

## Introduction

### Why a *New Theory of the Human*?

The aim of this book is to elaborate the basis for a new theory of the human. What provokes such a project is a concern that recent and withering critiques of the category of the human and of human exceptionalism have left us bereft of a politically useful category of the human subject that theorists can mobilize to address the political crises of the day. Under critical scrutiny, the notion of the human has come to be perceived as an index of a historically specific fantasy of mastery over the self, the earth, and all its many creatures. The characteristics, qualities, and capacities that heretofore have been taken to define and distinguish a human, humanity—*the human*—have been so profoundly discredited through historical, social, and scientific analysis that the notion itself seems to be bankrupt, with very little left to recommend it. In fact, given the weight of recent theoretical work challenging and discrediting not only the coherence of the category of the human but also the efficacy of human action, it may seem to be that to work to recuperate or reformulate the category is to kick against the pricks. Why bother?

At the same time that “the concept of the human has exploded,” as

Rosi Braidotti puts it (2013: 1), humans are being called to task for their collective role in destroying the climate and the ecological resources of the planet and for their ineffectual social, political, and economic efforts to transform their modes of living in ways that are adequate to the gravity of the problem (Nixon 2011). As Steffen et al. (2011) explain, there is now almost incontrovertible evidence that “humankind, our own species, has become so large and active that it now rivals some of the great forces of nature in its impact on the functioning of the Earth system,” so much so that “humankind has become a global geological force in its own right” (843). Indeed, surveying the “major and still growing impacts of human activities on earth and atmosphere, and at all, including global, scales,” geologists along with climatologists and environmental scientists increasingly dub the era in which we live the Anthropocene (Crutzen and Stoermer 2000: 17). The likely disastrous climate and environmental transformations that are the mark of this age are a clarion call for humans to take concerted action to mitigate the effects of human exploitation of natural resources and the development of those resources into the means of our commodious existence. In other words, humans have to own up to and take collective responsibility for their role in precipitating crises of global proportion.

So, there is a bit of a theoretical problem in our understanding of what it is to be human. For as Dipesh Chakrabarty (2009) points out, even though the many critiques of the category of the human may incline us to deny that humans are anything as grand as “a geological agent . . . we appear to have become one at the level of species” (221). Moreover, in being called upon, urgently, to address the problems of climate change and environmental degradation, we are confronted with “a question of a human collectivity, an us” (222). If the convulsions and deprivations characteristic of the Anthropocene demand that we think of humans as culpable and responsible for the current predicament, the inescapable question about the nature of the “we” implied in the question “what should or can we do” entails that we reconsider what it might mean to refer to, to invoke, or to try to mobilize a human subject.

The conviction that the idea of the human is not much more than a hollow fantasy coexists uneasily with the claim that humans as a species are a geological force. Of course, it might seem to be an abstruse theoretical conceit to advance the notion that the human is a fantasy at the same time

that the very real effects of human industrial, agricultural, and consumer activity daily reshape the planet. But the strained antagonism between these two positions does not constitute an all-or-nothing impasse demanding that we throw up our theoretical hands in that ineffable gesture of dismissive exasperation. For a number of scholars have suggested that it is precisely because we have lived and labored under the fantasy of the human that we have wrought such terrible crises on the world (Bennett 2010; Latour 2004, 2013; Morton 2012). If this is the case, then a fundamental reconceptualization of what humans are, of what the human might be, could provide resources for cogent, creative, and robust engagement with the difficult question of how we should transform the ways we live.

As I shall show in the course of this introduction, many critiques of the idea of the human focus on the ways that the category is defined against a background of the natural and physical world, embodiment, animality, and organismic processes of living: these must be repudiated or denied value in order to construct the figure of an independent, self-sovereign, autonomous human agent. Implicit in the critiques that expose the fantasy as a grotesque and dangerous illusion are alternative figures for conceptualizing human creatures. These counter-concepts of the human are creatures who are embedded in various ecologies and networks of relations and who can integrate their acknowledgment of their embodiment, animality, physicality, dependence, and vulnerability into their self-conception and their orientation toward and modes of being in the world. This book is an effort to consolidate, animate, and give theoretical substance to these implicit counter-concepts. The hope is that if I can articulate and elaborate the theoretical shifts attendant to such an alternative, I might provide the basis for a conception of the human that can be theoretically serviceable and politically generative as we face the social and ecological devastation, the droughts, the famines, the population displacements, the economic and political upheavals, and the wars that apparently accompany the inexorable unfolding of the Anthropocene.

In transforming the chastening critiques of the human into an affirmative alternative, the book proposes that we conceive of humans as biocultural creatures. Exactly what that might mean will hopefully become clear in the pages and chapters that follow. But a brief orienting overview here of these key terms will perhaps set the stage for engagement.

So, I use the term “creatures.” To describe humans as creatures here is

to be held to account for human creatureliness, for the ways that humans, like all other creatures, are alive and are able to stay alive because they are embedded in and draw manifold forms of sustenance from a habitat of some kind. To insist on human creatureliness is not to deny humans' difference from other creatures—all creatures are different from one another, and there does not seem to be a particularly good reason to refuse to acknowledge the difference of human creatures from other creatures too. Rather, to insist on human creatureliness is to refuse the hubristic exception that would make humans a bizarre and almost unthinkable living phenomenon, abstracted from the habitats that are the condition of their being able to live.

I also use the term “biocultural.” All creatures are biocultural in the sense that they develop, grow, persist, and die in an environment or habitat that is the condition for their development, growth, persistence, and death. I settle on the term “biocultural” as a descriptor for humans because I want to create a conceptual binding or a constraint such that we can no longer disavow what has been most vehemently disavowed—our biological, organismic, living animality. And rather than using a term like “human animal” to capture this, I think “biocultural” encapsulates the mutual constitution of body and environment, of biology and habitat that has been so central to the challenge to the category of the human.

The “-cultural” part of the term is used here with the sense not of a noun but of a verb, as in “to culture,” to cultivate, to provide some kind of medium within which a thing or things can grow. I prefer to think of culture in terms of the verb because it nudges us to take into consideration not just dimensions of our living habitats that shape and give meaning to living bodies and deeply complex forms of social and political subjectivity but also those dimensions that materially compose living bodies. In other words, to think of culture in terms of cultivation enables us to incorporate in our thinking simultaneously and sometimes variously aesthetic, arboreal, commodified, composted, cruciferous, disruptive, economic, embodied, fermented, fractured, institutional, linguistic, metaphoric, normative, oceanic, organic, patterned, political, representational, subjective, trashed, treasured, violent . . . in short, the material, social, and symbolic worlds we inhabit. All these dimensions of the medium in which creatures are cultured are important to take into account.

