Gene-Culture Co-Evolution

An Emerging Paradigm

Books Under Review

Before the Dawn: Recovering the Lost History of Our Ancestors
by Nicholas Wade. Penguin, 2006.

Catching Fire: How Cooking Made Us Human
by Richard Wrangham. Basic Books, 2009.

The 10,000 Year Explosion: How Civilization Accelerated Human Evolution
by Gregory Cochran and Henry Harpending. Basic Books, 2009.

JOSEPH CARROLL

> The great process of gene-culture coevolution is the central problem of the social sciences and much of the humanities, and it is one of the great remaining problems of the natural sciences. Solving it is the obvious means by which the three great branches of learning can be foundationally united.
>
> —E. O. Wilson, "Sociobiology at Century's End" (viii)

> For social species the most important feature of the environment is their own society. So to the extent that people have shaped their own society, they have determined the conditions of their own evolution. The nature of this interaction between culture and evolution is not yet clear, because it has only just come to light.
>
> —Nicholas Wade, *Before the Dawn: Recovering the Lost History of Our Ancestors* (267)

REFLECTIONS ON A DEAD HORSE

We can trace an imaginative arc between the evolutionary vision in the conclusion to Darwin's *Descent of Man* (1871) and, just over a century later, E. O. Wilson's vision in the final chapter of *Sociobiology: The New Synthesis* (1975). In historical retrospect, that arc looks like a bridge over an intellectual abyss. So far as the social sciences are concerned, during the first three-quarters of the twentieth century, evolutionary thinking sank out of sight, replaced by a radical cultural constructivism that was both doctrinaire and conceptually incoherent.[1] Early on, Wilson realized that gene-culture co-evolution was the key

to understanding specifically human evolution. In company with Charles Lumsden, he wrote the first book on the subject.[2] But that was in 1981—too early. The evolutionary human sciences had barely gotten off the ground, and there was too little detailed information available to produce a usable framework for thinking about gene-culture co-evolution. The mathematical formulas offered by Wilson and Lumsden did not become a starting point for further research. Over the next three decades, though, researchers from many fields filled in the details that had been missing from the final chapter of *Sociobiology* and the follow-up book *On Human Nature*.[3]

Using the basic reproductive logic worked out by William Hamilton and Robert Trivers, sociobiologists and evolutionary anthropologists analyzed the interactions between reproduction, kinship, and social organization in contemporary hunter-gatherers.[4] Evolutionary psychologists used "reverse engineering" to link conditions in ancestral environments with psychological mechanisms,[5] and evolutionary anthropologists provided a more complex and nuanced understanding of the vicissitudes of those ancestral environments.[6] Evolutionary psychologists worked out the fine details in human criteria for selecting mates,[7] and linguists extended evolutionary explanations to language.[8] Rejecting the evolutionary psychologists' belief that the mind consists exclusively of "domain-specific modules," cognitive psychologists and archeologists integrated "domain-general intelligence" with "modules" that evolved to respond to massive regularities in ancestral environments.[9] Correcting the evolutionary psychologists' tendency to produce open-ended lists of "modules," life history theorists illuminated the systemic causal relations among modes of subsistence, reproductive systems, and particular forms of social organization.[10] Adopting a life history approach, developmental psychologists explained the adaptive functions of the extended human childhood.[11] Psychologists and neuroscientists isolated basic emotions and the underlying neurological systems that govern them.[12] Donald Brown drew a compelling portrait of "the universal people," and behavioral geneticists, working against the universalist grain in evolutionary psychology, produced important findings on individual and group differences.[13] Rejecting the sociobiologists' tendency to limit social interaction to nepotistic altruism and reciprocation, D. S. Wilson and others invoked "multi-level selection" in ways that broadened our understanding of evolved human sociality.[14] By comparing chimpanzee social organization with the social organization of hunter-gatherers, Christopher Boehm isolated the principles of dominance and egalitarianism at the heart of specifically human forms of social organization.[15] Cognitive developmental psychologists explored the faculty for empathy or "Theory of Mind" that makes specifically human forms of social interaction possible.[16] And finally, evolutionists in the humanities insistently drew attention to the evolutionary significance of the arts.[17]

The result of all this intersecting research is that we are now able, for the first time, to begin using gene-culture co-evolution as a comprehensive theoretical framework for understanding human evolution, and along with that historical understanding, to formulate, for the first time, adequately inclusive concepts of human nature. Two of the books here under review, those by Wrangham and by Cochran and Harpending, are primary, original contributions to a newly emerging consensus on the centrality of gene-culture co-evolution. The third book, Nicholas Wade's, is a comprehensive scholarly synthesis of the key elements in this emerging consensus.

These three books exemplify a fundamental shift in the center of gravity for the evolutionary human sciences. That same shift can be discerned by comparing the essays in *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (1992) with those in *The Evolution of Mind: Fundamental Questions and Controversies* (2007).[18] In the fifteen years separating these two collections, "narrow-school" or "orthodox" evolutionary psychology (EP) has given way to a much broader, more complex understanding of human nature.

As it is commonly used in discussions of EP, the deprecatory epithet "orthodox" suggests that the doctrines distinguishing this school have often been presented less as working hypotheses than as a priori truths, that is, as dogmas. The difference between a working hypothesis and a dogma is the difference between science and religion. A working hypothesis provides a framework within which to weigh and

assess evidence; researchers look equally for evidence that supports the hypothesis and evidence that weighs against it. A scientist using a working hypothesis makes good use of plausible alternative hypotheses as a means of calibrating degrees of probability in the force of evidence. A researcher who embraces a dogma, in contrast, sets alternative hypotheses aside and looks only for evidence that will support or illustrate the favored idea.

Dogmas of orthodox EP include the propositions that human evolution moves so slowly that no significant adaptive change can have occurred since the species assumed its anatomically modern form some 200,000 years ago; that "the adapted mind" consists only of adaptations to Pleistocene hunter-gatherer conditions; that all adaptations are adaptations to massive regularities, and that no adaptation can arise as a means of coping with variable conditions; that modern conditions produce radical and pervasive "mismatch" with evolved dispositions; that with respect to adaptive traits, all humans today are essentially the same, both as individuals and as continental populations (races); that fitness maximization, the "ultimate" evolutionary cause of behavior, is radically disjoined from "proximal" mechanisms, such as sexual desire, with the result that "reproduction" could not be a motive in itself; and that the mind is massively modular and contains no capacity for general intelligence ("*g*").[19]

One logical consequence of the orthodox EP conception of human nature is that the features distinguishing behaviorally modern humans need not be taken into account when trying to characterize the adapted mind. Behaviorally modern features include all technology beyond the simplest stone tools; complex social organizations with specialized roles and status hierarchies; settled dwellings with permanent buildings; complex forms of subsistence such as agriculture and industry; extensive trade networks regulated by laws and conducted through systems of monetary exchange; individuals' identification with large-scale social groups constituted not by kinship but by shared beliefs, values, and symbolic imagery; and indeed, all forms of "symbolic culture": religion, the arts, ideology, philosophy, history, and science. From the orthodox EP perspective, if these subjects are to be studied at all, they are to be understood only as "by-products" of cognitive dispositions that evolved to fulfill the needs of hunter-gatherers—not any particular hunter-gatherers, but rather a generic, statistically average composite of all hunter-gatherers, from all periods of the Pleistocene.

