DARWIN'S

BRIDGE

Uniting the Humanities & Sciences

edited by

JOSEPH CARROLL

DAN P. MCADAMS

EDWARD O. WILSON

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For Henry Harpending, 1944–2016

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FOREWORD

Alice Dreger

Perhaps because my mate and I are both scholars, our son didn't leave the "why?" stage according to the typical childhood developmental schedule. By the age of four, if we answered his latest "why" question with "I don't know," rather than give up, he would push harder: "Well, do you have any *guesses*?"

When he was five years old, we took him in the car from Michigan to New York to visit my family. Around the 12th hour, just as we were stuck in New Jersey traffic heading onto the George Washington Bridge, he asked "why?" about something at a highway construction site. Exhausted from the trip and genuinely unsure about why the construction site worked as it did, I decided to preempt the inevitable follow-up question, curtly answering him, "Honey, I don't know *why* and I don't have any *guesses*, either."

A short moment of quiet ensued. Just as I thought I had managed liberation from this latest line of questioning, a small voice popped up from the back seat: "Well, then, do you have any *suspicions*?"

I often think of this amusing interchange when I'm talking to a journalist about something I've found, and the journalist is growing increasingly impatient with my tendency to stick to a historical description that lacks deeper causal explanation. *But why?*, reporters will ask. *Why did that person do that? Why did his or her colleagues react as they did? Why is our culture the way it is? Why has it changed?*

It seems impossible to get them to accept the answer, "Sometimes, as historians, all we can do is describe *what* happened." They don't want to hear that motivation for human action and the reasons for changes in human behaviors can be very, very difficult to know with any certainty.

As a species, we seem to love causal explanations. We can see that in the way we tell stories, in our analyses of these stories, and in the grand theories we build up from these analyses. We see it in our interactions with our doctors,

our therapists, our priests, our aches and pains, our TV remote controls, our meteorologists, and our children (*especially* when we're trying to get our babies to sleep). We also see it in this marvelously varied volume of studies.

Although we historians as a tribe tend to be extra cautious about offering causal explanations, like most humanists—like most *people*—we love a good causal explanation as much as any scientist. And yet, all humanists, including historians, have tended to be highly suspicious of biologists coming to offer "assistance" with causal explanations of human feelings and actions.

A few decades ago, that fear came dressed up as dire warnings about slippery slopes towards genocide and eugenics—admonitions that biological accounts of human behaviors would lead us as a species toward fascism, injustice, and the end of humanity as we have known it. These days, the suspicion is less alarmist, and also perhaps a little more self-focused: we humanists are less worried sociobiological explanations will lead to disaster, but we also don't like the idea of having the objects of our attentions "reduced" ultimately to chemicals, as if our subjects are animal bones to be cooked down for somebody else's tasty soup.

To tell many humanists that the subjects of our attractions are "reducible" to biology (and then to chemistry, and then to physics) is, I think, heard as telling us that we don't know our own work. So, many humanists are understandably hostile. The trick is, then—and I think the trick is pulled off in several places in this volume—to get humanities scholars to understand that the "consilient" perspective inspired by E.O. Wilson can help us pull out interesting *questions* rather than pushing on us boring *answers*. The consilient perspective, instead of simply splitting us into atoms, actually encourages some lumping; it asks us to try to understand what one human has in common with another as evolved beings.

Of course, willingness to entertain a consilient perspective requires a certain orientation towards empiricism, something not all contemporary humanists enjoy. (And I mean that in all the senses of "enjoy.") Some humanists don't want to hear that we should be checking our claims against the real world, and limiting our causal claims to things that can actually be checked. They lean more toward the artistic (idiosyncratic) side of the spectrum than the scientific (generalizable). What we do about that perhaps-irreconcilable worldview remains an open question, one that looks like it will unfortunately be settled by CPAs instead of PhDs.

The negative reaction some humanists have to consilience also comes, I guess, from a reading that sees the consilient approach as arrogant—as aiming at an impossible omniscience, if not omnipotence. Certainly, when the approach leads to a sprouting of just-so stories, a certain level of intellectual impatience is justified. But this isn't just your father's just-so stories. A close look at some of the essays in this volume reveals how a consilient orientation can actually foment a

rather compelling level of intellectual *humility*—a recognition that the weakness of some claims in the humanities in turn expose weaknesses of some in the sciences. We all struggle with finding the causal, and we all seem to let colleagues in our own disciplines get away with causal claims much too easily.

Reading this work, I found myself realizing that, when trying to get humanists to sit at the same table in the cafeteria with the biologists, "reduction" is probably not the best way to talk about the great chain of causality. Humanists are not being naive when they find the idea of "reduction" a poor way to represent the reality of our materiality as mortals. Yes, it's surely true that physics explains chemistry explains biology; but it's also as true that, although DNA makes proteins and proteins make cells and cells make organs and organs make us, if you take away the us, our DNA dies out. The links on the chain all make the chain, so to talk about "reduction" is to pay more attention to size and to time than to what really matters to most of us in our own spatial plane (kinship, getting laid, puppies).

Moreover, where one locates the point of intellectual *satisfaction* in the study of the great chain of causality depends on what one loves to know. I love nature and I love science—that's why I'm a historian of *science*—but I will confess I love particular human histories more. I have no doubt I am an evolved animal ultimately made up of atoms. But I also have no doubt that studying physics isn't going to tell me what I really want to know about, say, the experiences and ideas of Ben Franklin, Margaret Mead, or my great-grandmother. I am not a humanist because I suck at math.

Consilience aims for a grand nonfictional story, one that subsumes all other stories and even resolves them. But the smaller stories, and our gently and vigorously causal stories about the smaller stories, seem to have a purpose. Agricultural theory is grand and important, but you still have to farm to eat. The use of stories seems so pervasive in humanity, stories must (as several authors of this volume suggest) have some importance to the species. It seems very likely the smaller stories—including the ones about Franklin and Mead and our nobody ancestors, the ones constructed in poetry, song, paint, history journals, and even the deadly prose of postmodern literary criticism—sustain or heal. Perhaps they sustain or heal individuals' psyches; almost certainly, they sustain and heal human relationships.

We could say, then, that consilience, which promises to explain all our fictional and nonfictional stories in one grand nonfictional metastory, is the most important. It's at the top, right? But we haven't needed *it* to survive this long, the way it seems perhaps we have needed all the little tales. Again, agricultural theory is grand and important, but you still have to farm to eat. Paradoxically, if Wilson's vision of consilience does anything by virtue of having science finally

take the humanities seriously as its subject, it seems to verify the importance of the humanities to the species. (And I think Wilson would be delighted with that.)

Which then, in turn, would seem to mean that consilience tells humanists they have a certain importance about which they've perhaps been slacking. An obligation, a duty, a role that ought to be—maybe?—a little more focused on the rest of the people, and less on us?

