III-35. Unleashing Thought: Taming Brawn, Grunt, and Smarts

Quarterly Review of Biology: 81, 131-139 (2007). A review of Before the Dawn: Recovering the Lost History of Our Ancestors By Nicholas Wade, New York, The Penguin Press, (2006).

Who really knows? Who will proclaim it? Whence was it produced? Whence is this creation? The gods came afterwards, with the creation of this universe. Who then knows whence it has arisen? Whence this creation has arisen - perhaps it formed itself, or perhaps it did not - the one who looks down on it, in the highest heaven, only he knows - or perhaps he does not know. As musings (Rigved, circa 1200 BC) of curiosity were established as beliefs, Charles Darwin noted in *The Descent of Man*: "It has often and confidently been asserted, that man's origin can never be known: but ignorance more frequently begets confidence than does knowledge: it is those who know little, and not those who know much, who so positively assert that this or that problem will never be solved by science."

The fascinating story of emergence of human foragers into a complex society continues to be selfnarrated in ever greater detail. By building on external evidence, it is overcoming the unknown, avoiding the paradox of self-reference, and detouring nonexistent constructs. By taming instinctive brawn, grunt, and smarts, humans have managed to unleash the enormous potential of the extant reality. Grasp of the external world facilitates interplay of the external with the internal curiosity and awareness to shape it into cognition with recall. It facilitates shared reasoning to

validate perceptions that ultimately govern choices, decisions, and behaviors. In a nutshell, human evolution is about genes reinforced with language.

Evolution is rooted in the changes in the genetic material that facilitated the descent of great apes from trees. With two limbs free to do other things, in the last 100,000 years, the bipedal ape has acquired distinct abilities. What it could not do on its own, it does so with others and with tools. Apparently, changes in less than 1% of the genes gave graded responses to the vocalization apparatus. Graded vocalization permits interplay of awareness of sense experience with instincts. Reasoning gives time to evaluate and decide whether to act or not to act. Behavioral consequences of verbal communication facilitate a higher level of socialization. Shaped by parallel changes in language communication across the generations, cognitions and perceptions that result from awareness of the present in relation to the past and future are the bases of successful behaviors.

The Tao of the human genome is here and now. What Darwin and Wallace described as the positive natural selection of the increase in prevalence of advantageous traits (Darwin and Wallace 1858) can now be correlated with changes in parts of the genome. Distribution of DNA sequence variations across populations can be interpreted to obtain insights into the genetic origins and relations (Sabeti et al. 2006). Such tools continue to change our way of thinking, how we ask questions, and what we accept to be an answer. Evidence from genes is useful in charting when humans acquired certain traits such as bipedalism, language ability, social organization, resistance to diseases, and other adaptations necessitated by environments in which human

ancestors were successful. As tools and evidence evolve, deeper and broader relations about the ascent of man through prehistory continue to emerge.

Before the Dawn is one of the most recent discussions of this topic. Wade builds on DNA sequence information to outline human prehistory after some of the ancestors of the L3 branch of Y chromosome left Africa about 65,000 years ago. It is an admirable synthesis with wide-ranging facts and ideas to communicate reasoning about how humans came to be what they are. The newspaper style may appear annoyingly recursive and repetitive in places, but as a reporter and storyteller, the author's narrative is for nonexperts. Wade is an erudite messenger of the emerging ideas that are not intellectual constructs of any one particular person, yet the discussion is built within the framework of the theory of evolution. Genomic results are skillfully interwoven with findings from archeology and linguistics. Strengths and weaknesses of each continue to be sorted out in the emerging consensus. Although weak on the fundamentals, with the freedom of a storyteller for curious readers and nonexperts, the author anecdotally introduces evolving ideas of population genetics and molecular ecology to clarify and unify ideas from linguistics, archeology, anthropology, history, anecdotes of facts, and whatever else whether or not politically correct. The message is that the genetic evidence is compelling. Anything that does conform must be reevaluated and recalibrated, but cannot be ignored.

Syntheses of this magnitude raise questions. Plausible scenarios can only be sorted out with wide ranging advances. The problem is interesting and important enough that critical scrutiny will

continue until an acceptable consensus occurs. The layout of the book (or the way of reasoning) is not of a card-carrying academic researcher. It might as well be so. Experts will give their own opinions, and it is up to lumpers and splitters to agree on a viable construct. We are not there yet. However, it is worth taking note of *Before the Dawn*, even if Wade may not be fully aware of the limitations of the methods that relate observed mutations to infer population selection. This book is likely to be more widely read than a scholarly review, with a lasting influence on the direction of thought among the experts (Sabeti et al. 2006).