Another logical consequence of the orthodox EP conception is that individual and group differences are to be set aside as mere "noise" irrelevant to psychological explanation. From this perspective, individual differences in personality and group differences in behavioral traits, aptitudes, and forms of social and economic organization are to be explained only through the interaction of variable ecological conditions affecting a single, basic plan of evolved dispositions—the generic, statistical composite.[20]

Once one totes up everything that orthodox EP subtracts from human nature, what is left does not approximate very closely to anything distinctively human. It certainly does not match up well with our own experience as we go about conducting our daily affairs, doing business, playing or watching sports, attending PTA meetings, working in our gardens, reading the newspaper, watching television, going to concerts, chatting on the Internet, browsing the Web, reading and writing articles, or attending academic conferences. The EP conception of human nature includes language as a mechanism of social interaction, and it acknowledges the importance of the specifically human forms of reproduction, with heavy paternal investment and all that flows from that singular behavior. But apart from those two chief concessions to specifically human forms of evolved behavior, EP representations of human nature often look less like *Homo sapiens* than like some generalized primate—more like Washoe than like George Washington.

Now, there is still a good deal of Washoe lurking about in all of us. As a consequence, even in its narrowest forms, EP has had good success at formulating valid causal explanations for some forms of behavior that stabilized relatively early in the Pleistocene, especially reproductive behavior. Still, there are very serious limitations in what EP can take into its explanatory scope. Fortunately, those limitations are not inherent in "this view of life": the evolutionary conception of human nature. They are merely arbitrary features of a premature theoretical consolidation within one particular school of the evolutionary human sciences. The books here

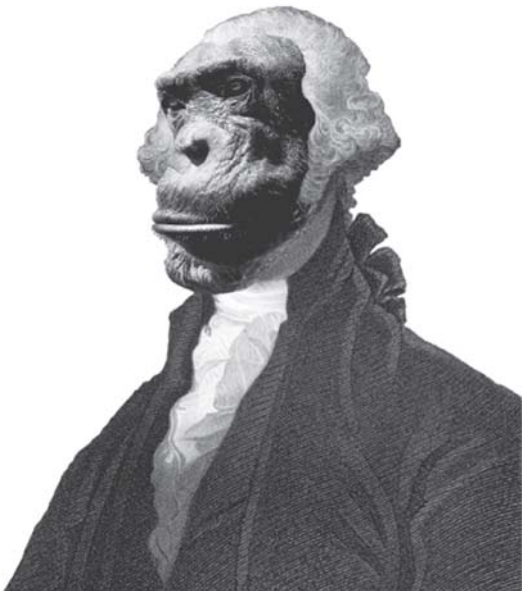

Figure 1. George Washoe.
First in War, First in Peace, and First in Line for Estrous Females.

under review give testimony that we're past that now. There is of course no use in beating a dead horse, but it is worth pausing long enough to recognize that the horse is in fact dead and to register why it died. It died because it fixated on a priori ideas and lost touch with empirical evidence. In that respect, it was like a species that gets locked into rigid patterns of behavior, fails to adapt to changing ecological conditions, and thus goes extinct.

CATCHING FIRE: HOW COOKING MADE US HUMAN

Wrangham has a truly important original argument—that eating cooked food was a primary engine in specifically human evolution. He argues that cooking was the probable cause for a major evolutionary shift, about 1.8 million years ago, from *Homo habilis*, who used simple stone tools to process meat, to *Homo erectus*, who had a larger brain and smaller teeth and gut (96–120). *Homo erectus* has lost the upper-body musculature that indicates habitual climbing. Wrangham infers that members of this species slept on the ground and that they also probably controlled fire, necessary to keep off predators at night (99–103). The anatomical evidence for controlling fire correlates with the anatomical evidence for cooking. Cooked food has much more energy value because cooking predigests food, breaking down molecules and making it easier to segregate nutrients from indigestible matter. As a result, cooking reduced the effort humans had to expend on eating and digesting, diminishing the size of the gut and freeing up metabolic resources for the brain. This causal argument is convincing, and it carries with it a host of implications for human social and reproductive behavior. Cooking helped make pair bonding and dual parental care part of the core set of specifically human adaptations that distinguish humans from their chimpanzee-like ancestors. In ancestral human populations, provisioning the metabolically expensive human brain required a sexual division of labor, with males doing the hunting and females doing the gathering and cooking. Hunting provided important but irregular supplies of animal protein. Bearing and tending children made hunting impracticable for females, but female gathering insured that the family group received regular provisioning despite unsuccessful days spent in hunting. Cooking would also have had a powerful influence on the organization of social groups, bringing the members of a band into close cooperative behavior and putting a premium on calm social interaction around a fire.

In humans as in most species, males compete for sexual access to females. Consequently, for pair-bonded dual parenting to have evolved in large, cooperative social groups containing multiple adult males, humans had to develop cultural norms defining and limiting rights of sexual access to females. Other species have adaptations for cooperation in social groups with specialized functions and status hierarchies. Humans alone regulate conduct by appealing to cultural norms.[21] Using cultural norms requires a capacity for symbolic thought that exceeds the cognitive capabilities of any other species. The hunter-gatherer way of life

thus formed a complex of interdependent causal forces in which specifically human cognitive capabilities co-evolved with specifically human strategies for nutrition, reproduction, and social organization.

By bringing the total human economy forcibly back into the picture, Wrangham does human evolutionary thinking a great service. Evolutionary psychology, adding modules to the basic reproductive logic crafted by sociobiology, has often seemed to treat the conditions of survival—especially the acquisition of food—as an evolutionary afterthought, hardly worth considering. What really matters, for the most tunnel-visioned acolytes of EP, is mate selection. Everything else is window dressing. Anthropologists advocating a life history approach have sought to correct this tunnel vision with a more systemic understanding of the total human economy. Wrangham's argument, by so forcefully bringing our attention to food as a primary causal factor, will do much to reorient thinking toward this systemic approach. It will certainly not be the last word, though, and not just because further discoveries or refinements in theory will alter our sense of the proportions among the contributing causal factors. Wrangham both oversells and undersells his argument and thus weakens its explanatory power.

Wrangham deviates from the standard of disinterested objectivity—the impartial weighing of evidence and the scrupulous attention to consistency—for, I think, two main reasons: ambition and the craving for social approval. Ambition prompts special pleading in support of the revolutionary originality of his argument. The craving for social approval prompts him to sacrifice depth and consistency to political correctness.

First, the ambition. At one point, Wrangham gestures toward a disinterested analysis of causal relations.

> Having a husband ensures that a woman's gathered foods will not be taken by others; having a wife ensures the man will have an evening meal. According to this idea, cooking created a simple marriage system; or perhaps it solidified a preexisting version of married life that could have been prompted by hunting or sexual competition. (154)

Cooking might or might not have been the primary causal factor in creating the human sexual pair bond. Fair enough. One waits to hear more, and doesn't. Wrangham is too eager to affirm his own revolutionary revision of "conventional thinking." He thus merely affirms his own idea without duly weighing it against the alternatives:

> The proposal that the human household originated in competition over food presents a challenge to conventional thinking because it holds economics as primary and sexual relations as secondary. Anthropologists often see marriage as an exchange in which women get resources and men get a guarantee of paternity. In that view, sex is the basis of our mating system; economic considerations are an add-on. (174)

Wrangham's alternative to "conventional thinking" is to flip it over into a simple reversal, affirming instead "the primary importance of food in determining mating arrangements." In supporting this reversal, he slips unmistakably into special pleading. "Food relationships appear to be more tightly regulated than sexual relationships" (175). Now, that's a startling proposition, startling enough so that one expects a careful, systematic survey of ethnographic evidence supporting it. Instead, Wrangham offers a single atypical ethnographic example (tolerance of female infidelity among the Bonerif).