Figuring out how to think about the “bio-” in “biocultural” is tricky. It

is tricky and difficult, I think, not necessarily because of disciplinary and subdisciplinary overspecialization, as Goodman and Leatherman (1998) propose, but rather because our conceptual habits and our philosophical vocabulary and grammar inevitably draw into the ambit of our thinking some notion of a pure, unadulterated, uncultivated dimension of a living body. Later in the book, I talk about this imaginary sequestered, uncultivated piece or aspect of living bodies as a fictive “überbiological” matter—something that persists unaffected by and in spite of environmental insult. In appending “bio-” to “-cultural” to form a working concept of “biocultural,” I push against this unwitting tendency to presume the “überbiological” and instead try to capture and elucidate how creatures become what they distinctively are through the habitats that culture them.

In the remainder of the introduction I will trace the contours of the debate that critically engage the idea of the human. In doing so, I will provide a theoretical context for the idea of the biocultural that is the focus of the chapters that follow.

### **The Critique of the Human**

Critics of the idea and category of the human pursue three interrelated approaches, challenging the composition of the group that comprises human individuals, questioning the purview of rights that attach to the human as a moral and political category, and contesting what is distinctive or characteristic in the actions that human agents undertake. The object of their critique is the following set of ideas: that to be human is to be a member of a moral community composed of those who consider themselves as and treat one another as equals. That to be human is to possess all the rights and responsibilities implied by and presumed to follow from that equality. And that, accordingly, the concept of the human implies moral worth and carries ethical duties or obligations for those captured under its umbrella. In fact, Jürgen Habermas (2003) explicitly ties together the social, the moral, and the biological, arguing that the idea of equality and the moral and political community that such equality makes possible depend crucially on a presumption that there is an essence of human lodged in a necessarily inviolable biological strata. Defending the idea of the human, Habermas (2003) claims that it is important to preserve some notion of a distinctive human nature because the moral duties and obligations that attend the idea of that distinctiveness provide the model for all other forms

of moral limits and duties. But as I will show, critics of the idea and category of the human are considerably less convinced that “the human” is a guarantor of a right and just collective life.

As an ideal, the category of the human has been construed as universal, which is to say that everyone supposedly is captured under its rubric. However, historically, those people considered to fall properly within the domain of the human have been constricted by religious, social, political, or cultural mores. As numerous scholars have shown, women, the laboring classes, the physically and mentally disabled, queers, and people of various cultural or national origins have been construed as dubiously human—as almost-but-not-quite human—because they have been perceived as lacking the clarity of mind and dispassionate distance in judgment afforded by the gift of reason (Baynton 2001; Bordo 1987; Chen 2012; Irigaray 1985; Lloyd 1984; Luciano and Chen 2015; Macpherson 1962; Mills 1997; Okin 1979; Pateman 1988; Schiebinger 1993). Distinctively trapped in and by the body, these “others” of the fully human were construed both as subject to the determinations of the biological or animal functions of the body and as vulnerable to a kind of behavioral determinism deriving from the failure of their “weak” intellects to isolate them from the solicitations, seductions, and predations of the social and cultural milieux. This putative intellectual and moral weakness meant that they could not be received as the equals of those who counted themselves rational. Lacking the capacity for self-mastery, they had to be managed and spoken for or represented by their supposed betters. As a consequence of being inferior versions of the human—indeed, if they were presumed to be human at all—they were not entitled to claim the rights or exercise the responsibilities that accrued to those who were fully human. Indeed, the subordination that seemed to arise from their very nature was often seen as both an explanation and a justification for their being subject to the control, exploitation, and cruelties of their fully human superiors.

What has become evident as scholars have traced out these histories is that the centrality of the category of the human to the forms of recognition and misrecognition that have structured and oriented our social lives and political institutions did not come from an embarrassing failure by some people to be expansive and broadminded in their understanding. Rather, the use and misuse of the category of the human has been bound up with the strategic imperatives central to the projects of nation-building and

imperial expansion (Alcoff 2005; Butler 2010, 2006, 2004; Collins 1998; Hirschmann 2013; Stoler 1995, 2010; Weheliye 2014). This bitter history has meant that even though the putative openness of the category of the human has made it available for appropriation by a range of excluded groups in their struggles for equality (Bunch and Frost 2000; Nussbaum 2000; Reilly 2007), the category *as a category* has also come under critical scrutiny. For in order for the category to be at once open (“everyone”) and exclusionary (“not everyone”), the qualities that define the human must be held as criteria against which claimants to ethical and political recognition must be measured (Brown 2004; Esposito 2012). It is not the case that one simply is human. Rather, one must be deemed so. To be human, then, is not a state of being or an attribute but rather an aspiration, an attribution, and an achievement.

The critical analyses that conceive of the human as a politically potent achievement turn on the insight that the category depends upon, and cannot be thought without, its comparative and differentiating functions (Esposito 2012). If the human is an implicitly comparative category, against what is it measured? If it entails a movement of differentiation, from what? And toward what? Three threads of argument that emerge from many and sophisticated efforts to interrogate these movements of comparison and differentiation focus on humans as an exceptional species, humans as bearers of rights, and humans as agents in a field of action. I will sketch each thread in turn.

The first thread of argument concerns the long-standing question of what differentiates humans as a species from other animal species. And what scholars have found is that in the Western tradition of thought at the very least, humans’ self-understanding as special, especially deserving, or exceptional rests on their somehow exceeding whatever qualities or capacities they share with animals. Elizabeth Grosz observes that Western philosophy and science have “attributed to man a power that animals lack”—the power of reason and speech, of intelligent response, or the moral capacity to experience shame (2011: 12). The imperative to differentiate humans via comparison is so strong that no sooner are bees, crows, orcas, or chimpanzees found capable of such “human” arts as dance, creative thinking, cultural formation, or war than these criteria for distinguishing the human are replaced by other characteristics or activities deemed exceptionally human. Giorgio Agamben (2003) suggests that the

inexhaustible search for criteria by which to distinguish humans from animals indicates that what is sought and valued in that search are not the capacities or characteristics themselves but rather the gap between animal and human that the capacities or characteristics are thought to evidence. As a consequence, Agamben says, we can see that “man is the animal that must recognize itself as human to be human” (2003: 26). Indeed, Agamben proposes that the practices of compulsive differentiation that produce the gap and thereby the human should be known collectively as “the anthropological machine” (2003).

The imperative to find a definitive difference between humans and animals—and the inability satisfactorily to do so—is not just a ghostly relic of past cultural and political efforts to demarcate and differentiate humans in ways that underwrite and justify colonial expansion, slavery, and eugenic management of populations (Esposito 2012; Foucault 1978, 2003, 2009; Schiebinger 1993). The project of spotting the difference continues today in contemporary science—and there is no remedy to be found there either. As the genomes of humans and other creatures have been mapped and studied, scientists have learned that because of our evolutionary history, many genes among bees, mice, chimpanzees, and humans are shared (Bejerano et al. 2004; Sharan et al. 2005). The conservation of genes and patterns of protein usage across species suggests that no one gene or set of genes definitively marks human difference. The difference is a matter of degrees, perhaps, rather than of kind (Grosz 2011). Similarly, recent archeological findings suggest that modern humans, that is, *Homo sapiens*, did not arise through a singular differentiation from their historical forebears but rather from mingling, living, and interbreeding with them. In other words, there is no human as a pure species because modern humans are a variegated hybrid of homo species, an amalgamation of Neanderthal, Denisovan, and other *Homo* variants (Aiello 2010; Callaway 2014; Lordkipanidze et al. 2013).