In the end, this volume leaves one with both an unsettling and a liberating thought: that although we may come to understand ourselves very well as a species, we may never really fully understand ourselves as individuals. In the humanity that is our mutual cause, as *n*'s of 1, we are only ever correlations to each other. We need the grander view that is both more microscopic and more macroscopic to know why we do what we do—to know why the child in the backseat wants to know why, and why he needs also to make his tired parents laugh.

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CONTRIBUTOR LIST

Christopher Boehm
Department of Biological Sciences
and Anthropology
Goodall Research Center
University of Southern California
Los Angeles, CA

Brian Boyd
English, Drama, and Writing Studies
University of Auckland
Auckland, New Zealand

Joseph Carroll
Department of English
University of Missouri, St. Louis
St. Louis, MO

Mathias Clasen
Department of English
Aarhus University
Aarhus, Denmark

Ellen Dissanayake
School of Music
University of Washington
Seattle, WA

Alice Dreger
East Lansing, MI

Herbert Gintis
Santa Fe Institute
Santa Fe, NM

Jonathan Gottschall
Department of English
Washington & Jefferson College
Washington, PA

Henry Harpending[†]
Department of Anthropology
University of Utah
Salt Lake City, UT

John Hawks
Department of Anthropology
University of Wisconsin, Madison
Madison, WI

John A. Johnson
Department of Psychology
The Pennsylvania State University
State College, PA

Daniel Kruger
Department of Health Behavior &
Health Education
University of Michigan School of
Public Health
Ann Arbor, MI

Dan P. McAdams
Department of Psychology
Northwestern University
Evanston, IL

[†] Henry Harpending unfortunately passed away before this book went to press.

Barbara Oakley
School of Engineering
Oakland University
Rochester, MI

Massimo Pigliucci
Department of Philosophy
The City College of New York
New York, NY

Michael R. Rose
Department of Ecology &
Evolutionary Biology
University of California, Irvine
Irvine, CA

Catherine Salmon
Department of Psychology
University of Redlands
Redlands, CA

David Sloan Wilson
Department of Biological Sciences
and Anthropology
Binghamton University
Binghamton, NY

Edward O. Wilson
Department of Organismic and
Evolutionary Biology
Harvard University
Cambridge, MA

INTRODUCTION

Joseph Carroll

The Content and Purpose of This Volume

The term *consilience* in its modern usage was established by Edward O. Wilson's 1998 book *Consilience: The Unity of Knowledge*. Wilson's thesis had two parts: that nature forms a unitary order of causal forces, organized hierarchically, and that scientific knowledge, because it delineates nature, also forms a unitary order. This volume is designed to give an account of consilience in one major range of knowledge—the range that extends from evolutionary biology through the social sciences to the humanities. Bringing together cutting-edge scientists and scholars in all three areas makes it possible to see how far we have come toward unifying knowledge about the human species, what major issues are still in contention, and thus what areas of research are most likely, in the near future, to produce further progress.

The essays in this volume raise and give substantial answers to questions such as these: What is the precise arc of human evolution? What were the main factors driving the evolution of the human brain and human motivational system? How closely does life among contemporary hunter-gatherers mirror conditions of ancestral life? In what ways have genes and culture co-evolved, reciprocally influencing one another? How does selection at the level of individuals interact with selection among groups? How complete and adequate are our current models of human nature? How well do these models integrate ideas about human universals, individual identity, and specific cultures? How well can we now delineate the causal chains leading from elementary principles of evolutionary biology to specifically human forms of social organization, individual identity, and imaginative culture? Are human proclivities to make and consume works of art by-products of adaptations, or are they themselves adaptations? Can evolutionary thinking guide us in giving close analytic and explanatory attention to individual works of art?

In this introduction, we shall first look closely at what consilience means, then consider the particular topics of the various essays: human evolution, human nature, social dynamics, art, and narrative.

Consilience as a Theme

What Consilience Means

To say that nature forms a unitary order of causal forces, organized hierarchically, is to say that all complex phenomena can be reduced to relations among simpler elements. Ecosystems can be reduced to interactions among organisms within a physical environment. Organisms can be reduced to organ systems or, for single-celled organisms, molecular interactions inside the cell. Organs are reducible to particular kinds of cells related functionally to one another. Cells consist of components such as membranes, nuclei, and organelles. All the parts of a cell are compounded of specific molecules, and specific molecules are formed by bonding among chemical elements. The chemical elements are atoms with specific numbers of protons, neutrons, and electrons. Protons and neutrons are, in turn, composed of subatomic particles. At levels of analysis available now only to informed scientific speculation, particles yield to still more basic structures such as strings.

It is in the nature of analysis to reduce complex structures to simpler elements. This process can, of course, be reversed. We can begin with subatomic particles and observe the way more complex structures emerge at higher levels of organization among component parts. Atoms interact to form molecules; organic molecules combine to form DNA, which regulates the organization of other molecules into cells and physiological processes. Cells combine to form tissues and organs; organ systems form organisms, which sometimes form social groups. Organisms interact with each other and with the physical environment to form ecosystems. The elementary components in all higher levels of organization are themselves composed of still smaller components at lower levels in the causal hierarchy. For instance, the elementary components in a social group are individual organisms, but individual organisms are themselves complex systems of organs or, for single-celled organisms, organelles and molecules.

The causal hierarchy in the natural order has emerged over time. Two main fields delineating this emergence are cosmological physics and biological commentary on "major transitions" in the evolution of life. Cosmological physics begins with the Big Bang and describes the formation of atoms, stars, and solar systems (Weinberg 1992, 1993). Commentaries on the "major transitions" of life begin with the formation of self-replicating molecules and work up through ever-more complex levels of organization—from nonnucleated to nucleated

single-celled organisms, multicellular organisms, organisms with organ systems, social animals, and human cultures (Maynard Smith and Szathmáry 1995; Shubin 2008; Lane 2009; Bourke 2011; Pross 2012; Shubin 2013).

So long as we are discussing only the physical and biological range of knowledge, most educated people would agree that scientific disciplines form a causal hierarchy corresponding to levels of organization in the physical world. Physics and astronomy deal with the fundamental forces in the physical world—gravity, electromagnetism, and strong and weak nuclear forces. Chemistry as a discipline begins with the organization of subatomic particles into specific kinds of atoms—the chemical elements. Geology explains how these elements have been organized in the history of Earth. Biology begins with the organization of chemical elements into organic molecules and explains the development of life through natural selection. Thus far, "consilience" seems little more than educated common sense.