Next, the craving for social approval. In writing a popular book on human evolution, Wrangham faced a marketing problem: if one is going to argue that the sexual division of labor has an evolutionary basis, how can one deflect accusations that one is using science to support a reactionary patriarchal ethos? Wrangham's solution is to speak about the sexual division of labor in a morally disapproving way. After having conceded, in passing, that marriage could have been "prompted by hunting or sexual competition" as well as by cooking, Wrangham concludes, "Either way, the result was a primitive protection racket in which husbands used their bonds with other men in the community to protect their wives from being robbed, and women returned the favor by preparing their husbands' meals" (154). Now, if someone comes to your candy store and says, "Give me a

hundred dollars a week, or I'll burn down your store," that's a protection racket. But if someone comes to your store and says, "If you supply my company parties with candy, I'll provide the supplies for all the candy you produce, and I'll also make sure none of the thugs in this neighborhood steal your candy," that's not a protection racket; it's a business proposition. There is a difference.

If cooking were the chief causal force driving specifically human forms of sexual and social interaction, then women would be invested through cooking with a considerable amount of autonomy and political power, would they not? According to Wrangham, the answer is both yes and no—depending on the needs of his rhetoric at any given moment. Here's the "yes" answer:

> Inequitable as marriage is in certain respects for hunter-gatherer women, that women have to cook for men empowers them. . . . Hunter-gatherer women are therefore not normally treated badly, and many ethnographers have concluded that, in comparison to most societies, married women lead lives of high status and considerable autonomy. (170–71)

That seems straightforward enough, but then, there is also the "no" answer. Describing a tribe in which women occupy a strong economic position, Wrangham observes, "Despite their economic independence and key role in their husbands' status, they were as frequently and as brutally beaten by their husbands as wives in any other savage society" (162).

So, which is it? Women are brutally beaten in a routine way, or women are not normally treated badly? We aren't supposed to ask. We are only supposed to keep our ideological antennae attuned, and nod with approval whenever such rhetorically pitched notes are struck. One can affirm women's power and dignity, or one can envision women as victims of cruel oppression. Either position remains on ideologically safe ground. Still, Wrangham is no doubt shrewd in giving the strongest emphasis to the idea of victimization. That emphasis offers him the surest protection against criticism. Hence the rhetorical posture adopted at the end of the chapter on the sexual division of labor: "Cooking freed women's time and fed their children, but it also trapped women into a newly subservient role enforced by male-dominated culture. Cooking created and perpetuated a novel system of male cultural superiority. It is not a pretty picture" (177).

One needs to parse this statement rather carefully. It might seem to suggest that in a state of nature, before the advent of cooking, women were free and equal. It was only culture, and one particularly sinister twist of culture, that gave males dominance. (Never mind male dominance among chimpanzees.) But then, that isn't what Wrangham's statement actually says, explicitly. If he were brought to the bar and charged with having adopted a gendered version of the Rousseauistic vision of woman in her natural state—everywhere woman is born free, and everywhere she is in chains—a smart lawyer could probably get him off scot-free. After all, the rhetoric of his declaration does not preclude the idea that male domination preceded anything we would define as culture, nor that culture was always male dominated. Consequently, Wrangham could not be held legally responsible for having suggested that culture is itself a sinister male invention designed to enslave women. He nonetheless gets the rhetorical benefit of suggesting this idea.

However it might be used or misused for local rhetorical purposes, the better of Wrangham's two contradictory theses is the idea that in hunter-gatherer culture cooking provides women with a good deal of autonomy and some leverage in the socioeconomic system. That idea acknowledges that the sexual division of labor in hunting and cooking constitutes a structured set of obligations and benefits. Gendered labor roles are economic trade-offs in a system ultimately governed by inclusive fitness. The system is designed not by gendered partisan politics but by natural selection. This is a systemic life history idea, not a sensationalistic political slogan, and it is inherently more plausible than Wrangham's crude image of male domination and female victimization.

Wrangham's decision to sacrifice consistency and explanatory power to a carefully orchestrated set of politically correct rhetorical gestures seems to have paid off. Dwight Garner, reviewing the book in the *New York Times*, quotes these passages with evident favor. Passing culinary judgment on the book as a whole, he declares it "tooth-

some, skillfully prepared brain food."[22] More than one kind of skill went into preparing this particular dish. Over time, the less honorable kinds of skill, having fulfilled their short-term functions of ambition and ideological expediency, will probably cease to have much effect on the wider world of knowledge. In the long run, the better kinds of skill will have contributed to making a permanent difference in our thinking about human evolution.

THE 10,000 YEAR EXPLOSION: HOW CIVILIZATION ACCELERATED HUMAN EVOLUTION

In *The Philosophical Baby*, developmental psychologist Alison Gopnik launches her arguments for the cognitive importance of childhood by sharply contrasting her conception of human nature with the conception in narrow-school EP. She repudiates the idea that "we're endowed with a set of fixed and distinct abilities, designed to suit the needs of our prehistoric ancestors 200,000 years ago in the Pleistocene." That view, she says, "can't explain the radical historical changes in human life."[23] Gregory Cochran and Henry Harpending would concur. And they would concur as well on identifying delayed gratification as a crucial feature in specifically human behavior. Gopnik stipulates that this capacity develops in children between the ages of three and five. It is, she argues, a salient instance of " 'executive control,' the ability to control your own actions, thoughts, and feelings." Ontogeny converges with phylogeny. "Imagining the different ways that I could be and actually implementing them lets me control and change my actions in a way that is unprecedented in evolutionary history."[24] Cochran and Harpending do not concern themselves much with the ontogeny of delayed gratification, but its phylogenetic history is their central theme:

> Foragers had no tradition of self-denial and no inclination to deny themselves. They weren't very good at self-denial back in the early Neolithic period, and they aren't very good at it even today: Efforts to teach Bushmen to become herders frequently fail when they eat all their goats. People can learn new traditions, but genetic differences must make this kind of self-denial easier for some people than it is for others. It takes a certain type of personality—with traits including patience, self-control, and the ability to look to long-term benefits instead of short-term satisfaction—and natural selection must have gradually made such personalities more common among peoples that farmed for a long time. (114)

If we connect Gopnik's argument on ontogeny with Cochran's and Harpending's argument on phylogeny, we must inevitably associate foragers, psychologically, with young children. That kind of association is the sort of politically sensitive issue from which most scientists would shy away in terror. Cochran and Harpending are imperturbable. They want to get to the truth about the causal forces that have produced modern forms of evolved psychology. They are evidently confident in their disinterested scientific stance and feel no need to make the sort of conciliatory rhetorical gestures that, in Wrangham's book, leave an aftertaste of bad faith.