One might claim that the search for what differentiates humans from animals seems like old-fashioned nonsense because really, in everyday life, it is quite obvious which creature is a human and which is not. But what is at issue in the historical and theoretical analyses rehearsed above is precisely that what counts as human has not been obvious—and remains questionable for many nonnormative or marginal populations, such as homosexuals and transsexuals, comatose medical patients, people with

physical or mental disabilities, racial and ethnic minorities, immigrants and refugees, prison inmates . . . the list goes on (Agamben 1998; Baynton 2001; Butler 2004; Esposito 2012; Hammonds and Herzig 2008). The critiques that trace the difficulty of differentiating the “truly” human from its nonhuman others suggest that rather than denoting a creature per se, the category of the human designates a constellation of rights, duties, and prerogatives that attach to those who recognize one another as worthy of carrying them.

So, the second thread of arguments examining how the human is defined via comparison and differentiation focuses on the designation of those rights, duties, and prerogatives. From this perspective, the human is conceived not as an essence of existence but as a particular form of coexistence. As Stanley Cavell (1979) might say, in this view, to be a human is a matter of acknowledgment within a relationship rather than a matter of knowledge. The category “human” here is an index of a moral dignity that requires consideration and that obliges interactions characterized by respect.

But to think of the category of the human as a kind of index of moral dignity and rights does little to save it from disintegration under critical scrutiny. The reason is that if the dignity and rights indexed do not attach to something essentially distinctive in humans, then the quality of regard, dignity, and respect to which the term refers can also attach to nonhuman creatures—to primates, to dogs and cats, to cows, sheep, and pigs, to animals generally (Cavell et al. 2008; Singer 2009; Sunstein and Nussbaum 2005). If the quality of regard, dignity, and respect commandeered by the category of the human do not attach necessarily and narrowly to those creatures we have called human, then the category suffers a kind of boundary failure. As Cary Wolfe notes, after scholars and activists repudiated assumptions that inclusion in the set of “the deserving” be restricted to select groups based on features such as gender, class, ethnicity, race, or national origin, “it was but one short step . . . to insist that species too should be set aside” (2003: xii). In this move, the expansion that abrogates the anthropocentric “rights like us” perspective renders the nominative “human” obsolete: the rights, obligations, and duties qua rights, obligations, and duties no longer require the modifier “human” to organize them or to be meaningful and persuasive. The collapse of the human as a qualitative category also leads to its collapse as a sign of moral exception.

The third set of arguments challenging the ways the human is defined

via comparison and differentiation is closely related to the ethical reevaluation of nonhuman creatures outlined above. Implicit in Habermas's plea to retain the human as a moral category—to uphold human exceptionalism—is not simply a desire to see the human as an exceptional repository of distinctive rights and obligations but also a desire to preserve the idea that humans are exceptional actors or agents (2003). What is at issue is the idea of humans as a very particular kind of agent, one who is distinct from the field in which he or she acts, and one whose actions are contained or delimited by his or her intention and self-conscious deliberation. But for decades, scholars have dismantled the notion that humans are agents of this sort. Pointing to the play and structure of language, to the mutual shaping of reason and the passions, to the embedding of economic norms, social expectations, and cultural conventions in the intimate depths of desire, psyche, and flesh, and to the reverberation of individual and collective actions through social and material space and time, scholars have discredited the notion that humans are self-mastering, that their actions are characterized by deliberation and autonomy, that their intention is realized in and contains the action that is its effect.

Critics of the notion of the human have mobilized these challenges to propose that there are many more agents afoot in the world than human exceptionalism has allowed. The idea here is that if human actions are conditioned by manifold social, material, institutional, and corporeal factors, if those factors contribute to, amplify, redirect, inspire, undercut, and make possible or impossible human activities, then those factors should also be considered as possessing what Diana Coole (2005, 2013) calls “agentic capacities.” The argument is not that we should grant to water resources, social networks, ecologies, germs, monetary systems, or digital technologies an agency they did not previously exercise. Rather, it is that we should recognize and bring within the ambit of our theoretical work the fact that they have always been efficacious in their activities in ways that conventionally have been captured under the rubric of agency (Bryant 2011; Connolly 2011; Coole 2013; Delanda 1997; Haraway 1991; Harman 2011; Hayles 1999; Latour 2007; Morton 2013a, 2013b, Stiegler 1998). Indeed, considering the ways that humans and nonhuman creatures and objects only together exert effects to transform the terms and possibilities of our coexistence, Jane Bennett proposes that we relinquish the idea of *individual* agents and think instead in terms of “a heterogeneous assem-

blage” that produces effects through its various and changing interrelations (2010: 23).

This kind of intervention resolves what has been thought as merely the context or field of human action into heterogeneous elements of a broad network of enabling and constraining factors that must be ignored or abjured if humans are to conceive of themselves as self-sovereign subjects. Whatever node, spark, energy, or force we might have thought as the distinctively human capacity to bend intention into action becomes, in such analyses, yet another myth or illusion, a narrow hypostasizing of many causes and forces that serves to conjure the human as the origin of its actions and as the master of an action’s realization and effects. Critics have zeroed in on the presumption that humans-as-agents transcend “the bonds of materiality and embodiment altogether” (Wolfe 2010: xv). And they counter this presumption by positing “a certain nonhuman agency as the condition of possibility of human agency” (Bennett 2010: 98). They contend that what makes humans effective is not their differentiation from their embodied existence or from the social and material contexts of their actions but precisely the opposite condition, to wit, “the irreducible imbrication of human/nonhuman or natural/social processes” (Coole 2013: 454).

Together, these three threads of argument call on us to think carefully about what we are saying when we talk of humans as exceptions to the animal rules, when we invoke humans as a group or the human as a moral and political category. The critiques do not amount to a denial that there are human creatures in and on this world. Nor do they add up to a claim that there is nothing whatsoever that is distinctive about human creatures in the ways that they live, love, and die. As Sharon Krause rightfully notes, to acknowledge the distributed forms of efficacy by which material environments, social institutions, creatures, ecologies, and technologies condition human action is not necessarily to deprive humans of any capacity to act or to absolve them of responsibility for what they have done or continue to do (2011). Rather, these critical challenges to the concept of the human constitute an effort to show that, as Cary Wolfe puts it, “the ‘human’ . . . is not now, and never was, itself” (2003: xiii). The human as we have tended to think it is built around a profound refusal to admit or to acknowledge some of the muddy and messy conditions of existence that humans share with all living creatures. The challenges, then, call on

us to rethink and animate differently the category's founding elisions and conditions, to elucidate and then to refigure the contours and texture of our self-understanding so that the work the concept of the human does in our thinking does not carry and elaborate what is noxious in its previous assumptions (Wolfe 2010: xvi).