It is only when we get to the human world that disagreement begins. Many educated people still maintain various forms of human exceptionalism—the idea that the human mind or spirit, or human culture, somehow stands apart from the causal hierarchy that prevails in the rest of the natural order. Almost everyone would agree that the human world introduces something new to reality. From the consilient perspective, it is a "major transition," a more complex organization of the elements that produce atoms and chemicals, organisms and ecosystems. The alternative is that the human world is not merely a major transition but, rather, a qualitatively different kind of thing that separates humans fundamentally from the physical world. A nonconsilient perspective is thus necessarily dualistic. From a dualistic perspective, one part of the world consists of physical elements that combine into more complex forms of organization, which are, conversely, reducible to their components. That physical world is accessible to science. From the dualistic perspective, the other part, the spiritual or cultural part, can perhaps be influenced by physical elements, but it can never be reduced to those elements.

The consilient worldview is monistic. Researchers adopting this worldview do not believe that human mental experience gives evidence for any peculiarly human stuff that cannot be reduced to interactions among components in the physical world. From the monistic perspective, imaginative culture—norms, religious beliefs, ideologies, philosophies, and the arts—are products of brains interacting with other brains and are thus reducible to electrochemical interactions among neurons. Brains are embedded in environments, both social and physical. Cultural traditions form major elements in social environments, but cultural traditions are themselves the products of brain activity among social organisms transmitting information by means of symbols.

While advancing steadily since the Renaissance, science has approached ever closer to the human realm, advancing from astronomy ("celestial mechanics") to chemistry, anatomy and physiology, to geology and biology. During the past 40 years, the social sciences have finally taken a decisive turn toward consilience. Evolutionary social science began with the publication of Huxley's *Evidence as to Man's Place in Nature* in 1863, followed up by Darwin's *Descent of Man* in 1871, but in the second decade of the 20th century, anthropology and sociology segregated themselves sharply from evolutionary biology. The idea that culture is an autonomous human order, detached from evolved and genetically transmitted dispositions, governed standard social science from about 1911 through the 1970s (Degler 1991; Pinker 2002). The new Darwinian revolution of the past several decades is not yet complete, but has clearly passed the point of no return. One important indicator for this tectonic shift can be discerned in commentary on human behavior aimed at educated general readers. For the past several years, much of the most successful such commentary—successful in terms of sales, reviews, and prestige—has been deeply versed in current knowledge about evolved dispositions and neurobiological mechanisms such as brain structures, hormones, and neurotransmitters (Ridley 1994, 1996; Pinker 1997, 2002; Buss 2005b; Goleman 2006; Haidt 2006; Wade 2006; Angier 2007; Linden 2007; Cacioppo and Patrick 2008; Carroll 2009; Cochran and Harpending 2009; Dutton 2009; Lane 2009; Wrangham 2009; Damasio 2010; Thagard 2010; Baron-Cohen 2011; Brooks 2011; Kean 2011; Kenrick 2011; Linden 2011; Pinker 2011; Gottschall 2012; Haidt 2012; Kean 2012; Wilson 2012). Currently, writers who ignore or deprecate biological influences on behavior would, in the judgment of many generally educated readers, relegate themselves automatically to the margins of informed discussion.

Among academic disciplines, the humanities are the strongest outpost of resistance to a monistic worldview grounded in evolutionary biology. Humanists are heavily dependent on theories in other disciplines but make little or no use of empirical research in other disciplines. In the academic literary establishment, as in other humanistic disciplines, the current framework of theory is still grounded in obsolete forms of sociology (Marxism), psychology (Freudianism), and linguistics (Saussurean linguistics and Derridean language philosophy) (Carroll 1995). For the first three-quarters of the 20th century, humanists treated the arts as the prime medium for the supposedly transcendent autonomy of the human spirit. For the past four decades, "discourse" or "culture" has been invested with autonomy (Abrams 1997; Carroll 2011b, 259–277). For about two decades now, though, evolutionists in the humanities have been making sustained progress in incorporating information from empirical research in the evolutionary social sciences and have sometimes also incorporated empirical methods. Although evolutionary humanists like those included in this volume still constitute only

a tiny fraction of academic humanists, some anticipate that the humanities as a whole will eventually be fully assimilated to the consilient worldview.

Because nature is continuous in organization, disciplines focused on specific levels in the causal hierarchy bleed into each other at the margins. Chemists dealing with nanostructures often do work indistinguishable from that of physicists. Biochemists and molecular biologists occupy the border ground between chemistry and biology, and, indeed, most biologists necessarily deal with phenomena at a chemical level. Neurobiologists, for instance, occupy themselves with the chemical components of hormones and neurotransmitters. Biologists concerned with animal behavior are "ethologists," and one branch of ethology is "human ethology" (Eibl-Eibesfeldt 1989). Primatologists compare species ranging from lemurs and baboons to chimpanzees to humans. Some of the most important findings about human social evolution and human cognitive development have been produced by researchers who compare chimpanzees and humans, thus working simultaneously as primatologists and anthropologists or primatologists and cognitive scientists (Boehm 1999; Tomasello et al. 2005; Boehm 2012). In developing hypotheses about human social and cognitive evolution, anthropologists and archeologists extend their reach backward to hominins and forward to the Neolithic (Mellars and Stringer 1989; Mithen 1996; Klein 2002; Mithen 2004; Wade 2006; Mellars 2007). Genetics, anthropology, and cultural history converge in the study of gene-culture coevolution (Richerson and Boyd 2005; Cochran and Harpending 2009). Scientists with a primary training in fields such as biology, archeology, or psychology have developed hypotheses about the human proclivity for producing aesthetic ornamentation and works of imagination (Darwin 1871; Mithen 1996; Wilson 1998; Miller 2000). Humanists with a primary training in fields such as philosophy, art history, or literature have assimilated and critiqued those hypotheses (Dissanayake 2000; Boyd 2009; Dutton 2009; Boyd et al. 2010; Carroll 2012; Gottschall 2012).

Biology is the pivotal discipline linking the physical sciences, the social sciences, and the humanities. The building blocks of biology are derived from chemistry, geology, and even directly from physics—for example, the influence of planetary motions on the diurnal rhythms of plants and animals, the effects of sunlight and other sources of thermal energy on the life cycle of individual organisms and ecosystems, and the way animals use light, sound, and electromagnetism for navigating their environments. In the other direction in the causal hierarchy, basic concepts in evolutionary biology inform virtually all evolutionary research in the social sciences and the humanities: adaptation by means of natural selection and sexual selection (Darwin 1859, 1871), inclusive fitness (Hamilton 1964a, 1964b), differential parental investment (Trivers 1972), and reciprocal altruism (Trivers 1971).