Genetic evidence has provided better tools to evaluate Darwin's ideas. Mutations in two parts of human DNA are of particular interest in tracing back the human lineage, but different influences are recorded on the two types of DNA. First, the Y chromosome found only in males is transmitted from father to son, and its genes control male fertility. Thus, mutations in the Y chromosome provide a more stable measure of the time-dependent changes that are less likely to be subject to vagaries of environment. Second, the transmission mechanism for primates is such that only the mother's m-DNA is transmitted to both male and female offspring. Mutations in the m-DNA apparently control energy metabolism and, therefore, are more likely to leave a trace of the behavior changes associated with the climatic changes through which the ancestors persisted successfully. Not surprisingly, the genetic measures of matrimony and patrimony do not always match family trees. Since the mother is the only reliable measure of the family line, departures in Y chromosome suggest nonpaternity events (i.e., the biological father is not the same as the father of record). Various measures show that in different cultures, nonpaternity events account for less than 1% to more

than 25% of the births, and the current frequency in the U. S. and European population is approximately 4%.

Useful insights have emerged from teleological rationalizations of the patterns of genetic mutations found in the Y chromosome and m-DNA. They provide a window into the genetic past of the populations to infer human lineage. For example, with sufficient (but unknown) numbers of accumulated mutations, species evolve and go their genetically separate ways when they cannot interbreed. Genetic variations within species arise from fixation of a single nucleotide polymorphism. Over a shorter period of less than 70,000 years, advantageous alleles sweep through populations, and selected alleles become established as haplotype in a chromosomal region. In effect, selection pressure, hybrid vigor, and genetic drifts can amplify a single mutation such that within few generations, its bearers begin to dominate the group behavior. The clock for the onset of each of these mutations has to be set by other independent and reliable means.

Since behaviors are determined by genes, changes in behaviors are coded in mutated genes. About five million years ago, human species diverged from the branch of modern apes and bonobos that share more than 97% genomic similarity with humans. The basis for the difference between the distant cousins is in less than 3% of the nucleotide sequence of DNA. Most of the altered genes have not been functionally identified, but recall that 97% of the genomic sequence is filler and only 3% appears to code for functional proteins. It is too early to even suspect that the filler does not have a function. In any case, it is intriguing that although remaining similar for millions of years, during the last 100,000 years, the genetic and behavioral changes on the human

branch have apparently accelerated. The change appears even more pronounced in a genomic branch traceable to a few hundred people who left Africa about 65,000 years ago by crossing the Gates of Grief at the southern end of the Red Sea. Within 20,000 years after leaving Africa, their male and female descendents reached Australia. Along the way, they populated the coastline of India and the Indonesian archipelago, where a group went south to Australia, and another went north to China and Japan. There is emerging consensus based on the DNA evidence from the Y chromosome of male line and the mitochondrial DNA of female line that the genetic ancestry of all modern humans outside sub-Saharan Africa (more than seven billion strong now) is from this small group of individuals of childbearing age. Their saga is a story of selection through sexually expressed preferences and choices made under pressures of geography, climate, diseases, and whatever else came in their way. In the process, humans have destroyed other species, including other human groups.

This outline of the human prehistory is based on the key result that the L3 variant of the Y chromosome predominates in males from all continents except sub-Saharan Africa. A single genetic origin of L3 in effect rules out separate evolution of human groups, while the L3 variants provide a temporal measure of the course of selection dominated by the local conditions. The interhuman differences of traits and behaviors, often attributed to the races, must have been due to such selection. Here the picture from the bearers of the M and N branches of m-DNA is generally consistent, but less complete. Such early challenges with strong selection pressures included learning to fish, building and navigating canoes, controlled brawls, and defense of territory while maintaining genetic diversity. Additional innovations were

certainly needed as the tropical coastal groups living near the river delta moved up the rivers. The northward migration required genetic changes for adaptation to cooler and dryer climates.