In an analysis that participates in this chastening of the human subject via an elaboration of the agency particular to objects of various shapes and sizes, Timothy Morton (2013a) claims not only that humans are far from being the most important protagonists in the emerging disasters of global climate change and environmental degradation but also that specifically “nonhuman beings are responsible for the next moment of human history and thinking” (201). Indeed, in a particularly pessimistic coda, he suggests that the evident impotence of humans-as-agents combined with the enormity and momentum of the looming catastrophes means that our predicament is best captured by the primeval relation of a mortal to an unpredictable and impetuous god (201). But it seems to me that to cringe, pray, hope for the best, and prepare for the worst is to cede too much, to throw in the proverbial towel.

For what is at issue here is not simply whether and the extent to which we can transform our modes of living in such a manner as to ameliorate rather than compound the problems with climate and environment. Nor is it whether we can leverage social and scientific technologies to limit the effects of the damage we have evidently wrought. We also need to consider how to mitigate the ways that the accretion of political and economic injustices creates specific forms of vulnerability to disaster for particular regional, national, and subnational populations. This need is compelling, since many of the deleterious effects of global warming and environmental degradation are structured and riven by human, that is, social and political, categories and relations. As Jesse Ribot (2014) remarks, as important as it is to attend to the geological effects of climate change, such a focus can also divert attention from “the grounded social causes of precarity that expose and sensitize people to hazard” (668). In other words, Ribot claims, what makes climate change and environmental degradation disastrous in many communities is to a large degree institutionalized obstacles to broad-based social and political self-determination. To meet the challenge of the disasters is to have to come to terms not only with what humans do to the world they inhabit but also with what they do to and with

one another. The inequalities and the differential forms of vulnerability to which they give rise are social and political products to be problematized and countered rather than taken for granted, naturalized, and accepted as an inevitable state of affairs (Ribot 2014).

As we face the burgeoning and unpredictable effects of global climate change and environmental degradation, as well as the forms of conflict and devastation that accompany them, the various challenges to the concept of the human demand that we consider and consider again what kinds of actions we can and should take. If environmental and climate catastrophes demand a response from a specifically human subject, as Chakrabarty contends, the breadth and depth of criticism aimed at long-standing conceptions of such a subject suggests that we tread carefully as we imagine the contours and characteristics of this critically important political actor. What we need in the place of the fantasy of human exceptionalism is a different figure of the human, one that does not succumb to the conceits of old but also does not conceptually dissolve humans as identifiable agents and thereby absolve them of the crises that mark the Anthropocene.

The counter-concept of the human that is implicit in the critiques outlined above is one of a creature who is an embodied and thoughtful animal as well as a technological aficionado, a creature embedded in and composed by the social and material contexts of its existence, an agent whose actions are dependent on and conditioned by manifold networks of ecological, institutional, social, and symbolic relations. In this book, I endeavor to make this implicit refiguration explicit. I turn to the life sciences to sketch the basis for this refiguration in part because so much of what drove the old project of the human was a revolt against embodiment, against the animality, the organismic, the materiality of human creaturely existence. Indeed, what I find so exciting and intriguing in turning to the life sciences to think about this refiguration is the convergence of insights in social theory with grand and profound shifts in scientists' understandings of what humans are. Like social theorists, scientists increasingly confirm that there are complex interactions and interchanges between biological and social processes that muddle any distinction we might want to make between body and environment. And as Celia Roberts notes in her study of hormones, the research that traces these binary-busting processes is being used to develop models that provide a radical reconfiguration

of who and what we are (2007: xv). Nikolas Rose proposes that the convergence between critical theoretical, social scientific, and emerging life science understandings of the human demand that we revisit questions such as “how we should live as humans, why we should live as humans, of what we owe to ourselves and others, of what we can know, what we should do, what we can hope for” (2013: 23). In many respects, this book is the beginning of an answer to just such an invitation.

### **“Wait! Science?”**

Of course, the idea that one might draw on the life sciences to help develop the basis for a new theory of the human could cause many a theorist to issue a spluttering, snorting cough in surprise. The discomfiting ambivalence toward science that fuels such an aspirated eruption has roughly two dimensions.

The first dimension elaborates the concern that, today as in other historical periods, the sciences as a form of knowledge are inextricably bound up with the forms of political economy and population management that exacerbate and perpetuate inequality and injustice. Even if scientists do not actively or knowingly collude with nefarious political actors, they are immersed in, absorb, and articulate their questions and findings in the terms that structure and animate historically specific norms and political ideologies (Code 2006; Franklin 2000; Harding 2004; Hubbard 1990; Montoya 2007; Shapin and Schaffer 1989). For instance, Nikolas Rose (2007) argues that biotechnological developments prompt individuals to conceive of themselves and to associate with others in terms of biological characteristics such as disease, injury, bodily modification, or the travails of reproduction. The conglomeration of investment, research, and service institutions dedicated to providing assistance in such matters encourages individuals to become adept at self-management. And in a fashion that Wendy Brown claims is the signature of a neoliberal political economic formation, this push to self-management turns individuals away from broad-based collective political action in favor of issue-specific group lobbying efforts that meld together expertise, scientific technologies, and corporatist forms of fundraising (2005). Similarly, as Duana Fullwiley (2015), Jonathan Inda (2014), Kim Tallbear (2013), Dorothy Roberts (2011), and Anne Fausto-Sterling (2005) argue, even as scientists might disavow racism and anticipate that genomic sciences could undermine any claim that

racial inequalities have a biological basis and explanation, the forces of the pharmacological-biotechnological market combine with linguistic habits and histories of racial inequalities to (re)consolidate the worn and dangerous idea that race is bound up with genetics.

At the heart of this concern, then, is the realization that every form of knowledge is shaped by reigning ideological imperatives and that no form of knowledge—the sciences included—can be insulated or isolated from the cultural, moral, and political tensions that define and texture collective life (Haraway 1991; Lewontin and Levins 2007). The worry is that the use of findings in the life sciences as a resource for reconceptualizing “who and what we are” could result in a stealth importation of racial, gender, or other ideological biases into work that is oriented precisely around the historicization of and critical challenge to them. Even if, as Nikolas Rose (1998) suggests, we credit scientists with working within a framework that is “normed by truth and characterized by a philosophy of veridicality” (161), such a framework cannot account for the ways that dominant political norms and assumptions work their way into science unreflectively and unintentionally. If such assumptions inflect science in spite of the efforts of numerous scholars and activists to raise awareness of how they infiltrate the practices and institutions through which scientific research proceeds, then it would seem naïve, foolhardy, or even somehow complicit to make a resource of science research without at the same time constantly calling it into question.