Cochran and Harpending concentrate on phases of human evolution later than those with which Wrangham is concerned, but their hypotheses dovetail neatly with his. The reorganization of reproductive and social relations produced or facilitated by cooking was a necessary precondition for gradually reducing the level of violent aggression among hominids. (That gradual reduction is revealed in the gracilization of the skeleton and skull.) The ability to get along peaceably in large settled groups was, in turn, a precondition for agriculture. Settling into agriculture "led to the birth of property" (114), hence to surpluses, differences of status, and governments that could control and administer accumulated wealth. Government control produced selection pressures for docility in the great mass of people. The feedback loop between means of subsistence and social organization eventually produced a population that was, compared with hunter-gatherers, not only more docile but also more "selfish, hardworking, self-denying" (117).

All this sounds rather bleak and grim, but there is an upside to the process: the same conditions that produced

greater self-control also placed a premium on innovation. As Cochran and Harpending tell the story, the selective pressures favoring capacities for innovation have been increasing, and with an increasing momentum, through the whole course of human evolutionary history. Innovation can be discerned as far back as the use of the first stone tools, but the most dramatic moment in this evolutionary history was the "creative explosion" of the Upper Paleolithic, in Europe and Northern Asia, some 40,000 years ago (225). This "human revolution" sharply segregated behaviorally modern humans from the patterns of life led by their ancestors, and after this watershed, the momentum for change never let up. "Just as humans 40,000 years ago were significantly different from their ancestors 100,000 years ago (much more inventive, in particular), humans today are different in many ways from our ancestors of 40,000 BC, and, considering the accelerated rate of change, different from our ancestors of early historical times as well" (18–19).

Cochran and Harpending present a good deal of evidence, genetic, anthropological, and archeological, to support their historical narrative. They have not of course definitively confirmed genetic causes for all the large-scale historical changes they attribute to gene-culture co-evolution: "the expansion of the Indo-Europeans, the successful European settlement of the Americas and Australia, the failure of the 'scramble for Africa,' the entry of the Ashkenazi Jews onto the intellectual stage, possibly even the industrial revolution and the rise of science" (227). They are not producing definitive proofs, just strong scientific hypotheses that can be tested and either falsified or supported. By proposing falsifiable hypotheses, they earn the right to their final declaration, with its odd echo of *The Communist Manifesto*: "It's time for researchers in the human sciences to shrug off the chains of dogmas like evolutionary stasis and 'psychic unity' " (227).

Like Darwin in *The Origin of Species*, Cochran and Harpending are drawing out the implications from the available evidence. Darwin's hypotheses in the *Origin* awaited the test of genetics, a science that had not yet been invented. We shall not have to wait nearly so long for empirical verdicts on the hypotheses put forward by Cochran and Harpending.

BEFORE THE DAWN: RECOVERING THE LOST HISTORY OF OUR ANCESTORS

Before the Dawn is a powerfully synthetic work. Wade is a science journalist, not a practicing scientist. Although there is perhaps not a single original discovery in his book, Wade succeeds in putting all the pieces together into a coherent picture while clearly articulating basic causal principles. That in itself is an original contribution. Wade absorbs the works of Wrangham and of Cochran and Harpending (through articles they published before the books here under review), and he assimilates much else besides, from genetics, paleoanthropology, evolutionary anthropology, archeology, evolutionary biology, behavioral genetics, primatology, sociobiology, linguistics, and evolutionary psychology. *Before the Dawn* offers a compendium of what should now be common knowledge among evolutionists in the human sciences.

Wade's twelve chapters are divided between essays on major transitions in human evolutionary history and essays on major themes in that history: sociality, race, language, genetic historiography, and prospects for future evolutionary change. The major transitions delineated by Wade converge closely with those delineated by Wrangham and by Cochran and Harpending: the australopithecines, distinguished by upright posture (4.4 million years ago); *Homo habilis*, distinguished by a larger brain and the use of stone tools (2.5 million years ago); *Homo erectus*, distinguished by major brain expansion, improved tools, and reduced male-female size difference indicating male-female pair bonding (1.7 million years ago); behaviorally modern humans, distinguished by complex multipart tools—including those of bone, antler, and ivory—ceremonial burial, ornaments and musical instruments, and adaptations for warfare, religion, and trade (50,000 years ago); and finally a shift to settled life that required reduced aggression, specialization of social roles, status hierarchies, ownership of property, surpluses, government, and more complex forms of trade (15,000 to 10,000 years ago).

Wade gives a strong emphasis to his claim that settled life (sedentism) is a more decisive evolutionary step than agriculture, which is, he argues, one of the consequences

of sedentism (101). Registering the significance of Boehm's arguments on egalitarianism among hunter-gatherers, Wade evokes the psychological adaptations that had to occur to make settlement possible:

> Settlement may seem a natural choice to us, but it requires a set of wrenching adjustments for hunter-gatherers. They must learn to live with strangers. They must abandon the freedom to move away from danger or from people they don't get along with. They must yield their firmly egalitarian way of life for a hateful social order of superior and inferior rife with rules and priests and officials. (101)

Settlement is a precondition for civilization. So also is the whole set of cognitive aptitudes that characterize "the human revolution," the transition that occurred between 100,000 and 40,000 years ago. Like Richard Klein, Derek Bickerton, and Cochran and Harpending, Wade favors the hypothesis that this major transition involved a genetic mutation enabling fully grammatical speech.[25] (Wade goes into some detail on the FOXP2 gene.) From this point onward—50,000 years ago to the present day—the keynotes in human evolution are inventiveness, innovation, and cumulative cultural acquisition. Wade thus does not envision post-agricultural civilization as a matter of massive mismatch with evolved dispositions. In this respect, his vision could hardly be more different from that of narrow-school EP. In their introduction to *The Adapted Mind*, Cosmides, Barkow, and Tooby tell us that the human mind "was shaped to cope" with "Pleistocene conditions, rather than modern conditions."[26] Wade, in contrast, tell us that "human nature is the set of adaptive behaviors that have evolved in the human genome for living in today's societies" (265).

Each of Wade's chapters is preceded by an epigraph, often lengthy, from *On the Origin of Species* or *The Descent of Man*. The citations are apt and impressive, and the very fact of citing Darwin in this way gives testimony to Wade's acuity and to the scope of his theoretical and historical perspective. Wade recognizes that Darwin's observations display exceptional judiciousness: a quality combining incisiveness, intellectual honesty, and the kind of modesty that makes it possible to get one's own ego out of the way and achieve an objective appreciation for the weight of evidence. As the epigraph to his last chapter, Wade uses the last paragraph in *The Descent of Man*. In this paragraph, after offering palliative thoughts for the distress he knows his ideas will cause, Darwin declares, "But we are not here concerned with hopes or fears, only with the truth as far as our reason permits us to discover it; and I have given the evidence to the best of my ability" (264 in Wade). Wade adopts the same stance:

> The narrative of the human genome explains our origins, our history, and our nature, but many of its implications are far from welcome to one group or another. . . . Geneticists are likely to provide ever greater detail about how individuals vary, how men and women have different interests and abilities, and how races differ. . . . But however discomforting such findings may be, to falter in scientific inquiry would be a retreat into darkness. (266)

Through most of his book, Wade could himself legitimately claim that he has given the evidence to the best of his ability. Topics that display his powers for judiciously weighing evidence include the controversy over the causes and timing of "the human revolution" (30–33); the debate between paleoanthropologists and archeologists on the timing for the origin of language (45–50); the question as to whether behaviorally modern humans' exodus from Africa occurred just once or multiple times (74–76); the question as to whether Neanderthals and humans interbred (92–93); possible reasons for the spread of two alleles affecting brain size, one 37,000 years ago and another 6,000 years ago (97–99); and alternative hypotheses about the causes of the genetic diseases common among Ashkenazi Jews (252–54).