The forces of genetic selection that operate in niche environments often quicken the pace of the observed changes through further selection. It remains to be discovered what accelerated the change, and what role local conditions played in subsequent selection, hybrid vigor, genetic drift, and segregation. Geography and climatic changes are the obvious determinants for color, size, and shape of body. Human choices do matter and have unintended consequences. Random actions in limiting environments cascade in unexpected and unpredictable ways. For example, after humans lost their natural fur, the louse deserted humans because exposed human skin does not provide warmth. About 70,000 years ago louse the recolonized humans, presumably as hosts began to use clothes. Similarly, certain variant strains and species come to dominate in a very short time through the selection and breeding of crops and animals with desirable traits. The converse is also true, as unrestrained human choices continue to wipe out large mammals and human groups within few generations. The rate of resource and species depletion has increased with the pace of human intervention. In this kind of competitive environment, lions and kings are evolutionary dead ends, while ants, cockroaches, and turtles are winners.

Inland migration routes accelerated around 35,000 years ago as the coastal foragers began to move upstream along rivers. Apparently, a group settled in the Sindhu (Indus) valley that was

crisscrossed by the five rivers of the northwest Indian subcontinent near Afghanistan. A branch of these L3 bearers arrived Iberian Peninsula about 25,000 years ago, wiping out the Neanderthals along the way. It is not clear how many of them survived the Ice Age that followed, but their genetic trace is now found mostly in the m-DNA of the groups living along Mediterranean coast. Meanwhile, another group went northeast from Afghanistan. About 14,000 years ago, they reached Alaska via Siberia. Along the way, they populated north central Asia and northern Japan. Near the end of the last Ice Age, they also crossed the Bering Strait to the Americas. This group was selected for a body form with reduced heat loss. They accepted the docile wolf as a friendly sentry and self-carrying source of food-on-legs for the lean times. Adoption of the dog was not the beginning of the domestication of sheep, cattle, and horses. Innovations in the isolation of Americas, like those in Australia or islands, did not make rapid strides. Although confined groups carved out selfsustaining cultures, they could go no farther with minimal human and animal resources and technologies available in their niche environment.

Success beyond survival was built on more. Rudimentary agriculture and domestication of animals was beginning to take hold about 10,000 years ago in the landmass that ws crisscrossed by rivers and bounded by India, China, Iraq, Iran, and Egypt. These conditions were right for movements of people and the transfer of diverse resources aided by language communication. Such adaptation facilitated technological innovation. As Europe warmed again after the Ice Age the L3 Eurasians went west with their agriculture and animal-herding technologies, and the Indo-European languages that continue to this day. Diamond (Jain

1998) has made a convincing case that the Eurasians had the advantages of climatic, geographical, and population resources to innovate through the genetic selection of crops and animals. At all levels, genetic diversity played a role in providing hybrid vigor. Within a few millennia, this group emerged as a complex urban society where regimented behavior required taming instincts. Codes of conduct led to the need of a social contract that cared for its own. Further cohesiveness was coaxed with acts of guilt, demonization, and warfare. Selection aided by climatic and meteorological changes took hold over the time course of centuries. Dominance of alleles that conferred certain advantages has become apparent within few generations as the immigrant ethos of America (Jain 2005). Just as geographical reality shapes behaviors, local contexts encourage innovation from a base of technologies if time is spared from the basic survival needs. Virtually all cultures put aside time and resources for mind-altering activities and warfare. The 30% death rate from wars in the primitive societies matches the 30% resource allocation for the "defense needs" by modern nations. Not unlike the our primitive cousins, modern individuals also spend approximately 3 hours a day for food, and twice as much time on socialization, grooming, entertainment, and snorting drugs. In sedentary human societies, choices take hold that cause survival to thrive by making use of opportunities as they emerge.

Just as economic necessities facilitate real world constructs, they also quicken the pace toward apparently kinder, gentler, and less violent behaviors. Here, deception and destruction are intertwined with “let buyer beware.” Rather than a change in human natures (Jain 2001, 2006), changing contexts requires strategic modifications in the selection pressures modulated with

alliances. We can neither predict what the circumstances would hold, nor what genes are likely to prevail. Time is the only witness of the surviving genes adapted to thrive under the emerging circumstances. Nimbleness is required to deal with such uncertainties and should probably be of concern for those who plan to choose a genetic makeover for their progeny. Like the choices inherent in human constructs of ideals and technologies of yesteryear, we seem to be guided by the promise of choices. Building on the premise of what else may or may not be out there, of course, requires venturing into brave new worlds. Many of them turn out to be paradoxical and nonexistent worlds. Yet few real ones that we venture upon change the landscape of choices by creating real value. Possibly survival for success is this quest "at the threshold of another world like none before." Could it be the basis for directed evolution by design or random selection?