The second dimension of the ambivalence toward science is elaborated around the concern that a turn to the life sciences for the purposes of a theoretical refiguration of the human could serve to bolster the already pervasive aggrandizement of the sciences as the only legitimate or worthwhile form of knowledge. Scholars in the fields of science and technology studies have done great work tracing the social, political, and economic dynamics through which scientific practices are constituted as authoritative and as a superior form of knowledge production (Åsberg and Birke 2010; Code 2006; Hird 2004; Kirby and Wilson 2011; Longino 2002). The authority attributed to scientific modes of knowledge production translates into substantial corporate and foundation financing for research and institutional stature for its academic practitioners. Such financing and stature are so proportionally great compared with the humanities and social sciences that the scholars in the latter fields find themselves sidelined or

marginalized in their academic institutions—their work little understood, poorly resourced, and generally undervalued by administrators.

Maurizio Meloni notes that these complex dynamics of authority, stature, and resource provision can lead to the perception that the biological sciences, with their emphasis on empirical findings, aim to “colonize the social” (2014: 733). And indeed, Meloni points out, quantitative social scientists have turned to the life sciences with the idea that it could provide “a foundational vocabulary” (734) for the study of social and political life, with the idea, that is, that biology could “authenticate” (739) the concepts and terms that more qualitatively oriented scholars might use to develop their analyses and arguments. For scholars who do qualitative research, such an imperialist ambition is objectionable in (at least) two ways. First, it demeans the rigor of the methodologies and the generativity of the insights that turn on critical reflection about individual, collective, and historical forms of self-understanding. Second, it presumes—absurdly—that those vastly complex and manifold forms of self-understanding that we call culture could be reduced to and explained in the empirical terms of biological functioning.

These two general concerns about the inevitable complicity of scientific findings with political imperatives and the widespread mission creep of scientific modes of knowledge production are extremely important. Nonetheless, I do not think they justify a refusal to engage with the intriguing developments in contemporary science. The reasons are threefold.

First, there is the remarkable convergence of contemporary science with some of the best and most critical forms of theoretical work on the insight that there is no “pure” biosubstrate, with the consequence that “bio-” is not something to which an explanation of any phenomenon can be reduced. The theoretical challenges to the concept of the human that highlight what William Connolly (2013b) describes as “our manifold entanglements with nonhuman processes, both within the body and outside humanity” (401) are mirrored in scientists’ fairly trenchant reconsideration of the relationship between living organisms and the worlds they inhabit. Rabinow and Caduff (2006) remark that whereas geneticists historically have tended to focus on the genes within cells as the key determinant of creaturely growth and behavior, a growing number now also look for explanation beyond the enclosure of the cellular nuclei housing the genes—and beyond the confines of the body itself. Instead, they attend to “the com-

plex interactions between cells, systems of cells, multicellular organisms, populations of organisms and their environment” (330). Confirming this broader sense of what is included in the domain of biology, George Slavich and Steven Cole (2013) observe that the complex interdependencies evidenced through these interactions have undermined scientists’ “long-standing belief . . . that we are relatively stable biological entities . . . [who] live in a dynamic social environment” (343; see also Robinson et al. 2005; Robinson et al. 2008). It turns out that rather than conceiving of cells as hermetic units that protect their contents from the vagaries of the world, “our molecular ‘selves’ are far more fluid and permeable to social-environmental influence than we have generally appreciated” (Cole 2009; Slavich and Cole 2013: 343).

In this emerging view, the embodied human does not simply move in a field of action but absorbs manifold substances from its habitat and responds perceptually, biochemically, and viscerally to the threats and promises that the social and material world present (Landecker 2011; Landecker and Panofsky 2013; Lock 2013; Niewöhner 2011). Scientists conceive of this traffic into the body and its cells as nutrients, gases, chemicals, and toxins that transit the skin, the mucous membranes, and the cellular membranes of the body through breathing, eating, and absorption (Guthman and Mansfield 2013; Mansfield 2012a). Perhaps more strikingly, they also conceive of it as “nurture, culture . . . geography, experience, and history,” as Fausto-Sterling puts it (2008: 683), in other words, the structured, experienced, imagined, or anticipated social encounters and relations that form the texture of daily life (Kuzawa and Sweet 2009; Slavich and Cole 2013; Thayer and Kuzawa 2011). Indeed, Slavich and Cole point out that together, the material and the social and cultural habitats in which a living body develops, grows, and lives is a considerably more significant determinant of which genes are used in the body and how they are used than what we could call “in-born” genetic factors (333). Julie Guthman and Becky Mansfield (2013) rightly note that these findings, which indicate that the processes of development and growth in organisms are shaped by myriad environmental factors, are “paradigm-shifting” (491)—and are all the more remarkable for their consonance with shifts in social and political theory.

Elaborating some of the implications of such studies, Guthman and Mansfield (2013) observe that “there is nothing about the body that forms

a solid boundary—or threshold—between it and the external environment” (497). In these kinds of analyses, the body is conceived as porous or permeable in a way that belies the sense either that the “self” is distinct from the body or that the body is distinct from the social and material environment (Landecker 2011; Lock 2013). Rather than containing some portion that is “given” in biology and some portion that is “made” through culture and environment, the human body is increasingly conceived as hybrid, as constituted through “active processes that are simultaneously political and biophysical” (Guthman and Mansfield 2013: 490). So pervasive is this emerging sensibility that scholars are now trying out various ways to capture this simultaneity, offering such terms as *transcorporeality* and *viscous porosity* to indicate the traffic between body and environment (Alaimo 2010; Tuana 2008), *nature-cultures* or *naturecultures* to indicate the thoroughly mixed or hybrid domains we inhabit (Haraway 2008; Latour 1993), and *biocultural* (Davis and Morris 2007; Fausto-Sterling 2008; Goodman and Leatherman 1998; Saldanha 2009) and *socionatural* (Guthman and Mansfield 2013) to point to the combination of forces and factors that inextricably together compose human life.

For theorists as well as contemporary scientists, then, humans are constituted through a matrix of biological and cultural processes that shape one another over various time scales in such a way that neither one nor the other can be conceived as distinct. As in social and critical theory, so in the sciences this sense of the reciprocal shaping of body and environment has reached a point that Susan Oyama (2000a) and Evelyn Fox Keller (2010) caution against talking as if the environment and the body *interact* to shape one another: the conjunction “and” that binds the body and the environment grammatically in such a formulation places the two as a priori distinct phenomena that (then) come together. However, Keller notes that “the image of separable ingredients continues to exert a surprisingly strong hold on our imagination, even long after we have learned better,” which is to say that there is nevertheless a persistent tendency among scientists and social and political theorists to think and work as if there is “a space between nature and nurture” (2010: 30). And in an effort to counter such a tendency, Karen Barad has suggested that the concept of “intra-action,” or action within a field, might better capture the processes by which the biological and the social reciprocally work on one another (2007).