Because nature forms a causal hierarchy, influence is asymmetrical among disciplines at different levels in the hierarchy. Discoveries in physics are more likely to influence chemistry than discoveries in chemistry to influence physics, and discoveries in chemistry are more likely to influence biology than the other way around. So also for biology and the social sciences, and for the social sciences and the humanities. Researchers in disciplines downstream in the causal hierarchy nonetheless have a crucial role in determining whether efforts at causal reduction wrongly strip out emergent phenomena in their own fields. For example, social scientists have effectively countered the idea that all human social interaction can be reduced simply to reciprocal altruism and have formulated more adequate alternative hypotheses (Haidt 2012). Humanists have effectively countered the idea that all human imaginative production can be reduced to sexual display and have formulated more adequate alternative hypotheses (Dissanayake 2000, and Chapter 7 in this volume; Carroll 2008a, 119–128, 2008b, 349–368, 2012).

Researchers in disciplines downstream in a causal hierarchy are not solely dependent on causal explanations from upstream disciplines. Good explanations identify simpler forces at work in complex phenomena, but emergent structures also have causal force on one another. For instance, populations within ecosystems have reciprocally causal effects on one another and on individual organisms within each population (Darwin 1859; Wilson 1992). Large-scale institutional structures—nation states, political parties, economies, and religions—interact in reciprocally causal ways with each other and with the evolved psychological characteristics of individual people (McAdams 2006; Turchin 2006; Haidt 2012). So also with subjects in the humanities. Artistic traditions and conventions have reciprocally causal effects on each other and on individual artists and individual works of art (Wilson 1931; Wellek 1949a, 1949b; Abrams 1953; Wellek 1961; Abrams 1965; and see Boyd, Chapter 13, in this volume). Good explanations at any level of emergent complexity are likely to identify causal relations among forces at that level and link them with causal forces at lower levels in the causal hierarchy.

Good explanations take account of the causal interactions among emergent phenomena, but valid conceptions of emergent phenomena depend on correctly identifying the elements that make up the emergent phenomena (Pinker 2005). Ignoring principles of natural selection, for instance, produces false conceptions of the way populations interact with each other and with individual organisms (Carroll 2001; Easterlin 2004). Deprecating or dismissing ideas of an evolved and adapted human nature produces false conceptions of the way institutions and cultural practices interact with each other and with individual people (Freeman 1983; Degler 1991; Tooby and Cosmides 1992; Pinker 2002). Repudiating the idea that authors intend to communicate definite meanings

about a shared reality produces false conceptions of the way literary conventions interact with each other and with individual artists and their audiences (Carroll 1995; Abrams 1997; Boyd 2006).

Specialists can give expert testimony in their own fields, but there are no rigid boundaries in a consilient research community. Biologists also have intervened effectively in expanding the scope of concepts included in the analysis of human social dynamics (Sober and Wilson 1998; Wilson 2012). Biologists and social scientists have contributed in important ways to evolutionary theories about religion, the arts, and other products of human mind and imagination (Mithen 1996; Wilson 1998; Wilson 2002; Dissanayake 2011).

Researchers downstream in a causal hierarchy sometimes express resentment at the idea that they are on the receiving end of an asymmetrical disciplinary influence. Such resentment is hardly a scientific motive, but it is a human fact, and it has had and will perhaps continue to have a distorting influence on intellectual history. When the social sciences, at their inception, segregated themselves from biology and declared their independence, they were moved in part by a determination to focus on organizational principles appropriate to their particular fields of study. But they were also moved by a desire to assert causal primacy, at whatever cost to logic or explanatory power (Fox 1989; Degler 1991; Pinker 2002). Similar motives, both good and bad, can often be detected among humanists resisting connections to biology or the evolutionary social sciences (Dawson 2006; Goodheart 2007; Deresiewicz 2009; Kramnick 2011).

As a counterweight to that kind of biasing resentment, it is wholesome to remember that a hierarchy of causal reduction can be flipped over into a hierarchy of emergent complexity. Chemists absorb the principles of physics and introduce new causal principles active in the relations among chemical elements; biologists absorb chemistry and deal with phenomena—organisms and ecosystems extending over evolutionary time—at levels of complexity higher than that of the periodic table. Evolutionary social scientists absorb the fundamental principles of biology but also study forms of human social organization that are more complex than the social organization of other species. Evolutionary humanists, working downstream from all these disciplines, absorb their explanatory principles but also deal with the products of the human mind, with religion, myth, philosophical speculation, and cultural history, and with works of art. Following the logic of emergent complexity, the topics that are the peculiar province of humanists are the most complex subjects available to scientific inquiry—so complex that for a majority of humanists still, and for not a few scientists, the gap between the sciences and the humanities presents itself as an unbridgeable gulf.

Causal reduction and emergent complexity are the two poles of a consilient universe. For researchers alert to the continuum between those two poles, the

boasting rights of either pole are far less important and interesting than the advances in knowledge that can be produced, in any given field, by delineating linkages between them. To give a salient example, the theory of gene-culture co-evolution is now in its infancy but is clearly a central point of convergence for biology, the social sciences, and the humanities. Within the next 20 years, it seems likely that research in this area will produce some of the most important advances in an evolutionary understanding of the human species. Those advances will depend on work that synthesizes findings in all three major areas of research. Geneticists and evolutionary biologists are in the best position to identify changes in gene frequencies relevant to human social and cultural activity. Social scientists, including anthropologists and archeologists, are in the best position to delineate the elementary forces at work in human social organization over both evolutionary and historical timescales. Humanists are in the best position to identify the character and structure of the products of the imagination—religions, ideologies, stories, music, and the visual arts—that interact in reciprocally causal ways with the evolved dispositions commonly designated by the term "human nature." Researchers in any of these three areas can assimilate findings from the other two areas, characterize the current state of knowledge, and generate new hypotheses that stimulate further research.

Challenges to the Idea of Consilience

Two of the essays in this volume, those of Hawks and Pigliucci, express skepticism about the possibilities of consilience. Hawks comments on the difficulty of being able to identify empathically with the subjective lives of ancient peoples, with special reference to Neanderthals. Empathic identification would require the anthropologist to cross boundaries between species-typical forms of sensation and also between radically different ecological conditions. Working out from this problem, Hawks draws a broad contrast between scientific and interpretive schools or styles of anthropology. The scientific style uses meticulous reconstruction of objective facts and seeks causal reductions empirically tested by predictions. The interpretive style, as Hawks conceives it, plays with broad speculative theories, bringing them into conjunction with the subject matter of anthropology. Interpretive anthropologists "focus on the aesthetics of an improvised encounter between observation and theory." Despite such conflicts in standards and values, Hawks believes that "we can develop some knowledge about the subjective lives of these people." Empirical inquiry and speculative theory are always in some tension, but the tension can be productive. Hawks affirms that in using scientific methods we are also "building a humanistic understanding of Neandertals and other ancient people."