Newspapers report the "gene of the week." If genes control behaviors, what can be achieved with reconstructed genes? Genes code for proteins that are the functional movers and doers for an organism. If random genetic changes tailor proteins to overcome limitations of the existing design, such limitations become apparent only with the survival needs in the niche of here and now. Changes that perpetuate are considered advantageous. Changes that did not work out leave little functional trace for the progeny. It is a long leap of faith to assign behavioral consequences to a certain set of genes on the basis of what happens when a particular mutation is interpreted to be associated with a modified function, handicap, disease, or protection from a plague, pox, or AIDS. Even if the test-tube function of the affected gene is known, its regulatory influence on complex behaviors can hardly be surmised in broad, general

terms. On the other hand, associating single gene defects (Mendelian) with diseases is useful, but such genetic changes may also confer other advantages that may not be included in the evaluation criteria. We know test-tube functions of possibly less than 5% of the genes, and evaluation criteria for less than 1% of these. The enormity of the problem is analogous to a machine that may become nonfunctional due to a particular defective part, and may also be dysfunctional if it is not tuned to function in relation to others in the hierarchy.

In virtually all aspects of human existence, language communication has become indispensable to survive and thrive. An overarching function of language is that it is the only means to share and cross-validate what is behind the eyes (inner world of self) with what is in front of the eyes (external world experienced through senses). Experiences of the inner world are not so uncommon whether through natural curiosity, meditation, bias, dream, or elicited by hypnosis, trans, asphyxiation, sickness, starvation, alcohol, or hallucinogens. Such experiences may bring an individual to “the door of perception'\” or “cosmic consciousness,'” but reasoning and validation are required to weed out the nonexistent constructs that are paradoxical, self-referential, and cannot be relied upon or dealt with in real time. Yet people continue to believe in miracles, gambling, and lotteries even though these are not viable business models. Not only they do not create value, but in all such cases the desired outcome is not assured by specific action. Indeed, it is a paradox of language expression that as such it does not distinguish the real worlds from the imagined.

The transition from grunt and gesture to human language skills is truly unique. Although language consequences are beyond immediate control of genes, positive selection pressures from language skills are remarkable because it is the only means by which inner intentions are expressed. The key genes associated with language ability appear to have emerged during the last 100,000 years. Linguists have tried to piece together artifacts of verbal representation that are embedded in current languages. Linguistic roots of some of the most rudimentary words can be traced back about 8000 years. There is no reliable way to evaluate the significance of such artifacts embedded in the language families. It is likely that Indo-European words developed with the spread of the Y chromosomes of the practitioners of agricultural technology or warfare. Little or no correlation is apparent with m-DNA. Apparently, factors influencing proliferation of a language do not overlap the selection pressure on genes. If at all, few generalizations are likely until it becomes clear how the increase of isolated words is related to the spread of genes.

The vitality of popular cultures shows that the aphrodisiac of vocalization is not just for toads. Certainly most if not all behavior choices boil down to sex. Appearances are often deceiving. Language and speech better mirror the inner workings by which we process inputs to reason beyond the immediate. Language is more than words. Language communication touches virtually all spheres of human existence, or at least public behaviors. Its relationship to specific events in the course of human evolution is unlikely to be straightforward. External political and cultural influences may be retained in the formal written part of languages such as alphabets. However, writing is a relatively recent invention. Very few alphabets were established 2000 years ago,

and we are still striving toward universal literacy. It is also a misnomer to consider Sanskrit as the basis of the Indo-European languages, or even at the root of the Indo-Iranian languages. Sanskrit was never a spoken language. The word Sans-krit means "created by purification." It is a very rigid set of 4000 rules of grammar formalized by Panini of Afghanistan around 350 BCE. It assimilated practical terms from many ancient natural languages (the Prakrits) at the root of most of the current regional languages on the Indian subcontinent. The relationship is not much different than the evolution of modern English, with words borrowed from virtually all languages on the planet. Now it is making inroads toward wider acceptance in international communication, and is utilized even by those who do not use it in their daily life. Of course, English now has many more technical words.