In contrast to these judicious expositions, there are two issues on which, in my view, Wade contents himself with a superficial analysis. He follows Robin Dunbar on attributing a purely social origin for the evolutionary expansion of the human brain (19). And, like D. S. Wilson, he regards religion exclusively as a form of social glue, thus

neglecting its utility in providing a coherent worldview for its followers (164).[27]

Had Wade attended more closely to the lessons he learned from Wrangham, he would not have made the first of these two mistakes. Wade picks up Wrangham's idea that cooking is the basis for pair bonding, but he does not quite grasp two key points in Wrangham's exposition. The first point is that subsistence, not social organization, is the driving force in this particular evolutionary step. Cooking speaks to nutrition. It ultimately has a profound impact on the form of reproduction and also on social organization, but the immediate adaptive cause for the adoption of cooking is enhanced nutrition, not enhanced social organization. Wade has not fully registered Wrangham's point that subsistence sometimes has causal priority in evolutionary change. If an animal starves to death before it can reproduce, all other evolutionary questions are, for that animal, moot. The second point is that cooking is itself a "cultural" technology. Like most commentators who discuss "gene-culture co-evolution," Wade tends to limit "culture" to very recent forms of human development, citing, as everyone does, lactose tolerance as the signal instance. But lactose tolerance has been around for only a few thousand years and is not a universal feature of human nature. The use of cooked food—a cultural technology—has been around for vastly longer stretches of evolutionary time, and the whole human digestive-neurological system has evolved in adaptive response to that technology. Moreover, tool use precedes cooking, and tool use, also, is a cultural technology. As Cochran and Harpending observe, "Cultural innovation has been a driving force behind biological change in humans for a long time—certainly since the first use of tools some 2.5 million years ago" (225).

If Wade fails fully to grasp Wrangham's point about the primacy of nutrition and Cochran's and Harpending's point about the chronological depth of gene-culture co-evolution, we can easily enough correct those failures by appealing directly to Wrangham and to Cochran and Harpending. But Wade's second mistake—regarding religion purely as a form of social glue—reveals a blind spot that he shares with many evolutionists in the human sciences, though not with most evolutionists in the humanities.[28] By thinking of religion exclusively in social terms, Wade displays a lingering adherence to a main feature in the narrow-school version of EP: marginalizing imaginative culture. The standard EP line on religion is that it is merely a spandrel or side effect, a kind of cognitive parasite hitchhiking on our hypertrophic disposition for attributing intentionality to mechanical events.[29] But even narrow-school EP acknowledges that humans have adaptive social dispositions. Explaining religion as a means of subserving those dispositions invests religion with an adaptive function but still fails to get at what is central or peculiar in religion: it is one form of an imagined virtual world. People don't just share religious beliefs as a form of costly commitment to group identity. They use religious beliefs to give intelligible form to the cosmos, including all the supposedly supernatural forces that transcend their rational and practical understanding.

THE LAST PIECE OF THE PUZZLE

The three books here under review constitute a major step forward in our understanding of human nature. None of them, though, takes the final step toward formulating a comprehensive understanding of human nature: recognizing that humans create imaginative virtual worlds and live in them—not as side effects, and not exclusively to subserve adaptive social functions. The capacity for inhabiting imaginative virtual worlds transforms an instinct-driven organism into an organism that makes decisions based on complex mental representations of the world. Damasio and others have made it a commonplace that emotional engagement is a crucial component in human decision making.[30] Religion, ideology, speculative philosophy, and the arts all provide emotionally saturated imaginative representations. They organize our conceptions of ourselves, our fellows, and the worlds we inhabit. This idea isn't very abstruse, but it bears repeating.[31] Eventually, we'll all get the point. And once we do, we'll be able to say that we've accomplished another major transition in our understanding of human nature.

BIBLIOGRAPHY

Atran, Scott. *In Gods We Trust: The Evolutionary Landscape of Religion*. Oxford: Oxford University Press, 2002.

———, and Ara Norenzayan. "Religion's Evolutionary Landscape: Counterintuition, Commitment, Compassion, Communion." *Behavioral and Brain Sciences* 27 (2004): 713–30 (followed by peer commentary and the authors' response, 730–70).

Barkow, Jerome, Leda Cosmides, and John Tooby, eds. *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*. New York: Oxford University Press, 1992.

Baron-Cohen, Simon. "The Empathizing System: A Revision of the 1994 Model of the Mindreading System." In *Origins of the Social Mind: Evolutionary Psychology and Child Development*, edited by Bruce J. Ellis and David F. Bjorklund, 468–92. New York: Guilford, 2005.

Barrett, Louise, Robin Dunbar, and John Lycett. *Human Evolutionary Psychology*. Princeton: Princeton University Press, 2002.

Baumeister, Roy F. *The Cultural Animal: Human Nature, Meaning, and Social Life*. Oxford: Oxford University Press, 2005.

Bickerton, Derek. *Adam's Tongue: How Humans Made Language, How Language Made Humans*. New York: Hill and Wang, 2009.

———. *Language and Species*. Chicago: University of Chicago Press, 1990.

Bjorklund, David F., and Anthony D. Pellegrini. *The Origins of Human Nature: Evolutionary Developmental Psychology*. Washington, DC: American Psychological Association, 2002.

Boehm, Christopher. *Hierarchy in the Forest: The Evolution of Egalitarian Behavior*. Cambridge: Harvard University Press, 1999.

Boyd, Brian. *On the Origin of Stories: Evolution, Cognition, and Fiction*. Cambridge: Harvard University Press, 2009.

———, Joseph Carroll, and Jonathan Gottschall, eds. *Evolution, Literature, and Film: A Reader*. New York: Columbia University Press, 2010.

Boyer, Pascal. *Religion Explained: The Evolutionary Origins of Religious Thought*. New York: Basic Books, 2001.

Brown, Donald. *Human Universals*. Philadelphia: Temple University Press, 1991.

Buss, David M. *Evolutionary Psychology: The New Science of the Mind*. 3rd ed. Boston: Allyn and Bacon, 2007.

———. *The Evolution of Desire: Strategies of Human Mating*. Rev. ed. New York: Basic Books, 2003.

Cacioppo, John T., and William Patrick. *Loneliness: Human Nature and the Need for Social Connection*. New York: W. W. Norton, 2008.

Carroll, Joseph. *Evolution and Literary Theory*. Columbia: University of Missouri Press, 1995

———. "An Evolutionary Paradigm for Literary Study." *Style* 42 (2008): 103–35.

———. "The Human Revolution and the Adaptive Function of Literature." *Philosophy and Literature* 30 (2006): 33–49.

———. *Literary Darwinism: Evolution, Human Nature, and Literature*. New York: Routledge, 2004.