Hawks's essay probes potential methodological problems in achieving consilience. Pigliucci's essay, in contrast, suggests that consilience, as a philosophical vision and a research program, is essentially misconceived, so that its fulfillment is neither possible nor desirable. As a scholar and scientist with doctoral degrees in genetics, botany, and philosophy, Pigliucci is in a good position to offer a representative sampling of objections to the idea of consilience. The version of consilience that Pigliucci criticizes is reductionist in purpose but has little concern for "convergence" among disciplines, it fails to register the emergence of more complex structures from the interaction of simpler elements, it is committed to a strong version of "meme" theory—the idea that bits of cultural information are essentially parallel in character and function to genes—but overlooks the theory of gene-culture coevolution, and it pursues "ultimate objective truth," an unattainable will o' the wisp, as its chief goal. One might reasonably question whether that version of consilience is represented by any actual person. In any case, it is represented by none of the essays in this current volume.

As an alternative to the consilient program, Pigliucci suggests that the traditional division of the disciplines, especially the divide between the humanities and sciences, represents a natural and necessary accommodation to the human mind as it has developed historically. "There may be better ways to organize our knowledge, in some absolute sense, but likely what we have come up with is something that works well for us as biological–cultural beings of a certain type and with a certain history." Other contributors to the volume regard the current arrangement of academic disciplines as a historical artifact that reflects obsolete conceptions of life and mind. Wilson, for instance, describes the current arrangement not as a culminating and final state of affairs but as a transition to a more complete and unified vision of human life:

> The major features of the biological origins of our species are coming into focus, and with this clarification the potential of a more fruitful contact between science and the humanities. The convergence between these two great branches of learning will matter hugely when enough people have thought it through. On the science side, genetics, the brain sciences, evolutionary biology, and paleontology will be seen in a different light. Students will be taught prehistory as well as conventional history—the whole presented as the living world's greatest epic.

Wilson's formulations imply we already have the information necessary for this transformation. The only remaining obstacle is that enough people have not yet "thought it through." If Wilson is correct, it seems likely that this one remaining obstacle will be rapidly eroded by the intellectual vigor of the species,

the increasing speed at which knowledge is generated, and the expanding means for the sharing of knowledge.

Degrees of Paradigmatic Consensus in the Disciplines

A scientific paradigm is a stable framework within which researchers can produce progressive, cumulative knowledge. The framework is stable because researchers agree that its core concepts are internally coherent, grounded in empirical findings, and concordant with concepts in other empirically grounded disciplines. It is progressive because its core concepts are so broad and basic they can incorporate new discoveries. In geology, for instance, the paradigmatic synthesis produced by Charles Lyell during the 1830s was so broad and basic that it could incorporate 20th-century discoveries about plate tectonics.

During the 1930s, the period of "The Modern Synthesis," evolutionary biology finally achieved the status of a paradigm. Darwin had provided basic materials for that paradigm in the theory of descent with modification by means of natural selection, but uncertainties about the mechanisms of inheritance rendered the theory of natural selection controversial for some seven decades after the theory had first been proposed (Huxley 1942; Mayr 1982; Bowler 1988). The Modern Synthesis had sufficient breadth and validity so that it could be expanded, during the next several decades, to include discoveries such as DNA, inclusive fitness, differential parental investment, and, most recently, multilevel selection, including selection at the level of the group.

Evolutionary psychology is still in the process of forming a paradigm. Early sociobiology too directly invoked the theory of fitness maximization as a primary motive in human behavior. Evolutionary psychologists corrected that mistake by insisting on an intermediate stage of proximal mechanisms—for instance, the desire for sex rather than the desire for offspring (Symons 1992). In turn, though, the early evolutionary psychologists eliminated or minimized the domain-general powers of human intelligence (Mithen 1996; Sterelny 2003; Geary 2005), failed to register the systemic relations among disparate proximal mechanisms (Smith et al. 2001; Kaplan and Gangestad 2005), eliminated or minimized the significance of individual variation in humans (Nettle 2006, 2007), oversimplified the environment of evolutionary adaptedness EEA (Foley 1995; Irons 1998; Potts 1998), envisioned an exaggerated contrast between modern conditions and human adaptive dispositions (Zuk 2013), and thus forestalled any adequate recognition of ongoing gene-culture coevolution (Richerson and Boyd 2005; Cochran and Harpending 2009). During the past two decades, evolutionary social scientists have been correcting all those premature theoretical

reductions and thus building more accurate models of human evolution and human nature. During this same period, the early sociobiological emphasis on selection at the level of individuals has been giving way to a more complex understanding of evolved human dispositions for social life (Sober and Wilson 1998; Boehm 1999, 2012; Haidt 2012; Wilson 2012). Evolutionary psychology has not yet fully stabilized as a true paradigm, but it is well on the way (Buss 2005a; Dunbar and Barrett 2007; Gangestad and Simpson 2007; Laland and Brown 2011). The most important phenomena that have yet to be fully incorporated within a reasoned consensus are the products of imaginative culture—the arts, religions, philosophies, and ideologies (Dissanayake 2000; Boyd 2009; Boyd et al. 2010; Carroll 2011b; Dissanayake 2011; Gottschall 2012).

Several of the essays in this volume discuss active controversies within their own fields. Wilson explains the conflict over group selection. Boehm surveys the various hypotheses that have been proposed to explain altruism and makes a case for a comprehensive theory that incorporates and revises existing hypotheses. Harpending and Harris propose serious qualifications for the common assumption that hunter-gatherers can be taken as proxies for ancestral humans. All these issues are important, but they are all also points of dispute within a broad consensus about the evolved and adapted character of the human mind. Contributors from literary studies register more basic disagreements within their own discipline. Focusing specifically on horror fiction, Clasen sets his evolutionary approach into sharp contrast with "theoretically flawed approaches that have dominated horror studies in recent decades, especially psychoanalysis and the various forms of 'blank slate' political ideology." In a similar vein, Boyd contrasts a "biocultural" approach to literary study with the exclusively cultural approach that has dominated literary study for decades. Carroll et al. observe that the majority of literary scholars still reject an evolutionary view of human behavior and, even more broadly, the idea that science can produce objective knowledge. Carroll et al. argue that literary studies currently display the kind of "epistemic disorder that characterizes most disciplines in the period before a paradigm has formed."

Cross-Disciplinary Linkages

Oakley observes that "the history of science has shown that it's possible to work for decades—even centuries—using an underlying perspective on a given challenge or situation that makes it impossible to make progress." Such situations require reframing the problem, changing the context of inquiry. As Oakley puts it, "a subtle, simple perspective shift can allow for vital breakthroughs to take place." Oakley is one of several contributors who link multiple disciplines

either to produce broad general ideas or give concentrated analytic attention to particular topics. Linkages include biology and paleoanthropology (Wilson), psychology and engineering (Oakley); paleoanthropology and developmental psychology (Dissanayake), and psychology and narrative theory (McAdams; Carroll et al.; Boyd; Clasen).