Linguists ignore a very fundamental aspect of language that lies well beyond word etymology. Learning to manipulate symbols is key to training the mind without too much genetic tinkering. Such symbolic means are effective in communicating complex skills to the young. The gene complex involved in symbolic thought manipulation probably precedes the evolution of language ability. Syntax ability or its precursor is certainly associated with pattern recognition that underlies the complex skills needed from spotting prey to the weaving of nets and baskets. We still require adolescents to be proficient in relations of geometry and algebra, including ratios and fractions. Recursion with combinatorial skills is inherent in the recall of identifying relations one inside the other, as for successive approximation and midcourse correction in navigation. Use of recall and differentiation provides ways to organize and categorize on the basis of defined criteria and the search for context. Together, such

skills are necessary to look ahead and infer consequences before acting. Of course, such skills precede language, although the tools of language often facilitate transfer of skills and experience to develop cognitive tools. If choices are made on the basis of adopt or opt out, decisions must evaluate the costs and benefits to take risk and discount the future. Even conceptually, it is not easy to see how starting with the syntax ability and abstraction (i.e., ability to manipulate symbols) of cognized inputs it is possible to arrive at perceptions that underlie choices and decisions. Such givens of human nature are now increasingly intertwined with language ability. It is not clear what its relation was in the past.

Organized society evolved from and necessitated the ability of symbolic expression. Conventions based on symbols code knowledge to facilitate sharing. Language communication has played a major role in charting the course of human progress, so much so that now it is indispensable for survival in, as well as of, an organized society. Language unleashes reason. Shared thought provides a basis for validation that paves the way to store and recall experiences without face-to-face communication or confrontation. Like recalled facts, verified thoughts are a viable and reliable alternative to personal experience, just as reason is a preferred alternative to brawn and grunt for conflict resolution. In effect, language does what genes cannot do, at least not as rapidly. In the last few millennia, symbolic expression and communication has emerged from song and dance to accounting and mathematics based on elaborate modes of symbolic reasoning. Such skills fine-tune behaviors for socialization in real time. In fact, symbolic constructs can now be reliably transferred at electronic speed over astronomical distances (Berners-Lee 1999). Paradoxically such developments have also increased interdependence and

homogenization of preferences and choices. The content can be far more easily censored and manipulated by a few, creating a need for far stricter ethical standards than the moral codes of yesteryear.

To spread DNA and ideas in a complex society, individuals rely on intricacies of group behaviors that take advantage of available niches as they arise. Playfulness and language skills signal mental health. Playfulness obscures intentions until opportunity arises. Large social gatherings such as fairs and festivals provide opportunities to trade necessities and create new alliances, including potential mates tamed and domesticated by cultural rituals. For the individual, identity, curiosity, and fear are groomed with literature, music, and arts shared with peers. Myths evolve to provide a shared platform for a culture to base their practices and innovations (Campbell 1988). The taming effect of myths is not call for inaction or timidity against the unknown, but to weed out constructs of the nonexistent that are irrelevant in practice.

Myths are not religion, and vice versa. Most cultures have myths, and far fewer have religion. Like most people, Wade confuses myth with religion. Religions build on myths about the unknown, but religions are structured on a scaffold of nonexistent ideals and miracles. Myths evolve from the inconsistencies of a perceived unknown, whereas organized religions thrive on contradiction of the nonexistent. Religion, and certainly a God, is a relatively recent invention. In effect, Judeo-Christian-Islamic religions have taken away the tentative and personal nature of inspiration from shared constructs inherent in evolving myths. Followers of Yahweh turned myths into a delusion of faith and truth for the

chosen few (Dawkins 2006). In designing heaven and hell, they perpetuated quaint notions of omniscience (religion) backed by omnipotence (war). Besides providing legitimacy to fiefdoms, keepers of the higher purposes fuel their own ambition for greed and grab. History tells us that it has been a dangerous mix for nonbelievers. In the 20th century alone, we have witnessed unprecedented mass killings that are justified with sound bites and justified true beliefs of one brand or the other. Of course, true motives are obscured by intellectual-, social-, political-, or faith-based notions that seek advantage for the chosen few through devices of cunning. Although defeated, such notions and interpretations never seem to disappear. No matter what their initial purpose, without accountability and external reference. in the long run, all vices and institutions exist for their own good. Arguably, such notions are promoted by few freeloaders, rather than to weed out freeloaders, as Wade suggests is the purpose of religion.