———. "Rejoinder." *Style* 42 (2008): 309–412.

Chagnon, Napoleon A. *Yanomamö: The Fierce People*. 3rd ed. New York: Holt, Rinehart, and Winston, 1979.

———, and William Irons, eds. *Evolutionary Biology and Human Social Behavior: An Anthropological Perspective*. North Scituate, MA: Duxbury Press, 1979.

Cosmides, Leda, John Tooby, and Jerome Barkow. "Introduction: Evolutionary Psychology and Conceptual Integration." In *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, edited by Jerome Barkow, Leda Cosmides, and John Tooby, 3–15. New York: Oxford University Press, 1992.

Damasio, Antonio R. *Descartes' Error: Emotion, Reason, and the Human Brain*. New York: Putnam's, 1994.

Darwin, Charles. *The Descent of Man, and Selection in Relation to Sex*. Edited by John Tyler Bonner and Robert M. May. 1871. 2 vols. In 1. Princeton: Princeton University Press, 1981.

Deacon, Terrence W. *The Symbolic Species The Co-Evolution of Language and the Brain*. New York: W. W. Norton, 1997.

Degler, Carl. *In Search of Human Nature: The Decline and Revival of Darwinism in American Social Thought*. New York: Oxford University Press, 1991.

Dissanayake, Ellen. *Art and Intimacy: How the Arts Began*. Seattle: University of Washington Press, 2000.

Dunbar, Robin. *The Human Story: A New History of Mankind's Evolution*. London: Faber and Faber, 2004.

———. "Why Are Good Writers So Rare? An Evolutionary Perspective on Literature." *Journal of Evolutionary and Cultural Psychology* 3 (2005): 7–22

———, and Louise Barrett. "Evolutionary Psychology in the Round." In *Oxford Handbook of Evolutionary Psychology*, edited by Robin Dunbar and Louise Barrett, 3–9. Oxford: Oxford University Press, 2007.

Dutton, Denis. *The Art Instinct*. New York: Bloomsbury, 2009.

Eibl-Eibesfeldt, Irenäus. *Human Ethology*. Hawthorne, NY: Aldine de Gruyter, 1989.

Ekman, Paul. *Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life*. New York: Henry Holt, 2003.

Evans, Dylan. *Emotions: The Science of Sentiment*. Oxford: Oxford University Press, 2001.

Flinn, Mark V., and Carol V. Ward. "Ontogeny and Evolution of the Social Child." In *Origins of the Social Mind*, edited by Bruce

J. Ellis and David F. Bjorklund, 19–44. New York: Guilford, 2005.

Foley, Robert. "The Adaptive Legacy of Human Evolution: A Search for the Environment of Evolutionary Adaptedness." *Evolutionary Anthropology* 4 (1996): 194–203.

———. *Humans before Humanity: An Evolutionary Perspective*. Oxford: Blackwell, 1995.

Fox, Robin. *The Search for Society: Quest for a Biosocial Science and Morality*. New Brunswick: Rutgers University Press, 1989.

Gangestad, Steven W., and Jeffry A. Simpson. *The Evolution of Mind: Fundamental Questions and Controversies*. New York: Guilford, 2007.

Garner, Dwight. "Why Are Humans Different from All Other Apes? It's the Cooking, Stupid." Review of *Catching Fire: How Cooking Made Us Human*, by Richard Wrangham. *New York Times*, May 27, 2009, http://www.nytimes.com/2009/05/27/books/27garn.html?pagewanted=all; print version, May 27, 2009, New York edition, section C4.

Gaulin, Steven J. C., and Donald H. McBurney. *Psychology: An Evolutionary Approach*. Upper Saddle River, NJ: Prentice-Hall, 2001.

Geary, David C. *Male, Female: The Evolution of Human Sex Differences*. Washington, DC: American Psychological Association, 1998.

———. *The Origin of Mind: Evolution of Brain, Cognition, and General Intelligence*. Washington, DC: American Psychological Association, 2005.

———, and Mark V. Flinn. "Evolution of Human Parental Behavior and the Human Family." *Parenting: Science and Practice* 1 (2001): 5–61.

Gigerenzer, Gerd. *Gut Feelings: The Intelligence of the Unconscious*. New York: Viking, 2007.

Goleman, Daniel. *Social Intelligence: The New Science of Human Relationships*. New York: Arrow, 2007.

Gopnik, Alison. *The Philosophical Baby: What Children's Minds Tell Us About Truth, Love, and the Meaning of Life*. New York: Farrar, Straus and Giroux, 2009.

Gottschall, Jonathan. *Literature, Science, and a New Humanities*. New York: Palgrave Macmillan, 2008.

———, and David Sloan Wilson, eds. *The Literary Animal: Evolution and the Nature of Narrative*. Evanston, IL: Northwestern University Press, 2005.

Griffiths, Paul E. *What Emotions Really Are*. Chicago: University of Chicago Press, 1997.

Harpending, Henry, and Gregory Cochran. "In Our Genes." *Proceedings of the National Academy of Sciences of the United States of America* 99 (2002): 10–12.

Headlam Wells, Robin, and Johnjoe McFadden, eds. *Human Nature: Fact and Fiction*. London: Continuum, 2006.

Hill, Kim. "Evolutionary Biology, Cognitive Adaptations, and Human Culture." In The Evolution of Mind: Fundamental Questions and Controversies, edited by S. W. Gangestad and J. A. Simpson, 348–56. New York: Guilford, 2007.

Holcomb, Harmon R., III, ed. *Conceptual Challenges in Evolutionary Psychology: Innovative Research Strategies*. Dordrecht: Kluwer Academic Publishers, 2001.

Iacoboni, Marco. *Mirroring People: The Science of Empathy and How We Connect with Others*. New York: Picador, 2008.

Irons, William. "Adaptively Relevant Environments versus the Environment of Evolutionary Adaptedness." *Evolutionary Anthropology* 6 (1998): 194–204.

Johnson, John A., Joseph Carroll, Jonathan Gottschall, and Daniel J. Kruger. "Hierarchy in the Library: Egalitarian Dynamics in Victorian Novels." *Evolutionary Psychology* 6 (2008): 715–38.

Kaplan, Hillard S., Kim Hill, Jane Lancaster, and A. Magdalena Hurtado. "A Theory of Human Life History Evolution: Diet, Intelligence, and Longevity." *Evolutionary Anthropology* 9 (2000): 156–85.

Kaplan, Hillard S., and Steven W. Gangestad. "Life History Theory and Evolutionary Psychology." In *The Handbook of Evolutionary Psychology*, edited by D. Buss, 68–95. Hoboken, NJ: Wiley, 2005.

Kaplan, Hillard S., Paul L. Hooper, and Michael Gurven. "The Evolutionary and Ecological Roots of Human Social Organization." *Philosophical Transactions of the Royal Society* B 364 (2009): 3289–99.

Kirkpatrick, Lee A. *Attachment, Evolution, and the Psychology of Religion*. New York: Guilford, 2005.

Klein, Richard G., with Blake Edgar. *The Dawn of Human Culture*. New York: John Wiley and Sons, 2003.