Wilson's special areas of expertise include entomology and the evolution of sociality across the animal kingdom ("sociobiology"). Integrating information from that range of expertise with information from paleoanthropology and hunter-gatherer culture, Wilson develops a general theory of "eusociality." That theory, zoological in scope, has profound implications for the way we envision specifically human forms of social behavior. It creates a new context of inquiry for the ecological conditions underlying group formation, the division of labor, the relations among generations, and the relations between discrete social groups.

Oakley describes the intellectual path that led to her book *Evil Genes* (2007). By integrating research in neuroscience, personality disorders, and cultural and political history, she has been delineating the continuum between individual psychopathology and pathological social organization at the level of institutions and nation states. In her essay for this volume, Oakley brings her interdisciplinary expertise to bear on the problem of "pathological altruism." Discussing the cognitive bias that leads to dysfunctional forms of altruism, she makes a case that engineering could help put social and psychological theories to the hard test of reality. She sketches out a practicable interdisciplinary program in psychology and engineering. Neuroimaging points toward the kind of mechanization that has made such a profound difference in medical science. Connecting engineering with psychology extends the range of consilience, in this volume, beyond the life sciences. The mechanics of neuroimaging are grounded in physics as well as in neurochemistry.

Dissanayake, Boyd, and Clasen bring multiple fields to bear on highly specific topics in imaginative culture. Dissanayake's topic is mark-making among preliterate peoples: cupules and engraved or painted geometrics. To make sense of this topic, she incorporates ideas from anthropology, archeology, developmental psychology, neuroscience, and ethological research on a contemporary aboriginal group. Her chief disciplinary affiliations are human ethology and developmental psychology. She synthesizes current thinking on ancient petroglyphs and pictographs and uses developmental cognitive psychology to delineate parallels between ancient mark-making and the mark-making of young children. All this highly particular information has implications for a much broader issue: the controverted question of "the human revolution"—that is, the timing and pace at which humans began to produce distinctively human imaginative culture. Clasen's topic is a specific genre of fiction in literature and film: horror. Why do

people love to scare themselves with fictional monsters? To answer that question, Clasen synthesizes information from paleoanthropology, social psychology, and affective neuroscience. His conclusions make it possible for him to contribute evidence toward a crucial issue in human evolutionary theory—whether the arts are adaptively functional components in gene-culture coevolution. Boyd's topic is a set of parallels in processes in evolution, the sciences, and the arts. He uses two basic heuristics—problem–solution and cost–benefit—to provide a flexible analytic model for commentary on poetic and narrative structures. Drawing on cognitive and social neuroscience, he frames specific works of art as instances of "pattern recognition" and "shared attention." Like Clasen, he brings his conclusions to bear on the question of the adaptive function of the arts.

McAdams and Carroll et al. use overlapping bodies of interdisciplinary information to formulate complementary ideas about human identity and "meaning" in narrative. They integrate information from multiple fields of psychology to construct comprehensive models of individual identity. McAdams uses narrative theory to illuminate the autobiographical narratives of real individual people. Carroll et al. use the psychology of real individual people to illuminate the construction of fictional characters in Victorian novels.

McAdams's home discipline is personality psychology, but he has expanded the scope of personality psychology to include more than the usual five-factor set of personality variables (extraversion, conscientiousness, agreeableness, neuroticism, openness to experience). From evolutionary social psychology, he derives a set of basic life goals. Integrating developmental, cognitive, and narrative psychology, he constructs a theory of autobiographical narrative, the story every individual tells about his or her life. A life narrative is the way humans make "meaning" out of their lives. Life narratives delineate a continuously unfolding identity in which main sequences are shaped not just by events and actions, but also by goals achieved or not achieved, values affirmed or subverted, needs fulfilled or frustrated. Life narratives include the largest contexts within which people locate their own individual self-images—families, friends, communities, the natural world, and, for many people, a spiritual world. Meaning in a life derives largely from the value with which those contexts are invested—love, devotion, awe, reverence, pride—and the value attributed to one's place in them, whether one is loved or detested, despised or admired. Sustaining or changing the image of oneself within such contexts forms a chief motive for behavior.

Carroll et al. use human life-history theory to construct a set of basic motives and use Ekman's theory of basic emotions to register readers' emotional responses to characters. They differentiate individuals through motives and personality traits (the five-factor system) and differentiate sexes through motives and criteria for selecting mates. By correlating features of identity in characters with the

valenced emotional responses of readers to the characters, Carroll et al. identify the structure of values that prevails across the whole body of novels. By having readers sort characters into protagonists, antagonists, and minor characters, they produce a synoptic image of the positive and negative values that are shared by the authors and their readers. They report that antagonists are chiefly motivated by a desire for dominance. Protagonists are heavily motivated by self-effacing prosociality. That valenced antithesis helps form a community of shared values within which authors and readers construct their own life narratives.

Carroll et al. use empirical, quantitative methods. Two of the team members (Carroll and Gottschall) have training primarily as literary scholars, and two (Johnson and Kruger) primarily as psychologists. In interpreting their results, they invoke Boehm's claim that hunter-gatherers suppress dominance in individuals. They thus construct a model of human nature from concepts in biologically grounded psychology, use that model to produce empirical data about a literary subject, and interpret that data with ideas from research in primatology and anthropology.

The Trajectory of Human Evolution

Several contributors converge on two main themes in current thinking about human evolution: multilevel selection and gene-culture coevolution. Wilson, Boehm, McAdams, and Carroll et al. invoke selection pressures at the level of social groups. Wilson, Boehm, Harpending and Harris, Rose, McAdams, Clasen, Dissanayake, and Carroll et al. delineate ways in which ecological or social conditions have interacted causally, over evolutionary timescales, with specifically human forms of intelligence and imagination. Within that broad convergence, the contributors display significant differences of focus and emphasis.

Wilson and Boehm both identify hunting and meat-sharing as main factors in human evolution. Wilson also designates the use of defensible campsites as a pivotal event in human evolutionary history. Organizing social life around a campsite, he argues, generates a self-perpetuating cascade in human social intelligence. He postulates a causal connection between human social intelligence and the evolution of a specifically human power "to invent and rehearse competing scenarios." Wilson and McAdams both identify "group selection" as a major evolutionary force among humans. Boehm includes "group selection" in a list of the main theories that have been proposed to account for "altruistic" behavior in humans, but Boehm identifies a form of "social selection" that is distinct from "group selection" and interactive with it. Presenting evidence from modern hunter-gatherer populations, Boehm argues that specifically human forms

of cooperative behavior depend crucially on suppressing dominance behavior in individuals. Social pressure constraining individuals to suppress dominance behavior selects for the ability to internalize group norms, an ability that leads, ultimately, in modern humans to a specifically human form of social imagination: ideology. McAdams and Carroll et al. reflect on the way narratives display internalized group norms.