Constructs of religion can hardly be called product of a fundamental human need. It does not even serve the need as expressed in myths. Faith-based paradigms are putatively constructed to deal with the unknown. Their nontransparent reasoning tools about a nonexistent entity legitimize and empower the chosen few. Others are doomed to live with the faith in something that they cannot even grasp, let alone understand and reason with. Emergence of organized religions parallels emergence of empires whose boundaries are determined by available technologies, such as horse, sword, guns, and now the mass media. Empowered by the “good and right” on their side, believers crusade and colonize in the guise of making right of the demons and barbarians. This template is still used to

mobilize resources and justify use of power against others. Such practices rob most to empower a few, as spins and rationalizations place most in a subservient role. Beliefs shape not only a homogenized social identity, but also what is acceptable to mind. Such constrained expressions make it abundantly clear that restraining instinctive impulses means a call for inaction. Here taming breeds traits of timidity. This cannot be evolutionarily good. Thought and shared knowledge move through foot soldiers with widest possible participation for diverse inputs because evolution is about coexistence to express the potential of most.

The phenomenon of faith-based behaviors is intriguing (Armstrong 1993). It is a common misperception that all cultures have religion. In fact, the very construct of Truth or God stifles reason, thought, inspiration, and imagination. Most cultures do rely on myths to explore here and beyond without resorting to ad hoc constructs. In lumping the unknown with contradiction of omniscience, reality is mixed with the nonexistent in a very self-referential way. It is like a magic bag in which anything can go in and anything can come out. Having an ethical, social, and personal code of conduct is not the same as the faith in something this unaccountable, unknowable, and nonexistent as is often the bases for the moral precepts. Imagined worlds are useful devices to explore ethical alternatives that must conform to the existent world. Language is the only way to share and validate constructs of what we see, experience, and feel. Relevance of such perceptions may be a matter of individual preference and choice. However, evaluation of their relevance for shared social utility must meet stricter criteria for validation. Constructs of shared knowledge are validated and established not just on the basis of

internal consistency or non-contradiction, but with positive external and independent evidence. (For related topics see www.hira-pub.org).

As a way to overcome limitations of language, slowly but surely shared human knowledge continues to help us cut through the chase of the nonexistent that is often contradictory, inconsistent, paradoxical, and self-referential. In epigenetic worlds (Jain 1999), language is indispensable for the formulation of thought and communication of experience as the basis for shared knowledge. Instincts may respond to awareness of momentary reality. However, tangible group behaviors require choices and decisions governed by perceptions built on tangible patterns. As we learn to differentiate the unknowns of tangible personal and social value, it is inevitable that elements of faith and personal beliefs will influence social choices. Detours are not uncommon. Controversies appear where there initially may be none, and issues appear muddier than what they might be otherwise. Our collective perception of usable reality has certainly improved such that in many spheres of life, most of us are able to make bounded rational choices. How to do better is a continuing challenge that is unlikely to be addressed through the biology of neural organization, even if the basis for thought and associated mechanisms is established.

The evolution of language communication distinguishes humans from the rest. Language-based reasoning is indispensable. Even if language may not have changed human behaviors or natures, it is an effective means for behavior modulation, if not modification. Although reason is not infallible, it is a far more efficient means to explore behavior alternatives. It offers better ways of winning

over others, and language communication takes the edge off expressions and does a better job of cajoling people. Effective use of language provides a wider dynamic range of capable measures for socialization and abstraction. Under nonthreatening conditions, languages facilitate a dialogue of cognized inputs and thought. Taming thought with reason is about reasoning with cognized reality that is necessary for accountability and consequence evaluation. Boundaries of reasoned thought provide a glimpse into unknown worlds, and rules out nonexistent worlds. Language communication facilitates sharing, precision, and quantitative and qualitative differentiation to reduce ambiguity. Having ascertained the facts of information, it is easier to explore their relevance and meaning through a shared quest under nonthreatening conditions. Reasoned discourse promotes nonviolent means of conflict resolution. A reasoned consequence evaluation helps in arriving at suitable corrective measures of altruism, trust, reciprocity, and deception.