The broad outlines of the emerging scientific consensus about the po-

rosity or permeability of the biological body are so coincident with the criticisms of the disavowal of embodiment, corporeality, materiality, and interdependence made by theorists challenging the category of the human that some form of mutual engagement would promise to be productive. For just as those who have critically reconsidered the concept of the human carry forward presumptions and habits of thinking that have not yet been transformed, so too do scientists. For us to engage with one another's work through this moment of convergence seems to present an opportunity for each kind of critique to be thrown back on its assumptions, to discover new modes or perspectives for thinking, to become bewildered only to perceive a novel pattern or unexpected set of connections.

The second and related reason not to refuse to engage with developments in contemporary science concerns how theorists might take up the research findings. The engagement with science represented in this book does not amount to a call for theorists to become scientists or to become the “so-what” brigade tasked with elaborating the policy, regulatory, or administrative ramifications of particular experimental findings. The idea is not at all for theorists to learn the science so as to formulate a plan of action, as if we should adopt a purely instrumentalist orientation toward this form of knowledge with the presumption that “knowing will lead to knowing what to do” (Weigman 2010: 84). What is at stake in the engagement proposed is not an epistemological issue in which particular claims can be adduced true or false, verified or disproven. What is at stake is instead something akin to an ontological issue that addresses itself not to questions of truth or falsity but to our orientation to our world, to the patterns and connections we trace between phenomena, to the background framework within which the meaning of particular statements and claims can be assessed (White 2000; Zerilli 2005). The engagement with and creative appropriation of the general outlines of the human to be found both in the theoretical critiques of the concept of the human and in contemporary science can elucidate in new ways the terrain of our social and political lives. In doing so, they can “[bring] forth the ethical character of every act” and “[expose] the possibility and necessity of decision” (Fynsk 2004: 76).

Contemporary scientists are finding increasing evidence to support the claim that culture, symbolic forms of communication, and imaginative anticipation shape the ways that bodies compose and recompose themselves over time (Cole 2009; Kuzawa and Sweet 2009; McEwen 2012; Slavich

and Cole 2013). As in social theory, so in the life sciences, culture, environment, embodiment, and self are suddenly uncertain terms whose confusion and disorientation reverberate to similarly unsettle cognate concepts. The engagement with science that is partially undertaken here and that is offered for other theorists' imaginative, creative, and critical appropriation is a project of theoretical experimentation, an effort to push and rework those uncertain terms, to try to effect a gestalt shift that will generate new possibilities for thinking about politics.

A third reason for theorists to engage with the life sciences as we reimagine and refigure human being is that theorists' critical acumen is needed. Our dexterity with different frameworks for analyzing the ways that language, space, identity, norms, and cultural practice shape people's experiences of their material and social habitats must be brought to bear as scientific researchers continue to develop their own insights. The convergent shift in thinking about the human shows us that the social, economic, material, and ecological environments we inhabit shape us in our growth, development, interactions, and capacities in ways that are just as profound as the norms and disciplinary practices that invite, produce, and constrain our individual and collective identities. To broaden the terrain of our analysis to include this traffic will enable us to think more deeply about embodied subjectivity and the incorporation of norms and to do so in ways that might enhance the kinds of analysis of "intelligibility" and "framing" with which we are currently more familiar (Butler 1993, 2010). Similarly, by taking into substantive account the ways that the materiality of the environment as well as our responses to social interactions—real, symbolic, and imagined—become embedded in the body's composition and habitual function, we can enrich our theories of affect to include the ways that accumulated experience can entrain and constrain as well as enable future forms of mutual engagement (Leys 2011; Papoulias and Callard 2010).

Further, as this material enhances our understanding of biopolitics, it can also illuminate new fields for democratic politics. For instance, Guthman and Mansfield (2013) propose that the scientific findings indicating that the environment enters and transforms the body point to a need to think in terms not only of "the molecularization of life" through which biotechnological advances are sold as solutions to our problems but also of "the environmentalization of the molecule" (491). In other words, pushing against the constraints posed by extant theories of biopolitics, they explain

that the chemical molecules that enter and transform the substance of our bodies and selves do their work not just in the laboratory or the clinic but also in the environment—the environment here conceived as chemical, microbial, and fungal pollutants, health systems, patterns of nutrition, access to water, programs of waste disposal, and so forth. Accordingly, we should treat “the mutable, biological body as being constituted not only through intentional intervention and management but also through interactions with the wider environment” (500). One possible consequence of such understandings of the constituting activity of the environment could be the portrayal of individuals as responsible for their exposures (Landecker 2011; Mansfield 2012b)—a recapitulation of neoliberal biopolitics. But such an entailment is not a necessary one. Because these environments are shared, held in common through place and/or culture, the effects they have on cognition, health, judgment, social interactions, and habitual patterns of behavior—all of which are bound up with the capacity to participate in politics—can be conceived as collective problems with political and possibly democratic modes of resolution. And in the same way that the modes by which the social and material environment enters and transforms the body “are unlikely to be race-, class-, or gender-neutral” (Guthman and Mansfield 2013: 500), so too will researchers likely vehiculate the norms, assumptions, and forms of representation that constitute this crazy unjust world in which we live. Heeding Clare Hemmings’s (2005) cautionary reminder that culture is not a seamless entity, we have to bring to bear on our appropriation and elaboration of this life science research our critical awareness of the ways that norms and presumptions about race, gender, sexuality, and disability, the directives of nationalist ideology, and the imperatives of the economy together shape both the social and political worlds we inhabit and the ways we understand and write about ourselves.

### **A More Personal Beginning**

I came to this project as a scholar who had spent some time making sense of the materialist dimensions of Thomas Hobbes’s philosophy and theory of politics. In one of those wonderful refractions of thought that come from the bizarre conjunctions of graduate course work, I read Monique Wittig’s rants about the materiality of language and embodiment at the same time I revisited Hobbes’s *Leviathan* and *De Corpore*. It became clear

to me that Hobbes was a trenchant materialist, yet his political theory was consistently read as if he were an adherent of Cartesian rationalism. So my doctoral dissertation and my first book set out to explore what would happen to Hobbes's ethical and political thinking if we were to grant him his account of the subject as wholly embodied rather than as somehow split between body and mind, or body and soul (Frost 2008).

After that project, I wanted to continue to think about how a materialist understanding of the self might reshape our understanding of politics—and I hoped to do such thinking in a contemporary vein rather than continue working with Hobbes. However, I realized that whereas Hobbes provided a fairly well-elaborated account of the body from its minute bits to its gross form, I did not have a good grasp of current accounts of either the molecular or the systemic processes through which living bodies persist in their existence. So I took some courses in biology during a sabbatical and then secured a generous fellowship from the Andrew W. Mellon Foundation that funded an additional length of study, with the result in the end that I took various life science courses full-time for eighteen months.