Future research on human evolution will almost certainly concentrate on the tension between conserved adaptations and novel genetic attributes. In this volume, Wilson, Boehm, Dissanayake, Clasen, and Carroll et al. give a strong emphasis to the conservation of evolved dispositions—to the persistence of adaptations from among ancestral populations. Harpending and Harris point in the opposite direction. Taking up one particular issue—the tendency of people now to give preferential treatment to ethnically similar people—they give evidence for the selective force produced by relatively recent forms of human behavior: sedentism (living in settled communities), agriculture, and the pooling of ethnically diverse people in cities. Boehm and Harpending and Harris reflect on the relatively recent and sudden emergence of culturally modern human behavior—the kind of behavior that produces complex tools and symbolic artifacts. Dissanayake, in contrast, stresses gradualism and continuity in cultural development. Rose constructs an evolutionary hypothesis that emphasizes neither conserved nor novel traits for specific forms of behavior. Instead, he identifies a set of "general-purpose brain functions" that are "useful for both ecological and social competition" and that thus help explain "the complexity and versatility of human behavior."

A Biocultural Conception of Human Nature

Human Life History and Three Specifically Human Forms of Culture

All species have a nature—an evolved set of species-typical behaviors. In all species, these behaviors form a functionally integrated suite adapted to satisfy the two basic requirements of life: sustaining a body and reproducing (Alexander 1987; Lummaa 2007). The total life trajectory or "life history" of every species is a reproductive cycle that includes particular forms of birth, development to adulthood, mating, and longevity (Kaplan and Gangestad 2005; Flatt and Heyland 2011). Sustaining life involves adaptations for acquiring food and protecting the organism from environmental threats. For mammals, birds, and some other species, evolved characteristics also include dispositions for nurturing offspring. For social species, evolved characteristics include species-typical ways of interacting with conspecifics. For eusocial species, those forms of interaction involve

divisions of labor and cooperation aimed at fulfilling the needs of the group. Some few highly intelligent species transmit learned behavior that includes using simple tools.

Humans have developed the capacity for transmitting information in three ways that are either unique to human culture or exceptionally developed in it: (a) they retain and develop innovations to produce cumulative forms of learned behavior—social, mechanical, and intellectual (Sterelny 2003; Tomasello et al. 2005; Boyd and Richerson 2007); (b) they extrapolate general ideas (Hawkins 2004; Geary 2005); and (c) they produce imaginative artifacts (Dissanayake 2000; Dutton 2009; Carroll 2011b; Gottschall 2012). Through cumulative innovation, humans have transformed techniques into technology, tribes into civilizations, discoveries into progressive sciences, and individual works of art into artistic traditions. By extrapolating general ideas, they have produced ideologies, religions, philosophies, histories, scientific theories, and theories about civilization. Animals of other species dream, produce emotionally expressive vocalizations, engage in play, and even, in the case of bower birds, fashion aesthetically designed artifacts. Only humans produce imaginative artifacts through which they depict objects and actions, evoke the subjective experience of other creatures, express their own attitudes to those experiences, affirm or contest social norms, communicate systems of belief, and convey worldviews.

The three features that distinguish specifically human forms of culture—cumulative innovation, general ideas, and imaginative artifacts—interact in ways that have progressively altered the functionally integrated suite of adaptive behaviors in the hominin lineage. Gene-culture coevolution, beginning with the use of tools and the control of fire, has altered hominin characteristics all the way down to anatomy and physiology (Cochran and Harpending 2009; Wrangham 2009; Carroll 2011a). In *Homo sapiens*, culture is shaped and directed by genetically transmitted features of an evolved and adapted human nature, but cultural practices also form emergent levels of complexity in which the basic features of human nature interact with each other to produce phenotypically novel forms of behavior.

Humans are still driven by basic animal needs such as hunger and thirst, and they are still dependent, as a species, on the reproductive cycle. They have inherited from their ancestors forms of anatomy and physiology adapted to an omnivorous diet of cooked foods (Wrangham 2009); anatomical and cognitive traits derived originally from adaptations for living in trees and then for hunting and gathering on the ground (Wade 2006; Klein 2009; Boyd and Silk 2012); dispositions for pair bonding, dual parenting, and multigenerational care of the young (Geary and Flinn 2001; Wilson 2012); aptitudes for intense social interactions

in groups that work cooperatively to acquire resources and defend the group from predators, including other human groups (Wilson 2007; Boehm 2012; Wilson 2012); and impulses of fear and aggression in relation to threats (Buss 2005b; Panksepp and Biven 2012; Shackelford and Weekes-Shackelford 2012). All those biological characteristics form part of every known human culture. They are "human universals" (Brown 1991). Distinct human cultures organize these universal characteristics in different ways. Humans adapt to local ecological conditions by developing traditions in technology, social organization, belief systems, and artistic practices. The common elements among these local traditions, though, are themselves human universals. All human cultures have technology, complex social organization, belief systems, and artistic practices (Brown 1991; Dissanayake 2000; Baumeister 2005). The capacity to produce such traditions are part of the genetically transmitted features peculiar to the species. Humans are thus truly a biocultural species—the only biocultural species.

Sociality and Imagination

All the essays in this volume take as their subject one or another aspect of "human nature." From these various aspects, two main themes emerge: human nature is ultrasocial and it is imaginative. Wilson offers a representative statement about human sociality. "We are compulsively driven to create and belong to groups, variously nested, overlapping, or separate, and large or small." Affirming Wilson's ideas about eusociality and group selection, McAdams declares that it is part of human nature "to identify closely with groups, for throughout human evolution, individual survival has depended on the survival of the group as a whole and, more important, on one's particular standing within the group." Wilson also offers a representative statement about the human imagination, especially in its narrative forms. "We instinctively delight in the telling of countless stories about others as players on the inner stage. The best of it is expressed in the creative arts, political theory, and other higher level activities we have come to call the humanities." Dissanayake foregrounds a more basic form of imagination: the aesthetic "primitives" that manifest themselves first in nonsymbolic forms. She argues that humans have "an evolved behavioral predisposition" to "use special devices that attract attention, sustain interest, and create and manipulate emotion. Such devices include simplification or formalization, repetition, exaggeration, elaboration, and manipulation of expectation." Dissanayake directs attention away from the elite arts that are the typical subjects of the humanities. She focuses instead on the universal character of artistic activity. "All human societies perform ceremonial practices or rituals in which several arts combine—song, dance, and dramatic storytelling, in addition to the visual panoply of costumes and

other body adornment, masks, altered surroundings, and special objects, which could include painted or carved marks on stone."

