hospitable to humanities scholarship. The Mellon Foundation and other private granting agencies are interested in connecting the arts and sciences too.
- Finally, be open to job opportunities beyond your own discipline, whether as faculty in medical centers or in staff positions with policy organizations in the state or national government, the nonprofit arena, or the corporate sector.

In the chapters to come, I will identify a number of topics on which literary scholars can shed light. Evolution, genetics, and genomics will be my principal focus. As the field in which ELSI research first arose, the structure and significance of the endeavor is most prominent there. Moreover, the problems and promise of genetics have inspired a body of literature and cinema that provides an important archive for study. But what I have to say applies to most areas of policy that rely on expert testimony by researchers, scholars, and professionals. The opportunity exists for humanists concerned about climate change, disability, artificial intelligence, immigration, economic inequality, racism, sexuality, and more.

There are signs that some scholars in the humanities are beginning to take advantage of this opportunity. When the pressure comes from above to be interdisciplinary and to quantify research's public impact, these

developments can be troubling. Such external pressures, which result from the disturbing trend of universities toward corporatization, should be resisted.²³ But the neoliberal economy that has created the corporate university is proving difficult to contest, and simply protesting the development is not going to be enough. The economic forces that threaten to marginalize the humanities require us to formulate new responses. The old strategy of staunchly maintaining the purity and integrity of a humanities sphere, set aside from the contaminating touch of commerce and society, manifestly has not worked. (I will say more about the origins and failures of this strategy in Chapter 2). Humanists insist on the importance of studying culture for its own sake – something I support as steadfastly as any of my peers and do my best to practice here – but we need to articulate a better rationale for the value of our enterprise than the one that has already failed to persuade our colleagues in the rest of the university and much of society.

As policy issues invade every aspect of the sciences, the humanities have a chance to speak with a renewed power about civic values. But we can do so only by embracing a new type of transdisciplinarity, one that thinks in terms of alliances among disciplinary investigators rather than of mastery of alien realms of thought.²⁴ The growth of research that depends on transdisciplinary teams has carved out a place for scholars whose areas of expertise concern meaning, symbolic forms, values, and interpretation. Social scientists and bioethicists have rushed in to occupy this space. Literary scholars should too. What they would find to work on in that space are novels, films, poetry, plays, and a vast array of popular culture about genetics.

Turning our attention to the policy sphere opens up new opportunities for a reconceived humanities that continues to read literature for its own sake but learns to speak about the experience of that reading to a new audience and in the language of public policy. This audience is not made up primarily of scientists. Scientists have other priorities to occupy their time, and even when they happen to enjoy literature, it plays no role in their research methods. *Humanists should address science policy analysts, not scientists themselves.* Most scientists cannot engage with the kind of sensationalistic distortions of their work that often appear in film and popular culture on any level other than outrage. But science policy experts do take such representations seriously, since the impact of culture on science matters regardless of the distorted images it purveys. That is why I propose targeting an interdisciplinary audience that is already engaged with cultural issues – the policy world.

For the project to succeed, we do not need to prove that cultural representations of science have important consequences, something everyone admits. Rather we need to show that humanistic perspectives on those consequences can be of value to policy debates. As specialists deeply versed in literature, the arts, and cultural questions, humanities scholars can add something distinctive to collaborative policy groups and problem-oriented projects. The case will be made by offering humanistic methods and expertise to granting agencies outside the usual handful of humanities foundations; to our colleagues in the sciences who are often required to include a public impact or ethics component in their grant applications and almost always call on people in other fields to provide that component; to conferences in other areas; to journals of public policy; and, ultimately, to the commissions that formulate the rules that govern scientific research.

This book is my offering.