Laland, Kevin N. "Niche Construction, Human Behavioural Ecology and Evolutionary Psychology." In *Oxford Handbook of Evolutionary Psychology*, edited by Robin Dunbar and Louise Barrett, 35–47. Oxford: Oxford University Press, 2007.

LeDoux, Joseph. *The Emotional Brain: The Mysterious Underpinnings of Emotional Life*. New York: Simon and Schuster, 1996.

Low, Bobbi S. *Why Sex Matters: A Darwinian Look at Human Behavior*. Princeton: Princeton University Press, 2000.

Lumsden, Charles J., and Edward O. Wilson. *Genes, Mind and Culture: The Coevolutionary Process*. Cambridge, MA: Harvard University Press, 1981.

———. *Promethean Fire: Reflections on the Origin of Mind*. Cambridge, MA: Harvard University Press, 1983.

MacDonald, Kevin B. "Evolution and a Dual Processing Theory of Culture: Applications to Moral Idealism and Political Philosophy." Politics and Culture, no. 1 (2010), http://www.politicsandculture.org/2010/04/29/evolution-and-a-dual-processing-theory-of-culture-applications-to-moral-idealism-and-political-philosophy/.

———. "Evolution, The Five-Factor Model, and Levels of Personality." *Journal of Personality* 63 (1995): 525–67.

———. "Life History Theory and Human Reproductive Behavior: Environmental/Contextual Influences and Heritable Variation." *Human Behavior* 8 (1997): 327–59.

———. "A Perspective on Darwinian Psychology: The Importance of Domain-General Mechanisms, Plasticity, and Individual Differences." *Ethology and Sociobiology* 12 (1991): 449–80.

Mellars, Paul, Katie Boyle, Ofer Bar-Yosef, and Chris Stringer, eds. *Rethinking the Human Revolution: New Behavioural and Biological Perspectives on the Origin and Dispersal of Modern Humans*. Exeter, UK: MacDonald Institute, 2007.

Mellars, Paul, and Chris Stringer, eds. *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*. Princeton: Princeton University Press, 1989.

Mithen, Steven. *After the Ice: A Global Human History, 20,000–5000 BC*. London: Weidenfeld and Nicholson, 2003.

———. *The Prehistory of the Mind: The Cognitive Origins of Art, Religion, and Science*. London: Thames and Hudson, 1996.

Nettle, Daniel. "Individual Differences." In *Oxford Handbook of Evolutionary Psychology*, edited by Robin Dunbar and Louise Barrett, 479–90. Oxford: Oxford University Press, 2007.

———. *Personality: What Makes You the Way You Are*. Oxford: Oxford University Press, 2007.

Panksepp, Jaak. *Affective Neuroscience: The Foundations of Human and Animal Emotions*. Oxford: Oxford University Press, 1998.

———. "Emotions as Natural Kinds within the Mammalian Brain." In *The Handbook of Emotions*, edited by M. Lewis and J Haviland, 137–56. New York: Guilford, 2000.

———, and Jules B. Panksepp. "The Seven Sins of Evolutionary Psychology." *Evolution and Cognition* 6 (2000): 108–31.

Pinker, Steven. *The Blank Slate: The Modern Denial of Human Nature*. New York: Viking, 2002.

———. *How the Mind Works*. New York: W. W. Norton, 1977.

———. *The Language Instinct: How the Mind Creates Language*. New York: William Morrow, 1994.

———. *The Stuff of Thought: Language as a Window into Human Nature*. New York: Viking, 2007.

Plomin, Robert. *Behavioral Genetics*. 5th ed. New York: Worth, 2008.

Plutchik, Robert. *Emotions and Life: Perspectives from Psychology, Biology, and Evolution*. Washington, DC: American Psychological Association, 2003.

Potts, Rick. *Humanity's Descent: The Consequences of Ecological Instability*. New York: William Morrow, 1996.

———. "Variability Selection in Hominid Evolution." *Evolutionary Anthropology* 7 (1998): 81–96.

Rushton, J. Philippe. *Race, Evolution, and Behavior: A Life History Perspective*. New Brunswick, NJ: Transaction, 1995.

Salmon, Catherine, and Donald Symons. "Slash Fiction and Human Mating Psychology." *Journal of Sex Research* 41 (2004): 94–100.

———, and Todd Shackelford, eds. *Family Relationships: An Evolutionary Perspective*. Oxford: Oxford University Press, 2008.

Sarich, Vince, and Frank Miele. *Race: The Reality of Human Differences*. Boulder, CO: Westview Press, 2004.

Segal, Nancy L. *Entwined Lives: Twins and What They Tell Us about Human Behavior*. New York: Dutton, 1999.

Sober, Elliott, and David Sloan Wilson. *Unto Others: The Evolution and Psychology of Unselfish Behavior*. Cambridge: Harvard University Press, 1998.

Sperber, Dan. *Explaining Culture: A Naturalistic Approach*. Oxford: Blackwell, 1996.

———. *Metarepresentations: A Multidisciplinary Approach*. Oxford: Oxford University Press, 2000.

Sterelny, Kim. *Thought in a Hostile World: The Evolution of Human Cognition*. Malden, MA: Blackwell, 2003.

Symons, Donald. *The Evolution of Human Sexuality*. New York: Oxford University Press, 1979.

———. "On the Use and Misuse of Darwinism in the Study of Human Behavior." In *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, edited by Jerome H. Barkow, Leda Cosmides, and John Tooby, 137–62. Oxford: Oxford University Press, 1992.

Tanaka, Daniel. "What Is Copernican? A Few Common Barriers to Darwinian Thinking about the Mind." *The Evolutionary Review* 1 (2010): 6–12.

Tooby, John, and Leda Cosmides. "Does Beauty Build Adapted Minds? Toward an Evolutionary Theory of Aesthetics, Fiction, and the Arts." *SubStance* 30 (2001): 6–27.

———. "The Psychological Foundations of Culture." In *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, edited by Jerome Barkow, Leda Cosmides, John Tooby, 19–136. New York: Oxford University Press, 1992.
Wilson, David Sloan. "Adaptive Genetic Variation and Human Evolutionary Psychology." *Ethology and Sociobiology* 15 (1994): 219–35.
———. *Darwin's Cathedral: Evolution, Religion, and the Nature of Society*. Chicago: University of Chicago Press, 2003.
———. *Evolution for Everyone: How Darwin's Theory Can Change the Way We Think about Our Lives*. New York: Delacorte, 2007.
———. "Learning from the Immune System about Evolutionary Psychology." *The Evolutionary Review: Art, Science, Culture* 1 (2010): 13–17.
———, and Edward O. Wilson. "Rethinking the Theoretical Foundation of Sociobiology." *The Quarterly Review of Biology* 82 (2007): 327–48.
Wilson, Edward O., *Consilience: The Unity of Knowledge*. New York: Alfred A. Knopf, 1998.
———. *On Human Nature*. Cambridge, MA: Harvard University Press, 1978.
———. "Sociobiology at Century's End." In *Sociobiology: The New Synthesis, Twenty-Fifth Anniversary Edition*, v–viii. Cambridge, MA: Harvard University Press, 2000.
———. *Sociobiology: The New Synthesis*. Cambridge, MA: Harvard University Press, 1975.
Wilson, Timothy D. *Strangers to Ourselves: Discovering the Adaptive Unconscious*. Cambridge: Harvard University Press, 2002.
Wright, William. *Born That Way: Genes, Behavior, Personality*. New York: Knopf, 1998.