I worked through organic chemistry, molecular genetics, and the biology of perception, through biochemistry, cell signaling, endocrinology, and the metabolism of brain function, and to courses on primatology and environmental toxicology. I sat through some fascinating lectures, read lots and lots of textbooks, talked with my professors, and engaged in longer conversations with some of those same professors as my colleagues.

I would like to be able to say that I was a gracious and composed student. But I wasn't. As a professional academic and a parent coordinating childcare and the general continuance of daily life, I didn't have enough time to study in the way I remembered being able to study, which was frustrating for the nerd in me. The language and concepts initially were so alien that the readings took me forever. Without a background or commonsense understanding of what was at issue, I did not know at first how to select, distinguish between, or remember the relevant or important pieces of information. I was aghast at how stressful test-taking was, particularly because I did not anticipate how the questions on the tests would take forms different from those in the humanities courses I generally teach. It was bracing, exciting, and energizing. I was humbled, humiliated, shocked, and wonderstruck.

Eventually, I became more conversant in the concepts, more familiar

with the abbreviations and acronyms. In the middle of the training the world picture started to congeal, and I was able to perceive, play with, and anticipate patterns in the material I encountered. And this led to a different kind of difficulty—which was how to relate my new-found knowledge to political and cultural theory. At times, new information or insights from the scientific studies would throw me back on my habits of thinking, my theoretical training, my critical proclivities, and leave me bewildered about what I know.

And of course, that bewilderment became a running theme in my intellectual life after my stint taking courses was over. I had to figure out what to do with it all. I had not simply absorbed an enormous amount of information; I had acclimated to a new conceptual vocabulary, inhabited a different mode of being in and looking at the world. But what in the world would or could I do with it?

Over the past decades, the body has been beautifully rendered as a cultural artifact, as a product of norms, culture, discipline, and power, as ground, matrix, or extension of socially mandated and carefully elaborated forms of subjectivity. To say “You are a body” as a theorist is to invoke all that work. It seems a different thing, a more complicated thing theoretically, to say “You are a living body (you are alive).” With some notable exceptions, I think theorists are more comfortable with general or theoretically abstracted notions of embodiment as manifest in the notions of corporeity, vitality, liveliness, and generative becoming than we are with notions of living bodies persisting with and because of biological functions and processes (Ahmed 2008; Connolly 1999, 2002, 2011, 2013a; Davis 2009; Haraway 2008; Hird 2009a; Kirby 1997; van der Tuin 2008). To describe someone as a living body, as alive, seems at once to be absurdly obvious and also theoretically suspect—as if the statement of something so clearly incontrovertible must carry another agenda, that is, the aim to reduce someone to a biological substrate (the implication of course being that liveliness is something to which humans could be reduced, that humans are more than our biology . . . a presumption that in turn rests on the conviction that biology and culture are fundamentally, substantively, qualitatively distinct).

In reflecting on her efforts to persuade scientists to think beyond the gene—to incorporate the complex life cycle and organisms’ social and material environments in the study of development and evolution—Susan

Oyama wryly notes, “Theorists are annoyed when they are told what they have ‘always known.’ Yet there is a difference between knowing in a parenthetical ‘of course it’s important’ way . . . and incorporating the knowledge into models and explanations, research and theory” (2000a: 200–201). Oyama’s identification of the “parenthetical ‘of course’” is an allegory for what theorists know about being alive and what we are willing to integrate into our critical and theoretical work. Even though we can accept that we are embodied creatures and even though we often advocate for an understanding of the ways that the meanings we attribute to bodies accrete to become the very experience of the flesh, there is also a broad tendency to presume a mutual exteriority between the human and biological self. Observing such a tendency, Georges Canguilhem notes that “man sometimes marvels at the living” and yet is also sometimes “scandalized at being himself a living being” (2008: xix). This sense of scandal, of impropriety, of disapprobation and indignation reveals the force of this presumption of mutual exteriority, suggesting that it is fairly fundamental to the ways we have made sense of ourselves and the world.

This book is a step toward facing that scandal, an effort to begin thinking theoretically about humans as alive, as living bodies, as biocultural creatures.

### ***Biocultural Creatures: Structure, Puzzles, and Concepts***

In the text that follows, I draw on different dimensions of the life sciences to think through and recast the conceptual terms and the figures according to which we understand what humans are. Very broadly speaking, my aim in this book is to exploit the convergence of scientific findings with contemporary theory to elaborate a granular, substantively detailed ontological warrant for thinking the human as a theoretical and political category in the context of posthumanism. In the course of doing so, I provide some language, conceptual terms, and theoretical movements that might prove helpful in challenging the theoretical habits that sometimes lodge in our thinking and that make it difficult fully to occupy the idea that humans are biocultural creatures. But even as the book lays out some of the groundwork for reconceptualizing humans as biocultural creatures, it is important to note at the outset that humans as a distinct species and as a particular kind of subject do not actually appear much in the pages that follow. Explaining why will help clarify what I am trying to do.

This book does not contribute to the literature that displaces the human

by denaturalizing the categories through which conventionally it is understood. In playing conceptually with molecules and proteins, it does not broach a nonanthropocentric starting point as a lesson-in-perspective for the habitually and chronically anthropologically minded, as is so provocatively done by Myra Hird (2009b) in her investigation of bacteria or Michael Marder (2013) in his reflections on plant life. Rather than chastening the human, this book takes as an instructive point of departure the posthumanist critiques of the category of the human, filling out the conceptual hunches at the heart of those critiques. It is because this book is an effort to figure humans in a way that does not exclude materiality, “objectness,” animality, or embeddedness in habitats that it starts with energy and atoms and works up through the scales of molecules, cells, proteins, to gross organisms . . . and ends by merely gesturing to humans.

Another way to elucidate this particular strategy is by noting an observation made by Pheng Cheah (1996) in one of his early critical engagements with theories that focus on the materiality or corporeity of the subject. With an impressive depth of analysis of arguments offered by Judith Butler and Elizabeth Grosz, Cheah notes that considerations of the matter of corporeity or of encultured embodiment often turn on or operate with an anthropocentric starting point. He suggests that a more thoroughgoing transformation of our understanding of the materiality of embodiment might turn on a reconfiguration not of the relation between culture and the body but of the distinction between form and matter (134). In a sense, the trajectory of this book is the result of a what-if, as in, what if I were to start with quantum physics, which fuzzes the very distinction between form and matter. The very first chapter, on carbon, begins with the formulation that matter or substance is an effect of energy that is constrained in the ways it can relate to itself. The effects and manifestations of energy-constrained become a running theme through the book, drawing attention to the dynamic processes and activities that constitute living embodiment at different spatial and temporal scales.