Ultrasociality and imagination are intertwined in reciprocally causal ways. Several of the essays in this volume probe those causal relationships. Wilson attributes the evolution of imaginative activity directly to social interaction. Boehm, Dissanayake, McAdams, and Carroll et al. identify forms of imaginative activity that serve adaptive social functions. Clasen, invoking a hypothesis originally formulated by Wilson, explains the adaptive function of imagination in ways that encompass sociality but are not limited to it.

Research into adaptations for living in social groups has converged on one basic dichotomy, variously formulated: cooperation and competition, getting along and getting ahead, affiliation and dominance. As McAdams explains, "Going back even to Freud's (1930/1961) famous dichotomy of Eros and aggression, researchers have repeatedly distinguished between two classes of basic human motivations: those designed to promote communion, love, intimacy, affiliation, group bonding, and interdependence on the one hand; and those aimed to promote individual control, power, status, achievement, self-expansion, and independence on the other." In this volume, Wilson, Boehm, Harpending and Harris, McAdams, and Carroll et al. use variations on this dichotomy to pry open the complexities of social relationships. McAdams invokes Wilson's idea that competition between individuals within groups parallels competition between groups, but Wilson and McAdams both also acknowledge that life within groups consists of a perpetual dynamic tension between cooperation and competition. Boehm gives close attention to the way group life transforms prosocial behavior into a selective advantage for individuals within a group. Carroll et al. argue that Victorian fiction stigmatizes dominance behavior, affirms prosociality, and thus helps bind its readers into members "within a community dependent on shared norms of cooperative behavior."

Humans are so thoroughly social, and also now live in an environment so thoroughly domesticated to human use, that it is easy to lose sight of the way social life fits into the broader suite of adaptive characteristics in human nature. McAdams quotes psychologist Robert Hogan, who affirms that "getting along and getting ahead are the two great problems in life that each person must solve." From a life-history perspective, the two great problems in life are survival and reproduction. The complications of social life are built on that foundation. Wilson and Boehm are certainly correct that for the human species subsistence and sociality are closely intertwined. Cooperative hunting for meat is a core feature in the evolutionary trajectory of the species. So, too, for humans, as for all mammals, mother–infant bonding is a core feature in the trajectory of the species. For humans, mother–infant bonding is embedded in complex

social networks that include sexual pair bonding, dual parenting, multigenerational cooperation in the care of offspring, and cooperative work. Without integration in a social group, ancestral human mothers would not have been able to rear offspring. Nonetheless, in the hierarchy of causal reductions leading to inclusive fitness, adaptations for social life are adaptations to aid survival and reproduction—not the other way around.

Evolutionary commentary on imaginative artifacts has centered on the question of adaptive function: whether they have any adaptive functions, and if so, what those might be. Carroll et al. summarize the various theories that have been put forward. Dissanayake gives a critique of the idea that imaginative activity serves chiefly as a form of sexual display. McAdams considers the hypothesis that the arts are essentially a nonadaptive by-product of other characteristics that have adaptive value. He argues that storytelling is grounded in universal dispositions but suggests that highly individualized autobiographical narratives are particularly salient and psychologically functional in complex modern cultures. This is an empirical question of considerable interest. In literary theory, it can be closely associated with a canonical historical issue: the rise of the novel (Watt 1957; McKeon 1987). Is it the case that a personal life narrative becomes crucially important only in modern societies? Or is it the case that all people, even those living in preliterate cultures using simple forms of technology, have a universal need to envision their own life trajectories within their total worldview? Do "archetypal" myths and folktales provide, for more ancient or simpler cultures, prototypes for life narratives? And is it also the case that in more modern and more complex cultures, highly individualized life narratives parallel increased individualization both in the real life of individuals and in fictional narratives? Such questions are susceptible to adjudication by appeal to evidence. They offer rich opportunities for researchers capable of producing empirical data, and also for historical scholars capable of integrating data with scholarly information.

Ethologist Niko Tinbergen (1963) identifies four areas in which research into animal behavior should seek integrated answers: phylogeny, ontogeny, mechanism, and adaptive function. Phylogeny concerns the evolutionary history of a species and ontogeny the individual development of an organism within that species. Mechanisms consist of genetic, physiological, and neurological structures that produce the behavior. Hypotheses about adaptive function offer explanations for ways in which a behavior meets the needs of survival and reproduction. For the human proclivity to produce imaginative artifacts, a phylogenetic analysis would identify the way that proclivity evolved, the antecedent characteristics necessary for it to have evolved, when it first emerged as a distinct feature, and how it developed later in the evolutionary history of the species. In this volume, Wilson, Boehm, Rose, Dissanayake, and Carroll et al. give attention to that

question. Analysis of the ontogeny of imaginative activity would focus on how and when that activity develops during childhood. Dissanayake and McAdams take up that issue, and Dissanayake develops an argument for parallels in the phylogeny and ontogeny of imaginative activity. Arguments about mechanisms of imaginative activity identify the cognitive, affective, and sensory equipment used for producing and consuming imaginative artifacts. Referencing research by Tomasello, Edelman, and others, Boyd discusses mechanisms of shared attention and pattern recognition. Clasen and Carroll et al. reference empirical research that identifies narrative as a form of "simulation." Hypotheses about the adaptive function of imaginative activity would explain how that activity contributes ultimately to the survival and reproduction of individuals living in groups and how it contributes to the success of groups competing with other groups.

Hypotheses about adaptive function have larger explanatory scope than hypotheses about the other three ethological questions. Understanding how a characteristic of an organism contributes to survival and reproduction provides crucial clues regarding why that characteristic has evolved in the way that it has, how it fits into the developmental trajectory of the animal, and how and why its mechanisms work as they do.

Contributors to this volume offer three main hypotheses, overlapping and complementary, about the adaptive function of the arts, especially narrative: building scenarios, internalizing social norms, and helping create a total imaginative universe. Wilson, McAdams, and Clasen all formulate versions of the idea that fictional narratives are scenarios that enable readers to envision alternative possible courses of action. McAdams and Carroll et al. postulate that narratives, autobiographical and fictional, help people internalize the beliefs and norms of their culture. This idea has a clear parallel with Boehm's arguments that humans evolved in such a way as to internalize cultural norms. Fictional narratives would be a cultural technology through which virtual or vicarious experience helps people to build morally valenced imaginative structures within which they can locate their own behavior. Dissanayake argues that all the arts are incorporated in rituals and ceremonies through which social groups affirm their collective identity and integrate individuals into the group. Though focusing on a highly particular subject, horror fiction, Clasen suggests the broadest encompassing theory about the adaptive function of the arts. He argues that horror fiction "gives us experience with negative emotion at levels of intensity not safely come by in real life. It thus allows us to incorporate the imagination of danger into our total imaginative universe."

The seminal formulation for the idea of a total imaginative universe appears in Wilson's *Consilience* (1998, Chapter 10; and see Carroll 2012). Wilson argues that cognitive and behavioral flexibility are defining characteristics of