NOTES

1. Brown, *Human Universals*; Degler, *In Search of Human Nature*; Fox, *The Search of Society*, chapters 3 and 4; Pinker, *The Blank Slate*; Tooby and Cosmides, "Psychological Foundations."

2. Lumsden and Wilson, *Genes*. *Promethean Fire* is a more popular version of the same book.

3. Buss, *Evolutionary Psychology*, 17–18.

4. Chagnon, *Yanomamö*; Chagnon and Irons, eds., *Evolutionary Biology*; Eibl-Eibesfeldt, *Human Ethology*; Harpending and Cochran, "In Our Genes."

5. Symons, *Human Sexuality*; Symons, "Use and Misuse"; Pinker, *How the Mind Works*; Tooby and Cosmides, "Psychological Foundations."

6. Mellars and Stringer, eds., *The Human Revolution*; Mellars et al., eds., *Rethinking the Human Revolution*; Foley, "Adaptive Legacy"; Foley, *Humans*; Irons, "Adaptively Relevant Environments"; Mithen, *Prehistory*, Mithen, *After the Ice*; Potts, "Variability Selection"; Potts, *Humanity's Descent*. For an overview, see Carroll, "Human Revolution."

7. Symons, *Human Sexuality*; Buss, *Evolution of Desire*; Geary, *Male, Female*.

8. Bickerton, *Language*; Bickerton, *Adam's Tongue*; Pinker, *Language Instinct*; Pinker, *Stuff*.

9. Geary, *Origin*; MacDonald, "Perspective"; Mithen, *Prehistory*; Sterelny, *Thought*.

10. Kaplan et al., "Human Life History"; Kaplan and Gangestad, "Life History Theory"; Kaplan, Hooper, and Gurven, "Evolutionary and Ecological Roots"; Low, *Why Sex Matters*; MacDonald, "Life History Theory."

11. Bjorklund and Pellegrini, *Origins*; Flinn and Ward, "Ontogeny"; Geary and Flinn, "Evolution"; Gopnik, *Philosophical Baby*; Salmon and Shackelford, eds., *Family Relationships*.

12. Ekman, *Emotions Revealed*; Evans, *Emotion*; LeDoux, *Emotional Brain*; Panksepp, *Affective Neuroscience*; Plutchik, *Emotions*.

13. Brown, *Human Universals*; MacDonald, "Evolution"; Nettle, "Individual Differences"; Nettle, *Personality*; Plomin, *Behavioral Genetics*; Rushton, *Race*; Sarich and Miele, *Race*; Segal, *Entwined Lives*; Wright, *Born That Way*; D. S. Wilson, "Adaptive Genetic Variation."

14. Sober and Wilson, *Unto Others*; D. S. Wilson, *Evolution for Everyone*; Wilson and Wilson, "Theoretical Foundation."

15. Boehm, *Hierarchy*.

16. Baron-Cohen, "Empathizing System"; Cacioppo and Patrick, *Loneliness*; Goleman, *Social Intelligence*; Gopnik, *Philosophical Baby*; Iacoboni, *Mirroring People*.

17. Boyd, *Origin*; Boyd, Carroll, and Gottschall, *Evolution*; Carroll, *Evolution*; Carroll, *Literary Darwinism*; Dissanayake, *Art*; Dutton, *Art Instinct*; Gottschall, *Literature*; Gottschall and Wilson, *Literary Animal*; Headlam Wells and McFadden, *Human Nature*.

18. Barkow, Cosmides, and Tooby, eds., *The Adapted Mind*; Gangestad and Simpson, eds., *The Evolution of Mind*.

19. Cosmides, Barkow, and Tooby, "Introduction"; Buss, *Evolutionary Psychology*; Gaulin and McBurney, *Psychology*; Pinker, *How the Mind Works*; Sperber, *Explaining Culture*; Sperber, ed., *Metarepresentations*; Symons, *Human Sexuality*; Symons, "Use and Misuse"; Tooby and Cosmides, "Psychological Foundations."

20. For critiques of narrow or orthodox EP, see Barrett, Dunbar, and Lycett, *Evolutionary Psychology*, 8–21; Carroll, "Evolutionary

Paradigm," 122–24; Carroll, "Human Revolution"; Carroll, *Literary Darwinism*, 190–97; Dunbar and Barrett, "Evolutionary Psychology"; Foley, "Adaptive Legacy"; Griffiths, *Emotions*, 106–36; Hill, "Evolutionary Biology"; Holcomb, ed., *Conceptual Challenges*; Laland, "Niche Construction"; Irons, "Adaptively Relevant Environments"; McDonald, "Perspective"; Mithen, *Prehistory*; Panksepp, "Emotions"; Panksepp and Panksepp, "Seven Sins"; Potts, "Variability Selection"; Sterelny, *Thought*, 144, 146, 162–73, 177–221; D. S. Wilson, "Adaptive Genetic Variation"; D. S. Wilson, "Learning."

21. Boehm, *Hierarchy*; Dissanayake, *Art*, 73–79; Hill, "Evolutionary Biology"; MacDonald, "Dual Processing Theory"; E. O. Wilson, *Consilience*, chapter 10.

22. Garner, "Why Are Humans Different?"

23. Gopnik, *Philosophical Baby*, 7.

24. Gopnik, *Philosophical Baby*, 59, 60.

25. Klein, *Human Culture*; Bickerton, *Adam's Tongue*.

26. Cosmides, Tooby, and Barkow, "Introduction," 5.

27. Dunbar, *Human Story*; D. S. Wilson, *Darwin's Cathedral*.

28. Scientists who recognize that "imagination" is a distinguishing feature of the specifically human mind include Baumeister, *Cultural Animal*; Deacon, *Symbolic Species*, 21–22; Dunbar, "Good Writers"; Gopnik, *Philosophical Baby*; Johnson, Carroll, Gottschall, and Kruger, "Hierarchy"; Mithen, *Prehistory*; Panksepp and Panksepp, "Seven Sins"; and E. O. Wilson, *Consilience*, chapter 10. In "Does Beauty Build Adapted Minds?" Tooby and Cosmides offer a significant modification of their views on the arts as side effects. Salmon and Symons, "Slash Fiction," follow Tooby and Cosmides in this revised conception of the arts. The narrow-school EP conception of the arts is most clearly articulated in Pinker's *How the Mind Works*, 524–43.

29. Atran, *In Gods We Trust*; Atran and Norenzayan, "Religion's Evolutionary Landscape"; Boyer, *Religion*; Kirkpatrick, *Attachment*.

30. Damasio, *Descartes' Error*; Ekman, *Emotions Revealed*; Gigerenzer, *Gut Feelings*; Plutchik, *Emotions*; Tanaka, "What Is Copernican?"; T. D. Wilson, *Strangers*.

31. Carroll, "Evolutionary Paradigm," 119–28; Carroll, "Rejoinder," 349–68; Carroll, "Human Revolution"; Carroll, *Literary Darwinism*, 63–68, 200–02; Dissanayake, *Art*, 73–79; Dutton, *The Art Instinct*, chapter 6; E. O. Wilson, *Consilience*, chapter 10; Tooby and Cosmides, "Does Beauty Build?"