Further, and related, I want to note that in elaborating on the energetics of matter and living processes, I do not intend thereby to disavow the forms of representation, the norms, and the myriad social and political practices that organize spaces and inflect modes of living to an extent that they become a part of who and what people are. Rather, holding on to the insights of contemporary theory, I hope to fill out a dimension of hu-

man subjectivity that is frequently acknowledged as complex but not often given much bona fide texture (Frost 2014). I am trying to give substance and theoretical form to Susan Oyama's insight that the "interdependence of organism and environment" entails that they "define the relevant aspects of, and can affect, each other" (2000a: 3); I am trying to make good on Elizabeth Grosz's claim that it is because we are alive that we can participate in "social, political, and personal life" (2004: 1–2). In short, I hope to provide concrete details and a set of theoretical figures of movement that may enrich our understanding of the processes through which humans in particular live in and become acculturated to and through their worlds.

In experimentally rebuilding our imagination of the human, I have written this book so that the chapters follow a cumulative logic. Because of this logic, the book's insights are more readily to be conjured through a straight read rather than selective picking. Each chapter is oriented around both a puzzle raised by my encounter with the science and a key concept that contributes to a refiguration of the human. In most cases, the putative resolution to the puzzle accomplished by each chapter is bound up in the puzzle that organizes and motivates the next. I give fairly robust overviews of the chapters here so that they can serve as a resource to orient readers as they work through the narrative details of the text.

Chapter 1 stages an encounter between on the one hand contemporary theoretical fascination with materialization, corporealization, animation, and vitality and on the other what we know ("of course") about the nature of matter in our nontheoretical, daily-engaged-with-the-world kinds of ways. The chapter starts from the puzzle that while matter or materiality is currently conceived as an important starting point for thinking about embodiment and politics, in physics and chemistry, "matter" is conceived as energy. What exactly does it mean to say that matter is "really" energy? What would we have to adjust in our theories of materiality, materialism, corporeity, or embodiment if we were to conceive of matter in terms of energy? Drawing on insights from quantum physics and organic chemistry, this chapter proposes that energy takes form as matter through its constrained self-relation. What we know and experience as matter is energy under a particular form of constraint. This chapter uses this insight to outline the reasons that carbon is the kind of matter that forms the basis of life as we know it.

Chapter 2 builds on the first chapter's explanation of the ways that

energy is constrained in its self-relation to reconsider the nature of boundaries and identity. It does so by meditating on the way that the constraints on energy that make it take form as matter also compel matter's arrangement into porous cell membranes. The puzzle here concerns that membrane porosity: if a cell membrane is constitutively porous, which is to say that it is composed in a manner that enables a rapid and constant flow of biochemicals into and out of cells, then what kind of boundary is it? This chapter proposes that what makes the puzzle puzzling is that we tend to think about boundaries that distinguish one side from another in terms of substances. What makes a cell or a living creature a discrete cell or living creature if its "inside" is constituted through a continual chemical exchange with its "outside"? This chapter suggests that we should eschew the tendency to think of boundaries in terms of a topographical demarcation of substances. It proposes instead that we think about the boundaries effected by the composition of cell membranes as creating conditions for distinct kinds of activities. The permeability of a cell membrane facilitates a constant and continuous influx and efflux of chemicals into and out of a cell, which enables a distinctive and distinguishing kind of cellular activity to take place. In this case, the "inside" and the "outside" established by cell membranes mark not different substances but different zones of activity. This chapter proposes that this theoretical formulation enables us to begin to imagine how creatures might be embedded in and constituted by their environs or habitats yet also identifiably distinct from them.

Chapter 3 broaches anxieties about biological reductionism that often motivate a cautionary orientation toward biology or lurk beneath a reluctance to draw on aspects of the biological sciences for thinking about cultural and political phenomena. This chapter refigures the nature of biological matter and biological agency by tracing the composition and activity of the proteins that facilitate and regulate the traffic of substances into and out of cells through those porous membranes. In elucidating how genes are used in the composition and activity of those proteins, the chapter engages the puzzle of how a biochemical process involving molecules can unfold in precise, specific, responsive, and reliably repeated ways without there being some kind of agent who makes it happen. It explains that each step in a biochemical process depends on both a prior action and the availability or arrival *en scène* of biochemical molecules from elsewhere in the cell, from outside the cell, and possibly from beyond the boundaries

of the organism. The prior biochemical action and the availability of specific biochemical ingredients constitute both the enabling and the limiting conditions that make a specific step in a biochemical activity possible. The conceptual formulation that captures this chapter's insight is that because of these enabling and limiting conditions, biological processes have direction—but direction without intention. The chapter proposes that this formulation enables us to account for the precision and directedness of biological activity without that activity being reducible to anything at all. The formulation also makes it impossible to identify any part of the body that is “purely” biological: the entirety of a living organism is biocultural.

Chapter 4 draws on the insights of the previous chapters to bring into sharper focus the relationship between an organism and its habitat. Revisiting the idea that biological processes and their constituent biochemical activities are possible because of the traffic of biochemicals across the boundaries effected by porous cell membranes, this chapter traces what oxygen does in a living body. Pushing against the tendency to see ingestion as compositional (in the sense of adding stuff to the body), the chapter argues that the activity of oxygen requires that we conceive of bodies as “energy in transition,” as a system of processes that mobilize and take advantage of the ways that energy subsists and transforms under constraints. The puzzle engaged by this chapter concerns the vital importance of oxygen: if every step in a biochemical process is a critical condition for the next step, and if a failure in any step could mean a failure in the biochemical process, why is the aspiration and use of oxygen so very critical for survival? The chapter suggests that while every step in every biochemical process in a cell is the condition of the next, the presence of oxygen in a cell is an index of the whole organism's exposure to and utter dependence on its engagement with its habitat. The theoretical point of the chapter is that we can only properly appreciate the micro-level biochemical processes that constitute living if we remember that they occur in whole organisms who engage with and are dependent on their habitats.

Chapter 5 begins with the recognition that the insights of chapter 4 take us extraordinarily close to the position that a living organism is not much more than—and is possibly reducible to—its interactions with its habitat. This chapter thus reconsiders whether we can think of living creatures as discrete organisms rather than as effects of the environmental relationships and dynamics in which they live. Put slightly differently, the chapter

engages the puzzle of how to conceive of the “it-ness” or fleshy reality of bodies in a context in which we conceive of bodies in the terms of energy in transition and interchange with habitat. If living bodies are porous and are constituted through their continuous engagement with their habitats, how can we conceive of them as distinct from their environments rather than merely reducible to them? The chapter engages this puzzle by exploring the temporality of the relationship between organisms and their habitats. The chapter explains how the permeability of germ cell membranes entails that a creature’s response to a habitat in one generation can shape the development and growth of offspring in subsequent generations via epigenetic markers. The chapter proposes that this anticipatory, cross-generational carrying-forward of creatures’ engagement with and response to their habitats indicates that bodies are noncontemporaneous with their habitats. It is this noncontemporaneity that makes organisms exceed the determinations of their habitats even as they cannot be thought apart from those habitats.

Together, these chapters spell out some of the concepts, movements, and figures through which we can imagine humans as biocultural creatures. It is just a beginning. I hope that the experiment in thinking that the book as a whole represents provides resources for other thinkers to do creative and politically generative work.