Evolution is the story of success of survival, but it is not a dead end in the tree of relations. It is written a posteriori, and is justified with criteria pieced together for consistency. It is not an exercise of consequence evaluation from a priori. In the absence of brutal constraints, the number of possible outcomes gets out of hand (chaotic). As such the system is not amenable to closed analytical scrutiny because survivors tell little about what else happened, or could have happened even if the boundary conditions could be defined. Even if the criteria of success are not known a priori, it is useful to contemplate plausible scenarios for consequence evaluation. It can tell whether additional details are needed, and what remains to be examined and explored. Evolutionary, social, family, language, and historical insights

provide criteria and constraints to overcome limitations of the view from a single window. Inferred relations in a complex system rarely have binary outcome. Straightforward answers are unlikely for the questions that aspire to peek into the future on the basis of the past. Of course we can muse about: Is evolution in genes? Are genes pre-adopted? Is there a purpose? Are choices, decisions, and goals built into the random walk of mutation? If nothing else, at all major junctures in the history of human thought, such questions have helped us redefine our notions of our self and to nudge away from the pitfalls of the self-reference paradox.

The decoding of the genome is a seminal event that will continue to influence our perceptions of epigenetic worlds. Such perceptions guide thinking and understanding of the world around us for decision-making. They help us revise notions, including the very notion of ourself. Chemical sequences coded in genes have provided remarkable insights into the biological being that is coded in the genetic material. It is also a reality in that the "purpose" of a biological being ends after its genetic material is passed on. This evolutionary purpose defines the boundaries of population biology, yet it also provides insights into human natures and behaviors. *Before the Dawn* is certainly not the last word on the subject, nor is it about dawn of New Age. It is unlikely to appeal to anyone who is not swayed by facts, or those who seek meaning in the nonexistent or unknown, or are swayed by myths of perpetual meaning within assumed stability of faith. Reasoning through facts requires courage to sort out the wishful and imagined. If the meaning of acts and actions is a matter of interpretation of the facts of cognized reality, understanding their significance is the realm of the perceptions of the actor.

Armstrong K. 1993. *A History of God: The 4000 Year Quest of Judaism, Christianity, and Islam*. New York: A. A. Knopf.

Berners-Lee T. 1999. *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web by its Inventor*. San Francisco (CA): Harper. pp. 226.

Campbell J. 1988. *The Power of Myth*. New York: Doubleday.

Darwin C., and Wallace, A. R. 1858. *Journal of the Proceedings of the Linnean Scociety, London. Zoology*. 3:45-62.

Dawkins R. 2006. The God Delusion: New York: Houghton-Mifflin Co.

Jain M K. 1998. Greed and grab: many are called yet few are chosen. A Review of *Guns Germs and Steel: The Fates of Human Societies*, by Jared Diamond. *Quarterly Review of Biology*, 73(3):329-332.

—. 1999. Ascertain nature's veracity. A Commentary on Consilience: The Unity of Knowledge, by Edward O. Wilson. *Quarterly Review of Biology*, 74(1):47-49.

—. 2001. A Review *Human Natures: Genes, Cultures, and the Human Prospect*, by Paul R. Ehrlich. *Quarterly Review of Biology*, 76(3):345-346.

—. 2005. Do not self-indulge. A Review of *American Mania: When More is not Enough*, by Peter C Whybrow. *Quarterly Rev. Biol.*, 80(4):460-464.

—. 2006. A Review of Is human nature obsolete?: Genetics, Bioengineering, and the Furture of the Human Condition, edited by Harold W Baillie and Tomothy K. Casey. *Quarterly Rev. Biol.*, 81(1):91-92.

Sabeti, P. C., S. F. Schaffner, B. Fry, J. Lohmuller, P. Varilly, O. Shamovsky, A. Palma, T. S. Mikkelsen, D. Altshuler, and E. S. Lander. 2006. Positive natural selection in the human lineage. *Science* 312(5780):1614-1620.

V. J. Stenger, *God: The Failed Hypothesis. How Science Shows that God Does Not Exist*. Prometheus Books, New York (2007).

Lewis Wolpert: *Six Impossible Things Before Breakfast: The Evolutionary Origins of Belief*. Norton, New York. (2007).

Joan Roughgarden: *Evolution and Christian Faith: Reflections of an Evolutionary Biologist*, Island (2007).

Against Gods and Humbug